

HARNESSING THE COMMUNITY CAPACITY OF SMALL FARMER ORGANIZATIONS  
TO REDUCE PESTICIDE-RELATED ENVIRONMENTAL HEALTH RISKS: A CASE  
STUDY IN AN INDIGENOUS COMMUNITY IN THE SOUTHERN RANGES OF  
ECUADOR, 2007-2008

by

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## **Abstract**

This work aims to better understand the capacity of small farmers, their organizations and other social players in the Ecuadorian indigenous communities of Quilloac and San Rafael to reduce pesticide-related environmental health risks. I used a multi-method approach that included Pierre Bourdieu's field theory along with a 187-household survey, ethnographic methods, and participative approaches in 2007-2008. This study analyzed community capacity-building as social relationships co-determined by human agency and social structure in local and global contexts. By mapping community stakeholders' differential access to cultural, social and economic capital, this study reveals connections between the degree of access to resources and health vulnerabilities.

Four key findings emerged. First, in a context in which workers were forced to diversify their income through strategies such as emigration and urban employment, families had reduced time for their crops and increased reliance on pesticides. Members of households with fewer people applied pesticides more times. Elders from poor households were left to care for crops and experienced more problems with pesticide handling and symptoms. Children experienced increases in accidental pesticide poisoning cases that coincided with a period of high farmer migration to find work. Second, despite numerous well-intended efforts by community leaders, farmers with the highest participation in agriculture had less contact with community organizations. Third, structural factors such as inequitable land distribution, unfavorable market policies, and limited state support for small farmers represent critical barriers for harnessing the capacity of small farmer organizations. Fourth, community leaders tended to adopt peasantry-focused strategies that were likely to further marginalize some vulnerable families who combined non-agricultural activities with their farming, which was characterized by consumption crops with low workforce and high pesticide use.

My findings provide theoretical and practical contributions for understanding the causes of environmental health inequities. Results from this research informed the development of several community-based initiatives (workshops, a radio show). My approach described important contextual barriers that need to be addressed by national and international stakeholders in order to harness the capacity of local organizations. It also identified specific social mechanisms that could increase health inequities despite great efforts by community organizations.

## **Preface**

This study was approved by the Behavioural Research Ethical Board at the University of British Columbia in Vancouver, Canada (Id number: H07-00198).

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## **Dedication**

To Lauren and Samuel

## **Chapter 1: Introduction**

This work aims to better understand the capacity of small farmers,<sup>1</sup> their organizations and other social players in the communities of Quilloac and San Rafael to reduce environmental and health risks associated with pesticide use in agriculture. Quilloac, with 396 households, and San Rafael, with 136 households, are two contiguous communities of indigenous background in the southern ranges of Ecuador (see Figure 1.1). The idea of assessing pesticide-related harm and the capacity of community organizations to promote action originates from long-held concerns of community leaders.<sup>2</sup> This subject unites my interests in agriculture and health, and is one of the priority areas of study in our Global Health Program at the University of British Columbia. The indigenous peoples in the Ecuadorian Andean region are an appealing case to study because their social organizations have historically played key roles in addressing the vulnerabilities of their communities.

For these reasons, the efforts to reduce problems with pesticide handling in agriculture by farmers in Quilloac and San Rafael were of great interest for analysis. This paper seeks to explore the interconnections among the following three major concerns: 1) environmental and health problems associated with pesticide use in agriculture, 2) a growing awareness of health inequities as co-determined by global, regional and local social determinants of health of vulnerable groups such as indigenous peoples and small farmers, and 3) the extent to which local

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<sup>1</sup> Except when otherwise stated, in this paper small farmers refers to peasants with either small holdings (5 or less hectares) or small farmers (more than 5 hectares but less than 20).

<sup>2</sup> The opportunity to develop this project resulted as a consequence of my work as a research assistant with the University of British Columbia in a Canadian International Development Agency-funded inter-institutional initiative to build community capacity in order to reduce environmental health risks in Ecuador. Rafael Alulema, an indigenous leader who later became my main partner in this project, was a student at an International Master's Program in Ecosystem Health, and was a part of the initiative. When asked about potential subjects for his Master's thesis, Rafael Alulema presented an idea for assessing the environmental impact of pesticide use in his community. This proposal caught my attention because Rafael and two other members of the community were able to present their initiative after only one day of discussion with community leaders. The proposal was an example of the

community capacity can play a role in overcoming environmental health problems such as the impacts of pesticide use in agriculture. In this research, I apply Pierre Bourdieu's (1980b; 1986) approach to the forms of capital to analyze the capacity of small farmers in Quilloac and San Rafael to reduce pesticide-related risks as a health equity concern co-determined by human agency and social structure, which are embedded in layers of local, regional, national and global context.

### **1.1. Pesticide use as a growing global environmental health concern**

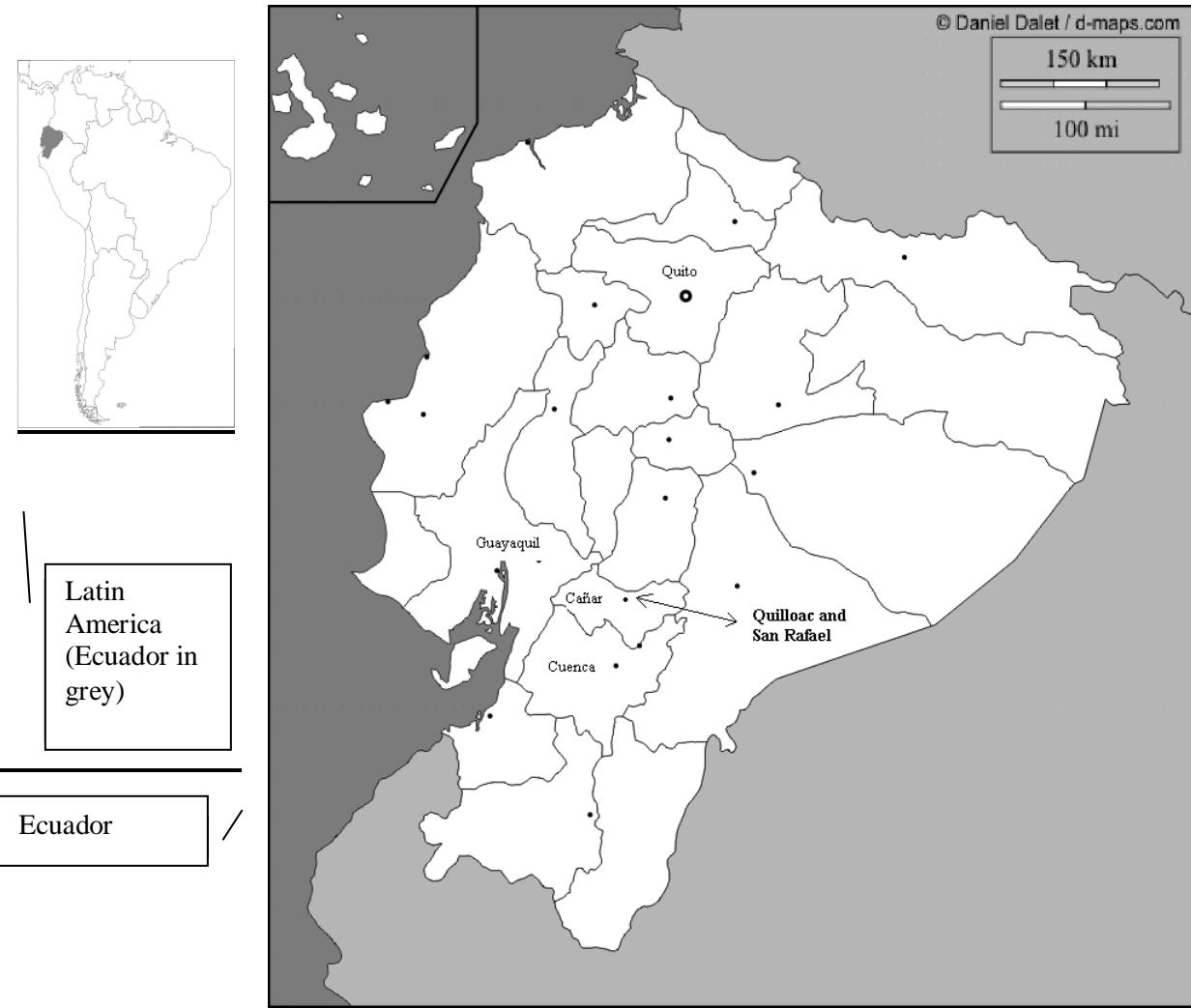
The use of pesticides is increasing worldwide, a growing public health concern because of potential environmental contamination and toxicity to humans. The development of modern crop varieties from the 1950's and 1960's, known as the Green Revolution, has also been accompanied by an increase in use and development of pesticides and artificial fertilizers. This is exemplified by the fact that the world trade in pesticides grew roughly by a factor of 14 worldwide from 1972 to 2002 (Gaybor, Nieto, & Velastegu, 2006). This worldwide phenomenon has also been experienced by countries in Latin America, including Ecuador (Gaybor et al., 2006, p.47).<sup>3</sup> Figure 1.2 shows the long-term trends in international trade of pesticides for different regions in America, illustrating a dramatic increase from 1961 to 2006. If the trend towards Green Revolution technologies continues, in the first 5 decades of the 21<sup>st</sup> century there will be close to a three-fold increase in the use of pesticides and fertilizers (Tilman et al., 2001).

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capacity of the organizations to promote a community-based agenda; Rafael was connecting with a long-held interest of community leaders.

<sup>3</sup> In the Ecuadorian case, this increased use of pesticides is determined by 1) an expanding agriculture frontier, 2) the increase use of mono-crops, which use pesticides more intensely than combined crops (also, short cycle crops use

**Figure 1.1 Quilloac and San Rafael in maps of Latin America and Ecuador**



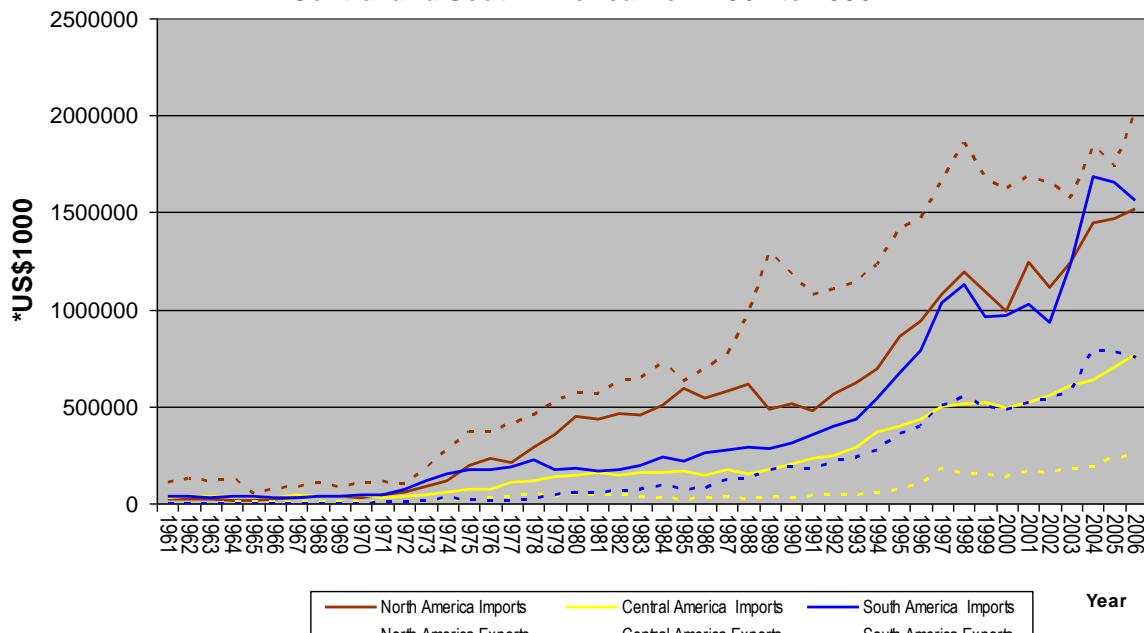
**Notes:** Despite its relatively small area and population (12.156.608 inhabitants), Ecuador has profound regional divisions that are expressed in several dimensions, including its agricultural activity. Ecuador is divided into 4 geophysical regions (the Coast to the west, the Andean Ranges from north to south in the centre, the Amazon to the east and the Galapagos Islands). However, most of its population is concentrated in the ranges (51.0%) and the coast (44.4%) (INEC, Several Years). The agricultural production in the coast is traditionally linked to exportation (cocoa and bananas). By contrast, the Andean production tends to cover the Ecuadorian markets (Larrea, 2006). Oil extraction in the Amazon region is an important source of revenue.

**Source:** (Darlet, 2007-2010a, 2007-2010b)-© free under terms of license.

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more pesticides, affecting mainly small farmers), finally, 3) the adoption of agricultural techniques that increasingly use more pesticides per hectare (Gaybor et al., 2006: 57-66).

**Figure 1.2. Cost of importations and exportations of pesticides in North, Central and South America from 1961 to 2006**



Source: Based on data from FAOSTAT | FAO Statistics Division 2010 | Retrieved on 09 July 2010 from <http://faostat.fao.org/site/424/default.aspx#ancor>

In general economic terms, the Green Revolution may have led to a reduction in prices and an increase in total production yields, but its gains in terms of profit margins by farmers are less clear (Evenson & Gollin, 2003). Despite this, farmers have needed to use pesticides to maintain their competitiveness in the market. However, the adverse environmental and health effects of pesticide use in agriculture remain an important area of concern for environmental and public health action. In effect, the increase in crop production and the use of fertilizers and pesticides have contributed to the disruption of biotic loops and biodiversity with serious environmental consequences (Matson, Parton, Power, & Swift, 1997). In terms of human health, pesticide use associated with the Green Revolution accounts for millions of poisonings and thousands of deaths a year, generating public health and environmental costs close to US\$100 billion a year in the world, with detrimental effects on human health which particularly affect low and middle income countries (Pimentel, 1996).

Preventing environmental and health consequences of these growing trends in pesticide use requires urgent change at several levels towards safer alternatives, such as pesticide-free agriculture and a more rational use of existent technologies (Matson et al., 1997; Tilman et al., 2001).<sup>4</sup> First, farmers can adopt safety practices such as the use of personal protective equipment and adequate handling of products, equipment and disposals. Second, some changes in agricultural practices such as crop-rotation, sowing multiple products simultaneously and early pest surveillance can reduce the total use of chemicals. Third, technologies such as integrated pest management (IPM) techniques, organic agriculture, or permaculture are alternatives to Green Revolution agricultural practices.<sup>5</sup> Fourth, adequate policies are fundamental at the local, national and international levels (Yassi, Kjellstrom, de KoK, & Guidotti, 2001b). For instance, a number of the most toxic chemicals have been banned in high income countries but not in some low and middle income countries (Konradsen et al., 2003).

Despite these possibilities, the growing trends toward pesticide use and its environmental health problems are indicative that more research is needed to better understand barriers and opportunities to adopt safer agricultural practices. For instance, despite efforts by farmers and other stakeholders, poor safety practices in the use of pesticides are commonly reported in multiple contexts worldwide (Crissman, Yanggen, & Espinosa, 2003; Anna Karin Hurtig et al., 2003; Jors et al., 2006; Khan, Shabbir, Majid, Naqvi, & Khan, 2010; Ntow, Gijzen, Kelderman, & Drechsel, 2006; Palis, Flor, Warburton, & Hossain, 2006; Quandt et al., 2010; Recena, Pires, & Caldas, 2006; Singh & Gupta, 2009). Some research has identified behavioural barriers such

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<sup>4</sup> ‘Safe agricultural practices’ is an expression used in this text to make reference to an agricultural method of production that is healthier for humans and less contaminating and disruptive for natural environments.

<sup>5</sup> While IPM, organic agriculture, and permaculture are intersecting practices, some general differences can be argued. Some practices of IPM may have a limited use for pesticides (e.g., in traps). By contrast, in organic agriculture and permaculture, the use of synthetic substances is mostly avoided. Permaculture tries to have a more radical imitation of the ecological niches than some of the organic agriculture practices. In this paper, safer agricultural practices refer to all of these strategies in general, including a rational use of pesticides within the context of traditional crop technologies.

as farmers' belief systems that associate chemicals with medicine or low education levels (Palis et al., 2006). Other social structural barriers such as high equipment cost (Elmore & Arcury, 2001), low access to information (WHO/UNEP, 1990, pp.94-97), or lack of appropriate institutional or financial support have also been identified (Hong et al., 2009; Tracy, 2007, pp. 56-57; Wilson & Tisdell, 2001, pp. 455-459).

My research project studies the case of Quilloac and San Rafael to provide further information for the debate about concrete action to reduce pesticide-related environmental health risk. Despite continued interest and multiple initiatives by community organizations, some Non-Governmental Organizations (NGOs) and state stakeholders, so far attempts to overcome the potential problems of pesticides in Quilloac and San Rafael have failed. In analysing the change processes of these three groups, I focus on social structural factors and the perspectives and practices of individuals and groups embedded in these structures. Their case helps to inform the debate from a public health perspective, and will hopefully serve to reduce health inequities. As small farmers and indigenous peoples in a low and middle income country, peasants in Quilloac and San Rafael are vulnerable to many negative social determinants of health. My hope is that my research will lead to more justice for them and others like them.

## **1.2. Health equity dimensions of pesticide-related risk**

In reducing environmental health impacts of pesticide use, the protection of the natural environment and the reduction of health inequities are interconnected. There has been, in recent years, a growing academic interest in social inequities and their connection to social determinants of health and environmental justice. The World Health Organization's Commission on the Social Determinants of Health (Rother, Hall, & London, 2008) reported that social inequity within and across countries, rather than wealth, is more associated with different types of health outcomes such as child mortality. Consistent scientific evidence also shows that the most marginalized communities are the most vulnerable to ecological problems (Agyeman, Cole, Haluza-DeLay, & O'Riley, 2009; Masuda, Zupancic, Poland, & Cole, 2008; WHO & CSDH, 2008). This holds true in terms of pesticide-related harm. For instance, while less than 20% of pesticide use is concentrated in low and middle income countries, these countries account for more than 90% of deaths from pesticide poisoning (Kesavachandran et al., 2009). Lack of adequate regulations, insufficient control, poverty, and low credit and technical assistance may contribute to this unbalance (Kesavachandran et al., 2009; London, 2009).

While there is some consensus among scholars about the role of social determinants in health inequities, which particular strategies will reduce the health gap is still a matter of great debate (Muntaner, Sridharan, Solar, & Benach, 2009). The report by the World Health Organization Commission states that social inequities resulting in gaps in health status are determined by several socioeconomic and political factors that go beyond the scope of health care services. Consequently, the Commission suggests 1) improving the living conditions of people in extreme poverty, and 2) tackling inequities of power, money, resources, and the factors behind these inequities (WHO & CSDH, 2008, pp. 69-71). Going beyond this general statement,

authors such as Carles Muntaner, Sanjeev Sridharan, Orielle Solar, and Joan Benach (2009) suggest that there is a need to move from general formulas to particular strategies and policies that adequately conceptualize the context in which they are embedded (local, regional, national and global) in order to reduce health inequities. Research should also refine methodological approaches to identify and target the most vulnerable.

In this proposal, I aim to contribute to the discussion about strategies to reduce pesticide-related harm with an emphasis on health equity. I focus on the communities of Quilloac and San Rafael and their placement in a local, regional, national and global context. In the next section, I will briefly introduce the position of small farmers in the indigenous communities of Quilloac and San Rafael as vulnerable groups in the Ecuadorian context.

**1.2.1. Vulnerability of small farmers of indigenous background in Ecuador.** Farmers in Quilloac and San Rafael are an extremely vulnerable population for reasons related to their country, their property, and their indigenous background. First, Ecuador is a relatively poor and highly inequitable country (as is true in many Latin American countries). In 2000, 39.8% of Ecuadorians lived below the consumption poverty line,<sup>6</sup> and Ecuador's GINI index was 53.6 for 2007 (WB, 2007a).<sup>7</sup> In the late 1990's and early 2000's Ecuador experienced an economic crisis that worsened poverty and income inequities (Acosta, Lopez, & Villamar, 2006; Beckerman & Solinamo, 2002, pp. 7-12; Parandekar, Vos, & Winkler, 2002, p.128). In 1998 and 1999, the economic crisis reached such levels that the net growth of the

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<sup>6</sup> Consumption poverty is defined as the number of people with a purchasing power below the poverty line, which is understood as the amount of money needed for basic goods.

<sup>7</sup> The GINI index is an indicator of income concentration according to which 0 is absolute equality and 100, absolute inequality. Despite the fact that data from different countries is not completely comparable due to divergence in the methodology, this index can provide a general idea of the international place of Ecuadorian income distribution: Canada 32.6, United States 40.8, Mexico 46.1, Costa Rica 49.8, Argentina 51.3, Peru 52, Colombia 58.6 (WB, 2007a).

Gross Domestic Product was negative.<sup>8</sup><sup>9</sup> Dollarization, which was adopted in 2000 to stop high rates of inflation, triggered an increase in the consumer price index.<sup>10</sup> Domestic prices grew almost 100% in 2000, but later became more stable in 2001 (Beckerman & Solinamo, 2002, pp.7-12).

While urban poverty has grown faster in recent years, rural areas are still poorer than urban areas in the three most populated regions of the country as shown in Table 1.1 (INEC & WB, Several Years).<sup>11</sup> Furthermore, despite the fact that rural poverty on the coast is more widespread, the number of poor in the rural population of the Andes has grown faster. While rural consumption poverty in the coast was steady between 1990 and 2001, it grew 15% in the Andes (WB, 2004). The province of Cañar, where Quilloac and San Rafael are located, has total increase in poverty percentages that are higher than the Andean region as a whole, but similar to the national average. This coincides with a trend in the whole of Latin America and the Caribbean where, excluding Brazil, rural poverty has been constant or rising, with higher numbers of poor rural inhabitants than poor urban dwellers (de Janvry & Sadoulet, 2000).<sup>12</sup>

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<sup>8</sup> Amidst avid academic discussion, there is controversy about the determinants of the crisis. Some triggering factors can be mentioned: 1) a growing inequity in the country and difficulties reaching consensus about national policies, 2) the Ecuadorian fiscal structure and an economy that has always depended on export commodities that are currently subject to international crisis (e.g. oil), 3) the international debt crisis in the 1980's, 4) a marked debility of institutional capacity, 5) a banking crisis in 1998, which also showed problems in regulation, concentration of loans and vulnerability of portfolios to high interest (Beckerman & Solinamo, 2002).

<sup>9</sup> In addition to the economic crisis, Ecuador also experienced a political crisis in the 1990's and 2000's. Some aspects of the political crisis, as well as the emergence of an indigenous movement in the country, will be described later in this document.

<sup>10</sup> Dollarization is the change of currency from Ecuadorian Sucre to US Dollar, which is still the currency in use in Ecuador.

<sup>11</sup> Despite being less prevalent than rural poverty, urban poverty has grown faster. In effect, in a process that has been called urbanization of poverty, urban poverty has grown at a higher rate since the 1980's in Ecuador. This process is the combined result of 1) migration from rural to urban areas, 2) changes in employment in urban centres, and 3) the effects of the economic crisis of the 1990's on the cities' middle class (WB, 2004).

<sup>12</sup> In recent years, Brazil has implemented a series of state policies with the goal of reducing rural poverty. The effect of Brazil makes the average of the whole region look positive for rural poverty reduction. In addition, it should be noted that urban poverty is a fundamental concern for Latin America, with worse poverty indicators than the rural areas in many countries (de Janvry & Sadoulet, 2000).

Overall, the Ecuadorian economy has experienced a relative loss in the value of its crop and livestock production in the last several decades.<sup>13</sup>

**Table 1.1 Percentages of poor and extremely poor in population for different indicators according to region and area in Ecuador, 2006**

	Ranges (%)			Coast (%)			Amazons (%)			Country (%)		
	Rur	Urb	Tot	Rur	Urb	Tot	Rur	Urb	Tot	Rur	Urb	Tot
<b>Consumption poverty</b>	58.8	16.0	33.7	62.1	31.4	40.1	73.3	21.8	59.5	61.5	24.8	38.2
<b>Extreme consumption poverty</b>	25.7	2.9	12.3	22.0	6.2	10.7	51.9	5.6	39.4	26.8	4.8	12.8
<b>Unsatisfied basic needs</b>	68.1	26.2	43.5	90.2	50.5	61.8	79.6	49.0	71.4	77.8	40.3	54.0

Notes: Rur = Rural, Urb= Urban, Tot= Total

**Consumption poverty** is defined as the number of people with a purchasing power below the poverty line, which is understood as the amount of money needed for basic goods.

**Extreme consumption poverty** is defined as the number of people with a purchasing power below the extreme poverty line, which is understood as the amount of money needed to meet minimum nutritional needs. It represents the inability to satisfy minimum nutritional requirements.

**Unsatisfied basic needs** makes reference to the number of people unable to fulfill basic needs such as housing, health, education and employment.

Data from INEC, & WB. (2006). Quality of Life Survey. Quito: National Institute of Censuses and Statistics- Instituto Nacional de Estadísticas y Censos-INEC, Ecuador; World Bank.

Farmers in Ecuador also face inequitable land distribution. Three major land reforms (in 1964, 1973 and 1994) have done little to reduce inequity in land distribution, despite favouring some communities.<sup>14</sup> Sixty percent of agricultural land (60.4%) is still controlled by 6.4 % of persons (those owning more than 50 hectares). Conversely, more than sixty percent of persons (63.5%, those with fewer than 5 hectares) own only 6.3% of the agriculturally productive area. In the province of Cañar, 2% of those with 50 hectares or more control 53.5% of the land, leaving 77.8% of people (those with less than 5 hectares) with just 19.6% of the land (INEC-SICA, 2000). In the Ecuadorian context, Manuel Chiriboga (1997) has suggested that people with 5 or fewer hectares have little chance for economic viability. Moreover, the international political

<sup>13</sup> In the early 1980's the country shifted from having a majority rural population to having more of its inhabitants in urban centres (FAO, 2004). This trend is consistent with the evolution of the world's population during the twentieth century (Cohen, 2003; Homer-Dixon, 2006). Similar to other countries in the region, the Ecuadorian agricultural sector, as a percentage of the Ecuadorian Gross Domestic Product, has decreased.

<sup>14</sup> With Costa Rica, Honduras and Uruguay, Ecuador was one of the Latin American countries with the smallest area of land modified by the land reforms (ECLAC and FAO, 1986 as quoted by Kay, 1998).

agenda promoted in the last decades by the Washington Consensus, which entails, among other things, an export driven model for agriculture, the liberation of domestic markets for imports, and the decrease in direct support from state institutions, has particularly affected small farmers in developing countries (Mazoyer & Roudart, 1997).<sup>15</sup>

Marginalized as small farmers, the indigenous population is also the poorest ethnic group in Ecuador. According to the National Population and Household Census of 2001, self-identified Ecuadorian indigenous inhabitants make up 6.8% of the total population (INEC, Several Years).<sup>16</sup> Most of this population is concentrated in the Andean region. For instance, in 2001, 71.7% of self-identified indigenous inhabitants lived in the ranges, and 19.6% lived in the Amazonian region (CEPAL, 2005; INEC, Several Years). According to the National Quality of Life Survey for 2006, the percentage of self-identified indigenous communities living below the consumption poverty line reached 69.8%. This was followed by Afro-Ecuadorians at 48.6%, mixed-race Ecuadorians at 34.5%, and Caucasian Ecuadorians at 33% (INEC & WB, Several Years).

Summarizing, most of the indigenous communities in Ecuador experience two of the key conditions for marginalization: being rural dwellers and indigenous. In addition, as small

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<sup>15</sup> I am by no means suggesting that the burden of the solution to health and environmental problems posed by pesticides lies on the shoulders of small farmers. On the contrary, while small farming may offer important alternatives for overcoming the limitations of the Green Revolution, as stated before, large-scale farming is associated with great health and environmental problems. According to M. Altieri, small farmers are fundamental for several reasons. First, with just 34.5% of the total crop area in Latin America, small farmers produce 51% of the maize, 77% of the beans, and 61% of the potatoes for domestic use. Furthermore, they use more polycultures than large farms, which is important for biodiversity. Combinations of multiple crops can also have more yields if all the products are accounted for, while tending to be more sustainable in environmental terms (Altieri, 2008; Rosset, 2000). In addition, small farming is an important source of employment since the creation of new jobs in small farming is cheaper than in other economic sectors (Rosset, 2000).

<sup>16</sup> This estimate is contested. By using other criteria such as language and cultural patterns, other authors have calculated that the indigenous population in Ecuador ranges between 24 and 51%, second only to Bolivia and Peru in the Andean region (Escarzaga, 2004:105 quoting Matos-Mar & Wermus, 2002). Self-identification may lead to underestimation due to the fact that some indigenous people may fear discrimination. It is also necessary to mention that the results have several political implications (Bartlett, Madariaga-Vignudo, O'Neil, & Kuhnlein, 2007). In this document, I use the estimates by the Ecuadorian Institute of Statistics and Censuses (INEC), based on self-

farmers in a middle and low income country, inhabitants of Quilloac and San Rafael are in a disadvantageous position to overcome global changes such as integration of global markets, reduction of state support, and competition from high intensity technological developments in agriculture. Their use of pesticide is embedded in this context. This proposal studies their efforts with a view toward health equity and reduction of vulnerability at local, regional, national and international levels. This paper wishes to understand the capacity of peasants in Quilloac and San Rafael to engage in transformative action.

### **1.3. Community capacity as an instrument for reduction of environmental health inequities**

Focused on the search for effective interventions for pesticide related harm, I intend to focus on the extent to which community capacity can play a decisive role in building healthy, environmentally safe and sustainable alternatives for small farmers. There is not consensus about the concept of community capacity, which is often overlapped with terms such as community participation, empowerment and social capital (Craig, 2007; Kwan, Frankish, Quantz, & Flores, 2003; Verity, 2007). In this research, I understand community capacity as a group's potential to achieve change for promoting their health or improving their environment. This builds on public health scholars who, using the notion of empowerment to refer to increased control over life conditions, have defined community capacity as a social relationship (Labonte & Laverack, 2001a; Laverack, 2006; Laverack, 2007). My interest in community capacity started with the considerable number of academic papers and public health agencies that have highlighted the need for community capacity-building for public health initiatives. Some of the commonly quoted potential benefits of community capacity-building are empowerment and involvement of

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identification. These estimates are also used in other official data such as poverty rates. However, there is a need to

groups and individuals, facilitation of democratic decision making, greater accountability for policies and projects, provision of services adequate to community needs, better acceptance of projects and initiatives by community members, and increased mobilization of resources and enhanced support networks (Maclellan-Wright et al., 2007, p 229; Verity, 2007, p. 11). Of particular interest is the fact that, in the recent World Development Report 2008, *Agriculture for Development*, the World Bank includes the strengthening of social capital and civil society as one of its fundamental strategies for overcoming the limitations of the Green Revolution. It states:

Decentralized governance allows greater access to local information and use of local social capital in regulating externalities. Civil society has the capacity to provide technical assistance and help organize farmers and communities to meet the more stringent environmental standards. Community organizations and producer cooperatives were at the heart of the recent expansion of organic export production in East Africa. (WB, 2007b, pp.188-189).

Despite optimism about notions such as community capacity, engagement or social capital, the intense debate about the notion of social capital promoted by the World Bank (2000) is illustrative of some of the challenges of effectively implementing perspectives on community capacity to address inequities. The World Bank's approach is mainly based on work by Robert Putnam (1993; 1995), who defines social capital as networks, norms and social trust that facilitate collective action for mutual benefit. Applications of this concept are common in public health research (Kawachi, Kim, Coutts, & Subramanian, 2004; Moore, Shiell, Hawe, & Haines, 2005; Whitley & McKenzie, 2005). However, some authors have raised concerns about the extent to which power and inequities are not central to this social capital notion and appear as an add-on with the potential of depoliticizing and deviating the discussion from the central social structures that generate inequalities (Fine, 2001, 2007; Morrissey, 2006). This is related to inadequate approaches to history and social context in mainstream social capital research (Farr,

2004). Acknowledging this debate, Anthony Bebbington, Scott Guggenheim, Elizabeth Olson, and Michael Woolcock (2004) suggest that behind the discussion about social capital there has been a struggle between different groups within the World Bank to promote different political agendas about empowerment and community participation in development. Beyond this debate, a central issue requiring more development is the extent to which community engagement and empowerment can be central to the reduction of social inequities, and challenge their factors of origin (Bebbington et al., 2004).

In public health sciences, questions about the role of vulnerable people in overcoming their own health risks are very important given the high prevalence of works that overemphasize individual responsibility. Studying the case of pesticide intoxication in South African farmers, Leslie London (2003) describes the extent to which public health practice very often resorts to explaining the origin of the problems in the behaviour of workers. This approach tends to ‘blame the victim’ by overemphasizing their role without a proper assessment of the context and structural forces that co-determine the problems. Alternative approaches such as ‘collective lifestyles’ have emerged to overcome this issue by making the relationship between practices and social structure central to the development of action paths to health equity (Frohlich, Corin, & Potvin, 2001; Frohlich & Potvin, 2008b; Potvin, Gendron, Bilodeau, & Chabot, 2005). In terms of strategies to harness community capacity to reduce health inequities, human agency goes beyond personal responsibility to harness resources for overcoming structural disadvantages. Several scholars have used concepts such as empowerment to highlight the extent to which human agency and social structure should be approached together as co-determined and embedded in local, regional, national and international contexts (Labonte, 2004; Labonte & Laverack, 2001a; Raeburn, Akerman, Chuengsatiansup, Mejia, & Oladepo, 2006; Wallerstein, 2002). A fundamental concern is to better understand the extent to which promoting local

community capacity can effectively contribute to reduce health inequities, while simultaneously avoiding overburdening already marginalized populations with problems for which other groups are ultimately responsible. This requires a clear understanding of the links between human agency and social structure as mutually determined and embedded in multiple layers of social context.

My approach to health equity is based on the work by the French sociologist Pierre Bourdieu (1980b; 1986). Bourdieu's work first offers a refined framework for approaching human agency and social structure simultaneously, and responds to questions of co-determination and embedment in social contexts. Second, Bourdieu places equity and power issues at the centre by utilizing a multidimensional approach to the distribution of cultural, economic and social resources. This is similar to discourses of empowerment, which, based on Foucauldian and feminist scholars, approach power as a multidimensional and dynamic process localized in social relationships (Labonte, 2004; Wallerstein, 2002). Finally, while other empowerment perspectives, such as Nina Wallerstein's (2002), conceive of power as a limitless resource that can be harnessed by community organization and collaboration, the work by Bourdieu assumes cultural, social and capital resources as relatively limited assets, the objects of constant struggles to control by social groups in a particular context. By mapping community stakeholders' differential access to social resources, I aim to map differential barriers and opportunities by social players. The work by Bourdieu has been previously used for approaching issues of equity in health sciences and other disciplines (Buzzelli, 2007; Campbell, Cornish, & Mclean, 2004; Kim & Kim, 2009; Lynam & Cowley, 2007; Osborne, Baum, & Ziersch, 2009; Veenstra, 2007). Further details about my application of his work are provided below.

By applying Bourdieu's work to analyzing the capacity of Quilloac and San Rafael's farmers to reduce pesticide-related risks, I offer new insights about the role of vulnerable peoples in reducing environmental health inequities. In Latin America, the marginalization suffered by small farmers in recent decades has led to the rise of different types of farmer movements that clamour for better production conditions, including more environmentally friendly agriculture (McMichael, 2006). Quilloac and San Rafael have been organizational centres for the Cañari indigenous peoples in the area and active participants in the wider Ecuadorian indigenous movement. Both communities contain a large number of community organizations within their borders. These organizations have a long history of struggle for the betterment of their inhabitants. In the 1950's and 1960's, they fought for land. In the 1970's and 1980's they also fought to control water and conditions for their agricultural production. However, despite their struggle, farmers in Quilloac and San Rafael remain in a vulnerable social position; their use of pesticides is embedded in this context.

#### **1.4. Overview of the research**

Building on this triple interest in the pesticide-related environmental health problems, health equity, and community capacity, this paper aims to better understand what role, if any, small farmers, their organizations and other community members can play in establishing healthier and environmentally friendlier agriculture in the communities of my study. The key questions are: *What can small farmers do to change their conditions and build long-term solutions for problems with pesticide handling?* and *How can small farmers in the southern ranges of Ecuador mobilize their resources to affect social change?* To answer these overriding questions,

I identified the following sub-questions, which then guided the articulation of specific objectives for investigation:

*1: Is pesticide handling really a problem in the communities of study? Is there evidence to warrant the reduction of pesticide related risk as part of the agenda of community organizations? If so, who are the community members that are more likely to face health risks because of pesticide use?*

- **Specific Objective 1:** To better understand diverse patterns of human exposure to pesticides in agricultural practices, and to identify problems with pesticide handling by inhabitants of Quilloac and San Rafael.

*2: What is the capacity of small farmer organizations to address the problems related to pesticide use? What are the main structural conditions determining the capacity of small farmer organizations to promote healthier and environmentally friendlier agriculture in the communities of my study?*

- **Specific Objective 2:** To better understand structural factors determining the capacity of small farmer organizations to promote healthier and environmentally friendlier agriculture in the communities of my study, Quilloac and San Rafael.

*3: What are the main strategies adopted by farmers and farmer organizations to adapt to their conditions and survive? How do these strategies affect the capacity of small farmer organizations to develop sustainable and healthier agriculture alternatives in their communities?*

- **Specific Objective 3:** To better understand the extent to which individual and organizational adaptation strategies affect the community capacity for developing sustainable and healthier agriculture alternatives in the communities of study.

*4: What strategies are needed for harnessing community capacity to reduce environmental and health risk associated with pesticide use in Quilloac and San Rafael?*

- **Specific Objective 4:** To identify strategies for harnessing community capacity to reduce environmental and health risk associated with pesticide use in Quilloac and San Rafael.

I do not aim to suggest that small farmers should bear the core of the responsibility for transforming structural conditions that are sometimes out of their control. On the contrary, I would like to contribute to the discussion to better understand the extent to which these farmers can act within their capabilities. This would also help to better understand the role of other stakeholders such as governmental institutions, universities and the chemical industry. In this thesis, I intend to provide possible answers to these questions by focusing on the case of small farming in the southern ranges of Ecuador. As most small farmers in the southern ranges of Ecuador are indigenous, I am also going to focus on these farmers being doubly marginalized: as small farmers and as indigenous people.

To answer these questions, I have based my analysis on Bourdieu's (1980b; 1986) approach to the forms of capital within a defined social field. To simplify, for Bourdieu, a field is a system of relationships constituted by social agents related to the production and promotion of a particular product. A field is constituted by two elements: the existence of a common capital and the struggle for its appropriation by different social actors (Bourdieu, 1980b, 1986). Different social players compete for the acquisition of determinate forms of accumulated capital in a given

*field.*<sup>17</sup> Any field is codetermined by a broader social structure that shapes its organization, even though its internal dynamics are partially autonomous. A field can change over time. For instance, the adoption of the Green Revolution in agriculture may have been favoured in rural settings by the change in the field of agriculture to favour more capitalist forms of production, with the need for greater profits for accumulation. In the case of this work, the Ecuadorian rural setting linked to agriculture is understood as a field.<sup>18</sup> Small-farmer organizations are one of many social actors competing for access to the forms of capital that allow them to survive.<sup>19</sup>

Codetermined by the field, *habitus* is a social learning that constitutes the basis for perceptions that generate practices. It is learned according to a person's position in society and also helps to reproduce society's structure (Bourdieu, 1980b, 1986). Focusing on community capacity building for public health, I will provide more details on this approach in Chapter 2.

To achieve my objectives, I conducted a descriptive case study using a mixed-method design. My approach combined quantitative, qualitative, and participatory components. To address Objective 1, I conducted a cross-sectional study that aimed to identify patterns of exposure and perceived symptoms. A sample of 187 households was randomly selected out of the 532 families in the communities (71 households from San Rafael and 116 from Quilloac), and a survey was applied to adult family members that identified themselves as household

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<sup>17</sup> For Bourdieu, capital in general is accumulated labour, which can be expressed in objects. When appropriated by groups or individuals, capital can harness social energy for specific objectives. The forms of capital include other kinds of capital different from the economic type, which is the most commonly acknowledged. They include, for instance, social capital, defined as resources embedded in more or less institutionalized networks of mutual acquaintance and recognition. Social capital is used by groups or individuals according to their interests. Furthermore, cultural capital refers to forms of knowledge, including skills and education, which may provide benefits to a group or person according to their position in society. Habitus, socially constructed knowledge, is very important for cultural capital (Bourdieu, 1986).

<sup>18</sup> Among other social spaces, the notion of field was applied by Bourdieu to rural settings linked to agricultural production in Algeria and France (Bourdieu, 2008; Grenfell, 2006). The sociology of Bourdieu has also been suggested as appropriate for rural studies in Ecuador (Martinez, 2005a).

<sup>19</sup> On the other hand, the role of small-farmer organizations is linked to the role of small farmers; however, they are not the same. While there are small-farmers that are not linked to such organizations, many organizations that group small-farmers are not just defined by their presence. The case of indigenous organizations will be discussed below.

leaders. Pentox®, a 10-minute screening survey under development by partners in Ecuador for problems with pesticide handling, was adapted and included. In addition to the household survey, I reviewed hospital discharge records from 1998 to 2008 at the local hospital to identify cases of pesticide poisoning. Data from in-depth interviews and an exploratory case-control study was used to better characterize cases of accidental poisoning in children.

For the second, third and fourth objectives, I combined three main approaches. First, ethnographic methods applying observation and in-depth interviews with key actors were used, together with an archival literature analysis. This helped to examine perceptions about the dynamics of different forms of capital and community capacity. Second, I included in the household survey a set of questions asking for perceptions about trust and unity and social capital (e.g. access to networks and social resources). Third, based on my findings, I developed an action research component to work with community leaders to promote a number of initiatives to reduce pesticide related harm in the communities. Some of the initiatives included an eight month radio show and a number of workshops with farmers and community leaders. The progress in the development of the initiatives was the subject of collective analysis with community leaders. More details about my methodological approach are provided in Chapter 5.

In addition to this introduction, the final report is organized into nine chapters as follows: Chapter 2 provides a brief summary of some key issues from the literature on community capacity building in health sciences. This chapter also develops my theoretical perspective on community capacity, which is based on Bourdieu's (1980b; 1986) approach to the forms of capital.

In Chapter 3, I summarize some of the potential health and environmental challenges of pesticide use. I focus on the pesticides most commonly used in each area. I also briefly describe

some alternatives to pesticide use that can reduce the environmental health risks associated with pesticide use, with particular attention to some challenges for training of farmers and for transforming agricultural practices at the local level.

In Chapter 4, I describe the main factors that determine the structure of the field of agriculture for small farmers in the southern ranges in Ecuador. I focus on inequitable land distribution, inadequate market access, and limited state support as fundamental challenges for the adoption of safer agricultural practices. In addition, I discuss international migration as a phenomenon affecting the capacity of small farmers to transform their agriculture.

Chapter 5 provides a detailed description of my methodological approach. It starts with a full description of my conceptual models and my operationalization of key concepts. It also contains a discussion of my main methodological approach and a detailed description of its main components: household survey, ethnographic methods, action participation research, and analysis of hospital discharge records.

I present the results of my investigation in Chapters 6, 7 and 8. In Chapter 6, I show the results focused on gaining an understanding of the diverse patterns of human exposure to pesticides in agricultural practices, and to describing problems with pesticide handling by inhabitants of Quilloac and San Rafael (Specific Objective 1). I emphasize the fact that some of the most vulnerable members of the community are simultaneously the most likely to participate in agriculture (and use of pesticides): older and less educated community members, and households with less income and land. I also identify the extent to which pesticides were effectively a problem for the communities. Poor safety practices predominated. Furthermore, farmers who had recently applied pesticides were significantly more likely to have had symptoms such as diarrhoea and nausea. In addition, based on hospital discharge records, I

describe a peak of accidental poisoning in children from 2001 to 2004, which may have been associated with non-parental childcare in a period of economic hardship and high migration rates in the communities.

Chapter 7 shows data related to the development of Specific Objective 2: to better understand structural factors determining the capacity of small farmer organizations for promoting healthier and environmentally friendlier agriculture. I state that the communities had an important density of organizations with knowledge and technical capacity for transforming agricultural practices. However, the dimension of challenges such as smallholdings and lack of resources limit their capacity to develop sustainable action. This is reflected by the fact that the number of community members who had contact with the organizations was limited. Only a small number of farmers had access to a number of resources such as free credit and assistance for pesticide use. A limited number of farmers who had better than average household income and education level had more contact with organizations and more access to social resources. By contrast, the fact that community members with the highest levels of participation in agriculture had less contact with their main organizations was concerning. A large number of farmers had little trust in the capacity of their organizations to improve the quality of life in their communities.

Specific Objective 3, aiming to better understanding the extent to which individual and organizational adaptation strategies affect community capacity for developing healthier agriculture alternatives, is developed in Chapter 8. I suggest that while leaders of farmer organizations tended to rely on an agriculture-centred vision of the community (either ancestral or modern), a substantial number of community members were simultaneously resorting to other survival strategies which did not necessarily centre in agriculture. I identified six different

clusters of households based on their sources of income. Among the clusters with less access to community organizations were some of the most vulnerable families. These were households which, having little land and low income, resorted to participation in agriculture combined with non-agricultural work. The scarcity of manpower was central to limiting their access to community organizations and reducing their capacity to reduce pesticide use.

Finally, Chapter 9 contains the discussion of findings and conclusions. While community organizations had managed to build a pool of services for farmers despite their scarcity or resources, an important sector of the community was left behind, with important implications for health equity. A cluster of community households had already moved away from agriculture, and had little contact with organizations. More relevant, some of the most marginalized farmers (elders with low levels of education and households with less land and income) were simultaneously among the most exposed to pesticide use (farmers with some of the highest levels of participation in agriculture) and among the groups with less contact with community organizations (households with multiple non-agricultural employment combined with subsistence agriculture).

While I celebrate the possibilities for building democratic solutions to the environmental health problems related to pesticide use, I argue that, to harness the capacity and dynamism of small farmers and their organizations towards effectively reducing health and environmental impacts of pesticide use, these farmers and organizations need to be provided with adequate resources, coherent state support, and favourable policies in order to access land, credit and financial support. Otherwise, small farming has little chance, not only to make the transition towards new forms of production, but also to survive. Without significant change, agriculture will be the sole domain of large producers who have better access to forms of capital in the field.

## **Chapter 2: A review of key community capacity-building issues for working with marginalized communities**

In order to better understand the potential role of small farmers and their community-level organizations in reducing their environmental health vulnerabilities to pesticide use, there is a need for a reinterpretation of the community capacity-building literature in public health at different levels. It starts by better understanding the notion of community as a setting for health action. In this discussion, I focus on three central issues. First, behavioral change in the use of pesticides needs to build on research efforts that approach the contextual limitations of peoples' actions to enable transformation, while avoiding traditional bio-medical perspectives that overemphasize individual responsibility and blame the victim. Second, within a social determinants of health approach, there is a need to move from general diagnostics to identifying context-relevant actions to tackle the structural foundations of health inequities. Local action to reduce pesticide-related environmental health vulnerabilities needs to build on efforts to approach the international, national and regional forces that favour pesticide risks in the context of a increasingly global food production system. Third, local community capacity-building requires an understanding of the potential role of a diverse range of community and state stakeholders in supporting or challenging the local and global power dynamics that favour environmental health vulnerabilities to pesticides.

In this work, I build on approaches to community capacity-building as an instrument for health promotion, as a tool for the empowerment of vulnerable groups (Labonte, 2004; Wallerstein, 2002), and as the product of social relationships which are structured in particular contexts (Labonte & Laverack, 2001a, 2001b). These perspectives are informed by the work of Bourdieu (1986). I believe that this theoretical perspective is appropriate for better understanding the extent to which marginalized groups can engage in developing sustainable

action for promoting their health, while identifying some contextual constraints that are the responsibility of other agents.

## **2.1. The concept of community**

The use of the term community in the health literature is vague. Over the years, it has been used mainly regarding geographical, relational, or interest elements of a group of people (Phillips, 2007: 57). Table 2.1 summarizes some of the approaches to community, while identifying some of their advantages and disadvantages for academic work and public health action.

Describing a case study of community engagement for environmental and health protection, Meg Huby and Rupert Adams (2008) point out that the conceptual ambiguity of ‘community’ leads to different answers regarding community work and health interventions, as well as questions about whom to involve as stakeholders and how to engage community members in a particular project depending on the adopted approach. The scheme in Table 2.1, however, shows advantages and disadvantages for different approaches. Most of the literature on community capacity-building that is discussed below inherits the difficulties in defining community.

**Table 2.1 Three different approaches to the definition of community**

Approach	Some Advantages	Some Disadvantages
<b>Geographical</b> Group of people from a geographical area.	<ul style="list-style-type: none"> <li>• It may reflect political and administrative areas, which better coincide to available data.</li> <li>• It facilitates the focus of public health interventions and public policies.</li> <li>• It can include diversity.</li> <li>• It may help to identify inequities across geographical areas.</li> </ul>	<ul style="list-style-type: none"> <li>• People from a particular area do not necessarily share the same characteristics or interest (Craig, 2007: 337-338).</li> <li>• Some communities that are not necessarily related to place are overlooked (such as migrants).</li> <li>• It may hide inequities within geographical areas.</li> </ul>
<b>Interest</b> Group of people sharing some elements such as common interest, values, identity, beliefs or activities (e.g., occupation, religion, culture, etc.).	<ul style="list-style-type: none"> <li>• It can help to identify differences within a geographical area, while focusing on elements that may be of particular interest (e.g., small farmers).</li> <li>• It may provide more efficacy in public health interventions and public policies as it targets people with common traits.</li> <li>• It allows the opportunity for ‘community members’ to identify themselves according to their perspective (even though it can also give room to outsider’s labeling... see next column).</li> </ul>	<ul style="list-style-type: none"> <li>• A commonality in one element such as identity does not reflect a commonality of other elements.</li> <li>• There is always a risk of externally labeling negative aspects of the community.<sup>20</sup></li> <li>• Identity labels may favour control over marginalized groups.</li> <li>• There may be a gap between perceived commonalities and real differences.</li> <li>• It may hide differences among the ‘community members’ regarding other aspects different from the ones identified.</li> </ul>
<b>Relational</b> Group of people who are interconnected by means of relations of loyalty, affect or activities (Brint, 2001:8 according to Phillips, 2007) (e.g., workers of an agribusiness, who may not share the same values or interests).	<ul style="list-style-type: none"> <li>• It can help to identify differences within a geographical area.</li> <li>• The set of relationships and bonds can explain some components of social action that are not fully motivated by common interest.</li> </ul>	<ul style="list-style-type: none"> <li>• Social relationships can help to maintain inequities in a particular group of people.</li> </ul>

Notes: Elaborated by F. Cabarcas, based on (Craig, 2007; Phillips, 2007; Verity, 2007)

<sup>20</sup> This problem is very common for development and health projects. For instance, defining a community because they are poor or vulnerable implies a negative image of the community members that can have unintended consequences. First, it can label community members as negative members of a particular society. Second, it can affect self-identity and foster paternalistic-dependant relationships. Some authors have suggested a more positive approach to community capacity-building. For instance, mapping different types of community assets (traditional and non-traditional) can help to achieve a more positive vision of the community (Kretzman & McKnight, 1993).

Depending on the particular object of interest, one possible alternative is to combine different perspectives when approaching a particular setting for research or action. An awareness of the multiple levels may be beneficial for analysis. For example, in the case of small farmers in the southern ranges of Ecuador, I am mainly using an interest-type of community. This is the community of small farmers who use pesticides. Most of them also happen to be indigenous in the particular communities of my interest. I believe that this focus can help to target public health action and better understand its circumstances. However, I am also using other types of approaches to community when necessary. A relational type of community definition is going to be fundamental for my approach to community capacity. I will focus on the type of organizations that can affect agricultural practices, particularly on small farmer organizations. Furthermore, a geographical type of community is used for some aspects such as some techniques for data collection and to better understand the context and history of the area.

## **2.2. Defining community capacity-building**

The term community capacity in health disciplines has been applied to a wide variety of concepts. In health literature, Brenda Kwan, Jim Frankish, Darryl Quantz and Julieta Flores (2003) identified a total of 83 characteristics of community capacity used in the literature until 2003.<sup>21</sup> Some terms that are usually associated to community capacity-building in the literature

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<sup>21</sup> The level and scope of the term ‘community capacity’ are also broad. Summarizing their literature search and based on focus group discussions, Brenda Kwan et al. (2003) described a framework that covers three levels (individual, organization, and community) across four dimensions (context, resources, activities, and outcomes). Fiona Verity (2007) identified six domains at the community level: physical (infrastructure), institutional (policies, structures, and inter-system interaction), economic (resources, opportunities, and knowledge), social (networks, participation, and trust), and human (skills, motivation, etc.). Glenn Laverack (2006) identifies nine domains in his notion of empowerment: participation, local leadership, problem assessment capacities, critical evaluation of goals and rationale, organizational structures, resource mobilization, internal community-program collaboration, external partnerships, and control over management.

are participation, community empowerment, community development and social capital (Kwan et al., 2003). According to Kwan et al (2003), most definitions of community capacity make reference to the potential of community change for improving health or quality of life, and this potential is usually referred to as a cyclical process for achieving particular goals. Accordingly, in her literature review, Fiona Verity also found a great variety of definitions, grouped in three major types of work: conceptual literature, literature focused on practical applications and literature focused on critical analysis of the approaches to the term. Overall, the notion of community capacity also usually refers to community effort, resources or actions towards particular objectives of change. Community participation is usually central to the notion of community capacity (Verity, 2007). In this section, I will summarize some challenges emerging from the imprecise use of the notion of community capacity in the literature. I will next focus on the development of community capacity as a source of power in health promotion as a central notion for addressing health vulnerabilities.

Despite the fact that particular approaches to community capacity may provide very important insights for achieving health goals in different settings, the imprecision of the term reduces its analytical power. In a report for Health Canada on the use of the term community capacity, Richard Crilly (2003) states that there are no universally accepted definitions of community capacity. He found that the term is often used inconsistently to the point of being mentioned in some projects where community engagement is not part of the activities (Crilly, 2003). This has also been highlighted by other authors (Chaskin, 2001; Kwan et al., 2003). The fact that the term community capacity is so broadly defined leads to the need to specify the debates and name the contradictions that can emerge.

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The need for proper conceptualization deeply related to measurement, particularly regarding the role of public policy in community capacity (Kwan et al., 2003). Despite general agreement about the value of community capacity and some of its principles such as community participation, proper evaluation is still lacking. In addition to the lack of conceptual consensus, community capacity-building outcomes are usually expected in a time frame longer than the funding cycle of the projects (Crilly, 2003). Some authors have suggested that alternative evaluation methods such as action research and qualitative approaches are required (Boutilier, Rajkumar, Poland, Tobin, & Badgley, 2001). Evidence from some case studies has shown some positive health benefits of community engagement, although academic consensus does not exist (Raeburn et al., 2006).

Table 2.2 shows some examples of successful community capacity-building cases, but also provides an illustration of the diversity of approaches and contexts in which the notion is used. Overall, there is huge potential for community capacity-building and community participation to be better understood and evaluated. In evaluation, there has to be a clear answer to questions such as who participates, what participation is for, who defines the sectors of the community that participates, how decisions are made, and who is excluded from the decision-making process. Otherwise, the use of imprecise models and assumptions can lead to frustrating results. For instance, an analysis of the outcome of community participation in local councils in Uganda showed that the initial interest of community members declined with time due to fatigue and unwarranted assumptions about the role of the community in policy-making (Golooba-Mutebi, 2004).

Amidst this inconsistency, my discussion about the notion of community capacity-building is mostly informed by an approach to community capacity-building as empowerment, which has

been central to health promotion debates in the public health sciences (Labonte & Laverack, 2001a; Laverack, 2007). The notion of empowerment focuses on the ability of community groups to control the determinants of their health vulnerabilities (Labonte & Laverack, 2001a). Capacity-building is understood a dimension of power in social relationships which are embedded in a particular context (Labonte & Laverack, 2001a; Laverack, 2007). From this perspective, community capacity is fundamental for marginalized communities to gain control over their social determinants of health and the projects and initiatives that affect them (Labonte, 2004). I will discuss three major concerns that are relevant to small farmers' efforts to reduce pesticide-related environmental harm in Quilloac and San Rafael. First, human behaviour and its contextual determinants need to be analyzed simultaneously to avoid placing an excessive emphasis on the responsibility of farmers and their organizations while addressing structural mechanisms supporting health inequities. Second, as the use of pesticides in agriculture is a worldwide problem embedded in the terrain of a global food system, it is important to approach its driving forces across multiple layers of international, national, regional and local context. Third, my objective of understanding what role small farmer organizations can play in reducing environmental health risk in Quilloac and San Rafael speaks to a need to identify asymmetries in power distribution among a diversity of state and community stakeholders embedded in local, regional, national and international contexts. My emphasis on the latter is central to my use of Bourdieu's work (1986) in approaching community capacity.

**Table 2.2 Some examples of successful ‘community capacity-building’ projects, their evaluation approach, and the key elements of their view of community capacity**

Project	General Description	Evaluation Approach	Key Elements of Community Capacity-Building
Promoting environmental justice through community-based participatory research (Minkler, Vasquez, Tajik, & Petersen, 2008).	<ul style="list-style-type: none"> <li>Evaluation of partnerships in the United States with focus on environmental health problems.</li> <li>The results are mostly focused on process evaluation, highlighting the importance of the following elements: leadership, participation, skills, resources, ability to form and maintain social and organizational networks, and shared values.</li> <li>Also highlighted that although the projects had solid partnerships, differences between community members and institutional stakeholders may be a source of conflict.</li> </ul>	A multiple case study of four community action research projects, following the approach suggested by Yin, 2003. In-depth interviews and focus groups were conducted.	It includes the mobilization of a community and the use of their power for environmental health organization. It also involves the leadership of researchers, health practitioners and their institutions for the same goal. Some domains are mentioned: leadership, participation, skills, resources, social and organizational networks, sense of community and of partnership identity, understanding of community history, community power (defined as the ability to act to make or resist change that affects the environment), shared values, critical reflection (defined as the ability to analyze successes and failures) (Goodman et al., 1998 and Freudenberg, 2004 according to Minkler et al., 2008).
Participation for perinatal health (Turan, Say, Gungor, Demarco, & Yazzgan, 2003)	<ul style="list-style-type: none"> <li>Evaluation of a project to promote community participation in prenatal health projects in Istanbul, Turkey.</li> <li>The results show gains in health outcomes and community capacity.</li> </ul>	Pre- and post-tests with program participants and interviews with participants.	<ol style="list-style-type: none"> <li>1) Participation in decision-making.</li> <li>2) Improved knowledge and skills of community members.</li> <li>3) Continuity of participants and health program.</li> <li>4) Initiation of new activities.</li> </ol> <ul style="list-style-type: none"> <li>In addition, health indicators were used for outcome.</li> </ul>
The implementation and evaluation of a healthy communities process (Smith, 2000)	<ul style="list-style-type: none"> <li>This article describes the evaluation of Healthy Community Initiatives in a health region in Alberta, Canada.</li> <li>It concludes that the evaluation should include non-traditional outcomes. The process may result in enhanced demands on institutions and policies.</li> <li>Community leadership ranged from being very strong to being weak.</li> </ul>	<ul style="list-style-type: none"> <li>Surveys and interviews of community participants and the facilitation team.</li> <li>Other qualitative techniques such as monthly written stories were used.</li> <li>The region’s capacity to engage in community development was assessed.</li> </ul>	Structural and relational dimensions of capacity components included: communication, participation, ongoing learning, a shared vision, sense of community, knowledge/skills/resources, and leadership.

**Table 2.2 Some examples of successful ‘community capacity-building’ projects, their evaluation approach, and the key elements of their view of community capacity**

Project	General Description	Evaluation Approach	Key Elements of Community Capacity-Building
Evaluating the effectiveness of a multi-component intervention to improve health (J. Spiegel et al., 2003; Yassi et al. 2003)	<ul style="list-style-type: none"> <li>These articles evaluate the effectiveness of a multi-component intervention to improve health, housing and lifestyles.</li> <li>The overall plan was found to be highly successful in terms of housing and some lifestyle outcomes.</li> <li>Extensive community involvement, based on existing community-based organization, was found.</li> </ul>	<ul style="list-style-type: none"> <li>Ecological approach.</li> <li>Qualitative study</li> <li>Quantitative study with not randomized pre and post evaluation.</li> <li>Community workshop to choose indicators.</li> </ul>	<ul style="list-style-type: none"> <li>Inputs =&gt; outputs =&gt; outcomes =&gt; impact</li> <li>Inputs: materials, labour, administrative time, travel, community support (type of leadership, community involvement, etc.).</li> <li>Outputs: houses repaired, street repairs, lights, cultural activities, water supply connections, solid waste collected.</li> <li>Outcome (needs reduced): Improved housing conditions; improved cultural live in community; improved safety and feeling of security; community integration.</li> <li>Impact: averted cost, improved health, improved satisfaction and quality of life.</li> </ul>

**2.2.1. Focusing on human agency and focusing on structural challenges.** The inclusion by the World Health Organization (1986b) of public policies and community capacity-building as strategies in the Ottawa Charter for Health Promotion is one of the important milestones that marked the emergence during the second half of the twentieth century of several efforts in health sciences to overcome bio-medical perspectives that emphasized individual risk behaviours and health education for disease prevention. This emphasis, which is still highly prevalent in public health practice and research, tends to approach health risks as the product of peoples' beliefs and actions, and emphasizes education as the main tool for modifying lifestyles.<sup>22</sup> One of the consequences is that the contextual limitations of behaviour are not properly assessed, which leads to placing responsibility for change on individuals and to ignoring the social structures that may be determining health outcomes in the first place. This process has been referred to as “blaming the victim” because vulnerable groups, who suffer from unjust distribution of social determinants of health, are labelled as ultimately responsible for their health outcomes

(Bacigalupe, Esnaola, Martin, & Zuazagoitia, 2010). The consequences of this viewpoint are facing renewed investigation as the growing awareness about the social determinants of health inequities become a priority for public health action (Bacigalupe et al., 2010; Spiegel, Labonte, Hatcher-Roberts, Girard, & Neufeld, 2003; WHO & CSDH, 2008).

The need to overcome approaches that blame the victim is central to efforts to reduce environmental health risks associated with pesticide use (London, 2003). Farmers are frequently encouraged to use protective equipment and to avoid hazardous use of pesticides. However, structural conditions in agricultural production, such as increased competition, the need to reduce economic risks generated by pests, the high price of some of safer chemical products and protective equipment, and inadequate access to safety information, also contribute to increase the farmers' potential to come to harm (see Chapter 3 for more details). Erika Rosenthal (2003) describes an illustrative example to support this point. In a rural town in Peru, the death by pesticide poisoning of 24 children was attributed by the chemical industry to accident and poor safety practices. However, Rosenthal discusses that the industry promoted highly toxic products, such as methyl parathion (classified as extremely hazardous by the World Health Organization), among farmers who did not speak the language in which the caution labels were printed and who had little access to protective equipment. Rosenthal is one of an increasing number of scholars who indicate that the most toxic pesticides should be banned in such a context (Kesavachandran et al., 2009; Konradsen et al., 2003; Rosenthal, 2003). The analysis of the social context in which environmental health risk associated with pesticide use occurs should be a part of the search for solutions (Sherwood, Cole, & Paredes, 2003).

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<sup>22</sup> This is different from progressive efforts in popular education that try to approach social change by engaging community members in a participative learning process in which the social structures that generate injustices are the subject of study (Freire, [1970] ).

In terms of determinants of health problems, several scholarly efforts have offered alternative perspectives that aim to integrate the codetermination of human agency and social context, a notion that is central for the reduction of health inequities. The Latin American Social Medicine Movement has been, for instance, one of the pioneer perspectives in developing an approach to identify the social processes that determine health (Iriart, Waitzkin, Breilh, Estrada, & Merhy, 2002). Examples in Canada are the Settings Approach to health promotion (Dooris et al., 2007; Poland, Frohlich, & Cargo, 2009; Poland, Lehoux, Holmes, & Andrews, 2005) and the notion of Collective Lifestyles developed by Katherine Frohlich et al (2001). This later perspective is heavily informed by the work of Pierre Bourdieu (1980a; 1980b; 1993), Anthony Giddens (1984; 1993) and Amartya Sen (1988; 1992). Collective lifestyles are shared perceptions and actions embedded in a social environment (Frohlich et al., 2001b). This notion helps to overcome approaches that ‘blame the victim’ by overemphasizing individual behaviour, but instead focus on the extent to which lifestyles and context are co-determined (Frohlich et al., 2001). In addition, social determinants of health are not independent risk factors that directly affect health. Conversely, social determinants are dynamic factors embedded in a context (Frohlich et al., 2001; Potvin, Gendron, Bilodeau, & Chabot, 2005). Context is therefore dynamic and encompasses place and people’s actions and practices (Frohlich et al., 2001). The concept of collective lifestyles aims to make the relationship between practices and social structure central to the development of actions paths to health equity (Frohlich & Potvin, 2008).

The dominant bio-medical perspective that focuses primarily on individual responsibility has to be offset by a focus on structural challenges such as social determinants of health (Raphael, 2003). Community action is also co-determined by people’s structural conditions in their social context. In effect, the emphasis on individual responsibilities is also prevalent in some approaches to community capacity-building. Glenn Laverack (2007, pp. 134-135) mentions the

example of government campaigns to promote awareness about ‘informed consumer choice’ (e.g., in terms of information about toxic substances). This type of initiative usually leaves social determinants of health untouched, while encouraging individual behavioural change to avoid risk (defined according to the government criteria). This emphasis can deepen inequities and increase the ‘victim blaming’ of already stigmatized communities. Marginalized people usually have fewer options to choose from and fewer ‘resources’ to mobilize than other community members. If adequate support is not provided, the expectation that under-resourced and marginalized people bear the main responsibility for transforming their position in society can become unrealistic (Phillips, 2007, p. 66). To overcome inequities in the absence of an exceptional instability of any society, marginalized groups need resources, assistance, and political will. Paradoxically, local community capacity-building projects often resort to voluntary work by community members. For instance, volunteerism has often been suggested as a central issue to promote environmental protection, in low and middle income countries, including those in Latin America (Danielsen et al., 2009). This emphasis has to be accompanied by adequate support to overcome the structural limitations that create the vulnerabilities in the first place. If contextual and behavioural dimensions are articulated, the use of community resources, such as volunteers, can be an opportunity to promote change by articulating people’s action in terms of the structural causes of their vulnerabilities. This is central to community-capacity building approaches that emphasize building on strengths that had previously been overlooked by community stakeholders (Kretzman & McKnight, 1993).

Both community agency and social structure should be taken into account to adequately harness community capacity for positive change. In addition to people’s actions and perceptions, a society’s contextual aspects, such as class structure, economic trends and political landscape, need to be considered for adequate promotion of community capacity for marginalized groups.

In a five-case study of institutional community projects for health promotion in Canada, it was found that community engagement was influenced by determinants such as bureaucratic rules, resources and organizational structure (Boyce, 2001, 2002). In another example that evaluated participative strategies for tree planting and soil conservation in rural villages in the Philippines, it was found that the community's specific history and existing socio-economic elements explained differences in people's involvement (Walters, Cadelina, Cardano, & Visitacion, 1999).

Overall, inequity problems linked to both society's structure and people's behaviour need to be addressed for effectively channelling community capacity for health promotion. This is central to my approach to community capacity-building as the product of social relationship, which are embedded in a particular context. This is a central concern in the approach to empowerment that informs this notion (Labonte & Laverack, 2001a; Laverack & Labonte, 2000). As a part of, and building on, a tradition of approaches that promote social change through critical collective learning and action,<sup>23</sup> Ronald Labonte and Glenn Laverack (2001a; 2000) have described empowerment as the increasing ability by community members to define, understand, evaluate and act to solve their health issues which are caused by social determinants in their particular context. The authors clearly express that empowerment should go beyond notions of "psychological empowerment" to specifically address the material and political dimensions of the social determinants of health (Labonte & Laverack, 2008, pp. 182- 184). The central issue to be considered amidst the confusion of concepts and terminology in community capacity-building should be the socio-economic and political power structures that determine health inequities in the first place (Labonte, 2004; Wallerstein, 2002).

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<sup>23</sup> See, for instance, Freire, 1970; Goodman et al., 1998; Jackson et al., 2003; Kretzman & McKnight, 1993; Kretzmann & McKnight, 1993.

While building on the notion of empowerment to inform the central questions of my community capacity-building approach, I also use the work of Bourdieu (1980a; 1986) as stated earlier. From its inception, the notion of empowerment has received criticism for the lack of theoretical ground in its description of social relationships, human agency and social context (Rissel, 1994). In spite of the fact that scholars of empowerment in health promotion have built on the work by Michael Foucault (1972; 1982; 1988; 1995) and Steven Lukes (1974; 2004; 2005) to inform their approach to power (Labonte & Laverack, 2008, pp. 25-26; Wallerstein, 2002), most of the literature offers little discussion about the notion of social context and the extent to which it is related to human agency and power. I therefore turn to the sociological work of Bourdieu to focus on the interaction between human agency and structure and the power dynamics that emerge from this interaction. Details will be provided in the final section of this chapter.

**2.2.2. Approaching local context with a global perspective.** In order to better understand the potential role of small farmers and their organizations in reducing environmental health risks in the communities of Quilloac and San Rafael, there is a need to approach the contextual determinants of health across multiples layers of international, national, regional and local contexts. Chapter 1 describes the extent to which environmental health risk from pesticide use in agriculture is a worldwide problem. It also introduces the notion that the vulnerabilities associated with pesticide use are unevenly distributed between countries and across marginalized groups according to predictable patterns, which are codetermined by global and local contexts. This is consistent with the growing interest in public health literature about the need to better understand the multiple connections between global forces and local action (Gilbert & Gilbert, 2004; Raeburn et al., 2006; Spiegel & Andruske, 2005).

Laverack and Labonte (2008) argue that the emphasis on community and local action by many health promotion and empowerment initiatives should be complimented by an analysis of the extent to which many of the social determinants of health are driven by forces beyond community limits. This is consistent with other authors such as John Raeburn, Marco Akerman, Komatra Chuengsatiansup and Fanny Mejia (2006), who argue that community capacity-building action that will face emerging global challenges should simultaneously focus on collaboration for international, national and regional action to tackle macro-determinants of health, and local action to address the needs of the most vulnerable.

Public health literature has seen increased efforts to conceptualize the global scale of social determinants of health. Labonte (2008) identifies several competing frameworks for discussing the health dimensions of global changes: health as commodity, security, development, global public good, and/or human right. Amidst this debate, the concept of globalization has been used

to describe the process of closer interaction of activities across a range of spheres including economic, political, social and cultural, but whose effects are explicitly being considered at the community level (Bettcher & Lee, 2002; Spiegel, Labonte, & Ostry, 2004). Labonte, Jerry Spiegel and Alex Ostry (2004) identify six characteristics of global changes in recent decades: 1) a higher importance of international institutions, 2) different axes of power with more truly global patterns of trade dominated by western Europe, east Asia and North America, 3) increased international capital flows, 4) a greater role of foreign investment in services, 5) neo-liberal policies promoted by the World Bank and the International Monetary Fund, and 6) changes in migration patterns with increased international emigration of high-skilled workers from low and middle income countries.

The extent to which global changes and local settings are codertermined in different contexts, and the consequences for community capacity-building, is also a subject of debate in the literature. The notion of glocalization has been used to describe the extent to which global and local contexts are interconnected and codetermined (Kickbusch, 1999). Global changes entail a set of processes that are reflected in local settings and people's everyday lives (Spiegel & Andruske, 2005). Global trends are not homogenously expressed in particular contexts as local players adopt diverse strategies according to their specific circumstances (Giulianotti & Robertson, 2006; Kickbusch, 1999). An example of glocalization is recent immigrants' health and their decreased capacity to respond to social change in new settings (Carballo & Mboup, 2005; Williams & Labonte, 2007). Another example is international organizations' policymaking practices reducing the capacity of local democratic institutions to control their environment (Alston, 2002; Cameron & Wise, 2004). Bourdieu (2002) points out that the extent to which local social movements, whose priorities lie in specific social issues such as housing, employment and health, are part of a global process of resistance to unjust policies (Bourdieu,

2002). An analysis of local community capacity-building efforts, as in the case of small farmers in Quillaoac and San Rafael, requires an analysis of the local expression of international, national and regional dynamics. Understanding their potential role in the reduction of pesticide-related risk can assist understanding about the particular mechanisms that contribute to the regional, national and international dimensions of the problem.

**2.2.3. Questioning community: power differences among diverse community and state stakeholders.** A central purpose in understanding community capacity-building as social relationships is that it provides an analytical tool to avoid romantic or simplistic descriptions of local communities as unitary entities with positive properties. Discussing community setting approaches to health promotion, Blake Poland (2000) identifies that perspectives on capacity-building, social capital or empowerment that highlight positive aspects, such as engagement and participation, as properties of the entire population can contribute to perpetuating the conditions that reinforce social inequities within and beyond the community. Labonte and Laverack (2001a; 2008) promote the notion of community capacity-building as relationship in order to overcome a tendency to identify community properties (empowerment, social capital, capacity, etc.) as concrete and collective objects that can be assessed and modified to achieve particular objectives. These characteristics are not the attributable to all individuals as they vary across groups and are co-determined by social structures, state support and institutional support. In approaching community capacity-building, there has to be a clear answer to questions such as who participates, what the participation is for, who defines the sectors of the community that participate, how decisions are made, and who is excluded from the decision-making process. In this section, I emphasize three dimensions of these questions: 1) power inequities among

community members, 2) hierarchical power structures within institutions and projects (top-down and bottom-up approaches), and 3) the interaction between state and civil society stakeholders as a social relationship.

***2.2.3.1 Approaching community capacity-building as a social relationship among heterogeneous groups with differential access to power.*** The contrast between different approaches to the concept of social capital can be illustrative of the importance of understanding community capacity as a social relationship in which the role of diverse groups with differential access to power needs to be clearly identified. The term ‘social capital’ has been commonly used in public health research to describe features such as networks, interpersonal trust, and norms of reciprocity (Kawachi, Kennedy, & Glass, 1999; Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997). This approach is mainly based on work by Robert Putnam (1993; 1995), who defines social capital as networks, norms and social trust that facilitate collective action for mutual benefit. To Putnam, social capital tends to have a collective focus. Social capital is an asset of a collective. High levels of trust and social cohesion tend to benefit the entire community. This is a different use of the term from the use that Bourdieu (1986) gives to the notion of social capital, defined by him as resources embedded in more or less institutionalized networks of mutual acquaintance and recognition. In effect, while according to Putnam, social capital is about collective values and societal integration, Bourdieu emphasizes actors engaged in struggles to achieve their interests (Siisiäinen, 2000). This difference has important implications for equity analysis. While Putman’s work has provided some interesting analysis on the cooperative social determinants of health, some authors ask for more attention to be paid to inequity and power (Sapag & Kawachi, 2007; Wakefield & Poland, 2005). A key question is the

extent to which power and inequities can be central to the analysis and not only “confounding variables” (Fine, 2001).

Community capacity-building strategies that aim to engage community members can have a double effect: while they favour the engagement of some community members in institutional structures, they also have the potential to exclude the most marginalized sectors of society. Peter Coyte and Dave Holmes (2006) discuss the extent to which health policies and initiatives whose goal is to benefit the entire population can lead to exclusion of marginalized groups. In one of their examples, an initiative promoted to increase engagement of community members in the decision-making process around health care could help to improve social welfare by integrating services to answer to needs of the community. However, patients who participate may also be the same patients that were initially more capable of adapting to institutional programs. Marginalized community members could be further excluded when their level of responsibility is increased by the terms institutional programs demand. They have more difficulties adapting. Coyte and Holmes suggest that this ambiguous result stresses the need for awareness about the effect that institutional policies may have on marginalized members of society in inequitable communities (Coyte & Holmes, 2006).

In some cases, community capacity-building initiatives can lead to increased inequities by favouring traditional elites. In Brazil, for example, a study about the impact of internationally funded non-governmental organizations (NGOs) on elections found that the NGOs played an ambiguous role. At a national level, NGOs opened some political channels by advocating about key issues affecting vulnerable communities. However, at a local level, local NGOs helped to strengthen existing elites who had higher access to the resources provided by the organizations (Brown, Brown, & Desposato, 2007). In another example, the work of Bourdieu was used to

analyze the extent to which local elites in Hong Kong used the participative efforts by government institutions to legitimate their power in the community. The elite's participation in the planning of local festivities provided an opportunity for their control of rituals and symbolic mechanisms that perpetuated their hegemony (Wong, 2007).

Furthermore, different segments of civil society may act in favour of or against marginalized community members (Santoro-Rocha, 2007). For instance, Labonte and Laverack (2008, p. 179) warn against xenophobic groups who can use community capacity-building efforts to further exclude newcomers and ethnic minorities. In the Indian state of Gujarat in 2002, efforts by right wing organizations to promote community development and political change, were used by community groups to justify the construction of physical fences that served as barriers preventing minorities from accessing their territory. The result was a polarized environment that led to violent confrontations (Jha, 2009).

Community capacity-building initiatives that aim to close gaps in health inequities, as is true in the case of the reduction of pesticide-related harm to vulnerable people in Quilloac and San Rafel, need utilize a critical approach, viewing community as a heterogeneous setting with power imbalances among different groups. This is central to better understanding the potential role that community organizations can play in reducing pesticide risks. In the final section of this chapter, I will describe Bourdieu's work as a powerful analytical tool for this purpose.

**3.2.3.2. Hierarchical power structures within institutions and projects: ‘top-down’ and ‘bottom-up’ approaches to community capacity.** Labonte, Laverack, Georgia Bell Woodard, and Karen Chad (2002) have introduced the notion of ‘parallel track’ to highlight the extent to which community capacity-building needs to integrate ‘top-down’ and ‘bottom-up’ approaches to development and project management (see also Braunack-Mayer & Louise, 2008 for a similar argument). The phrases ‘bottom-up’ and ‘top-down’ refer to differential power hierarchies in community and institutional settings. ‘Bottom-up’ is used to describe initiatives that emerge and are controlled by community members at a grassroots level. In contrast, ‘top-down’ approaches, traditional to some health prevention programs, aim to engage community members in goals and activities defined by institutions or professionals. In practice, stakeholders in institutions, projects and programs are subject to tensions between ‘top-down’ and ‘bottom-up’ approaches which have to be acknowledged and explicitly addressed in order to avoid problems in the implementation of initiatives. For example, according to Danny MacKinnon (2002), decentralized rural development projects led by the state in Scotland created limited empowerment of local communities. One of the main reasons for this was the limited decision-making capacity of grassroots initiatives because the institutions’ direction and financial goals were previously defined by the neo-liberal policies of state agents (MacKinnon, 2002).

Any possibility for synthesizing ‘top-down’ and ‘bottom-up’ approaches to health promotion requires not only an explicit framework of collaboration that identifies different interests but also a change in traditional perspectives of institutional engagement (Laverack & Labonte, 2000). In public health, state-driven activities are fundamental for health promotion and well-being (Raphael et al., 2001). However, there has to be a clear disclosure of institutional and stakeholders’ interests. This disclosure, which is not easy to reach, must be accompanied by a clear assessment of political, social, and economic inequities and their driving forces.

The need to acknowledge ideological differences in community participation has been highlighted in the literature of health sciences and community development (Fraser, 2005). This issue becomes more important in inequitable societies, such as most countries in Latin America. Concerned with some uncritical health participation literature from the mid-1980's, and triggered by progressive approaches to public health such as the Alma Ata declaration for Primary Health Care, Antonio Ugalde (1985) reviewed evidence from several decades of community development projects in rural areas in Latin America. His review showed that rural development projects had commonly adopted a participative approach that tended to see community member involvement in utilitarian terms. This meant that the community members were usually called on for activities such as volunteer work, excluding their engagement in the decision-making process and the control of resources. Nonetheless, these projects usually had very high expectations regarding the community's role. This approach contributed to the failure of community participation initiatives in most cases. In more inequitable societies, community engagement usually started with enthusiasm but rapidly became inaction. Moreover, the outcome often generated violence. When community members, empowered by the process, started to demand a reduction of inequities, projects and local elites retracted promises, generating violence among the groups (Ugalde, 1985). Ugalde (1985) argues that the symbolic use of community participation by international development agencies had the intention of legitimizing poor quality services and the authoritarian regimes that supported them.

According to Ugalde (1985), health institutions should not always encourage community participation. Community engagement should not be used by government or institutions to suit their interest. Its effectiveness is limited to some scenarios where equitable distribution of resources exists (Ugalde, 1985). This is a cautionary note to highlight the necessity of an awareness of hierarchical structures and mechanisms in programs, projects and institutions to

promote health. This understanding is fundamental for providing a critical basis to choose ‘top-down’ or ‘bottom-up’ as best favours particular goals for reducing health inequities (Braunack-Mayer & Louise, 2008; Laverack & Labonte, 2000).

#### ***2.2.3.3. Understanding the role of civil society and the state stakeholders as social players.***

The state–civil society conceptual division allows for insight into some relationships, but blurs other interactions. Claire Mercer (2002) points out that there is an important ideological tendency in the literature to emphasize the affirmative role of civil society and NGOs in democracy. This vision, which is based on a liberal perspective, assumes that 1) the democratic process is strengthened by civil society, 2) NGO’s and associations are part of civil society, and 3) NGOs strengthen civil society (Mercer, 2002). While this perspective has allowed for the recognition of the potential for change by societal elements different from the state,, it overlooks the existence of strategic alliances between state sectors and non-state sectors. In general, it oversimplifies the complexities of both the state and civil society. For instance, any state has different levels playing diverse roles for democracy. Some levels of the state may be used by different groups in civil society to defend their privileges. Overemphasizing the role of civil society in democracy (as opposed to the state) could lead to overlook power mechanisms that are a part of any society (Fine, 2001; Fontana, 2006).

Civil society and state are both a political arena in which social groups struggle to gain control for advancing their particular interests. This is fundamental for granting some marginalized communities’ rights. Discussing the case of indigenous and peasant movements in Latin America, Gerardo Otero challenges some scholars’ argument that there has been, in recent decades, a loss of relevance of the nation-state as a setting for struggles in favour of subordinated

communities. Otero argues that despite the fact that the nation-state is fundamental for defending the interests of dominant sectors of society, vulnerable communities that are able to establish local political pressure are capable of influencing domestic public policies (Otero, 2004). Resistance to the adverse health effects of globalization may take place in both state and non-state scenarios (Spiegel & Andruske, 2005).

In summary, despite the great potential for positive change that has been acknowledged by some scholars and institutions, the notion of ‘community capacity-building’ is problematic. The lack of clarity about the definition makes it difficult to use the term for action, research, or evaluation. In this chapter, I have turned to scholars who have defined community capacity-building as a social relationship which is embedded in social context, in order to highlight some of the challenges to better understanding the role of small farmers and their organizations in reducing pesticide risks in Quilloac and San Rafael. Central issues of importance when approaching pesticide-related risks from an environmental health equity perspective are 1) understanding human behaviour and agency as co-determined by social structure, 2) locating community capacity-building in multiple layers of interdependent international, national, regional and local contexts, and 3) developing a critical approach to power differences across different groups in a particular setting. In general, community capacity-building approaches in research or action need to explicitly address these issues while understanding the limitations of any particular approach.

### **2.3. An approach to community capacity-building**

No particular approach to community capacity-building addresses all of the challenges discussed above. Moreover, any particular study or project may require specific questions according to its goal and circumstances. In my work, I focus on certain issues. First, small farmers in the communities of study are vulnerable to structural problems such as poverty, which affect their capacity for change (see Chapters 1 and 4). Second, a strong indigenous tradition of farmers in my area of study shapes their relationship with the environment, their organizations, and their interaction with other members of society. Thus, small farmers' practices and perceptions are fundamental for understanding their potential to reduce pesticide-related harm. Third, my area of study has an impressively high density of institutions and organizations interested in transformations in agricultural practices. Better understanding differential access to social resources among diverse community and state stakeholders may be important for overcoming the limitations of the Green Revolution in these communities.<sup>24</sup> Fourth, the Ecuadorian indigenous movement has gained political visibility in the past two decades, and the national state is one of the political arenas in which they have fought to promote better conditions for their peoples (Otero, 2004). Hence, state-civil society relationships could be fundamental for harnessing community capacity for local change. Here, I am going to describe my attempt to approach the notion of community capacity so that some of these issues are addressed. In doing so, I will mainly draw upon Bourdieu's (1980a; 1986) approach to the forms of capital. Bourdieu's work has been used by several authors in health disciplines (Buzzelli, 2007; Carpiano, 2006; Veenstra, 2007; Ziersch, Baum, Macdougall, & Putland, 2005). I argue

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<sup>24</sup> The Green Revolution is a process of technical improvement of agricultural production that started in the 1950's (see Chapter 1). The improvement was based on the use of genetic engineering, chemical substances such as pesticides and fertilizers, and other related technology. However, in spite of important benefits for increasing

that his sociology can help to better understand the extent to which community capacity can be harnessed to promote safer agricultural production among small farmers.

The work by Bourdieu (1980a; 1986) offers some advantages for my objectives. First, his work provides a refined framework for approaching human agency and social structure simultaneously. Second, Bourdieu places equity and power issues at the centre by utilizing a multidimensional approach to the distribution of cultural, economic and social resources. Bourdieu assumes cultural, social and economic capital as relatively limited assets, the objects of constant struggles to control by social groups in a particular context. By mapping community stakeholders' differential access to social resources, I aim to map differential barriers and opportunities by social players.

One of the most powerful advantages of applying Bourdieu's work to community capacity-building is its potential to reconcile approaches based on human agency ('subjectivism') and approaches focused on society's structural conditions ('objectivism') (Bourdieu, 1990, pp. 29-51). An illustration of Bourdieu's effort to bridge objectivism and subjectivism is in his perspective on the extent to which culture and ideology can help to reinforce social inequities. Groups of people who occupy a particular position in society can be culturally labelled, making their differences appear self-evident (Bourdieu, 1993, p. 159). A minority group's identity is part of both its objective and perceived differences. Discrimination is explained by a group's position in a social structure, but reinforced by a shared perception of their place in society. Ideology and reality are co-determined. An example of this approach in health disciplines is provided by Judith Lynam and Sarah Cowley (2007). Following Bourdieu's perspective, they studied the process of marginalization of first-generation immigrant daughters and their mothers

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agricultural production, the Green Revolution has had negative environmental results. Furthermore, its benefits for

in the United Kingdom and Canada, and the extent to which this marginalization constitutes a social determinant of health. Marginalization occurred at two levels: as an actual exclusion from access to resources and opportunities, and as a discourse that undervalued the immigrant women's potential. This discourse had the capacity to justify and reinforce marginalization for the women. It also justified the perception of the person in power (Lynam & Cowley, 2007).

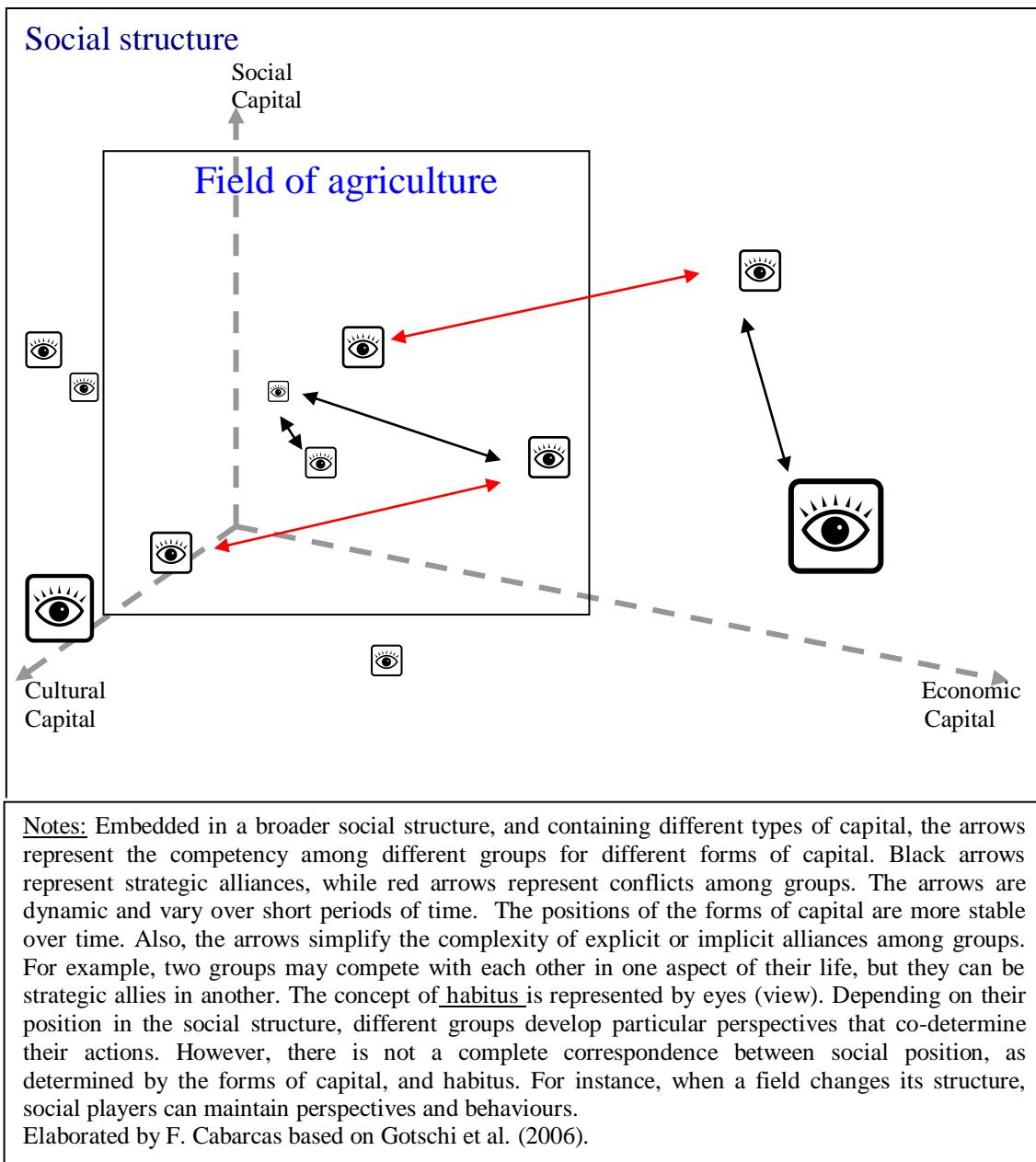
The concepts of 'field' and 'habitus' are central to better understanding the interconnection between subjective and objective realities, and hence agency and structure. For Bourdieu (1980a; 1986), a field is a system of relationships constituted by social agents related to the production and promotion of a particular product (e.g., a social product such as education or agriculture). A field is constituted by two elements: the existence of a common capital and the struggle for its appropriation by different social players (Bourdieu, 1980a, 1986).<sup>25</sup> Any field is co-determined by a broader social structure that shapes its organization, even though its internal dynamics are partially autonomous. Educational institutions are illustrative of a field that Bourdieu studied. Knowledge is a form of capital that faculty members aim to control. It is relatively autonomous since scholars' internal discussions determine most of the knowledge production. However, there is also a connection to a broader social structure that determines, for example, the social class represented in the faculty (Bourdieu, 2003, p. 284). Figure 2.1 shows a very simplified and schematic representation in the field of agriculture. Embedded in a broader social structure, and containing different types of capital, the arrows represent the competition between groups to control different forms of capital.

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improving the quality of life of farmers are not clear (Evenson & Gollin, 2003).

<sup>25</sup> For Bourdieu (1986), there are different types of capital in a particular field. I will discuss this below.

**Figure 2.1: Schematic representation of field and habitus**



Co-determined by the field, the dispositions adopted by individuals are called the habitus. To Bourdieu, “The habitus is a set of dispositions, reflexes, and forms of behaviour that people acquire through acting in society” (Bourdieu, 1980a). Habitus is considered the basis of perceptions and principles that generate practices. It is learned according to people’s position in society. It also helps to reproduce society’s structure (Bourdieu, 1980a, 1980b, 1986). In Figure 2.1, habitus is represented by the eye (perspective) that individuals and groups have according to their position in society. Consequently, it is usually similar within social classes or groups that share a position in the social structure. However, habitus is not the simple reflection of social structure. For instance, when a field changes its structure, social players could maintain their perspectives and behaviors. The habitus is highly related to the process of marginalization described above since it defines the limits of possibility, according to the individual’s perspective. Being the basis of social action (practice), habitus contributes to domination or resistance (Bourdieu, 1990, 1999). For instance, first nations’ learned forms of resistance allowed their survival through very difficult situations. The formation of the habitus is not a passive act. On the contrary, it is constituted by a constant struggle by individuals and groups to redefine their reality on their own terms. As Bourdieu says, “The construction of social reality is carried out in and through the innumerable antagonistic acts of construction that agents perform, at every moment, in their individual or collective, spontaneous or organized struggles to impose the representation of the social world that best corresponds to their interest” (Bourdieu, 2008, pp. 193-194).

A study in rural France by Bourdieu (2008) is illustrative of the extent to which the concepts of field and habitus can contribute to overcoming the tension between objectivism and subjectivism. The study describes a process of change during the 1960’s and 1970’s in a

traditional rural community. This process led to changes in marriage and migratory strategies. Traditionally, marriage was determined by the need to maintain the land property. The first-born sons of families with land had the right to inherit the land. As a consequence, they also had the best chances for marrying the best women (who had a dowry saved by their families to offer to the husband at marriage). In this scenario, a field of agricultural production was defined by elements such as the size of the farm (economic capital) and age (the cultural value associated to it) among other aspects. The traditional habitus defined survival strategies focused on agricultural production. Marriage was a practice centered on the protection of land as a resource. Age and land tenure were categories of status.

Nonetheless, the structure of the field changed due to factors such as rapid urbanization, better roads and a transformation in rural production that challenged traditional agriculture in favour of modern techniques and more competitive markets. These types of changes generated a symbolic transformation within the field. The symbolic value of land and age decreased in favour of urban cultural elements. This also generated a change in perceptions and behaviours. Young women, for instance, started to marry urban bachelors and to emigrate. Factors such as land tenure and age that in the traditional field favoured a ‘good’ marriage were associated with celibacy and low status in the new field of unified urban-rural spaces. Many elder sons resisted changes in the field and defended the values associated to their traditions. However, changes in habitus also generated transformations of the social structure. Migrant women and men started to become an important source of income for rural families (Bourdieu, 2008). It is important to point out that this transformation of the field operated at both objective and subjective levels:

“The unification of the social field, of which the unification of the symbolic goods market, and therefore of the matrimonial market, is one aspect, takes place both in objectivity – under the effect of a whole set of factors as different as the increased access to a form of secondary education, etc. – and in representations. One would be tempted to say that it takes place in objectivity – leading to phenomena of differential elimination, of

which the non-marriage of the heirs is the most significant example – only because it takes place in and through the subjectivity of the agents who grant a recognition that is at once extorted and accepted to processes oriented towards their own submission” (Bourdieu, 2008, p. 173).

In addition to offering conceptual alternatives to reconciling objective and subjective approaches to community capacity, Bourdieu views social inequities as a central issue. I have already described some examples above about the extent to which his approach has been used to analyze marginalization as a social determinant of health (Lynam & Cowley, 2007). Equally important, adapting Bourdieu’s perspective on community capacity-building makes it possible to examine the distribution of capital in both objective and subjective terms. Capital, in general, is accumulated labour, which can be expressed in objects. When appropriated by groups or individuals, capital can harness social energy for specific objectives. Individuals and groups are in constant competition to control sources of capital (Bourdieu, 1986). In Figure 2.1, the arrows represent conflict or strategic alliances among groups for either moving up or maintaining a position in the social structure.

Cultural capital refers to forms of knowledge, including skills and education. As another form of capital, it provides benefits to a group or person according to their position in society. Habitus, as a socially constructed knowledge, is very important for the reproduction of cultural capital. There are also different types of cultural capital: 1) embodied state, referring to people’s knowledge and skills, 2) cultural goods, which include material objects such as pieces of art with symbolic value, and 3) institutionalized capital, including credentials and recognized qualifications (Bourdieu, 1986). It is fundamental to understand that, as with economic capital, social groups can harness cultural capital as social energy for specific objectives. As such, in terms of community capacity-building, it can have positive or negative results. For instance, training of farmers can contribute to improving productivity and implementing safer forms of

production. However, particular groups of farmers can also monopolize cultural capital to achieve gains in the social structure represented in Chart 1. In this scenario, cultural capital has the potential to increase inequities, and prevent social change. In effect, cultural capital has been used as an instrument to identify health inequities. Gerry Veenstra (2007), for example, used a matrix combining economic and cultural capital to assess health inequities in the province of British Columbia, Canada. This study provided a more complete map of the social structure of the province with respect to health inequalities (Veenstra, 2007).

Social capital is another distinctive form of capital. It is defined by Bourdieu (1986) as resources embedded in more or less institutionalized networks of mutual acquaintance and recognition. Because, in this perspective, social capital is used by groups or individuals according to their interests, its analysis is important to better understand the reproduction of social inequities.<sup>26</sup> There are several reasons for this. First, social capital focuses on resources and their access by means of networks and groups. Second, as with other forms of capital, it represents a method of potential community transformation that can be used by groups to serve their particular interest. Therefore, it can lead to positive or negative results according to the distribution and use of available resources. Third, by assuming that groups protect their interest and use resources for making gains in social structure, the notion of social capital provides some elements to better understand power structures within a community (Carpiano, 2006; Siisiäinen, 2000; Ziersch et al., 2005). For example, in a study using Bourdieu's approach, for assessing health implications of social capital in some Adelaide, Australia neighbourhoods, Ziersch et al. (2005) found that some aspects of social capital, such as civil action, did not show any association with health status. In general, the authors determined that social capital had some

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<sup>26</sup> As discussed above, it is necessary to point out that this definition of social capital is different from the definition by Robert Putnam (1993; 1995), who defines social capital as networks, norms and social trust that facilitates collective action for mutual benefit..

positive effects for mental health. However, as a resource, it was unequally distributed among community members.

There are two characteristics of forms of capital that are necessary to point out. First, all forms of capital are symbolic. This means that social groups and individuals perceive their social relationships as justified according to their vision of a society's structure. In addition, people do not have a complete perspective of the power networks in which they are embedded (Bourdieu, 1986). In Figure 2.1, for instance, by mapping all three axes, we can obtain a more complete picture of social structures. However, the particular position of a group or individual is the product of social relationships in this particular society. Some of them are indicated by arrows. Second, all forms of capital can be transformed into other forms. For instance, education credentials or social status can favour the acquisition of economic capital (Bourdieu, 1993, pp. 166-178).

Applying Bourdieu's concepts about forms of capital has some important implications for the tension between 'top-down' and 'bottom-up' approaches to community capacity-building. First of all, a community with homogenous distribution of resources and capacity would be very difficult to find. Even when community members or organizations promote action (bottom-up), there is a need to question society's structure, marginalization, and distribution of forms of capital. Hence, there is a need to consider a 'top-down' component to any intervention or research. This is important when there is institutional involvement since any organization is a field by itself or part of a field. 'Top-down' approaches to community capacity-building are inevitable and always present. Furthermore, as part of an elite, leaders of organizations and external groups can have access to resources or perspectives that members of marginalized

communities do not have access to. This is due to their position in society. However, there has to be a constant examination of their interests, resources, capital, and marginalization.

Regarding civil society and state, both are also part of a field. Civil society and state stakeholders have access to different types of resources and are instruments of power and marginalization. According to Martti Siisiäinen (2000), Bourdieu's position regarding the concept of state is ambiguous. First, in some of his earlier works, the state is described as a super-force for symbolic violence and domination. Second, he acknowledges ambiguity (as has been mentioned above) because the state can be a guarantor of social rights and a promoter of change (Siisiäinen, 2000). I believe that both views of the state are true. Particular care needs to be taken in analyzing the potential for community capacity-building. In recent decades some of the resistance movement to neo-liberal policies led by different groups have turned to levels of the state as guarantors of rights (Otero, 2004; Rizvi, 2005; Spiegel & Andruske, 2005). Moreover, state regulation and direct support have been fundamental, when in existence, for promoting developmental projects for agricultural production, and welfare systems for marginalized communities.

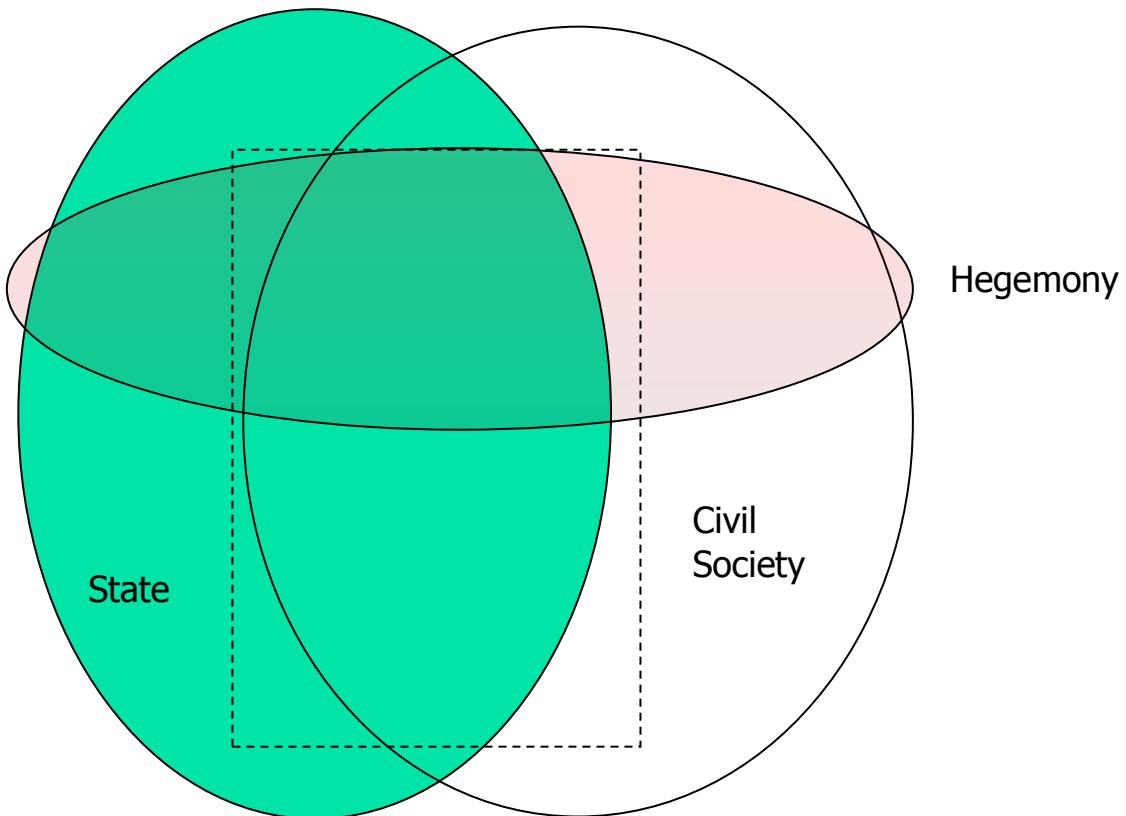
While the state may be a particular type of player in the field of agriculture, its different layers and roles need to be studied. My preferred approach is shown in Figure 2.2. The divide between civil society and state in part of the literature on community capacity-building is a contested issue. For example, based on the work by Antonio Gramsci, Benedetto Fontana (2006) mentions that civil society has the following characteristics: 1) it includes political and economical struggles (not harmonic or homogenous), 2) it exerts hegemony, which is a process of domination in which some groups have intellectual and moral leadership over others

(Fontana, 2006),<sup>27</sup> and 3) It forms part of the state. In effect, some authors such as Ben Fine (2001) and Claire Mercer (2002) have suggested that the whole notion of a separation between civil society and the state is misleading and only supported on the grounds of a liberal ideology. I agree that there is no sharp division between civil society and state institutions. For example, ‘civil society’ members can have connections and influence government decisions at different levels. The opposite is also plausible. There is an ample area of intersection between state and civil society. Some of the group alliances and competitions shown in Figure 2.1 are part of the intersection area shown in Figure 2.2, as represented by the dotted square. I also agree with the notion that the action of dominant groups in a particular society can occur either at state or civil society levels. Resistance also occurs at both levels (Santoro-Rocha, 2007). As a result, state institutions, and groups within the state, also need to be analyzed in terms of their position in a particular field. However, contrary to the notion that civil society is contained in the state, I think that it is important to maintain the possibility of differentiating between these groups. Some state institutions can turn to resources and power mechanisms that may not be available for other sectors of society. The possibility of a conceptual distinction between state and civil society may be important for countries where the state’s role has been weak, and where marginalized groups struggle for a more important role in the state regarding issues of social justice.

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<sup>27</sup> Hegemony is a process of political, economic and cultural domination in which some groups have intellectual and moral leadership over others. The use of cultural and moral instruments reduces the need for coercion or physical violence to a minority of cases (Fontana, 2006).

**Figure 2.2 Relationship between civil society and state**



Notes: The dotted square represents the area of figure 2.1.  
Elaborated by F. Cabarcas, based on Fontana (2006) and Mercer (2002)

In summary, I believe that using P. Bourdieu's approach to the forms of capital can help to overcome some of the problematic issues that have been discussed in this document regarding the notion of 'community capacity-building'. Pierre Bourdieu's approach can contribute to further develop efforts that define community capacity-building as a social relationship, which is embedded in social context (Labonte & Laverack, 2001a, 2001b; Labonte & Laverack, 2008). The main reason for his positive contribution is that he offers a bridge between objectivist and subjectivist approaches to social sciences. The result is a powerful conceptual tool for mapping the complexity of social structures for a particular field in a given community, and the extent to which, influenced by their position in society, different players aim to control available resources, and therefore, empower. This is appropriate for better understanding the extent to which small farmers can play a role in developing sustainable action for reducing pesticide-related harm, while identifying some structural constraints that require other people's main responsibility.

The emphasis is on different forms of capital and the extent to which different groups and individuals, based on their perceptions, build strategies for accessing resources. This focus makes P. Bourdieu's view very suitable for understanding determinants of health inequities. For communities facing long-term inequities such as the farming communities of my interest, it is important to identify the social dynamics that reinforce inequities and the role different social players have had in reproducing them. Developing a sustainable alternative to reduce pesticide-related harm for small farmers, who are marginalized members of society, will require a mobilization of different types of resources and groups of people. Better understanding the extent to which different forms of capital can be accessed and used by different groups in scenarios such as the state, civil society, and their vast intersection, is fundamental for

developing a feasible alternative for harnessing community capacity for a healthier and environmentally friendly agriculture. Chapter 5 provides a description of my operationalization of this approach.

## **Chapter 3: Review of pesticide use and health**

In this chapter, I will summarize some of the health and environmental concerns related to pesticide use in agriculture (with focus on the most frequent substances in the communities of interest). I state that, while pesticides are a valuable resource for farmers, they pose important known risks for humans and the environment. Efforts should be made to reduce associated risk by a transition to less intensive pesticide agricultural practices or by promoting proper use of toxic substances. I will describe some common practices for the reduction of pesticide-related harm in farming. My focus is on community level interventions and highlights some of the challenges for their development. While the objectives of this chapter are descriptive, the range of difficulties identified is suggestive of the need to accompany community level interventions with regional, national and international action. Some arguments will be developed in subsequent chapters.

### **3.1 Pesticides, human health and the environment**

The term ‘pesticide’ is used to denote a variety of substances and agents that are used in human activities, such as agriculture or animal production, to control undesirable biological agents, denominated ‘pests’ (fungi, plants, or insects) (Ecobichon, 2001). In this project, I focused on chemical substances and their toxicological effects. The vast range of chemical types used in agriculture as pesticides makes it difficult to summarize their effects on human health. For a general approach, the World Health Organization classifies pesticides into five classes according to their acute toxicity: Ia - Extremely Hazardous, Ib - Highly Hazardous, II -

Moderately Hazardous, III - Slightly Hazardous, and U - Unlikely to Present Acute Hazard (WHO, 2010).

Although this classification is an initial point of reference, there are some critical considerations to be made. First, the classification is primarily based on acute toxicity (Lethal Dose 50- LD50).<sup>28</sup> Chronic effects may not be adequately reflected. This is particularly relevant since chronic pesticide health effects can differ from acute problems. Pesticide doses that trigger acute health problems may also be different from the doses that originate chronic diseases. Chronic problems can appear after repeated low to moderate exposure for a long period of time, or long after a single high-level dose (Ecobichon, 2001: 767). Second, an environmental degradation product or metabolite of some substances may be more toxic and stable than the original substance. A particularly relevant example is the pesticide mancozeb, frequently used as fungicide in the communities of study. mancozeb is classified as U (Unlikely to Present Acute Hazard). However, mancozeb is transformed in the environment and human body into ethylenethiourea (ETU), a highly toxic substance identified as a potential carcinogen to the thyroid gland (NTP, 2005).<sup>29</sup> Third, the World Health Organization classification is based on expected regular use of the substances. Common events such as accidental poisoning, use with higher doses or inappropriate use with other substances can increase the potential risk of any pesticide. Improper use of pesticides is more frequent in developing countries (Kesavachandran et al., 2009).

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<sup>28</sup> Lethal Dose (LD50) is an indicator of toxicity that estimates the dose in which fifty percent of subjects in a population (usually rats in laboratory) are killed in experimental conditions. Human doses are usually calculated based on theoretical safety algorithms. Lethal doses are gross indicators of toxicity that are frequently used, and are helpful for comparing pesticides. However, this measure also has a number of limitations. First, health problems may appear well below the LD50. In this case, other indicators such as the NOAEL (no-observable-adverse-effect-level) or the LOAEL (lowest-observed-adverse-effect-level) are more appropriate as they identify the lowest doses for non-lethal effects of pesticides.

<sup>29</sup> Details on both substances are included in Table 3.1.

Health effects from pesticides can be underestimated for several reasons. First, many symptoms, such as headache and dizziness, are unspecific and can be attributed to other causes such as seasonal flu or alcohol consumption. Second, some of the potential effects of chronic exposure appear decades later. This makes it difficult to establish a clear association between health outcomes and the chemical hazard (WHO/UNEP, 2006). Third, experimental analyses are usually conducted in animals to avoid harm to human subjects. The susceptibility of different species can vary. Fourth, human exposure in real life conditions is difficult to assess. Assessment of occupational exposure usually entails the analysis of all activities (e.g., purchase and transport, storage, preparation, application, post-application activities, use of protective equipment, hygiene practices, etc.). An adequate assessment should also consider all paths of exposure (dermal, oral, and respiratory) (Arcury et al., 2006; McCauley et al., 2006).

Table 3.1 shows details on acute and chronic health effects for the most common substances used in the communities of study. The risk of pesticide-related effects on health is a function of the toxicity of the pesticide and the dose (or exposure). Common routes of human exposure are oral intake, dermal contact and inhalation. Table 3.1 also shows lethal doses of oral and dermal intake for acute pesticide poisoning. Dermal contact is the most frequent occupational route to pesticide exposure. Forearms and hands are the most common areas of contact (Ecobichon, 2001: 767-768; O'Malley, 2007). Further, Table 3.1 shows vapour pressure as one of the indicators of the volatility of a substance, which partially determines the likelihood of human inhalation.

In addition to health outcomes listed in Table 3.1, other potential effects have been identified by numerous studies. For instance, organophosphate compounds<sup>30</sup> have been consistently reported

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<sup>30</sup> Current insecticides usually act by affecting the neurological system of pests. For instance, organophosphates (such as methamidophos and profenofos in Table 3.1) and carbamate compounds (carbofuran in Table 3.1) inhibit

to produce chronic problems in the nervous system, such as alterations of peripheral sensibility, and loss of memory, coordination and concentration (Costa, 2006; London, 2009; Lucchini & Zimmerman, 2009). Another example is the growing attention to potential mental health effects that organophosphate pesticides can generate. Organophosphate compounds have also been associated with higher rates of depression, a mental health problem that is usually underreported (Beseler & Stallones, 2003; Beseler et al., 2008; Genuis, 2008; Stallones, 2006; Stallones & Beseler, 2002).

Some populations are more susceptible to pesticide harm than average. In particular, pesticides are more dangerous to children for several reasons. First, they are exposed to a higher dose per kilogram of toxic substances. Second, children's skin absorption can be higher than in adults. Third, some of their internal organs do not metabolize toxic substances as efficiently as they will in adulthood. Fourth, children have more chances of accidental intoxication due to their play activities (OCFP, 2004: 167-171).

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the acetyl-cholinesterase, a important enzyme in the human peripheral and central system and blood (Ecobichon, 2001).

**Table 3.1 Summary of literature on known health effects of common pesticides used in Quilloac and San Rafael, 2007**

Pesticide / Chemical Type (Use)	WHO Class*	LD50 (mg/kg) † and Vapour Pressure (mPa)	Acute Health Effects	Chronic Health Effects
Mancozeb / Ethylene-bis-dithiocarbamate (Fungicide)  Production of ethylenethiourea (ETU) (Panganiban et al., 2004; Steenland et al., 1997)	U	<ul style="list-style-type: none"> <li>• <b>LD50 Oral:</b> &gt;8000 (WHO, 2010)</li> <li>• <b>LD50 Dermal:</b> &gt; 10000 (EXTOXNET, 1996)</li> <li>• <b>Vapour Pressure:</b> 1.33 (Xu, 2000b)</li> <li>• <b>LD50 Oral ETU:</b> 1832 (CCOHS, 2004; DHHS, 1993)</li> </ul>	<ul style="list-style-type: none"> <li>• Irritant to skin (EXTOXNET, 1996; WHO, 2010)</li> <li>• <b>ETU:</b> Irritant to skin and/or eyes (OSHA &amp; EPA)</li> </ul>	<ul style="list-style-type: none"> <li>• Potential thyroidal dysfunction (EXTOXNET, 1996; Panganiban et al., 2004; Steenland et al., 1997)</li> <li>• <b>ETU:</b> Carcinogenic for thyroids (proven in animals- anticipated to be carcinogenic in humans) (IARC, 2001; NTP, 2005)</li> </ul>
Profenofos / Organophosphorus compound (Insecticide)	II	<ul style="list-style-type: none"> <li>• <b>LD50 Oral:</b> 358 (WHO, 2010)</li> <li>• <b>LD50 Dermal:</b> 1610 (CCOHS, 2004)</li> <li>• <b>Vapour Pressure:</b> 2.53 (AERU, 2010e)</li> </ul>	<ul style="list-style-type: none"> <li>• Cholinesterase inhibition in blood and brain (EPA, 2000)</li> <li>• Potential symptoms: skin irritation, increased secretions, bronchoconstriction, miosis, gastrointestinal cramps, diarrhea, urination, bradycardia, causing tachycardia, hypertension, muscle fasciculation, tremors, muscle weakness, emotional changes, ataxia, mental confusion, loss of memory, generalized weakness, convulsion, cyanosis, coma and death in high doses (AERU, 2010d; Ecobichon, 2001; EPA, 2000)</li> </ul>	<ul style="list-style-type: none"> <li>• Neurotoxicant (AERU, 2010d)</li> <li>• Potential of persistent neurological symptoms after single very high dose or repeated high doses (O'Malley, 2007)</li> </ul>
Carbofuran / Carbamate (insecticide)	Ib	<ul style="list-style-type: none"> <li>• <b>LD50 Oral:</b> 8 (WHO, 2010)</li> <li>• <b>LD50 Dermal:</b> 120 (CCOHS, 2004)</li> <li>• <b>Vapour Pressure:</b> 1.11 (low) (Evert, 2002)</li> </ul>	<ul style="list-style-type: none"> <li>• Cholinesterase inhibition in blood and brain (AERU, 2010a; EXTOXNET, 1996)</li> <li>• Potential symptoms: nausea, vomiting, abdominal cramps, sweating, diarrhea, excessive salivation, weakness, imbalance, blurring of vision, breathing difficulty, increased blood pressure, and incontinence (AERU, 2010a; EXTOXNET, 1996)</li> <li>• Death through oral, dermal and respiratory pathways (AERU, 2010a), potential nervous system malfunction (AERU, 2010a; EXTOXNET, 1996) and respiratory failure (EXTOXNET, 1996)</li> </ul>	<ul style="list-style-type: none"> <li>• Potential testicular degeneration (AERU, 2010a)</li> <li>• Potential of persistent neurological symptoms after single very high dose or repeated high doses (O'Malley, 2007: 543-544)</li> </ul>

**Table 3.1 Summary of literature on known health effects of common pesticides used in Quilloac and San Rafael, 2007**

Pesticide / Chemical Type (Use)	WHO Class*	LD50 (mg/kg) † and Vapour Pressure (mPa)	Acute Health Effects	Chronic Health Effects
$\lambda$ - Cyhalothrin / Pyrethroid (Insecticide)	II	<ul style="list-style-type: none"> <li>• <b>LD50 Oral:</b> 56-144 (variable) (CCOHS, 2004; WHO, 2010)</li> <li>• <b>LD50 Dermal:</b> 632 (CCOHS, 2004)</li> <li>• <b>Vapour Pressure:</b> 0.0002 (AERU, 2010b)</li> </ul>	<ul style="list-style-type: none"> <li>• Irritatant to skin, tingling, prickling and burning sensations (face in particular) (EPA &amp; OSU, 2001)</li> <li>• Dizziness, headache, nausea, anorexia, and fatigue, seizures and coma may occur (EPA &amp; OSU, 2001)</li> <li>• Respiratory track irritant (AERU, 2010b)</li> <li>• Affects nervous system by disrupting sodium channels (EPA &amp; OSU, 2001)</li> </ul>	<ul style="list-style-type: none"> <li>• Not likely to be carcinogenic (EPA &amp; OSU, 2001)</li> </ul>
Sulfuramid / Sulfonamide (Insecticide-inhibitor of insect energy production) (AERU, 2010g)	II	<ul style="list-style-type: none"> <li>• <b>LD50 Oral:</b> 543 (WHO, 2010)</li> <li>• <b>LD50 Dermal:</b> &gt; 2000 in rabbits (AERU, 2010g; EPA, 1989)</li> <li>• <b>Vapour Pressure:</b> 0.057 (AERU, 2010g)</li> </ul>	<ul style="list-style-type: none"> <li>• Low acute toxicity (EPA, 2001)</li> <li>• Not known (AERU, 2010g)</li> </ul>	<ul style="list-style-type: none"> <li>• Not longer approved for pesticide use in the United States for health concerns: potential reproductive and developmental effects (EPA, 2008b)</li> <li>• Potential of bioaccumulation of toxic metabolites (perfluorooctanesulfonate) in humans and animals (EPA, 2001, 2008b)</li> </ul>
Terbutylazine / Triazine derivative (Herbicide-inhibitor of photosynthesis.)	III	<ul style="list-style-type: none"> <li>• <b>LD50 Oral:</b> 2160 (WHO, 2010)</li> <li>• <b>LD50 Dermal:</b> &gt; 2000 (AERU, 2010h)</li> <li>• <b>Vapour Pressure:</b> 0.15 (AERU, 2010h)</li> </ul>	<ul style="list-style-type: none"> <li>• Potential symptoms: sedation, dyspnoea, diarrhea, and tremors (WHO, 2003)</li> <li>• Eye and respiratory tract irritant (AERU, 2010h)</li> <li>• Transitory reduced blood cell production in some animal studies (WHO, 2003)</li> <li>• Potentially lethal if inhaled (AERU, 2010h)</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for decreasing body weight (CCOHS, 2004; EPA, 1995)</li> </ul>
Methamidophos / Organophosphorus compound (Insecticide)	Ib	<ul style="list-style-type: none"> <li>• <b>LD50 Oral:</b> 30 (WHO, 2010)</li> <li>• <b>LD50 Dermal:</b> 69 in rabbits (AERU, 2010c)</li> <li>• <b>Vapour Pressure:</b> 2.3 (AERU, 2010c; FAO &amp; WHO, 2003)</li> </ul>	<ul style="list-style-type: none"> <li>• Acetyl-cholinesterase (AChE) inhibitor (EPA, 2006)</li> <li>• Potential symptoms: skin irritation, increased secretions, bronchoconstriction, miosis, gastrointestinal cramps, diarrhea, urination, bradycardia, causing tachycardia, hypertension, muscle fasciculation, tremors, muscle weakness, emotional changes, ataxia, mental confusion, loss of memory, generalized weakness, convulsion, cyanosis, coma (Ecobichon, 2001)</li> </ul>	<ul style="list-style-type: none"> <li>• Toxic to neurological system (AERU, 2010c)</li> <li>• Delayed peripheral neuropathy in humans (EPA, 2006:13)</li> <li>• Potential of persistent neurological symptoms after single very high dose or repeated high doses (O'Malley, 2007)</li> </ul>

**Table 3.1 Summary of literature on known health effects of common pesticides used in Quilloac and San Rafael, 2007**

Pesticide / Chemical Type (Use)	WHO Class*	LD50 (mg/kg) † and Vapour Pressure (mPa)	Acute Health Effects	Chronic Health Effects
Propineb / Dithiocarbamate (Herbicide)	U	<ul style="list-style-type: none"> <li>• LD50 Oral: 8500 (WHO, 2010)</li> <li>• LD50 Dermal: &gt; 5000 (AERU, 2010f)</li> <li>• Vapour Pressure: 0.16 (AERU, 2010f)</li> </ul>	<ul style="list-style-type: none"> <li>• May damage lungs or cause muscular problems (AERU, 2010f)</li> </ul>	<ul style="list-style-type: none"> <li>• Primarily distributes via the thyroid gland without known carcinogenic effects (AERU, 2010f)</li> </ul>

Notes: Pesticides are listed according to their frequency of use in the communities of Quilloac and San Rafael, according to the Household Survey (see Chapter 6). The list is consistent with data from the census of vendors conducted by Rafael Alulema (2008). Warehouses were asked for their five most common products. The results showed that mancozeb was reported by 85% of the vendors, profenofos by 60%, carbofuran by 45%, propineb by 40% and cyhalothrin by 35% (Alulema, 2008).

\*Toxicity classification: Ia - Extremely Hazardous, Ib - Highly Hazardous, II - Moderately Hazardous, III - Slightly Hazardous, and U - Unlikely Hazardous (WHO, 2010).

† LD50 (Lethal Dose 50) Unless otherwise noted, the data are based on experimental models with rats.

Table 3.2 shows a summary of the environmental fate of the most common pesticides used in Quilloac and San Rafael.<sup>31</sup> The search for scientific evidence about the environmental fate of pesticides is challenging due to the great number of substances and the variability of environments in which they are used. In most cases, dissipation of the original substance can occur. Depending on the chemical properties, a substance or its derivates can distribute in water, soil or air (e.g., see volatility in Table 3.2). In other cases, there may be concentrations of residue in organisms or other environmental compartments (bioaccumulation). In addition to the affinity to environmental compartments (water, soil, air or biota), the stability of a substance or its derivates can affect the time it lasts in the environment. An indicator of this persistence is the half-life, which is the time in which half of the substance is degraded in a particular media. Inadequate disposal of containers can lead to potentially longer persistence of pesticide residue

<sup>31</sup> A more detailed discussion of the environmental fate of pesticides can be found in the Master's thesis of my community partner, Rafael Alulema (Alulema, 2008).

than otherwise anticipated. Furthermore, some species may be particularly susceptible to some substances (Seiber, 2002). A particular example is the susceptibility of birds to the pesticide DDT (Carson, 1962).

<b>Table 3.2 Summary of literature on the known environmental fate of common pesticides used in Quilloac and San Rafael, 2007</b>			
Pesticide / Chemical Type (Use)	Water Solubility	Fate in Soil	Environmental Concerns
<b>Mancozeb</b> / Ethylene-bis-dithiocarbamate (Fungicide)  <b>Ethylenethiourea (ETU)</b>	<ul style="list-style-type: none"> <li><b>Low Solubility:</b> 6mg/L (EXTOXNET, 1996; Xu, 2000b)</li> <li><b>ETU= High Solubility</b> 20g/L (IARC, 2001)</li> <li><b>Half-Life (pH7):</b> 1 to 2 days (EXTOXNET, 1996; Xu, 2000b)</li> <li><b>Half-Life ETU:</b> 1-4 days (Xu, 2000a)</li> </ul>	<ul style="list-style-type: none"> <li><b>Weak Absorption</b> (Mancozeb and/or ETU)(Xu, 2000b)</li> <li><b>Low Soil Persistence:</b> Half-life: 1-8 days (EXTOXNET, 1996; Xu, 2000b)</li> <li><b>ETU:</b> 1-7 days in field conditions (Xu, 2000a)</li> </ul>	<ul style="list-style-type: none"> <li>Medium to high toxicity to aquatic species (EXTOXNET, 1996)</li> </ul>
<b>Profenofos</b> / Organophosphorus compound (Insecticide)	<ul style="list-style-type: none"> <li><b>Low to Moderate Solubility:</b> 28 mg/L at pH 6.9 (AERU, 2010e; FAO &amp; WHO, 2008 quoting Jäkel, 1987)</li> <li><b>Very Persistent -Half-Life (pH7):</b> 14.6 days (AERU, 2010e)</li> </ul>	<ul style="list-style-type: none"> <li><b>Low Soil Persistence:</b> Half-life: 7 days (AERU, 2010e)</li> </ul>	<ul style="list-style-type: none"> <li>Can be lethal for fish (EPA, 2000)</li> <li>High toxicity for birds, honeybees and fish (AERU, 2010d)</li> </ul>
<b>Carbofuran</b> / Carbamate (Insecticide)	<ul style="list-style-type: none"> <li><b>Moderate to High Solubility:</b> 322 -351 mg/L (at 25°C), potential to contaminate (AERU, 2010a; Evert, 2002; Iesce et al., 2006)</li> <li><b>Half-Life (pH7):</b> 27.7 days (Evert, 2002)</li> </ul>	<ul style="list-style-type: none"> <li><b>Low Soil Persistence:</b> Half-life: 14-29 days (AERU, 2010a)</li> </ul>	<ul style="list-style-type: none"> <li>Lethal for birds, in particular the granular products that can be confused for seeds - banned in United States (Evert, 2002)</li> <li>Honeybees are extremely sensitive (Evert, 2002).</li> <li>Potential microbial degradation in soils (Evert, 2002)</li> <li>Potential to contaminate water sources (AERU, 2010a; Evert, 2002; Iesce et al., 2006)</li> </ul>
<b>λ- Cyhalothrin</b> / Pyrethroid (Insecticide)	<ul style="list-style-type: none"> <li><b>Low Solubility:</b> 0.005 mg/L (AERU, 2010b; EPA &amp; OSU, 2001)</li> <li><b>Half-Life (pH9):</b> 7 days (EPA &amp; OSU, 2001)</li> </ul>	<ul style="list-style-type: none"> <li><b>High Binding Affinity - Non-Persistent.</b> Half-life: 25-30 days (AERU, 2010b; EPA &amp; OSU, 2001)</li> </ul>	<ul style="list-style-type: none"> <li>Toxic to aquatic animals and honeybees (EPA &amp; OSU, 2001)</li> <li>potential to bio-concentrate in fish and mammals (high octanol /water partition coefficient Log P: 6.9) (AERU, 2010b)</li> </ul>

**Table 3.2 Summary of literature on the known environmental fate of common pesticides used in Quilloac and San Rafael, 2007**

Pesticide / Chemical Type (Use)	Water Solubility	Fate in Soil	Environmental Concerns
Sulfluramid / Sulfonamide (Insecticide) (AERU, 2010g)	<ul style="list-style-type: none"> <li><b>Low Solubility:</b> 0.01 mg/L (AERU, 2010g)</li> </ul>	<ul style="list-style-type: none"> <li>Not available</li> </ul>	<ul style="list-style-type: none"> <li>Moderately toxic for aquatic organisms (AERU, 2010g)</li> <li>Potential risk to birds and small mammals (EPA, 2008b)</li> <li>Potential for bio-concentration (AERU, 2010g)</li> <li>Potential of metabolite perfluorooctylsulfonate (PFOS) to contaminate ground water (EPA, 2008b)</li> </ul>
Terbutylazine / Triazine derivative (inhibitor of photosynthesis.) (Herbicide)	<ul style="list-style-type: none"> <li><b>Low Solubility:</b> 6.6 mg/L – low (AERU, 2010h)</li> <li><b>Half-Life (pH7) (High persistency):</b> &gt;200 days (EPA, 1995; WHO, 2003)</li> </ul>	<ul style="list-style-type: none"> <li><b>Moderately Persistent:</b> Half-life: 19.4-75.1 days (AERU, 2010h)</li> </ul>	<ul style="list-style-type: none"> <li>Moderately toxic to fish and aquatic invertebrates (AERU, 2010h; EPA, 1995)</li> <li>Highly toxic to aquatic plants (EPA, 1995)</li> </ul>
Methamidophos / Organophosphorus compound (Insecticide)	<ul style="list-style-type: none"> <li><b>High Solubility:</b> 200000 mg/L (AERU, 2010c)</li> <li><b>Half-Life (pH7):</b> 30 days (FAO &amp; WHO, 2003)</li> </ul>	<ul style="list-style-type: none"> <li><b>Non-Persistent:</b> Half-life: 3.5-4 days (AERU, 2010c)</li> </ul>	<ul style="list-style-type: none"> <li>Highly toxic for mammals, birds, and honeybees (AERU, 2010c; EPA, 2008a)</li> <li>Highly toxic to aquatic invertebrates (EPA, 2008a)</li> </ul>
Propineb / Dithiocarbamate (Herbicide)	<ul style="list-style-type: none"> <li><b>Low Solubility:</b> 10 mg/L (AERU, 2010f)</li> <li><b>Half-Life (pH7):</b> 1.5 days (AERU, 2010f)</li> </ul>	<ul style="list-style-type: none"> <li><b>Non-Persistent:</b> Half-life: 3 days (AERU, 2010f)</li> </ul>	<ul style="list-style-type: none"> <li>Moderately toxic for algae, fish and honeybees (AERU, 2010f)</li> </ul>

Summarizing, the use of pesticides in agriculture can lead to human and environmental health problems of great concern. Tables 3.1 and 3.2 summarize some well-known health consequences. Other potential effects are currently under research. Furthermore, some human groups are more susceptible to adverse health effects by pesticides. Of particular concern are children who can be exposed in occupational use or by accidental poisoning.

### **3.2. Challenges for public health action at a community level**

In order to reduce human risk derived from pesticides, action at several levels is required. First, the use of personal protective equipment such as gloves, boots and proper pumps is necessary and possible. Second, human risk from pesticides may be reduced by means of good agricultural practices such as the rotation of crops, the use of proper doses of chemicals, and the proper use and storage of equipment and chemicals. Early surveillance systems for pests and diseases are also desirable. In addition, integrated pest management (IPM) techniques are also an option. IPM involves the application of several varied approaches towards pest control, ultimately reducing the need for pesticides. Methods used in IPM may include strategies for early detection of diseases, better use of chemicals to reduce doses of pesticides, continuous surveillance of crops to assure more specific control, and alternatives to the control of pests (Yassi et al., 2001b). Organic production and permaculture (agriculture within the natural feedbacks of an environmental niche) are also alternatives that have gained acceptance in recent decades.<sup>32</sup> In addition to changes in agricultural practices, advocacy and political action are required at the local, national and international levels so that favourable economic policies can be adopted. Appropriate reduction of pesticide-related harm depends on a combination of action at different levels (WHO/UNEP, 1990). In this section, I will focus on community level interventions, the subject of this study.<sup>33</sup> In particular, I will briefly discuss two dimensions of these changes: 1) implications for training of farmers, and 2) implications for a broader

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<sup>32</sup> While IPM, organic agriculture and permaculture are intersecting practices, some general differences can be argued. Some practices of IPM may have a limited use of pesticides (e.g., in traps). By contrast, in organic agriculture and permaculture, the use of synthetic substances is mostly avoided. Permaculture tries to have a more radical imitation of the ecological niches than some of the organic agricultural practices. In this paper, safer agricultural practices refer to all of these strategies in general, including a rational use of pesticides within the context of traditional crop technologies.

<sup>33</sup> Regional and national environmental and agricultural policies are powerful tools for public health action. In fact, my focus on community level interventions aims to develop the hypothesis that community level intervention and actions do not suffice in offering feasible alternatives for a transition to safer forms of agriculture.

transformation of agricultural practices. Chapters 4, 6, 7 and 8 will further explore some of these implications in the context of small farming in the Ecuadorian Andes. Overall, any of these strategies require the availability of different types of community resources, such as technical knowledge and financial assistance.

**3.2.1. Education and training for farmers.** A considerable volume of the literature on local level action for pesticide harm prevention has focused on farmer training. In a context with a prevalence of small family units, training has great potential for the adoption of protective practices by peasants. If adopted properly, these practices are powerful tools for preventing pesticide-related harm. For instance, the use of adequate gloves can reduce pesticide exposure by more than a third (Ecobichon, 2001: 769).<sup>34</sup> WorkSafeBC (2009) recommends the use of waterproof clothing, gloves, headgear, eye protection, footwear, respirators and hearing protection depending on circumstances. In addition, protective practices also include the regulation of times for re-entry into crops after application, storage and preparation care, and final disposal of receptacles and residue. Farmer education also has the potential of going beyond the use of protective equipment and towards training on integrated pest management approaches for crops. For example, traps for potato pests to reduce the use of carbofuran have been successfully implemented in Charchi, Ecuador, in potato crop production (Crissman et al., 2003).

However, despite numerous experiences in training, the use of protective equipment and the adoption of alternative pest management techniques remain relatively low for small farming in

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<sup>34</sup> In large scale farming, these practices can be systematically enforced. However, in small farming, the dispersion of production and variability of productive units makes systematic supervision and enforcement difficult.

low and middle income countries (Das & Dey, 2005; Delgado & Paumgartten, 2004; A. K. Hurtig et al., 2003; Moreira et al., 2002; Rendon von Osten, Epomex, Tinoco-Ojanguren, Soares, & Guilhermino, 2004). The farmers' belief systems (which are usually difficult to change) can offer additional barriers for the adoption of some practices (Palis et al., 2006). In addition to knowledge and attitudes, conditions such as discomfort, heat, and access to (or cost of) protective equipment have also been identified as potential determinants of poor safety practices (Elmore & Arcury, 2001).

Training of small farmers in low and middle income countries is a challenging task that requires adequate support and monitoring. The label of the product, which contains color coded indications of toxicity and adequate use, should be a timely and reliable source of information about adequate pesticide use. However, farmers who use pesticides may have low levels of formal education to interpret the (sometimes complex) labels. Under these conditions, the warehouse vendor is usually the main source of information (WHO/UNEP, 1990: 94-97). However, chemical producers usually have more influence on vendors than government agencies or community organizations.

The challenges of training for change in agricultural practices have forced the search of appropriate risk communication strategies. A relevant example, given its application in the Ecuadorian context, is the use of Farmer Field Schools. Farmer Field Schools are based on participatory adult education approaches. In Farmer Field Schools, facilitators accompany farmers in practical applications of new technology or practices in their own crops. The experience is facilitated in small groups of farmers that meet on a weekly or bi-weekly basis to implement new practices in real crops. This approach has been implemented with some success in Ecuador by government agencies, non-governmental organizations and international

collaboration projects. However, a study of some of these experiences showed that Field Schools had good potential, but the results varied according to the context and the way the new practices were implemented. Conflicting objectives that opposed economic viability and environmental health expectations undermined the results from some of these experiences (Tracy, 2007). Farmer Field Schools require a great deal of investment from the promoting organizations. Some other reasons cited for the potential failure of Farmer Field Schools are 1) low farmer participation, 2) predominance of top-down training and low-quality facilitators, 3) lack of planning, 4) failure to adapt to local contexts, 5) lack of institutional support, 6) lack of coordination among promoters, and 7) high cost of implementation (Tracy, 2007: 56-57). In Asia, some successful experiences have had strong state support (ILEIA, 2003).

**3.2.2. Transformation of agricultural practices.** In addition to adequate knowledge, there are other important challenges for the adoption of safer agricultural practices (e.g., the rotation of crops, the use of proper doses of chemicals, and the proper use and storage of equipment and chemicals). Based on a case study in Sri Lanka, Clevo Wilson and Clem Tisdell (2001) argue that the continued use of pesticides in developing countries is not cost-effective in the long-term since it entails higher costs and reduced capacity of ecosystems (with consequences for the sustainability of the production). These externalities affect farmers' overall return. However, the authors also indicate that in the short-term, market conditions in low and middle income countries usually favour a higher short-term return for pesticide users. This forces all producers in the market to adopt technologies with pesticide use in order to maintain production. With time, the cost of producing with pesticides increases. However, the costs of transforming the production are also high, forcing farmers to keep a pesticide-based production. Other potential reasons for continued use of pesticides are as follows. First, farmers have limited information about other techniques and the real risks and costs of pesticides. When information is available, chemical producers usually have more resources than other stakeholders and can control information about their products. Second, access to credit is sometimes easier for the purchase of chemicals than for the initial adoption of other approaches (despite long-term compensation). Third, there are great difficulties in associating pesticide use and health problems (related to the lack of quality health care). Fourth, subsistence farming, practiced by many small farmers, has limited capital and skills. These conditions make a potential transformation to safe agricultural practices difficult. Fifth, the institutional capacity necessary for supporting a transformation of agricultural practices is limited in some countries (Wilson & Tisdell, 2001: 455-459).

Some of these constraints can be illustrated by examining efforts to promote organic agriculture, which have been discussed with some detail. Small farmers willing to transform to organic agriculture need substantial support in order to be successful in terms of their profit margins and the crop yields. Evaluation of experiences in Brazil and China were consistent to show that, to be successful, farmers required marketing support, production assistance and help with formal certification processes. Credit and financial assistance were also necessary. In Brazil, state support was fundamental for a successful transition (Oelofse et al., 2010). In the European Union, many organic producers were dependant on direct payments from the state for their economic stability (Offermann, Nieberg, & Zander, 2009). In Scandinavia, state subsidies were associated with technological improvements in organic farms and a decreased likelihood of losing market shares (Sauer & Park, 2009).

An additional challenge for scaling up organic farming is the need for a more intensive use of human resources than in traditional farming. Labour was one of the challenges identified in the Netherlands when increasing organic farming. The reason was that organic farming required more manual control of weeds (de Jong & Van Zoest, 2001 and Leferink & Adriaans, 1998 according to Goewie, 2003). The need for more intensive labour to take care of the crops has also been described as a challenge for organic coffee growers in Nicaragua (Valkila, 2009).

Dependency on market constraints is also a significant challenge for organic farmers. For small coffee farmers in Nicaragua, the potential advantages of organic farming are dependant on the comparative prices between organic coffee and coffee from mainstream markets. When the prices of regular coffee were low, small organic farmers had a chance at some profit. When regular coffee prices went up, organic farmers were in a disadvantageous situation. However, in any scenario, the uncertainty of the market and the associated challenges made organic

production a relatively poor option to alleviate poverty (Valkila, 2009). This dependency is concerning because the markets for organic crops are still very limited even in richer countries. In 2000, Denmark had one of the highest shares of organic produce in the food market. However, the percentage did not reach 3% of the country's total food market. The combined share of organic product of the United Kingdom, Germany, France, the Netherlands, Belgium, Austria, Switzerland, Denmark, Sweden, the United States, and Japan was only close to 1% of the total food market (Liu, Boto, Kortbech-Olesen, Vrolijk, & Pilkauskas, 2001).

The challenges of transforming the productive process can generate further inequities between small and large producers. A comparison of small and large organic agriculture units in Mexico showed that the requirements for certification of organic produce favoured large-scale agribusinesses. The resources and technical capacity required for obtaining international certification of organic produce offered a burden that many small farmers could not bear. Large producers, on the contrary, had a wealth of resources that could be invested to obtain the sometimes onerous certification. The potential for increase in the gap between large and small producers is substantial (Gómez Tovar, Martin, Gómez Cruz, & Mutersbaugh, 2005). Standards for organic certification, which are required for adding value to the production, are usually defined in international settings with little input from small farmers. Thus, small farmers have the potential to be further alienated by the process of transformation to organic production (González & Nigh, 2005).

To sum up, the adoption of initiatives for reducing pesticide-related risks offers a number of important challenges for community level interventions. The cases of training programs for farmers and initiatives for transforming practices of pesticide use in agriculture are illustrative of some of the difficulties. Local stakeholders need to have the capacity to control a number of

factors such as coordination with other stakeholders, market access, financial assistance, technical support, lack of adequate and sufficient human resources, and cultural barriers. Having adequate answers to many of these questions would require other levels of intervention. The case of state, national and international policies is worth mentioning. For instance, Flemming Konradsen et al (2003) have pointed out that national policies restricting the use of the most toxic pesticides is fundamental for the reduction of cases of poisoning in developing countries. Sustainable agriculture needs to be supported by national and international policies (Pretty, 2008). While international, national and regional support and policies are required, some initiatives have focused on local policymaking. For instance, the provinces of Quebec and Ontario in Canada have banned the cosmetic use of some pesticides. However, promoting such initiatives also asks much of local stakeholders. Some of these challenges will be discussed in more detail in Chapter 4 when analysing the Ecuadorian context.

## **Chapter 4: Review on the challenges of small farmer organizations in the field of agriculture in the southern Ecuadorian ranges**

In this chapter, I identify trends in the field of agriculture that contribute to the vulnerabilities of small farmers in the southern ranges of Ecuador and pose challenges for their organizations in transitioning from the Green Revolution to a truly green chain production. While describing some elements of agricultural activity in Ecuador, I will highlight four main aspects. First, I will discuss land distribution and market policies, important issues for Ecuadorian agriculture that affect small farmers and their organizations by reducing their access to capital. Second, I will discuss state policies for promoting agriculture and the extent to which they have led to challenges for small farmer organizations. Third, I will discuss some aspects of the emergence of the indigenous movement in Ecuador, which has led part of the struggle in favour of small farmers in recent decades. Fourth, I will explore the issue of emigration and the extent to which it can offer challenges and opportunities for farmer organizations and profound transformations in the field of agriculture. I will argue that, if an emphasis on capacity building for small farmer organizations is not accompanied by profound change in the field of agriculture by means of strategies such as public policies providing more support, small farming in the southern Ecuadorian ranges has little chance of transitioning towards new forms of production. Social determinants such as inequitable land distribution, unfavourable market changes, limited state support and political capacity, and the overwhelming social changes of mass international migration are embedded in regional, national and international layers of context, but expressed locally in a reduced capacity to adopt safer agricultural practices.

#### **4.1. Challenges in the development of Ecuadorian agriculture**

Agricultural productivity in Ecuador, defined as the agricultural GDP by the Economically Active Population in agriculture, has grown 196.5% from 1980 (productivity of 1,839 Tons/Has.) to 2003 (productivity 3,614 Tons/Has.) (FAO, 2004).<sup>35</sup> However, this increased production occurs with less manpower. The trend is indicative of a more intensive use of technology in agricultural production in order to reduce the required human resources while increasing productivity<sup>36</sup>. In many cases, this transformation has occurred by resorting to genetically modified crops and pesticides, such as in the case of floriculture and bananas. This is a significant change for Ecuadorian farming, farming that is, not only heterogeneous, but also highly inequitable. In fact, small family farms do not usually have access to resources or technological support for improving productivity. In such circumstances, small farmer organizations are facing an overwhelming challenge. In this section, I will briefly discuss some of the determinants of productivity problems faced by small farmers and the extent to which they may affect their organizations. I will initially discuss land reform, leaving market problems for a later section. After briefly describing the process of land reform in Ecuador, I will argue that this process has had two major effects in terms of the capacity of farmer organizations in the Andean ranges in Ecuador. First, the land reform helped to consolidate and empower nascent farmer organizations, mainly in indigenous communities, by dismantling the traditional elites. Second, the process has also perpetuated an excessive fragmentation of land in some areas, entailing further difficulties for agricultural production and the coordination capacity of farmer organizations.

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<sup>35</sup> This has not been constant, with decrease points in 1983, 1998 and 2000. This type of trend is common for other countries in Latin America and the Caribbean (FAO, 2004).

<sup>36</sup> However, while technology use has increased over time, the technological gap between rich and poor countries has also increased, making it more difficult for poor countries to compete. This widening technological gap has been described for Andean countries including Ecuador (Pfeiffer, 2003).

**4.1.1. Land reforms and land distribution in Ecuador.** In the twentieth century, Ecuador had three major land reforms: in 1964, 1973 and 1994. The two initial reforms, politically promoted by a populist military dictatorship, helped to dismantle pre-capitalist forms of production and large landholdings such as the hacienda.<sup>37</sup> They were part of a group of similar reforms in other Latin American countries, such as Chile, Peru and Colombia, aiming to transform the country to pre-capitalist forms of rural production (Kay, 1998).<sup>38</sup> The reform in 1964 established a ceiling of 2,500 hectares per farm in the coastal region and 1,000 hectares in the Andes. It also continued with a previously set policy of promoting colonization of new lands, mainly in the Amazon. In addition, it attempted to distribute fallow lands and effectively created the Ecuadorian Institute of Land Reform for providing assistance. More importantly, it promoted the abandonment of pre-capitalist forms of labour exchange, such as non-remunerated work and vassalage, and provided some alternatives for credit and technical assistance to farmers.

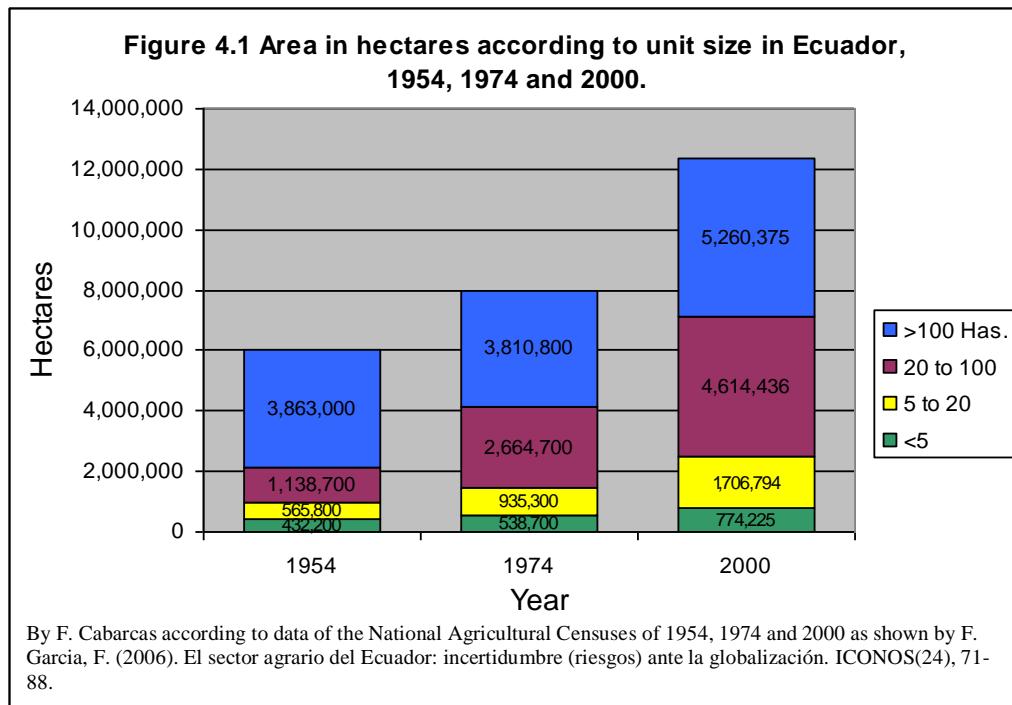
In effect, one of the mandates of state institutions was to support the adoption of pesticides to promote agricultural production (Viteri-Díaz, 2007). Within the same wave of reforms in Latin America, the Land Law of 1973 attempted to provide more assistance to boost agricultural production. In addition to further developing some of the initiatives of its predecessor, this law created zones for coordination of rural production policies and established productivity as one of the criteria for land expropriation (Viteri-Díaz, 2007). In addition, with a different ideological framework, in the 1990's another reform was carried out. In effect, the 1994 land reform was

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<sup>37</sup> Common to other Latin American countries, the Ecuadorian hacienda was a productive system usually associated with debt peonage in large ranches. In the 1950's the haciendas were mostly located in the Ecuadorian ranges, owned by mixed-race elites, and mostly populated by indigenous farmers. I will discuss the details of this later.

<sup>38</sup> Except for some countries such as Argentina and, to some extent, Brazil, agrarian reforms were adopted in most countries in Latin America. Several reasons may be mentioned as driving forces for the policies of agrarian reform: 1) the governments' fear of left-wing revolutions in the region after the experience of the Cuban revolution (agrarian reforms were part of the Alliance for Progress initiative by the United States government), 2) the pressures from farmers' uprisings in some regions (conflicts favouring deeper changes arose even in some regions where top-down reforms were implemented), and 3) the attempt by some reformist governments to promote a higher yields in agricultural production by strengthening capitalist forms of production (Kay, 1998).

executed in the framework of structural adjustment policies and the Washington Consensus.<sup>39</sup> This policy proceeded in an agenda of reinforced market-led strategies, such as the freedom to divide and trade communal lands, limitation of state expropriation, and requirement of payment for accessing new land (Nieto, 2004). The reform favoured an export-oriented agriculture and favored market control of other productive resources, mainly water.<sup>40</sup>



Despite having some positive effects for particular communities, land reforms have contributed very little to improving land distribution in Ecuador.<sup>41</sup> Despite some gains for some sectors of farmers, the reforms did not help to significantly change the country's indicators of

<sup>39</sup> This type of market-led reforms was also carried out in other countries in the world. It was promoted by international institutions as an alternative for improving agricultural production. However, there is evidence to suggest that this policy is prejudicial against small and poor farmers, favouring dominance by large landowners (Borras Jr., Carranza, & Franco, 2007; Gauster & Isakson, 2007; Lahiff, Borras, & Kay, 2007).

<sup>40</sup> Different from the reforms in 1964 and 1973, this law had opposition from indigenous organizations and some farmer organizations. First, while the uprisings of the 1960's and 1970's promoted further application of the reforms, the indigenous organizations in 1994 led a coordinated national uprising to oppose the reform because they perceived it as damaging from the perspective of small farmers (Novillo-Rameix, Hernández-Enríquez, & Dávalos, 1999).

<sup>41</sup> With Costa Rica, Honduras and Uruguay, Ecuador was one of the Latin American countries with the lowest area of land modified by the land reforms (ECLAC and FAO, 1986 as quoted by Kay, 1998).

land concentration. Figure 4.1 shows that there is a relative increase in area of units between 5 and 100 hectares and a relative reduction of importance of large landholdings as a percentage of the total agricultural area in Ecuador. The net increase in total crop area is behind part of the improvement in land distribution indicators.<sup>42</sup> In addition, in Ecuadorian agriculture from 1980 to 2005 there was further consolidation of social and territorial inequities that came from previous years (Garcia, 2006). Inequity is still a structural part of land distribution in Ecuador. Similar to other Latin American countries, Ecuador's land distribution is very unequal (Deininger & Olinto, 2000, pp. 23-24). The evolution of Land GINI went from 0.86 in 1954 to 0.85 in 1974.<sup>43</sup> There seems to have been a small improvement with the 0.80 Land GINI for 2000 (León, Amores, Izquierdo, Lucio, & Ponce, 2003b; Otáñez, 2000). However, as shown in Table 4.1, 60.4% of the agricultural land is controlled by the 6.4 % of units that have more than 50 hectares. On the other hand, the 63.5% of units with less than 5 hectares own only 6.3% of the agriculturally productive area. In the province of Cañar, the 2% of units with 50 hectares or more controls 53.5% of the land, leaving the 77.8% of units with less than 5 hectares with just 19.6% of the land (INEC-SICA, 2000).

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<sup>42</sup> Garcia suggests that part of the gain is explained by the settlement of new lands in the Amazon rather than distribution of previously exploited properties. In fact, from 1990 to 2004, the increase in land designated for agriculture and livestock was only 3%, while it had been 101% from 1960 to 1990. For agriculture alone, according to the FAO, there were 2,986,000 hectares. While close to 72.3% of this was gained for agriculture from 1960 to 1990, the increment was only 2.1% of hectares from 1990 to 2004. This data also suggests that the growth of the agricultural frontier has reached a limit (Garcia, 2006).

<sup>43</sup> The Land GINI is an indicator of concentration of land distribution. It ranges from 0 to 1. A value of 1 is the worst-case scenario in which one person has all the land. The global Land GINI for 1990 was 0.65 (Deininger & Olinto, 2000).

**Table 4.1 Distribution of number of agriculturally productive units and hectares according to different unit size in different areas of Ecuador, 2000**

	Unit Size (Has.)	Province of Cañar		Andean Region (Ranges)		Coastal Region		Total Country	
		Nº	%	Nº	%	Nº	%	Nº	%
Area in Hectares	0 to <1	4664	1.8%	83106	1.7%	12112	0.3%	95834	0.8%
	1 to <5	29050	11.2%	475745	10.0%	190575	4.0%	678391	5.5%
	5 to <10	21557	8.3%	394197	8.3%	264860	5.5%	688987	5.6%
	10 to <20	24911	9.6%	517098	10.9%	416516	8.7%	1017807	8.2%
	20 to <50	39856	15.4%	873843	18.3%	907362	19.0%	2372027	19.2%
	50 to <100	22165	8.6%	632866	13.3%	733745	15.4%	2242409	18.1%
	≥100 Has.	116029	44.9%	1785476	37.5%	2253691	47.2%	5260375	42.6%
	TOTAL	258232	100.0%	4762331	100.0%	4778859	100.0%	12355831	100.0%
Number of Productive Units	0 to <1	11996.5	37.3%	216999.1	38.2%	29090.9	13.2%	248397.7	29.5%
	1 to <5	13028.3	40.5%	208803.4	36.8%	73267.5	33.3%	286911.2	34.0%
	5 to <10	3268.7	10.2%	58417.6	10.3%	38162.2	17.4%	101065.9	12.0%
	10 to <20	1899.5	5.9%	38744.1	6.8%	30581.2	13.9%	75660.5	9.0%
	20 to <50	1338	4.2%	29375	5.2%	29679.8	13.5%	76792.4	9.1%
	50 to <100	333.8	1.0%	9612.8	1.7%	10902.6	5.0%	34497.8	4.1%
	≥100 Has.	308.7	1.0%	5669.4	1.0%	8125.2	3.7%	19556.5	2.3%
	TOTAL	32173.5	100.0%	567621.4	100.0%	219809.4	100.0%	842882	100.0%

Notes: The data from the whole country also includes the regions of Amazonas and Galapagos Islands, not detailed in this table. However, the majority of agriculturally productive units are in the ranges and on the coast.  
By F. Cabarcas according to data taken from INEC-SICA. (2000). III Censo Nacional Agropecuario [III National Census of Agriculture and Livestock Production]. Quito, Ecuador

Despite modest gains in land distribution, the agrarian reforms of 1964 and 1973 focused efforts on the rupture of the traditional hierarchies of the hacienda system, especially those hierarchies linked to indigenous communities. Perhaps the most important organizational change in the first half of the twentieth century in the hacienda system was the Law of Communes in 1937, promoting the creation of community assemblies in indigenous and non-indigenous rural communities. This law helped to create a sense of protection and belonging regarding a territory and reinforced a long-term process of protection of indigenous communities from colonial practices. The Law of Communes may have also have reinforced a previous process in indigenous communities as these communities adopted this structure in greater proportion than non-indigenous ones. However, they were not exempt from conflict, or from contradictory pulls between land protection and land abandonment (Ibarra, 2004). Although it

was one of the provinces in the Andes with more communes, the percentage of rural inhabitants in communes in Cañar in 1947 was just 20% (Tamayo Rubio, 1947 and CONADE-UNFPA, 1987 as quoted by Ibarra, 2004, p. 1300). Describing a case study in the northern Andes in Ecuador, Marc. Becker (1999) describes the extent to which some previously well-organized indigenous communities initially rejected the communes since 1) the communes maintained dependence on the state and traditional elites and therefore did not provide more autonomy, 2) the communes favoured the co-optation of social movements, and 3) the communes did not address issues of land or economic self-sufficiency. Basically, until the land reform of 1964, most of the rural Andes kept the social system of the hacienda, which gave the landowner monopoly of the land, the production and the workforce.<sup>44</sup> The huasipungos were farmers (and their families) who had the right to cultivate in exchange for labour. Other farmers (not huasipungos) who did not live on the hacienda also had the possibility of working for it in exchange for payment in-kind (Commander & Peek, 1986). In addition, the Catholic Church, which was also a land owner, was very important in maintaining a complex structure of authority and reciprocity among landowners and farmers (Lyons, 2006).

The agrarian reform helped to increase the mobility of farmers, to break the social structures of the hacienda, and to make it easier for the transition to capitalist forms of agriculture. The number of landowners with huasipungos reduced from more than 100,000 in 1950 to close to 2,600 in 1974 (MAG/ORSTON, 1978 as quoted by Commander & Peek, 1986). The break down of the traditional elite of landowners and Church facilitated the consolidation of some indigenous organizations, such as land cooperatives, which were actively promoted by the land reform of 1964. In effect, the period beginning with the first agrarian reform in 1964 was marked by an increasing density and the creation of local farmer organizations (Korovkin, 1997). In

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<sup>44</sup> On the coast, large landholdings adopted capitalist forms of labour earlier than in the ranges.

effect, even before the land reform, the pressure of a growing demand for food from the internal market and growing urban centers forced some haciendas to modify their labour structure in favour of capitalist and more flexible engagement by farmers (Commander & Peek, 1986). Furthermore, the land reform of 1964 promoted the creation of farmer cooperatives. The state also provided support for peasant organizations that started to control part of the productive process to some degree, further strengthening their capacity (Viteri-Díaz, 2007). Moreover, in some areas of the ranges, the struggle and mobilization of some communities helped to strengthen farmer organizations. Further, the resistance to the reform by a sector of the hacienda elites forced indigenous peoples and farmers to strengthen their organizations in order to gain control of the land (Korovkin, 1997).

In spite of favouring farmer organization's capacity, the agrarian reform perpetuated the problem of smallholdings in the Andes.<sup>45</sup> In general, the relative location of smallholdings with less than 5 hectares in the rural ranges in Ecuador has changed little as shown in Figure 4.1. However, the absolute number of productive units with less than 5 hectares has increased (Otáñez, 2000 based on data from National Agriculture Censuses of 1954, 1974 and 2000). Moreover, small farming is highly concentrated in the Andean ranges, including in the province of Cañar, as shown in Table 4.1. The 87.4% of productive units with less than 1 hectare and the 72.8% of units with between 1 and less than 5 hectares are located in the ranges (Calculation based on data from INEC-SICA, 2000). Despite the small improvement in the Land GINI described above, some forces threaten to worsen the problem of smallholdings. For instance, the 1994 reform freed communal lands, allowing their fragmentation. In addition to land markets, inheritance practices that divide the land in equal parts among all children have contributed to an

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<sup>45</sup> LNAME. Martinez categorizes the land reform of 1994 as a counter reform since it stopped state-led efforts for land distribution and freed some protected communal lands for the market (Martínez, 2004).

increase in the number of smallholdings (Martínez, 2004). Small farmers in Ecuador are mostly smallholders.

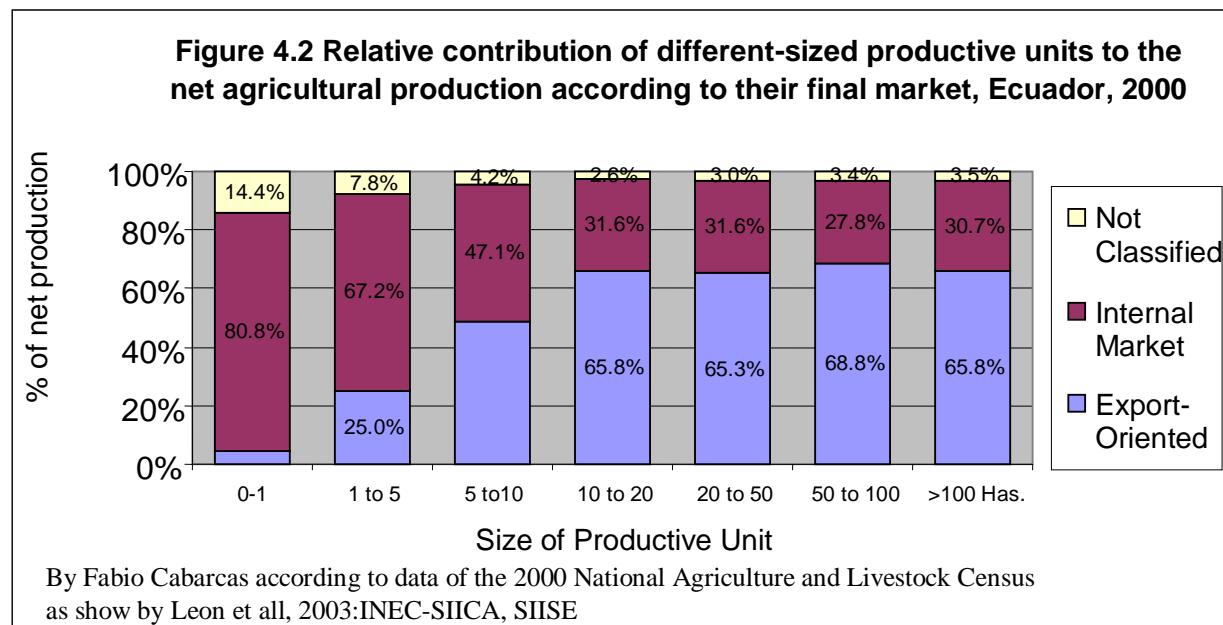
The fact that small farmers in the Ecuadorian Andes are mostly smallholders represents a challenge for farmer organizations trying to develop environmentally friendly production. Productive units with fewer than 5 hectares have poor chances of having economic viability in Ecuador (Chiriboga, 1997). This strikingly reduced probability for 63.5% of Ecuadorian productive units suggests that more demanding transaction costs and technical assistance are needed to develop these farms. Moreover, training for proper use of pesticides or development of alternative pest management requires a standardization of practices and training, which is more difficult with small and heterogeneous units.

For instance, at its outset organic farming created an important role for small farmers worldwide who sought to improve in their situation. However, international standardization and bureaucratic barriers are deterring small producers (Vogl, Kilcher, & Schmidt, 2005). Complex certification processes and the need for access to research have become a burden, particularly for small farmers in developing countries (Kilcher, 2007, p. 90). In addition, as small producers can afford very little economic risk, they require important types of support over the initial years in order to achieve suitable organic production (Crucefix, 1998). In cases studies of organic farming in Brazil, Ecuador and Guatemala, the number of small producers that engaged in the projects was determined by two main factors: 1) the support of government and 2) the liaison under contract of small farmers with larger agro-industrial companies (Damiani, 2000). Farmer organizations alone will have little chance to coordinate the efforts deemed necessary for building environmentally friendly and economically viable alternatives for small farmers.

Summarizing, the decline in traditional rural structures favoured by land distribution weakens the small family farm that characterizes an important part of the Ecuadorian ranges. Small farms, which are very important for generating employment, face important limitations to survive and adapt their productive system to the challenges imposed. This makes it more difficult to replace technology brought on by the Green Revolution.

**4.1.2. Market for rural products in Ecuador.** The Ecuadorian domestic market has been fundamental for the survival of small farmers. As shown in Figure 4.2, internal markets are supplied by small farmers, whereas export-oriented production is dominated by larger productive units. This two modal system also reflects differences in the type of product and region. Bananas and flowers, the main export-oriented agricultural products, account for 38.9% and 18.2%, respectively, of the net agricultural production in Ecuador. On the other hand, products such as rice, sugar cane, corn and potatoes, which are destined mainly for the internal market, account for 36.3% of total production. Traditionally, while most export products have been farmed in the coastal region, the ranges have mostly been focused on the internal market (León, Amores, Izquierdo, Lucio, & Ponce, 2003c). In recent years, policies favouring export-oriented agriculture have been adverse for the domestic market, and subsequently, for the small farmer-based agriculture of the ranges. In this section, I am first going to describe some market characteristics of agricultural products in Ecuador. I will focus on domestic markets, as they are more important for small farmers. Second, I am going to argue that market policies in Ecuador are deleterious for small farmers and for any attempt by their organizations to promote environmentally friendly practices.

During most of the twentieth century, the demand for agricultural products in Ecuador grew, forcing the transformation of the productive system and the adoption of Green Revolution technologies. The growth in population and the production boom in bananas and oil, combined with the growth of the urban population in Ecuador, generated an increased internal demand for agricultural products from the first half of the twentieth century. In effect, during their final years, some of the haciendas modified their productive systems by promoting mono-crops, changing labour relations, and implementing Green Revolution technology to supply the demand (Commander & Peek, 1986, p. 81).



The expanding rural markets had inefficiencies that were subsidized during the export substitution policy that predominated until the mid-1980's. As in other countries of Latin America, during the 1960's and 1970's, a policy of import substitution that was tied to earlier efforts for promoting industrial development predominated. Customs barriers and taxes blocked the importation of some products that were considered fundamental for the development of national industry and food security (Bielschowsky, 1998). However, according to M. Chiriboga, local rural markets in Latin America, usually consisting of traditional market squares, were also

described as inefficient due to high information costs and high transaction and transport costs. This implies that small farmers did not have the means to access information in order to ask for a better price or the means to reach more favourable markets elsewhere. Traditional markets were controlled by a few people who forced small farmers to reduce prices. During the import substitution period, the state-led policy subsidized traditional market inefficiencies by assuming some costs and direct trade. However, the state assumed a role that did not allow the markets to correct some of the problems. It did not help to reduce transport costs, to provide better flow of information, or to strengthen farmer organizations to a point that counterbalanced the traditional monopolies (Chiriboga, 1997, 2004).

The systematic institutional structural adjustment policies that started in Ecuador in the 1980's left small farmers in poor competitive conditions vis-à-vis the inefficiencies of the market. While the initial reforms to liberalize the Ecuadorian economy took place from 1988 to 1992, the core of the reforms happened from 1992 to 1996 during the government of Duran Ballen (Lefeber, 2003).<sup>46</sup> As in other Latin American countries, the Ecuadorian state support in terms of subsidies, direct services, and technical assistance was essentially dismantled without building adequate assistance in order to support small producers and farmer organizations in building capacity to deal with the inefficiencies. The result was that the competitive conditions of small producers deteriorated (Chiriboga, 1997). In addition, free trade agreements and the reduction of import taxes in Ecuador introduced products at a lower production cost, reducing even more the profit margins of small producers. Figure 4.3 shows the relative increase of cost of crops and livestock as a percentage of total imports in Ecuador. This increase is indicative of higher volumes of food imports that compete in traditional markets.

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<sup>46</sup> The economic crisis starting in 1982 implied one of the reasons for these changes, following a reduction in the oil revenues and an increase in the interest rates of international loans (Hey & Klak, 1999; Lucero, 2001).

In addition, small farmers have little control over or access to the internal market, with emerging factors, such as supermarkets, gaining control of the trade distribution. First, despite the market-led policies established since the 1980's, the internal market in Ecuador is still inefficient. For 2000, the percentage of farmers that sold to intermediaries was 50.5% in the province of Cañar, 59.4% in the ranges and 64.8% in the country, as compared to direct sales to the consumer, sales to the exporter or sales to a processing centre for generating added value (INEC-SICA, 2000). Supermarkets have quickly replaced the traditional markets of small farmers. Supermarkets represent a risk of market monopoly since it is estimated that in Asia, Africa and Latin America, three or four chains are able to control 50% or more of the supermarket sector (Reardon, Timmer, Barrett, & Berdegue, 2003). In Ecuador, chains of supermarkets have almost doubled their number from 1998 to 2004 (Zamora, 2005). The volume of supply required and the technical specifications that supermarkets ask for represent a challenge for small farmers. In order to take advantage of the supermarket opportunity, small farmers will require technical assistance to meet the increased market standards demanded for their products, coordination to provide the volume required by large distributors, and financial support to make these changes (Reardon et al., 2003; Zamora, 2005).

Market problems are one of the determinants that explain the fact that the trends in economic growth in agriculture have especially affected small farmers. From 1980 to 2005, the productivity by hectare increased, but the price of exported products decreased. There was also a marked increase in imports. This increase in imports was accompanied by a reduction of costs, again reducing profit margins (Garcia, 2006). In effect, taking the values for 1995 as reference (=100), the unit value of exported crops in Ecuador, defined as the price of one unit when sold for exportation, has decreased from 124 in 1980 to 92 in 2003 (FAO, 2004 table 146). The growth in production that was promoted by export agriculture is represented by products such as

flowers, bananas and processed foods. These types of export products require a greater investment and control of the market than the ones small farmers are easily able to produce. Traditional rural production has suffered because it has had a low generation of surplus in comparison to the new alternatives, accompanied by increasing competition from national and international non-traditional production. The agricultural model seems to favour more production of cheaper products, with very little support for small producers (Garcia, 2006).

In addition to the difficulties that markets present for small farmers, they provide very limited incentive for pesticide-free or organic production. Worldwide, despite the rapid growth of markets for organic products, mainly in developed countries, market share remains relatively small. For instance, in the year 2000, the share of organic foods in the markets of the United States, Japan and Europe was only close to 1%. The market with the highest percentage of organic products was Denmark, where organics made up just close to 3% of the total food trade (Liu et al., 2001). Moreover, markets for organic produce in developing countries are even smaller. In the case of bananas, for instance, it has been acknowledged that while there is some demand for organic products in developed countries, internal demand in developing countries is very small (Holderness, Sharrock, Frison, & Kairo, 1999).

Under such conditions, small farmers and their organizations have little chance of accessing markets without proper assistance. While domestic markets are fundamental for small farmers in Ecuador, the internal market's long term inefficiencies are worsened by the fact that customs policies have favoured competition from products from abroad, some of which are artificially low due to subsidies. Moreover, domestic markets offer little incentive for pesticide-free or ecologically-oriented products. Organizations of small farmers would require not only marketing expertise but also high technological and credit support to overcome these challenges. They

would also require an ample network of contacts and clients. Thus, market challenges are added to the difficulties in distribution of resources, such as land, which make it very difficult for small farmer organizations to facilitate viable alternatives to pesticide use.

**4.1.3. The role of the state and other organizations in supporting small farmers.** From the mid 1980's, there was a worldwide shift to allocate funds to Non-Governmental Organization (NGO) led programs. This was heightened in the mid 1990's by a change in emphasis on neo-liberal policies (second generation reforms). Institutional reform, decentralization and promoting social capital were part of the policy package (North, 2003; North & Cameron, 2003).<sup>47</sup> This process was accompanied by a reduction in state-level investment. Manuel Chiriboga (1997) describes the extent to which the adjustment policies for rural Ecuador have involved 1) the reduction in investment on public services and infrastructure, 2) the dismantling of sector-specific policies and the organizations in charge of carrying them out, and 3) the emergence of groups and organizations that provide project-based assistance (Chiriboga, 1997). This process may have been deleterious for the capacity of organizations to face the challenges of a changing rural scenario. However, the social situation for small farmers remains problematic. Several factors may contribute to this. First, while some indigenous and farmer organizations have gained some capabilities, their capacity is not enough to replace the need for effective state-led initiatives and policies. Second, the increased number of local organizations has meant an inefficient use of resources. External actors and sectors also compete for the same resources. In this section, I will focus on the above-mentioned factors to discuss the extent to which neo-liberal policies may affect the capacity of indigenous organization at the local level.

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<sup>47</sup> Despite this emphasis on institutions, the second generation reforms still prioritized economic policies (North, 2003; North & Cameron, 2003).

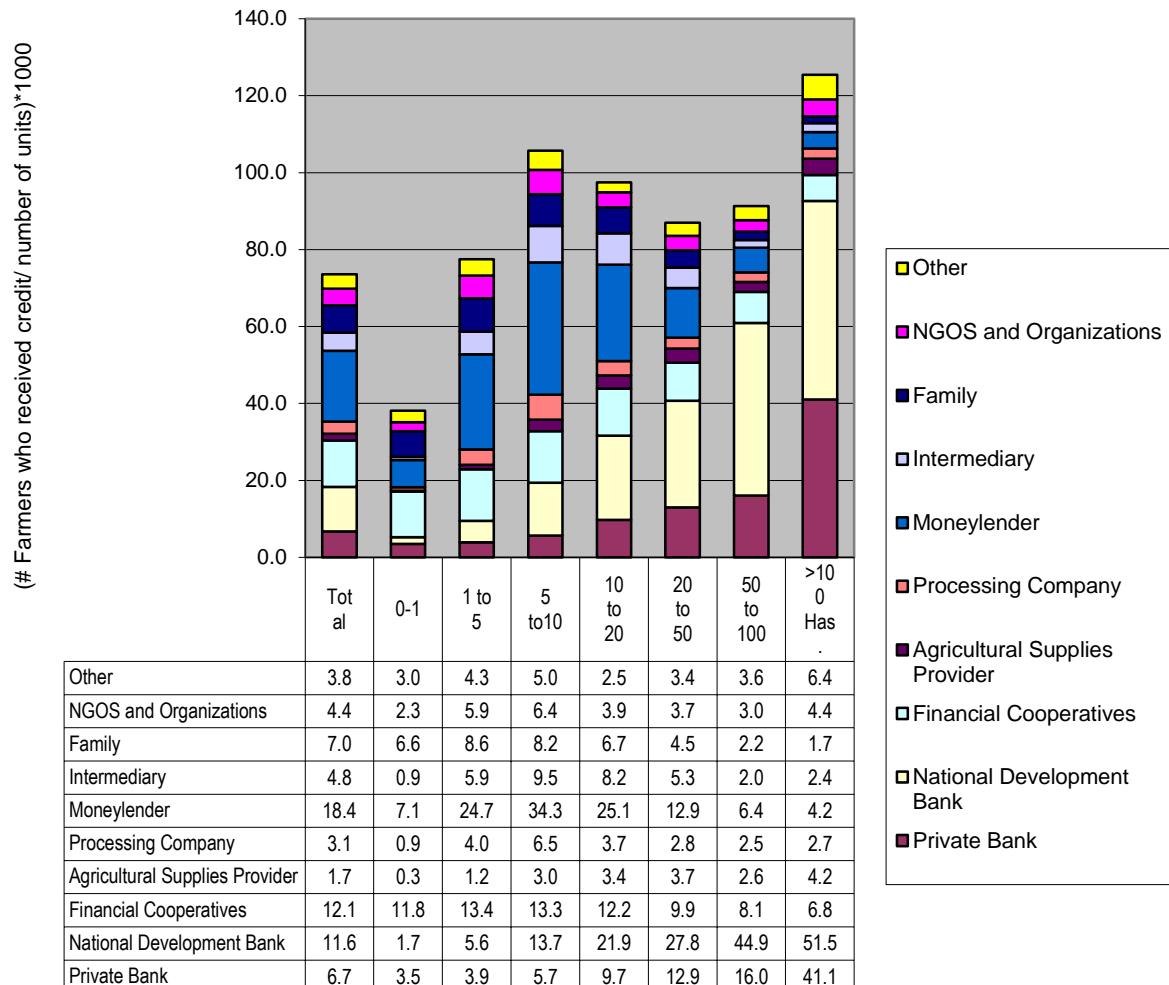
Support by the Ecuadorian state for development of agriculture, and particularly small farmers, has never been strong. Some important development initiatives in the rural areas were led by NGOs, showing the weakness of state intervention. For instance, in the 1960's and early 1970's, Andean Mission, an NGO linked to some sectors of the church, helped to trigger the creation of infrastructure such as roads and schools in the rural areas. In addition, it provided technical assistance that introduced the technological package of the Green Revolution (Breton, 2001, pp. 39-41). Other actors, such as agrochemical distributors, also helped to provide technical support to consolidate the use of pesticides.

Despite the weakness of the Ecuadorian state, its support helped to develop an environment in which some farmer organizations grew, and development projects were consolidated through state policies. For instance, the role of the state in subsidizing and protecting the inefficient rural markets was described above. Moreover, helped by oil revenues during the 1970's, the state led some infrastructure projects such as road construction, irrigation programs and technical assistance. For instance, the budget for rural and urban planning and housing was higher than 1% of the GDP from 1972 until 1992, when it fell below this percentage (BCE).

Regardless of the inefficiencies of the policies, the reduction of this already small role by the state left a vacuum that could not be filled by a myriad of lower scale programs led by small organizations. With a fiscal crisis in the early eighties, there was a diminution in the direct presence of the state followed by a proliferation of organizations and NGOs harnessing funds from international agencies through small programs targeted for special interest groups. The illustration in Figure 4.3 shows that the relative amount of money that NGOs and other organizations offer on credit to farmers of any productive unit size is small. Also small is the relative amount of money that both the National Development Bank and the private banks offer,

and these offers are highly skewed towards larger producers. To access credit, small farmers have few options. They are left with either the assistance of financial cooperatives, usually of small size, and moneylenders, who usually offer high interest rates. It is important, therefore, to highlight the larger significance that family loans have for small farmers.

**Figure 4.3 Ratio of farmers receiving different types of credit by 1000 productive units according to unit size, Ecuador, 2000**



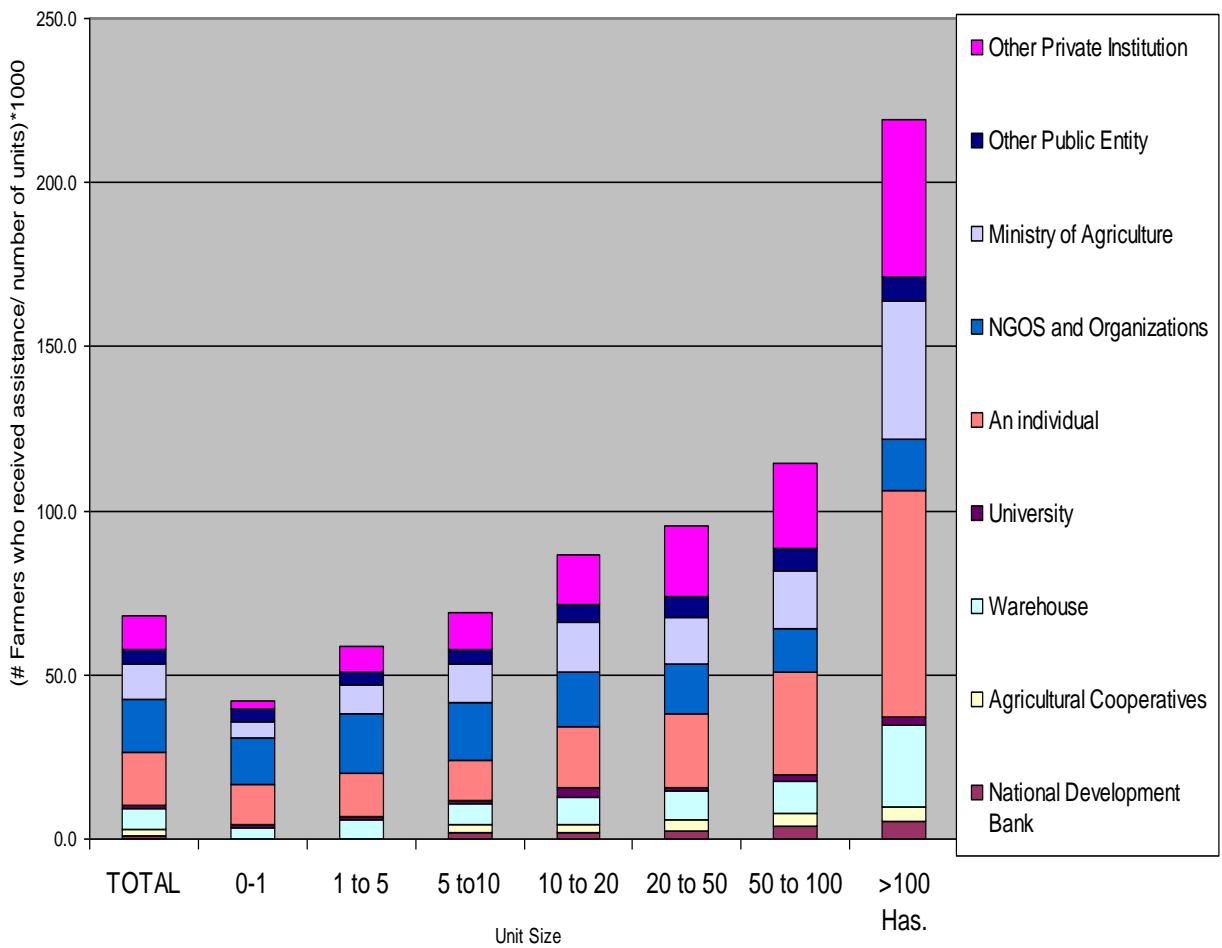
#### Unit Size

Index calculated by F. Cabarcas according to data from INEC-SICA. (2000). III Censo Nacional Agropecuario [III National Census of Agriculture and Livestock Production]. Quito, Ecuador

Another important illustration, shown in Figure 4.4, is the role that NGOs play in providing technical assistance to small farmers. Despite being relatively important to farmers with five or fewer hectares, the contribution of NGOs is insufficient to overcome the technical assistance gap between small farmers and large landholders. Again, the role of state institutions such as the Ministry of Agriculture is relatively small and heavily skewed to providing technical assistance to farmers in the largest productive units. Without proper credit or technical assistance, small farmers have little chance to engage in a process of environmentally friendly, sustainable and healthy agriculture.

The withdrawal of an already weak state also left different types of small organizations without resources such as technical assistance and financial and institutional support. As an example, traditional organizations may be fragile. In the case of the Zhuar Federation in the Ecuadorian Amazon, the rise of indigenous organizations had brought political and economic power to this group. However, the federation failed to adopt strategies for self-financing, while depending on external funding. In addition, indigenous organizations also lacked adequate internal control and accountability mechanisms, allowing leaders to push their own agendas. These internal problems were also exacerbated by national political and economic problems such as the macroeconomic public policy for the Amazonian region (Bebbington et al., 1993). In another case, Diane Bates (2007) identifies the combined effect of the disappearance of state subsidies and environmental degradation in worsening the agricultural crisis and favouring the migration of the labour force.

**Figure 4.4 Ratio of farmers receiving technical assistance by every 1000 productive units according to unit size, Ecuador, 2000**



Index calculated by F. Cabarcas according to data from INEC-SICA. (2000). III Censo Nacional Agropecuario [III National Census of Agriculture and Livestock Production]. Quito, Ecuador

In addition to the void left by the state, the increasing number of organizations has caused a fragmentation of approaches and a lack of coordination, generating competition among different groups. Basically, the need for accessing limited resources that are distributed in market-like conditions generates competition. This competition is increased by the fact that a high number of organizations tend to concentrate in some areas. In the Ecuadorian ranges, as more NGOs are working in a determinate area, more indigenous organizations are locating in the same area. This higher density of organizations is triggered by the requirements of development agencies. NGOs usually have to promote local organizations for accessing funding, generating exaggerated density in some particular regions that are of interest to donors. The diversity of organizations grouped in this complex structure lends itself to multiple sources of conflict and rivalry among different groups (Breton, 2001, pp. 39-50, 125-153). The multiplicity of micro-projects seen in neo-liberal policies can also mask important structural inequities (Petras & Veltmeyer, 2006).

To sum up, small farmers have traditionally had little support for developing sustainable production with lower use of pesticides. Even technical assistance, required for training in adequate use of pesticides, is reduced for small farmers. Even though some organizations may have gained ground in generating alternatives for small farmers, their scope is not wide enough to replace the void left by a state system that is not only small, but also skewed in favour of larger producers. Furthermore, the need to compete for resources and the diversity of agricultural settings generate overlap and potential conflicts among well-intended organizations.

**4.1.3.1. Small farmers and the emergence of the indigenous movement in Ecuador.** Taking into account that small farming in Ecuador is highly concentrated in the ranges, which is the area with the highest indigenous population, it is logical that in the past two decades, the demands for protection of small farmers in Ecuador have been made mostly by indigenous organizations. In the 1990's, the Ecuadorian indigenous movement gained worldwide attention due to several uprisings that partially contributed to the instability of several governments in the following years.<sup>48</sup> These events have been described by several authors as indicative of the indigenous movement's strength, at least at the national level (Macas, Belote, & Belote, 2003). Indigenous groups have made important ethnic demands, such as the search for acknowledgement of multiple cultural identities in Ecuadorian laws. However, they have also focused on socio-economic class and peasantry issues such as requests for better land distribution, adequate productive support and more favourable market policies (Otero & Jugenitz, 2003). The movement has been clearly opposed to neo-liberal policies, and demands better conditions for agrarian production while rejecting international trade agreements.<sup>49</sup> In this section, I am going to briefly describe the emergence of the indigenous movement in Ecuador as a very important defender of small farmers' interests within the context of the indigenous struggle in Ecuador.

Several factors contributed to the emergence of the majority of indigenous organizations in Ecuador after the agrarian reform in 1964, giving these indigenous organizations more power

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<sup>48</sup> The indigenous movement has led numerous campaigns and uprisings, starting with its first big protest in 1990. The reach of the movement has included, for instance, a people's assembly in 1997, which modified the constitution of the country to recognize ethnic diversity. The uprisings even precipitated the fall of the president, Jamil Mahuad, in 2000, a process that allowed the indigenous leadership to form part of the transitional government that followed. There was great support for the candidacy of Gutierrez, AN INDIGENOUS LEADER,? a few years later, although the effort created division after the deception by the government once in power (Kintto, 2000; Lucero, 2001).

<sup>49</sup> When, after the first coup in 2000, the then acting president Noboa tried to return to commitments to the International Monetary Fund, a new movement arose to oppose the policies (Kintto, 2000).

than small farmer organizations.<sup>50</sup> In the 1980's and early 1990's, the regional and local level indigenous organizations consolidated (Clark, 1997). Some external organizations, such as the Andean Mission, an NGO associated with progressive movements in the Catholic Church, facilitated the education of a generation of indigenous leaders (Breton, 2001, pp. 39-41). Another important factor that favoured the emergence of indigenous movements over farmer organizations may have been the limitations of traditional farmer movements, linked to leftist organizations, in addressing the particular needs of the indigenous farmer (e.g., discrimination based on race and culture was not adequately explained by traditional leftist analysis of social class and land property) (Breton, 2001). The 1980's reduced the power of traditional civil movements, such as labour unions, due to, among other factors, a reduction in national industrial production that affected mainly Quito and Guayaquil, the two largest Ecuadorian cities. This led to a crisis in some traditional farmer organizations that were linked to leftist movements, allowing the consolidation of the indigenous organizations who adopted some of the farmer organization's agricultural goals, but also retained a clear identity agenda (Clark, 1997).

Currently, the indigenous movement in Ecuador consists of various levels of organization. A diversity of organizations that group local, traditional structures as well as new community structures constitutes the first level. The second level of organizations is conformed by associations of the first level organizations in a determinate area of influence. The third level is made up of provincial level organizations that group the second level organizations. Provincial level organizations are grouped in three confederations that correspond to the three geographic regions in Ecuador. In 1986, a national level organization was constituted, the CONAIE

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<sup>50</sup> As mentioned, some organizations may have been the institutionalization of informal organizations present during the period of the hacienda.

(Confederation of Ecuadorian Indigenous Nations). This structure has allowed for a type of national level political advocacy that did not exist before (Kintto, 2000).

In the case of indigenous organizations, the political process for approval of the land reform in 1994 is illustrative of both their strengthened capacity and their weakness. In the 1960's and 1970's, indigenous uprisings in the central and southern ranges helped to promote the land reform they favoured. However, the reform was mostly promoted top-down. The indigenous uprising happened with little national coordination and occurred in some specific areas where local elites were opposed to the land reforms promoted by the government. By contrast, the indigenous organizations in the 1990's were in one of their most influential periods in Ecuadorian history. For instance, unified in the CONAIE, they led the formation of an Agrarian Coordinating Association (Coordinadora Agraria) with other sectors. In addition, in the early 1990's they had the capacity to shock the country with their mass actions to promote their rights as indigenous peoples. Furthermore, they presented an alternative bill to congress to promote more rights for small farmers (Novillo-Rameix et al., 1999). However, despite all their coordination and effort, the fact that the indigenous organization could not stop the law is also indicative of its limitations, even though they had gained so much ground since the first land reforms.

In addition, while a reinterpretation by the indigenous movement in Ecuador of their ethnic and cultural identity has brought some clear gains for small farmers, such as a number of policies and programs for rural development, it has also brought other consequences that are the subject of a contested scholarly debate in rural studies (Almeida Vinueza, 2005; Breton, 2001, pp.125-153; Herrera, 2007; Nieto, 2004). Following the work by Linda Alcoff (2006), I use the expression 'identity politics' to acknowledge positive and negative consequences of political

practices and policies that resort to identity categories to promote their objectives. Identity is understood as a social construct that is related to the subjects' experience. It is imposed by the others' perceptions, but it is also self-experienced and reinterpreted. Regardless of the fact that ethnic identity is claimed sometimes to be 'visible', it is the subject of social interpretation in a particular social and cultural context.

Identity politics has been a contested terrain in academic debate. For instance, 'identity politics' has been used to label political strategies that aim to create opposition and division among ethnic groups. It has also been used to refer to policies that highlight identity demands to move the social attention away from other issues such as poverty. Furthermore, policies based on identity have also been the subject of debate because they may lead to the treatment of assumed social constructs such as gender or race as fixed and trans-historical entities and not the product of human beliefs that are relative and biased interpretations of reality. However, identity is also perceived as real and substantive by the social players. Thus, the social construction of identity is also a space for contesting oppressive practices and creating a reinterpretation that allows for the promotion of a progressive agenda in favour of marginalized people (Alcoff, 2006).

In the Ecuadorian context, indigenous communities have been the subject of stigmatization based on a dominant social construction that interprets their race and culture as negative characteristics. However, simultaneously, indigenous peoples have constructed an assertive idea of their identity that has helped them to unify their communities, promote social spaces for recognition of differences, and advocate for policies and programs that reduce their marginalization in Ecuadorian society. Nonetheless, identity politics can help to further divide efforts by groups that otherwise may have had similar interests, such as other farmers of different ethnic backgrounds.

The promotion of policies and programs targeting indigenous groups has had some positive and some negative consequences for small-farming agriculture in Ecuador. First, the creation of new projects and settings for defending the rights of indigenous peoples has constituted an asset for ethnic groups that have always been marginalized in Ecuador. For instance, the creation in 1998 of the Project for the Development of the Indigenous Population and People of African Descent of Ecuador (PRODEPINE) with participation by the state, international development agencies and the communities, has brought some benefits, such as rural development projects and land distribution for indigenous communities (Nieto, 2004). On the other hand, despite the beneficial gains for particular groups, the emergence of rural funding targeting indigenous communities based on their ethnic identity has blurred the collaborative efforts for common problems such as agrarian reform and access to markets, which also affect mixed-race farmers. Even though the agrarian reform is still part of the discourse of indigenous leaders (Herrera, 2007), the political visibility of issues affecting different ethnicities, such as the need for land reform, is blurred by channelling the demands through divided ethnic groups (Breton, 2001, pp. 125-153).

Another unexpected consequence of identity politics is that they entail the risk of trapping the communities in their own identity labels, making it difficult for the organizations to respond to the real needs faced by the population. In the aforementioned case of PRODEPINE, for instance, most of the development projects are promoting agricultural production. This is consistent with the traditional image of the indigenous communities. However, increasing evidence is suggesting that the indigenous population is resorting to diverse economic strategies not necessarily related to agricultural production (Breton, 2005). Furthermore, the institutionalization of ethnic demands by the state and international agencies may have co-opted

this discourse, limiting its political efficacy by displacing other dimensions of social and economic inequities from the agenda (Almeida Vinuezza, 2005).

Identity politics may also help to concentrate efforts on the wrong targets. In a study exploring the geographical correlation between poverty and development projects, Victor Breton (2001)(Breton, 2001) showed that there is some correlation between development projects by NGOs and poverty. However, some of the poorest rural areas do not have the density of development projects that they should. On the other hand, some relatively wealthy regions, such as indigenous Otavalo in the north, receive much attention. In effect, the correlation between development projects and poverty seems to be less important than the correlation between development projects and predominantly indigenous areas. Despite the fact that indigenous inhabitants are, in statistical terms, the poorest of the country, they are not alone, particularly in areas such as the southern Andes where some mixed-race farmers also face the burden of inequalities. Being indigenous is the most important factor in Ecuador for becoming the target of development projects by NGOs (Breton, 2001, pp. 125-153).

To summarize, the phenomena of idealizing identities for political and economic gain is enmeshed in the culture of community organizations involved in the reduction of pesticide exposure in Quilloac and San Rafael. In addition, structural problems such as smallholdings and inequities linked to the agrarian reforms have made it increasingly difficult for small farmers to build alternatives for agricultural development. On the other hand, the advance of fragmented programs and projects led by NGOs and small organizations does not compensate for the lack of more supportive policies and technical assistance by the government. Problems regarding the capacity of organizations and small farmers are not resolved by the structural adjustment

policies. Meanwhile, neo-liberal policies have contributed to making the situation worse (Larrea & North, 1997; Parandekar et al., 2002).

**4.1.4. Migration.** Tomas Homer-Dixon (2006) mentions the problem of migration as one of the main tensions of contemporary global society. According to him, the population growth gaps between rich countries and poor countries, along with the reduced receptive capacity of the poor countries' megacities, are part of the roots of a migration problem for which modern society does not have an appropriate answer. Rich countries' border security policies, one of the main strategies for preventing immigration, are not sustainable (Homer-Dixon, 2006).<sup>51</sup> Migration affects most countries in Latin America, although migration has particularities according to its specific contexts.<sup>52</sup> In effect, Latin America and the Caribbean were, in 2007, the regions that received more remittances worldwide, reaching US\$59,900 million (Fajnzylber & López, 2008, p. 2). The size of this sum has supported the argument by some authors who see migration as an important development alternative that may be beneficial for low and middle income countries. For instance, according to Fajnsylber and Lopez in a report for the World Bank, poverty is reduced 0.4% for each percentage of increase in the remittances of the gross domestic product (Fajnzylber & López, 2008, p. 128). In the academic literature, while some authors defend the possibilities of remittances for development, others criticize them (Bebbington, 2000; Binford, 2003). Nevertheless, in this section, I am going to argue that despite the possible advantages for

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<sup>51</sup> There is debate in the literature on the determinants of migration. Some authors have pointed out that migration has multiple determinants including, for instance, cultural exchange, existing networks and global systems of labour markets. These factors play an important role, alongside poverty, in the communities of origin (Sassen, 2004).

<sup>52</sup> Migration is a heterogeneous phenomenon in the region. Remittances are more important for the Gross Domestic Product of countries in Central America and the Caribbean than the rest of Latin America. For Ecuador, in 2001, 3-5% of families received remittances. An important difference between the countries is the relative income of the beneficiaries. More poor families receive remittances in Mexico than do poor Peruvian families, for instance (Fajnzylber & López, 2008:4-5).

some groups, as a group strategy for social reproduction, migration has a negative effect on the capacity of farmer organizations to deal with the problems of rural development, creating an environmentally and socially unsustainable cycle. First, I will describe the main characteristics of the migratory phenomena in Ecuador, understood as a family strategy for social reproduction in a domain of limited possibilities. Second, I will describe the extent to which migration generates some undesirable effects in reducing pesticide use in the area. In effect, while migration is a group strategy for dealing with the difficulties of farming life, it is also a determining factor in worsening this situation.

**4.1.4.1. *Migration in Ecuador.*** Andean farmers in Ecuador have a long history of internal migration. Three simultaneous domestic migration trends in the twentieth century are identified by David Kyle (2000). First, from the first decades of the century, there was migration from the Andean ranges to the coast. Peasants from the southern ranges migrated to banana plantations in the southern coastal region. A second trend is the fact that during the 1950's and 1960's there was an increased migration to the Amazonian region due, in part, to government promotion. Finally, there was migration from the countryside to urban centres in the sierra and on the coast. This trend intensified during the 1970's due to the demand for employment in services and construction during Ecuador's oil. During this period, migration from the provinces in the north to Quito increased, while the migration from southern provinces continued (Kyle, 2000, pp. 25-26). From 1990 to 2001, all the provinces in the ranges showed more people emigrating than immigrating, with the exception of Pichincha, where the capital, Quito, is located (BCE, p. 23). In addition, it is important to mention a decrease since 1990 in internal migration to the

Amazonian region because the agricultural frontier in Ecuador has almost reached its limits (BCE, pp. 19-20)

In addition to internal national migration, mainly during the last three decades, there has been an increase in international migration. Initially, there was a small legal migration from the coast to the United States, which intensified during the 1960's. Second, starting in 1980, there was increased illegal migration mainly from the provinces of Cañar and Azuay in the southern ranges. Migrants included both rural and urban inhabitants. The trend, which intensified through the 1980's, was composed mainly of males between 20 and 50 years old, despite the fact that women have increased their emigration rates since the late 1980's (Kyle, 2000, pp. 26-37). In addition, the main destination of the emigrants has shifted from the United States to Spain (BCE, 2006; Sánchez, 2004). Regarding emigration to Spain, for 1996, there were close to 3,000 legal Ecuadorian immigrants registered by Spanish authorities. By contrast, for 2004, there were close to 191,000 (Carvajal, 2006, pp. 49, quoting Angeles Escriva and Natalia Rivas in 'migracion y desarrollo' p 19).<sup>53</sup> Figure 4.6 shows the marked increase in international migration in Ecuador during the last decade. It also shows a sharp increase in migration from 1997 to 2000, a peak that coincides with the decrease in economic growth in Ecuador from 1997 to 1998 (Carvajal, 2006; INEC, 2000). For 2000, close to 7% of Ecuadorian households had at least one member who had left the country (INEC, 2000).

The magnitude of Ecuadorian international migration is reflected in the increasing importance that remittances have for its economy. For 2000-2002, remittances were already the second most important source of international revenue for Ecuador after oil exports (León,

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<sup>53</sup> When emigration to the United States became more difficult because of tighter security and lower job demand, Spain emerged as an appealing alternative. Furthermore, in the case of emigrants to the United States, a long travel distance and illegality have led to more difficulties in establishing return cycles (Walmsley, 2001).

Amores, Izquierdo, Lucio, & Ponce, 2003a). This fact is the same for 2007 (Jácome, Martín-Mayoral, Varela, Rivera, & Endara, 2007, p. 90). While for 1993 only 1% of the GDP corresponded to remittances, for 2000-2002, close to 7% of the Ecuadorian GDP was generated by remittances. Since 1999, remittances in Ecuador have been of a higher amount than the international direct investment in the country (León et al., 2003a). Furthermore, despite variations in the flow of emigrants shown in Figure 4.5, remittances have steadily increased during the 1990's and the first decade of the new century (Cadena et al., 2005, p. 38; Jácome et al., 2007, pp. 59-61).<sup>54</sup> For 2001, they were 10 times higher than the international economic assistance and close to 5 times higher than the credit offered by the International Monetary Fund (B&A, 2003).

Despite its overall importance for the economy of the country, international migration is more concentrated in some regions of Ecuador, including the area of study. While the coast had a greater peak of migration during the economic crisis, historically, there are more emigrants from the Andes than from the coast. Higher rates of unemployment and poverty may contribute to higher emigration from the Andean region (Sánchez, 2004). For instance, for 2000, 1 out of 10 households in the Andes had international emigrants, whereas on the coast 1 out of 20 households had international emigrants (INEC, 2000). Moreover, it is important to remember that there is a tradition of internal migration from the Andes to the coast and other regions, which reflects the fact that emigration is a marked problem in the mountains.

In the ranges, emigration is concentrated in the south, with Cañar being one of the main migrating provinces. In effect, according to the Ecuadorian Central Bank, for 2007, the province of Cañar ranked 3rd according to the amount of remittances received, after the provinces of

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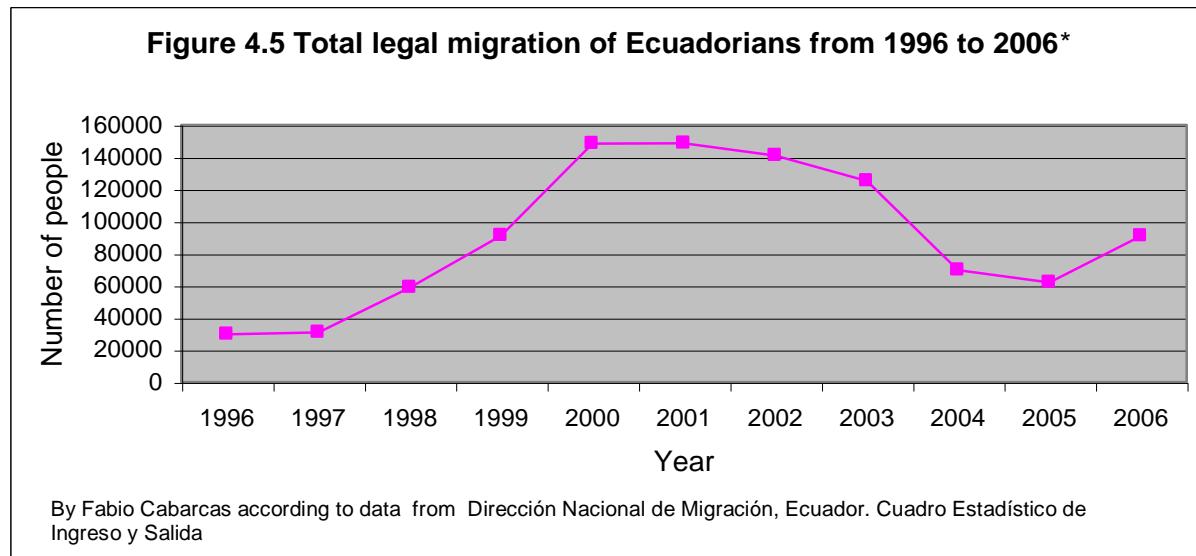
<sup>54</sup> In effect, the volume of remittances has grown steadily worldwide, despite not all regions being equal beneficiaries (Kapur, 2005).

Guayas (in the coastal region) and Azuay (south of Cañar in the ranges). Together, the provinces of Cañar, Azuay, Guayas and Loja received 66.3% of the total remittances for 2007 (BCE, 2007).

In recent years, more than twice the number of emigrants came from the city. However, rural households in Ecuador have lost many more family members to migration than urban households. Basically, while an urban household in Ecuador has, on average, 1.4 emigrant members, rural households have an average of 1.7 (INEC, 2000). This paradox may reflect the fact that there is a path of migration from the rural sector to the cities. In general, two new elements are part of the migratory path from rural areas in Ecuador: first, the workforce is not incorporated by the national job market as before, and second, the remittances are not channelled to improve family agricultural productivity (Martinez, 2005b).

As most of the indigenous population in Ecuador is located in the rural Andes, emigration also affects native peoples. In effect, similar to other non-indigenous communities, some indigenous communities in Ecuador have had a long history of temporary migration for work-related reasons. For instance, some communities such as the Otavalo nation in the north of the country's ranges have a long history of trade and migration, which is expressed in their identity (Maldonado, 2002). Furthermore, Andean indigenous communities have a more grounded tradition of temporary migration for work than communities in any other region of Ecuador. According to the First National Survey to Communities of First Nations and Peoples in Ecuador, 85% of indigenous nations in the ranges make up more than 80% of communities who have lost members to temporary migration for work-related reasons, compared to only 60% of nations in the coastal region and just 11% in the Amazon (SIISE & SIDENPE, 2002). Overall, indigenous

people in the Andes have migrated in similar percentages to other mixed-race Andean inhabitants (INEC, 2000).



**4.1.4.2. Migration and capacity of farmer organizations for reducing pesticide-related harm.** The magnitude of migration as described in the Ecuadorian case has triggered an important discussion of the impact of migration on development. Most of the discussion focuses on issues such as effects on the economy (Kapur, 2005), the determinants of the phenomena, the struggle of immigrants in their receiving countries, and the effects on equity and social life in the sending communities. In this section, I will draw mainly on the literature regarding effects on equity and social life in the sending communities in order to re-focus the discussion on the capacity of community organizations and governance in source communities. This aspect, which has received relatively little attention in the literature, is fundamental for reaching safer development alternatives in the communities of origin. I will focus on the capacity of farmer

organizations to develop sustainable agriculture, suggesting that migration is deleterious to a community's ability to control its development.

First, it may be argued that migration and remittances may alleviate the burden of farmer organizations by triggering local development. However, in spite of the fact that some authors claim the beneficial effects of remittances for communities sending migrants out (Ratha, 2005), as remittances occur in Ecuador, they do not favour the emergence of a strong agricultural economy for small farmers. On the contrary, remittances have helped to maintain the economic status quo, making it difficult to transform policies and settings that determine agricultural inefficiencies. From an economic point of view, agriculture is not a good investment, leading to low use of remittances into crops. According to a report by Bendixen & Associates for the Inter-American Development Bank, most of the recipients (61%) use remittances for daily expenses such as utilities and food, and another 17% of recipients use them for luxuries. Just 22% of recipients use remittances for investments. Other uses, such as real estate, education, savings and business, represent the rest of the expenses (B&A, 2003). This coincides with the Ecuadorian Central Bank assessment according to which, for 2003 and 2006, most of the remittances were used for household expenses (71.2%), when compared to just 20.9% allocated for investments and just 0.9% for savings (BCE, 2006).

The fact that investment in agriculture and local industry are not remittance spending priorities suggests that imports are assuming an important role in satisfying the demand created by the inflow of resources (Acosta et al., 2006). For instance, economic growth after 2001 was triggered by oil revenues and remittances, not national industry or agriculture. This implies that any possible effect of remittances in reducing poverty is not linked to internal development and better conditions for local production (Acosta et al., 2006).

In agriculture, this may have led to a practice where the received money subsidizes inefficient agriculture in a setting that does not favour its development. Farmers do not invest in agriculture because it is not profitable due to the problems discussed above such as smallholdings, inefficient markets and unfavourable public policies. In fact, non-profitable agriculture is one of the conditions that triggers migration in the first place. In parallel, the resources from emigrants may help to trigger the demand for a series of services in the rural population, such as retail and communication services. If taken advantage of with adequate policies, these activities may help to develop an economic model in which part-time work in agriculture is complemented by other activities that contribute to improving agricultural productivity. However, depending on a constant flow of remittances, this process is not sustainable unless structural conditions, such as better internal markets, regional and national policies and agreements, adequate technical support, proper financial assistance, and a proper financial system are developed (Annessi, 2002). As a consequence, the additional flow of capital helps to maintain the inadequate conditions for sustainable development of rural areas.

Even with an acknowledgement of the fact that remittances may not trigger sustainable forms of development, some authors suggest that harnessing some resources through organized networks such as an association of immigrants may be an answer for development (Davis, 2007; Lopez-Damm, 2006; Vargas-Lundius, 2006).<sup>55</sup> While the starting point of some of these organizations has been to improve the conditions of migrants in their receiving community, there are an increasing number of cases of such networks contributing to development initiatives for the community of origin. For instance, since 1990, an increase in the number of Latino ‘home town organizations’ and Latino NGOs has been registered in the United States. When these migrants started to improve their conditions in the receiving country, they moved on to also

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<sup>55</sup> This is a worldwide phenomenon that has also been described for Asian and African emigrants.

exploring forms of support for the sending country. However, most of these organizations are small, and the amount of money they send back home, estimated at under US\$10,000 in cash or kind per year, is relatively small compared to remittances. Despite the fact that their primary focus seems to be to improve the emigrants' situation in the receiving country, it has also been suggested that these type of organizations could have a more immediate and direct effect on development than do remittances (Orozco, 2000). While more research may be needed at different levels to assess their effectiveness, some alternatives that try to integrate state support and NGO support may be more sustainable. In Ecuador, a promising example is the co-development initiative promoted by the Spanish and Ecuadorian governments and partially funded by international development funds.<sup>56</sup> In addition to state support, this effort groups grass-roots organizations, such as migrant organizations, to promote projects in sending communities. One of the elements that makes this a promising example is the fact that it has active state support (Cortés-Maisonave, 2005).

However, in spite of such promising examples, these are the exception rather than the rule. Studying the early experiences of migration in Latin America, it has been suggested that the development of such migrant associations requires a number of conditions such as 1) an ethnic or regional sense of identity and cooperative tradition, 2) state promotion or, at least, not interference, 3) sufficient numbers of immigrants from a determinate community or region focused on a particular place, and 4) a level of emigrants' politicization, defined as a struggle for resources and self-determination as a group based on communal identity. In addition, another two conditions in the rural sphere of the sending communities are local political decentralization and underdevelopment (Hirabayashi, 1986). Furthermore, in order to improve the possibilities of

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<sup>56</sup> This is an interesting alternative to police enforcement in order to reduce migration through cooperation for development (Cortés-Maisonave, 2005).

sustainable development, there is a need for more state involvement (Orozco, 2000) Hence, while migrant associations and networks may help to trigger development experiences in some cases, the success of such initiatives depends on a series of elements that rule them out as a viable alternative for rural development in most cases.

On the other hand, while remittances do not help farmer organizations to improve rural production, the flow of money does not necessarily reduce the use of pesticides in agriculture. The additional family income received from remittances does not allow many families to abandon agriculture, perpetuating the practice of low-investment subsistence agriculture with poor technical assistance.<sup>57</sup> In effect, in most cases, remittances do not seem to cover the complete expenses of the household. For instance, for 2000 and 2001, in the period of economic crisis, remittances reached just 16% and 11%, respectively, of the total income of households in Ecuador (Acosta et al., 2006). The average money transfer was just US\$175, with 46% of households receiving just one transaction per month, according to a report for the World Bank. Taking into account that for 2002 the basic grocery needs for a family amounted to more than \$300, the income from remittances is complementary to other sources (Acosta, Lopez, & Villamar, 2005; B&A, 2003).

Due to the fact that remittances do not cover the majority of household expenses, subsistence agriculture survives. While agricultural production may have decreased in some areas of the country, including the southern ranges, there is still a significant amount of land devoted to agriculture, and this production is still widely practiced by small farmers. Some authors argue that agricultural production has decreased. According to the United Nations Food and Agriculture Organization (FAO, 2004), the number of hectares devoted to agriculture in Ecuador

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<sup>57</sup> As a result, long term efforts by farmer organizations for decreasing pesticides are not appealing to farmers.

decreased during the 1998 and 1999 economic crisis. As of 2003, agriculture had not returned to the levels of its maximum expansion in 1996. However, there was an increase in the total area of crops from 1999 to 2003 (FAO, 2004).<sup>58</sup> In the Andean region, from 2002-2004, there was a decrease of 10.8% in transitory crops and of 7.2% in permanent crops, contrasting an increase of 3.1% in pastures. This trend may be more important in the south due to the fact that the north-central Andean province of Pichincha accounts for a significant portion of the rate of growth in agriculture in the ranges (INEC & SEAN, 2002).<sup>59</sup> In the rural area of the province of Cañar, agriculture, as a core productive activity, has declined in favour of other activities including migration (Martínez, 2004).

However, data also shows that an important percentage of crops remain. According to another study in the area, the abandonment of productive lands in the southern ranges is less than anticipated, as most of the farmers still maintain production while resorting to other forms of income. (Jokisch, 2002). This remaining production combines some crops for markets and some crops for self-consumption. Since 1995 in Ecuador, non-agricultural sources amounted for 40% of income in rural areas (Lanjouw, 1999). In the province of Loja, also in the south of Ecuador, farmers combine part-time agriculture with multiple other occupations in order to survive (Annessi, 2002).

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<sup>58</sup> A report by the Ecuadorian National Institute for Statistics and Censuses (INEC) states that the overall area of transitory crops from 2000 to 2007 showed a reduction of 17.5% (INEC & SEAN, 2002). However, for 2001, this report takes data from the livestock and agriculture production census of 2001, which differs methodologically from the surveys for the subsequent years. For this reason, data from the surveys by the FAO are used in this description. They also offer the advantage of a longer time-series for comparison.

<sup>59</sup> Located mainly in the northern Ecuadorian ranges, export-oriented floriculture expanded ten times its crop area from 1990 to 2002. The effects of floriculture are twofold. While it generates employment, its social effects in terms of social instability and disruption of community organization are concerning, calling for a more clear policy for its regulation (Korovkin, 2004). In addition, harmful effects in terms of human health and pesticide use have been described (Breilh et al., 2005).

The type of agricultural hat has developed in parallel with other phenomena related to migration generates problems for farmer organizations trying to promote sustainable and healthy forms of production. This type of agriculture generates a crisis of human resources that may increase pesticide use and frustrate the search for other options. First, the fact that families as a whole and workers in particular resort to different occupations in addition to agriculture implies that they do not have enough time and resources to engage in the learning promoted by their organizations. Ecuadorian agriculture in the past decades was practiced with less manpower than in prior years. The FAO suggest that the sector of the Ecuadorian population that depends on agriculture will continue to decrease in order to reduce the gap between the participation in agriculture in the GDP, which is just 7% or 8%, and the population dependant on agricultural production, which is 19% (FAO, 2004, p. 126).<sup>60</sup> However, this process also indicates that in order to maintain productivity, there must be investment in technology and technical assistance that is beyond the capacity of traditional farmer organizations. Moreover, in an area that is dominated by small farming, the fact that the remaining workers are engaged in multiple occupations makes it more difficult for any institution to coordinate the type of technical assistance required. For instance, pesticide application is a technology that requires a smaller workforce because it suffices with few applications per crop cycle. This is very efficient for farmers who are too busy for technical assistance or training. Farmers have to pay attention to multiple responsibilities and may not have the time or interest in projects that improve agriculture.

In addition to the fact that scarcity of human resources taxes the search for safer alternatives for agricultural production, migration reduces farmer organization's human capital. The majority of Ecuadorian emigrants have a higher level of education than the rest of the population

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<sup>60</sup> This trend has also been experienced by other countries in Latin America (FAO, 2004).

(Camacho & Hernández, 2007). For instance, while 57% of Ecuadorian inhabitants have lower than or equivalent to elementary school education, only 27% of the migrant population has elementary or lower levels of training (B&A, 2003, p. 15).<sup>61</sup> In a research conducted in the same area as my study, most of the migrants belonged to the most productive age range and the best educated sector of the population (Martinez, 2005b). As a result, the community's best trained human resources leave, rather than contributing to their community organizations.

Besides draining the community's human resources, migration can further generate inequalities that disrupt traditional social structures in which some farmer organizations were created. The middle class migrates more than the poorest sector of society. In 2003, 51% of remittances were received by families with a monthly income between US\$250 and US\$500, even though this group represented just 27% of the total Ecuadorian population according to the national census. By contrast, the poorest sector of the population, receiving less than US\$250 for their monthly income, corresponds to 57% of Ecuadorians according to the census. This sector represented just 26% of the emigrants (B&A, 2003, p. 14). While confirming this divergence, Figure 4.7 also shows the extent to which families above the poverty line have had a higher incidence of migration in recent years than poor families. Overall, while it has been estimated that migration in Ecuador may have helped to reduce poverty by 5%, it has also helped to increase inequities. In 1990, 4.6% of income was received by the poorest 20% of the population, whereas the wealthiest 20% received 52% of the national income. In comparison, in 2000, 2.5% of the income was received by the poorest 20% of the population, while the richest 20% received 60% of income (Acosta et al., 2006). In addition to the fact the poor do not have the same

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<sup>61</sup> This trend places Ecuador in the middle of a range of countries that differ according to the wealth of emigrant families. For example, whereas 61% of households that received remittances in Mexico are poor, in Peru, only 6% of the households that receive remittances are located in the lowest income quartile. Ecuador is in a group of countries where close to 30% of the households that receive remittances are poor (Fajnzylber & López, 2008:4-5)

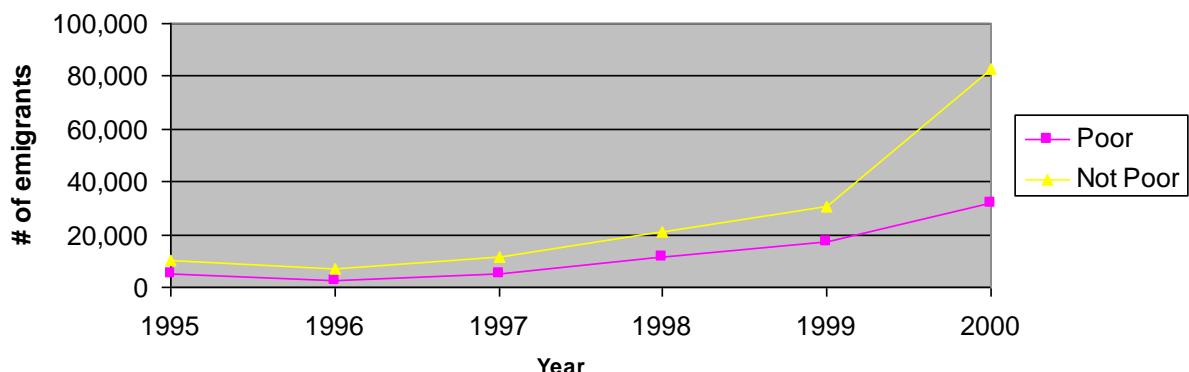
possibilities to migrate, the economic inflation derived from an increased flux of dollars makes it difficult for families that do not have remittances to cope (Acosta et al., 2006).<sup>62</sup>

The fact that migration may contribute to inequities leads to the disruption of social structures at the community level, making an impact on the capacity of traditional organizations to channel community projects. First, the fact that a sector of the community migrates increases differences among community members, creating either new forms of stratification or strengthening former stratification. In any type of community, migration can generate parallel networks that do not belong to the traditional structures supporting the organizations. This process divides community structure. For instance, in a mixed-race rural community in Cañar, migration may have contributed to weakening traditional forms of solidarity such as the minga and the prestamanos, and to strengthening unprecedented forms of social stratification (Walmsley, 2001). In another example, in the indigenous organization of the Tucayta in Cañar, migration has resulted in the transformation of traditional networks and structures in the communities and the emergence of new forms of identity, further weakening traditional organizations (Martínez, 2004).

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<sup>62</sup> An Ecuadorian may require from US\$7000 to US\$9000 to travel to the United States, whereas travelling to Spain costs approximately US\$4,000. Families usually need to have high interest loans to afford this enterprise (Jokisch & Pribilsky, 2002). This effort is out of reach for the poorest families.

**Figure 4.6. Emigrants for work-related reasons from Ecuador according to poverty line, years 1995 to 2000**



By F. Cabarcas according to data by EMEDINHO,  
INEC, 2000, Encuesta de medición de indicadores de la niñez y los hogares

In addition to changes in a community's equity and traditional structures, migration is a family strategy that involves cultural changes different from the traditional roles assumed by farmer or indigenous organizations. This poses adaptation challenges for organizations. Indeed, migration determinants include not only the economic factors of unemployment and low salaries, but also cultural dimensions that shape a distinctive family strategy (Goycochea & Ramírez-Gallegos, 2002). Ruptures with the traditional culture of sending communities are also a motive for sectors of the community to migrate. Competing visions of a determinate society, which Bourdieu calls heterodoxy, may be part of a larger political struggle for defining social structures in alternative forms (Bourdieu, 1993, pp. 155-166). <sup>63</sup> Migration is also an expression of alternative ambitions and worldviews that do not coincide with tradition. These alternative perspectives are interwoven with social structures. For instance, a study about Ecuadorian immigrants to the Netherlands found that among their reasons for leaving the country there was exclusion that was not only economic but also political and cultural (Ruiz, 2002). The

<sup>63</sup> By contrast, the concept of doxa refers to the rare situation where there is an almost complete correspondence between the social structure and its subjective representation (Bourdieu, 1993:160).

importance of local context, geographical and cultural characteristics for migration help to explain diverse strategies and migration patterns followed by similar social groups in different communities (Kyle, 2000).

Furthermore, the flow back to the community of information and alternative visions through established networks may contribute to weakening even more traditional perspectives of society. Networks and social capital contribute to facilitating migration (Massey & Aysa, 2005; Sánchez, 2004). The flow of information through these networks helps to generate new forms of identity and cultural visions in the sending communities. For instance, the construction of American-style houses in the sending communities of the southern ranges in Ecuador has been described as a new form of identity and prestige not linked to agricultural tradition (Jokisch, 2002; Martínez, 2004). As a consequence of the flow of competing visions of society, farmer organizations, either traditional or non-traditional, need to adapt to provide answers to a community whose traditional agricultural culture is constantly challenged.

Overall, the position of small farmers and their organizations in the field of agriculture is marked by three elements. First, an inequitable land distribution confines most of the peasants to smallholdings that make more difficult the coordination of safer and sustainable strategies. Second, unfavourable market policies have brought great competition to small farmer's products. The type of markets that would favour their transition to safer forms of agriculture may be beyond the reach of small farmer organizations. Third, the support from state and other civil society institutions that small farmer organizations receive is far from sufficient to overcome their limitations of access to resources. Furthermore, small farmer organizations may have more difficulties than larger producers in securing assistance. In the midst of these challenges, peasant and indigenous organizations in Ecuador have made a great effort to improve their conditions.

Nonetheless, their gains seem to fall short of changing their position in the field. The three elements (land distribution, market policies and access to adequate support) are the focus of attention of my analysis of the communities of Quilloac and San Rafael.

## **Chapter 5: Objectives and methods**

This chapter provides a detailed description of the methodological approach used to achieve my objectives, which are restated in the initial section. I also present my conceptual framework and the operationalization of some of the key concepts introduced in Chapters 1, 2, 3, and 4. Next, a discussion of my general methodological approach is presented, followed by a detailed description of its four main components: household survey, ethnographic methods, action participation research, and analysis of hospital discharge records. Finally, some ethical considerations are summarized.

### **5.1. General objective**

The general objective of this dissertation is to better understand what role small farmers, their organizations and other social players in the communities of Quilloac and San Rafael can play in reducing environmental and health risk associated with pesticide use in agriculture.

### **5.2. Specific objectives**

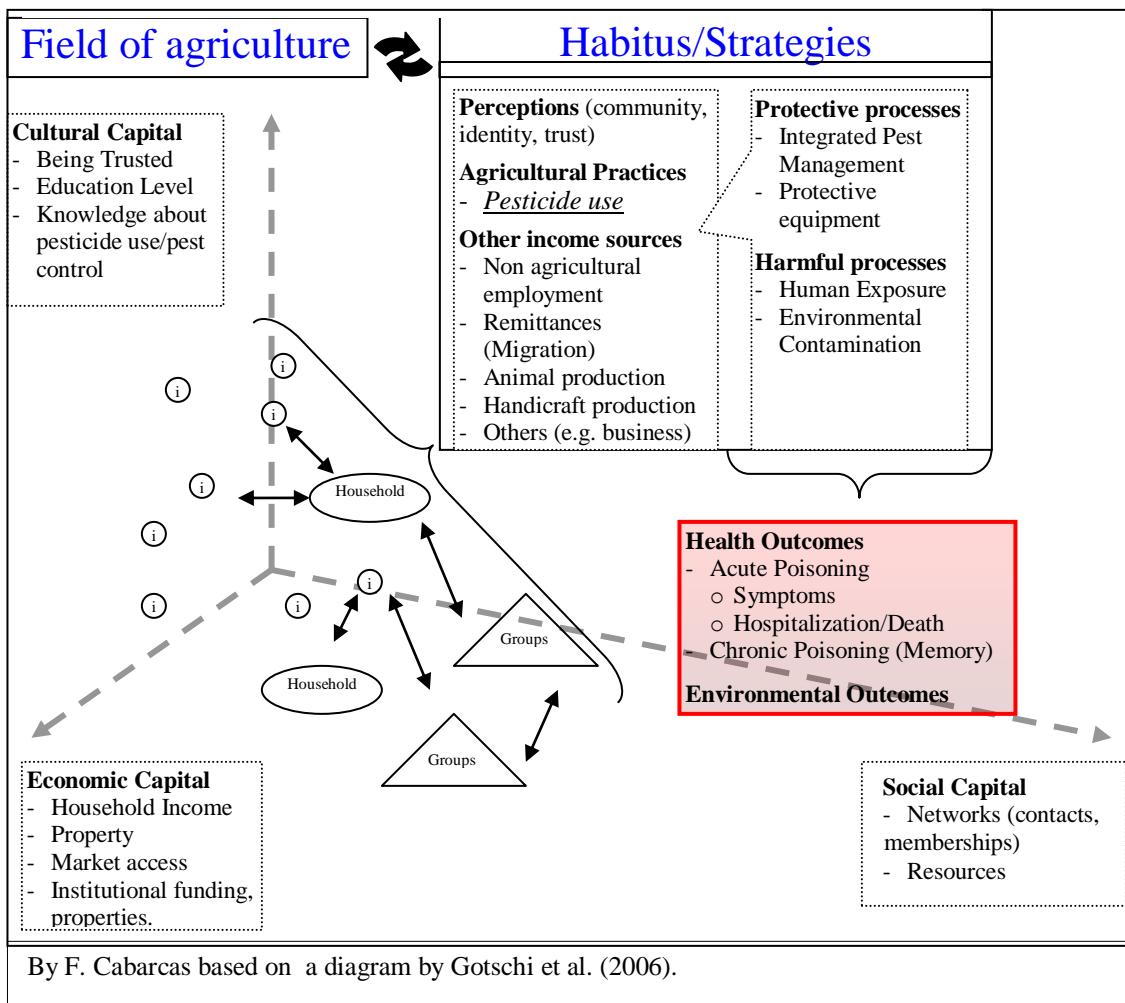
1. To better understand diverse patterns of human exposure to pesticides in agricultural practices, and to identify problems with pesticide handling by inhabitants of Quilloac and San Rafael.
2. To better understand structural factors that determine the capacity of small farmer organizations to promote healthier and environmentally friendlier agriculture in the communities of my study, Quilloac and San Rafael.

3. To better understand the extent to which individual and organizational adaptation strategies affect the community capacity to develop sustainable and healthier agriculture alternatives in the communities of study.
4. To identify strategies for harnessing community capacity to reduce environmental and health risk associated with pesticide use in Quilloac and San Rafael.

### **5.3. Conceptual framework**

This section details my conceptual framework, which is mainly based on the discussion presented in previous chapters. Figure 5.1 shows a schematic representation of these concepts. My approach to better understand the capacity of community organizations to reduce pesticide related risks is mainly based on the work by Pierre Bourdieu (Bourdieu, 1980b, 1980c, 1986), as introduced in Chapter 1. Some additional details about the extent to which these concepts were operationalized can be found in Appendix 1 (Operationalization of variables) and Appendix 2 (Household survey).

**Figure 5.1 Conceptual Framework**



Pesticide use in agriculture can be a dangerous practice for human health and ecosystems (see Chapter 3). I used screening techniques to discover whether pesticide use was a concern for farmers in Quilloac and San Rafael and their organizations.<sup>64</sup> In terms of human health, I conducted research about three potential outcomes: 1) acute intoxication requiring hospitalization, 2) a screening test for common symptoms of acute pesticide exposure, and 3) short-term memory loss as a potential chronic neurological effect of pesticide intoxication. In order to gather information about common symptoms of acute pesticide intoxication and memory loss due to chronic exposure, I adapted a validated 15-minute screening survey

<sup>64</sup> This research did not seek to discover all of the potential implications of pesticide use.

developed in Ecuador for assessing human exposure to pesticides (Breilh et al., 2005).<sup>65</sup> Furthermore, I reviewed medical records from the local hospital to identify cases of acute intoxication from pesticides. Ecosystem contamination was not directly assessed in this project because it was included in an environmental contamination assessment carried out by my partner, Rafael Alulema (2008). As part of his Masters thesis, Alulema extracted samples of water from the local irrigation channels to detect concentrations of Carbofuran, a frequently used substance.

The extent of any potential impact of pesticide use depends on a number of practices. First, I asked about the particular substances that were used for different crops in Quilloac and San Rafael, trying to identify trends according to the diversity of agricultural practices. According to the type of crop, I identified the type of chemicals, the frequency of use and the amounts employed by farmers. I also explored the most common pests identified by farmers and their substances of choice for controlling them. In addition, I examined experiences of integrated pest management or organic production in Quilloac, San Rafael and neighbouring communities. Second, in interviews and questionnaires, I asked for work behaviours that could increase human exposure and environmental contamination. Humans can absorb pesticides by ingestion, inhalation or dermal absorption (Yassi, Kjellstrom, de KoK, & Guidotti, 2001a). I asked about factors such as the type of clothing worn when working, the use of personal protective equipment, and hygiene practices after application. I also explored practices for the preparation of mixtures and the disposal of chemicals, including storage of pesticides. These factors are commonly quoted in the literature about pesticide use (Quandt et al., 2006). Furthermore, I asked

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<sup>65</sup> Other acute consequences to human health from exposure to pesticides can include common symptoms such as skin irritation, headache, dizziness, nausea, abdominal pain, and difficulty breathing. Long-term, pesticides can produce problems in the nervous system such as alterations in peripheral sensibility, and loss of memory, coordination and concentration (Costa, 2006). See Chapter 3.

farmers about their sources of information about pesticide use and their preferred warehouses for purchasing the chemicals.

Practices of pesticide use in Quilloac and San Rafael are understood in this thesis to be a part of the farmers' habitus. To Bourdieu (1980b), the habitus is a group of beliefs, attitudes and practices that are learned through social interaction. Habitus is considered to be the basis of perceptions and principles that generate practices (Bourdieu, 1980b, 1980c, 1986), as discussed in more detail in Chapter 2.

The use of pesticides is embedded in the set of practices that forms peasants' habitus of agricultural production. I follow the work of other scholars who have used Bourdieu's definition of habitus to understand agricultural practices as a community development process (Gotschi et al., 2006; Gray, 2000; Grenfell, 2006; Martinez, 2003, 2005b, 2007; Raedeke, Green, Hodge, & Valdivia, 2003). Social change is embedded in the intersection between people's habitus and the social structure of the field in which they interact. As a practice, the application of pesticides is part of a group of strategies that farmers use for their agricultural activities. These strategies can be adopted by individuals or by groups. In this project, I explore three main levels of analysis. The two initial levels of study for agricultural practices are the individual farmers and the households in their communities. While individuals may adopt particular agricultural practices according to their habitus, I focus on agriculture as part of a set of practices that integrate survival strategies adopted by households in Quilloac and San Rafael. A third level of analysis that sometimes intersects with the first two levels of analysis is the consideration of the organizations and institutions available in the communities. These are examined as a group.

As a household survival strategy, the practice of agriculture in the Ecuadorian Andes is very diverse. For instance, rural inhabitants can have their own crops and simultaneously be employed by other producers. Farmers can also exchange their labour for land, goods or other social benefits. All household members can have different levels of participation in the care of the crops. I explored this diversity of scenarios in surveys and interviews. At an individual level, I focused on the interviewee's perception of their level of participation in agriculture. I also asked about the subjects' main occupation and their interaction with pesticides in crops. At a household level, I calculated an index of household participation in agriculture (average of all adults' participation as perceived by the interviewee). In addition, I asked for the relative level of income that households received from their own crops, or from paid work in agriculture. I also asked about the number of hectares of land that a household owned and harvested.

In addition to participation in agriculture, I asked about other survival strategies adopted by households in Quilloac and San Rafael. In particular, I asked about the relative amount of income that the household received from animal production, remittances, non-agricultural employment, production of handicrafts, and other activities. The answers provided in the survey were the basis for the identification of clusters of households according to their profile of income from different sources. In addition, in interviews, surveys and observations, I explored in detail patterns of national and international migration. I also inquired about the farmers' marketing strategies.

In order to better understand the adoption of individual and household strategies, I asked in interviews and surveys about the study population's perception of their community, their agricultural practices and their organizations. First, I asked about the perception of agricultural practices as a part of the community identity. For example, I researched two reciprocity practices

that are related to agricultural tradition: *prestamanos* and *mingas*. Prestamanos is a form of non-monetary exchange of workers in the rural Andes, while mingas is a traditional form of collective labour that can be promoted by community members or their organizations (Ferraro, 2004). I also wanted to know if community members believed that they shared the same values with one another, and if they perceived themselves to be united. Regarding community organizations and institutions, I asked farmers about their trust in the capacity of community organizations to improve the population's quality of life. Trust is defined as a belief that the other is going to act according to one's interest. Trust implies the assessment that the other has encapsulated my interest to assure collaboration. Trust is relational and goal-related (Hardin, 2002).<sup>66</sup> I focus on the subjects' trust in the capacity of a number of relevant organizations and institutions to improve the quality of life in the community. As a perception, trust is part of habitus since it is defined by one's personal experience of interaction and cultural learning derived from a group.

Community organizations are understood to be a particular type of network with some form of institutionalized recognition by its members and other people in the community. A group's practices are developed according to their particular position in the social structure of the field of agriculture. Networks can be more or less institutionalized (Bourdieu, 1986). I identified different formal networks, groups, organizations and institutions relevant for the communities of

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<sup>66</sup> Assuming trust as a perception that is relational and goal-oriented differs from the conception adopted by some authors who see trust as a collective asset. For instance, Robert Putnam (1993b; 1995) uses a question related to whether most people are trusted or not (generalized trust). A similar approach is very common in health literature (Iisakka, 2006; Kawachi, 1999; Kawachi et al., 1999; Kawachi et al., 1997; Kennedy, Kawachi, Prothrow-Stith, Lochner, & Gupta, 1998; Kim & Kawachi, 2006; Kim, Subramanian, & Kawachi, 2006). By contrast, I follow work by Russel Hardin (2002), who sees trust as a relational and goal-oriented belief about another person. When a subject is asked whether or not he trusts people, the answer may refer to a close circle of acquaintances rather than to a generalized predisposition applicable to all members of a society. In addition, trust refers to particular actions. One may trust a person for some things, but not for others (Hardin, 2002). For instance, I may trust my neighbour to examine my crop for pests but not for applying pesticides in my land. Trust is not a collective asset; it is relational and depends on the intention.

study. I included both state and civil society networks, but my main focus was on community organizations. I explored their practices for providing support and services for households and individuals in Quilloac and San Rafael. In particular, I explored their activities for supporting a reduction in pesticide related harm in the communities. I also explored their perceptions about pesticide use, agriculture and community development in Quilloac and San Rafael. In addition, following the World Bank's guidelines for developing organizational profiles, I identified the origins and development of organizations, quality of membership, institutional capacity in terms of resources related to agriculture, and institutional linkages with other institutions inside and outside of the community (Frank, 2005).

Individual and group strategies are codetermined by the field of agriculture in Quilloac and San Rafael. To Bourdieu (1980b; 1986), a field is a system of relationships constituted by social agents related to the production and promotion of a particular product (such as agriculture). A field is constituted by two elements: the existence of a common capital and the struggle for its appropriation by different social players (Bourdieu, 1980b, 1986). I identify three key factors determining the field of agriculture at a regional level for the Southern Ecuadorian Andes, where Quilloac and San Rafael are located. These are 1) distribution of land, 2) access to markets for agricultural products, and 3) state and organizational support. In addition, I discuss international migration as a household strategy (habitus) that may affect the structure of the field of agriculture (See Chapters 4 and 8).

In general, the structure of a field, such as agriculture, is determined by the distribution of different forms of capital. Social players, individuals and/or groups, are in constant competition to control the forms of capital (1980c; 1986; 1997). When controlling any form of capital, groups or individuals can transform social energy to achieve their objectives. In this work, I

focus on the differential access that groups or individuals have to different forms of capital. I follow other authors who have focused on health and equity, seen as the objective and subjective distribution of different forms of capital (Lynam & Cowley, 2007; Veenstra, 2007).

Following Bourdieu (1986), I identified three main forms of capital in the field of agriculture: economic capital, social capital and cultural capital.<sup>67</sup> The first form of capital was economic. I understood all objects that could be the subject of direct monetary exchange to be economic capital. These included means of production. At a household level, I asked about household income level and area of land property. At an organizational level, I focused on financial instability, sources of funding and physical assets (e.g., buildings, land property, equipment, etc). The second form of capital was cultural. Cultural capital was defined as diverse forms knowledge, skills, education, and other non-economic mechanisms for attribution of social status.<sup>68</sup> For farmers and members of community organizations, I asked about education level. I also inquired about the individuals' knowledge of crop management techniques, including pesticide use, and their sources for this information. In addition, I also aimed to better understand the cultural construction of knowledge related to agriculture and indigenous identity, and the extent to this may affect the adoption of safer agricultural practices.<sup>69</sup>

The third form of capital was social. I paid special attention to social capital because it included networks and groups such as community organizations. Social capital was defined as

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<sup>67</sup> All forms of capital are symbolic and interchangeable. As symbolic, all forms of capital represent social relationships. However, people can perceive their social relationships as justified according to their beliefs. Individuals may not have a complete vision of the power networks in which they are embedded (Bourdieu, 1986; Bourdieu, 1997). In addition, any form of capital can be transformed in other forms by means of social transactions established in a particular society (Bourdieu, 1986).

<sup>68</sup> The habitus, as a socially constructed knowledge, is very important for the reproduction of cultural capital (Bourdieu, 1986).

<sup>69</sup> Furthermore, at an institutional level, I understand the condition of 'being trusted' by community members to improve their quality of life as part of the cultural capital. The condition of being trusted for improving the quality of life would grant organizations or institutions more capacity for mobilizing community resources for action.

resources embedded in more or less institutionalized networks of mutual acquaintance and recognition (Bourdieu, 1986). Thus, social capital analysis required the description of two elements: resources and networks (Carpiano, 2005). First, I described formal and informal networks that were relevant for agricultural development and pesticide use. I studied households and community organizations. I focused on the interaction between individuals, households and organizations at different levels, including state and civil society networks. At an individual level, I asked about relative frequency of contact with community organizations and other institutions in the communities. At a household level, I asked about household members' affiliation or membership to any organization or institution relevant for agricultural development in Quilloac and San Rafael. At an institutional level, I focused on identifying types of interaction between different groups or institutions, describing their collaborative alliances.

Second, I asked about economic, physical, cultural or knowledge resources that could be accessed through networks. The presence of resources in a network does not grant access to them. Hence, at the institutional level, I investigated conditions for providing these resources. At an individual level, I focused on conditions for effectively accessing the resources. I also asked farmers about their access to four types of social resources that could be obtained through networks in Quilloac and San Rafael: manpower for the crops, information about pest control or pesticide use, money borrowed without interest, and help with advocacy about laws or state regulations. I evaluated the strengths of the networks providing these resources by identifying whether or not they were made up of family members or acquaintances. I asked whether their resources came from networks that originated inside (bonding) or outside (bridging) the communities (Enns, Malinick, & Matthews, 2006).

In the search for effective interventions for pesticide related harm, I intend to focus on the extent to which community capacity can play a decisive role in building healthy, environmentally safe and sustainable alternatives for small farmers. I understand community capacity as a group's potential to achieve change for promoting their health or improving their environment. In this work, I focus on the capacity of community organizations to support this change. Their capacity depends on 1) their access to different forms of capital in the field of agriculture in the southern ranges in Ecuador, and 2) the particular strategies that they adopt to control the resources available in the field. I also study households as a basic social and economical unit. Households are defined as groups of people who live together and build strategies to access resources available in the field of agriculture. I also explore connections and commonalities between strategies built by community organizations and households.

#### **5.4. Methods**

This research is a descriptive case study focused on an area covered by the contiguous communities of Quilloac and San Rafael in the southern Ecuadorian ranges. The field work was carried out between April 2007 and February 2009. To achieve my research goals, I used a mixed method design integrating qualitative and quantitative techniques. There was also a core component involving a participatory action research process designed to build strategies for mobilizing community resources for pesticide harm reduction. First, I applied a household survey to a sample of the population to describe the distribution of health problems, harmful practices associated with pesticide use, their habitus, and some elements of the field structure. Second, I used ethnographic methods such as observation, in-depth interviews and the revision of documents in order to gain a better understanding of the subjects' habitus (perceptions and

practices) and the structure of field of agriculture. Third, I facilitated a participatory action process that engaged subjects in an interactive debate about pesticide use and in the development of some actions to reduce their associated harm. I complemented these three major approaches with a review of the discharge records at the local hospital which became the basis for a study of a series of cases of pesticide poisoning over ten years and an embedded control case study. I also analyzed the irrigation system database for the communities, which helped to document trends from 1997 to 2007 regarding the size of productive units in the communities. Details about these phases are described below.

A case study is research that aims to better understand a phenomenon with emphasis on the particularities of its context. In a case study, a large number of categories and variables are processed for a relatively small number of units of analysis, and multiple sources of information are collected for triangulation (Yin, 1994).<sup>70</sup> The case of farmers from Quilloac and San Rafael is particularly relevant to my objective to better understand the role that small farmers, their organizations, and other social players can play in reducing environmental and health risk associated with pesticide use in agriculture. Even though Quilloac and San Rafael's circumstances were not exceptional, these communities are relevant to my objectives for several reasons. First, farmers in Quilloac and San Rafael face double marginalization as both small farmers and indigenous peoples. Second, as one of the cultural hubs of the Cañari Nation, together, the communities of Quilloac and San Rafael had an impressively high density of community organizations. Third, the potential health and environmental impacts of pesticide use in the communities were a concern that community leaders had clearly expressed. Fourth, farmer organizations in the communities had a long standing record of programs and activities aiming to

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<sup>70</sup> Malcolm Tight (Palacios Nava, Garcia de la Torre, & Paz Roman, 2009) argues that a case study design is not significantly different from other qualitative or quantitative designs except for the extent to which there is a careful study of a small sample or unit of analysis from a particular perspective.

reduce harm related to pesticide use. Fifth, community organizations in Quilloac and San Rafael have been active participants in the process of empowerment that Ecuadorian aboriginal peoples have promoted at a national scale in recent decades (see Chapter 4).

In this project, I combined two different traditions in case study research: a predominantly inductive tradition, illustrated by the work of Robert Stake (1994; 1995), and a deductive tradition, exemplified in the work of Robert Yin (1994). First, an important part of my propositions and hypotheses were generated after preliminary observations and interviews during field work. This corresponded with suggestions by Stake according to which, in a case study, the analysis is done within the case so that it provides its own set of hypotheses and interpretations (Stake, 1994).<sup>71</sup> Second, I also established an initial set of preliminary propositions based on the literature and Bourdieu's work. This set of propositions was fundamental for the quantitative components. In doing this, I followed Yin's approach by developing a theoretical model, identifying particular hypotheses and variables related to its concepts and testing alternative hypotheses (Yin, 1994). Data collection, thus, was also informed by theory. In general, I adopted Yin's overall analytical strategy of testing for plausible rival hypothesis for both qualitative and quantitative data (Yin, 1994).<sup>72</sup> However, I departed from Yin's perspective because, following Stake (1994), I favoured an in-depth study of a single case and the emergence of inductive categories in my analysis.

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<sup>71</sup> Robert Stake's work is based on a phenomenological approach, which assumes the existence of several views of reality. The emphasis is put on finding one or multiple possible interpretations of phenomena whose knowledge has a local and contextual meaning embodied in the language and actions of social players. The main characteristic of a case study is the selection of the cases with emphasis on their uniqueness, history and particular context. Single case studies are encouraged because they allow a better understanding of meaning and perceptions in a particular context (Stake, 1994).

<sup>72</sup> Robert Yin's approach to case studies is positivist. The goal is to find replicable hypotheses in the cases. The model compares multiple case studies to multiple experiments. Hence, multiple case studies are preferred. One of the objectives of the data analysis is to separate the phenomenon of study from the context so that it can be explained regardless of the particular circumstances. If research questions change during data collection, the design should be changed (Yin, 1994).

This case study differed from the epistemological positions adopted by Yin (1994) and Stake (1994; 1995) because my analytical approach was based on a ‘constructivist structuralism’ as described by Bourdieu (1989). This approach acknowledged the existence and interdependency of two sources of social action: schemes of perception (habitus) and social structures (fields). Following Bourdieu (1989), schemes of perception can shape any society. However, the approach simultaneously explores the existence of ‘objective structures’ (outside of symbolic constructions), which are also capable of modifying perceptions. Scientific research must aim to understand objective structures, perceptions, and mutual interaction (1989; 2003).<sup>73</sup> Consequently, I focused on aiming to better understand the perceptions of community members, while simultaneously engaging in a process of actively tracking the extent to which social structures, as defined by the field of agriculture, may have co-determined self-understandings. To construct the best possible description of social structures, I based my conclusions on the triangulation of sources from academic literature, ethnographic observations, multiple informants, a household survey, and available records and documents. I actively aimed to better understand the extent to which peoples’ social positions may have been associated with their habitus (perceptions and practices), and the extent to which individuals and groups built strategies for controlling different forms of capital and modifying the structure of the field of agriculture.

Following Bourdieu (1999), I aimed to acknowledge the existence of asymmetric power relations among subjects and researchers. A central criterion is that a research relationship is also a social relationship. The researcher should not accept a respondent’s perspective as a direct representation of their social reality because the subject’s vision is partially the product of their

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<sup>73</sup> The extent to which a researcher may be able to ‘describe’ social structures beyond his or her personal perspective is a contested issue.

social position. Similarly, the perspective of the researcher is also biased. The discourse obtained in the research process has to be reconstructed according to the rules of the researcher's field (Bourdieu, 1999b, p. 611). However, this bias needs to be reduced as much as possible by a process of 'reflexivity' according to which the researcher engages in a process of auto-reflection that asks about the nature of the social relationship (Bourdieu, 1999b, 2003). This reflection is relational because it focuses more on the nature of the research relationship than on an autobiographical account by the researcher (Bourdieu, 1989).

According to this, I adopted several strategies aiming to reduce the biases of my research process. First, I aimed to actively identify disagreements between my perspectives and the perspectives held by the subjects of my research. I constantly discussed with local leaders my perceptions and working hypotheses about their community. I also received their feedback about my main conclusions. The objective was to identify if disagreements came from misleading data or diverging interpretations of the same data. I summarize below some areas of disagreement resulting from different views about the same pieces of information. Second, I agreed with the research participants on a set of principles for reducing asymmetries in our relationship as much as possible. They are discussed below as part of the action research component and the ethical guidelines. Third, I aimed to identify research biases in each one of the subcomponents of this research as indicated by accepted practices in my academic field. The elements that I identified are described in the methodological section for each component. Fourth, I compared results from multiple sources of data in a process of theoretical triangulation. Each type of data was analysed separately. Comparison and integration of data was carried out at the level of the theoretical

discussion once the results were obtained. I also integrated theoretical propositions from surveys and ethnographic components with the support of secondary literature (Begley, 1996).<sup>74</sup>

Taking into account the existence of unavoidable biases, I am confident that the propositions that I defend are valid within the boundaries of the particular context in which they were studied: the communities of Quilloac and San Rafael between April 2007 and February 2009. I do not attempt to claim a universal validity of the set of processes described for these communities. However, I also believe that my reflections about this case are relevant for an international discussion about three intersecting issues that frame my interest as a researcher in the field of public health. First, my narrative about the experience in Quilloac and San Rafael is intentionally constructed to inform the growing interest of the international public health community in further developing approaches to community capacity building for promoting public health initiatives. In particular, I aimed to provide a critical approach in order to better understand the extent to which community capacity building could contribute to reducing health inequities (see Chapter 2). Second, I also intend to contribute to the global debate on environmental health (Forget & Lebel, 2001; Lebel, 2005). By discussing alternatives for reducing pesticide related harm to ecosystems and human health, I want to provide insights that could help societies who are aiming to make a much needed transition towards healthier and environmentally friendlier forms of production (see Chapter 3). Third, based on my interest in the expression of global driving forces in local contexts, I have made an effort to develop an informed perspective about the relative position of farmers in Quilloac and San Rafael in a regional, national and

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<sup>74</sup> In addition to this process, ethnographic techniques such as archival records, interviews, direct observations, and participant observation complemented the initial design of the survey. The survey was also subject to discussion by community leaders. Accordingly, emergent categories from partial qualitative analysis, as well as more adequate definitions and terminology for the questions were integrated in the survey design.

international context. I use literature and my findings about local history to establish some of these connections (see Chapter 4).

**5.4.1. Methodological components.** This section describes the details of the methodological components.

**5.4.1.1. Household survey.** The household survey was the basis for a descriptive survey to ascertain agricultural practices, to understand the exposure distribution, and to screen for pesticide health effects. In addition, it included questions about key elements from the forms of capital such as educative level, household structure, land tenure, income level, and access to social resources and networking. A complete description of the variables used in the survey is provided in Appendix 1, while the complete survey is available in Appendix 2. In addition, the survey was conducted by trained interviewers in a stratified randomized sample based on households. Two strata, the contiguous communities of San Rafael and Quilloac, were considered in order to ensure an adequate representation of the smallest community, San Rafael, in the sample. The following sections describe in detail the sampling strategy, survey development, and data analysis for this survey.

*5.4.1.1.1. Target population and sampling strategy.* The population of interest was all Quilloac and San Rafael's households, which were the main social and productive units for agriculture. Within each household, I targeted one adult, woman or man, self-identified as the head of the household.<sup>75</sup>

The sampling strategy was a random selection of households from the two strata.<sup>76</sup> The identification of households for the sample frame was based on the maps of the irrigation system that community organizations agreed to provide. The maps were updated in consultancy with members of community organizations, resulting in a universe of 396 households in Quilloac and 136 in San Rafael. No names were used for identification.

The interviews were conducted by a group of five research assistants recruited from the Quilloac Technical Institute, which is a technical level institute for the education of intercultural school teachers in the region. The recruitment included indigenous students who did not live or have close relatives in the communities (in order to avoid potential coercive situations). Interviewers were previously trained by the researcher. After training, interviewers were assigned to households randomly within geographic areas to facilitate the collection of data. When approaching a household, the research assistants asked for the subject's consent at the moment of the survey (included in the first page of the survey). A period of no less than 24 hours was given to make a decision. The interviews were conducted in Spanish, which was spoken by all community members. However, all interviewers were also fluent in Kichwa, the most common aboriginal language, so that they were able to clarify any doubts expressed in any language.

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<sup>75</sup> In Ecuador, age of majority is reached at 18 years old.

<sup>76</sup> For each stratum, a simple random selection was performed.

The sample size was obtained for each one of the stratum (communities), using a proportion of 5% of expected prevalence of acute poisoning by pesticides.<sup>77</sup> In addition, an error of 3.5% and a confidence interval of 95% were used to obtain a sample size for each community (strata) according to the following equations (Daniel, 2005, p. 189):

$$\text{Sample size} = \frac{Z^2 * (p) * (1-p)}{d^2}$$

Where: Z = Z value (1.96 for 95% confidence level); p = percentage (.05 used for sample size needed); d = confidence interval, expressed as decimal (.035)

	Sample Size
Population Adjusted Sample Size=	Sample Size -1 1+ _____ N

Where: N = population

The resulting planned simple sizes were 72 households for San Rafael and 108 households for Quilloac. One household from each community was eliminated because the only people available to answer the survey were younger than 18 years of age. The final sample collected 71 households from San Rafael and 116 from Quilloac (an over sample selection was planned to ensure the sample size).

Table 5.1 shows the characteristics of the person who answered the survey in comparison with other household members 18 years old or older as reported in the survey by the

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<sup>77</sup> This percentage is an approximation. In a study in another province in Ecuador, Cole et al (2002) estimated that, among exposed farmers, the prevalence of symptomatic pesticide poisoning cases not requiring medical care was close to 4% (Cole, Sherwood, Crissman, Barrera, & Espinosa, 2002:183). This prevalence is an estimate that ranges from an estimated rate of 4 deaths per 10,000 inhabitants and 400 cases of sub-clinical neurological deficiencies related to pesticides per 10,000 farmers (Cole, Carpio, & Leon, 2000; Cole et al., 2002). Based on preliminary interviews, in the case of this research, it was reasonable to assume that the household head was the family member most frequently exposed to pesticides.

interviewees. In general, the people who answered the survey were older than other members of the household. More interviewees also had ‘farming’ as their main occupation, when compared to other occupants of the household as described by the interviewee. In addition, more men than women answered the survey.

**Table 5.1. Characteristics of survey respondents compared with other members of household 18 years old or older, in Quilloac and San Rafael, 2007**

	Respondent		Other household members	
	W mean	SE	W mean	SE
<b>Age*</b>	45.22	1.17	35.92	1.11
<b>Gender*</b>	<b>n</b>	<b>W Col %</b>	<b>n</b>	<b>W Col %</b>
Male	93	54.73	87	32.42
Female	84	45.27	172	67.58
<b>Main occupation</b>				
<b>Farmer*</b>	120	68.15	123	47.27
<b>Non-Farmer- non-skilled worker *</b>	20	11.66	23	8.50
<b>Professional or technician</b>	22	13.04	35	15.15
<b>Student*</b>	13	7.14	74	29.08
<b>Degree of participation in agriculture</b>				
Never	5	2.53	20	7.23
Occasionally	55	30.02	114	43.25
Often*	30	14.90	26	8.58
Always	85	52.54	98	40.95
<b>All</b>	<b>177</b>	<b>100.00</b>	<b>259</b>	<b>100.00</b>

Notes: n= frequency; W= weighted by strata, household cluster. W Col %: Column percent weighted by strata, household cluster; SE: Standard Error of mean

\* Significant association when other variables in the logistic model are held constant for an alpha error <0.05 (p). The odds ratios (OR) were:

Effects \ Odds Ratio Estimates	p	OR	95% Wald Confidence Limits	
Gender: Female vs Male	<0.001	0.30	0.18	0.52
Age	0.004	1.02	1.01	1.04
Occupation Farmer vs Non-Farmer- non-skilled	0.011	1.44	0.74	2.78
Occupation Professional or technician vs Farmer	0.605	0.88	0.48	1.62
Occupation Student vs Farmer	0.002	0.30	0.12	0.73
ParticAgr Often vs Never or Occasional	0.076	1.96	0.98	3.92
ParticAgr Always vs Never or Occasional	0.591	1.26	0.82	1.92

Source: Household Survey

*5.4.1.1.2. Survey development.* The survey instrument was developed by using the following strategies: 1) literature reviews were used to identify key conceptual categories and previously developed tools, 2) preliminary findings from the use of ethnographic techniques guided the adaptation and development of survey components, 3) the initial drafts for the survey were discussed with members of the thesis committee and members of farmers' organizations in the communities, and 4) the survey was pilot-tested in seven households of a neighbouring community that is similar to Quilloac and San Rafael.<sup>78</sup> The first three strategies improved the content validity, ensuring that the instruments are a proper representation of the concepts (Aday & Cornelius, 2006; Streiner & Norman, 2001). The consultancy with local community leaders, the pilot test and adequate training of the interviewers helped to improve the survey's reliability, understood here as response consistency from different subjects in diverse circumstances (Aday & Cornelius, 2006; Streiner & Norman, 2001). The final survey, available in Appendix 2, has the following sections: initial questions for adequate oral consent, demographic aspects and household structure, socio-economic conditions, forms of capital and resource generation, agricultural practices, practices of pesticide application, and problems with pesticide handling. Appendix 1 contains detailed information about variable operationalization.

Questions regarding social capital were adapted from several sources in the literature. First, for an assessment of resources available through networks, I adapted a resource generator. A resource generator is an instrument that asks individuals about the number of people, networks or institutions that could provide the subject with resources needed for responding to a particular concern. Compared with other tools for assessment of social capital, this instrument has the advantage of focusing on access to resources (Van der Gaag & Snijders, 2005). People who can provide resources can be classified as 1) relatives or acquaintances (allowing for the

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<sup>78</sup> This pilot test also contributed to the training of the interviewers.

identification of the *strength* of ties), and 2) links inside a community (*bonding*) or outside the community (*bridging* with other communities) (Van der Gaag & Snijders, 2005). The adaptation of the resource generator for this study was twofold. First, four questions about relevant social resources were constructed by means of interviews and consultation with local leaders. These questions regarded the following: 1) help with the crops, 2) free advice about pest management, 3) money lent without interest, and 4) help with advocacy about state regulations or bills. Second, based on the results of the pilot test, a four-level Likert Scale (ordinal scale) was used instead of the integer numeration suggested in the original tool. Farmers were asked to chose between none (1), few (2), some (3) and many (4) regarding number of ties (relatives or acquaintances and in or outside the community) that could provide each one of the resources.<sup>79</sup>

Second, in addition to the adaptation of a resource generator, survey sections about social capital were complemented with some questions adapted from the household module of the Social Capital Assessment Tool (SOCAT) developed by the World Bank (2010). Questions about household structure were taken from a summarized version of the household roster, selecting type of relationship, age, gender, and main occupation. A separate roster was used for household members living outside the community.

In addition, questions about problems with pesticide handling were based on an adaptation of Pentox®. Pentox® is a 15-minute screening survey for problems with pesticide handling and potential health effects caused by pesticides. The tool is under development by one of my partners in Ecuador and had been successfully used in floriculture in the Ecuadorian Andean region (Breilh, 2001, 2007; Breilh et al., 2005). The use of questions from Pentox ® was favoured for several reasons. First, it is a promising tool, which is underdevelopment for the

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<sup>79</sup> Accordingly, these variables were treated as either qualitative variables or statistical variables. Details about the statistical analysis are described below.

context of Ecuadorian agriculture. Second, the use of Pentox® allowed our Global Health team to gain more experience in the tool's potential for a larger research program on environmental health problems associated with pesticide use in Latin America. The Pentox® test is a simplification and adaptation of some of the tests originally included in the Neurobehavioral Evaluation System 2 (NES2)®. The NES2® is the second version of a computer-based neurological assessment battery that was developed in the 1980's (Baker & Letz, 1986; Baker, Letz, & Fidler, 1985; Letz, Green, & Woodard, 1996).<sup>80</sup> The NES 2® test was one of the most commonly accepted testing tools for toxicology in occupational health in the 1990's (Kent, 2003).

Based on the NES2®, the Pentox® selected and simplified a number of tests for application in participatory assessment of human pesticide exposure in flower and banana crops in Ecuador. The original Pentox® survey adapted a test for visual coordination, motor coordination, short-term memory and questions about symptoms potentially associated with acute pesticide intoxication (Breilh, 2001, 2007; Breilh et al., 2005).

My selection for this study included only the questions for short-term memory and symptoms potentially associated with acute pesticide intoxication because other segments of the test did not show good reliability in the pilot test of the survey. In particular, the motor coordination assessment and the visual integration component were eliminated from the survey since they required the farmers to draw some figures on paper. My pilot tests demonstrated that these components were in general very difficult for farmers from Quilloac and San Rafael's neighbouring communities. They also added too much time to the survey.

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<sup>80</sup> This development also builds on the proposal of the Neurobehavioral Core Test Battery (NCTB) developed by the World Health Organization (1986a).

Although the selected short-memory questions were adequate in the pilot test stage, the descriptive analysis of the final dataset showed some potential limitations in the context of Quilloac and San Rafael. The test is a face-recognition assessment tool based on the Benton Visual Memory test (Benton, Sivan, Hamsher, Varney, & Spreen, 1983), adapted by the Neurobehavioral Core Test Battery (NCTB) developed by the World Health Organization (1986a) and the NES2® (Baker et al., 1985). This component consists of three images representing human faces that were shown to the interviewee for 30 seconds. Next, the original three faces were hidden and the interviewee was asked to identify them in a chart with 25 faces. Four attempts were allowed. The original codification suggested by the authors was 1) badly (identification of the faces in the fourth attempt or more), 2) regular (when faces are recognized in the third attempt), 3) well (when all three faces are identified in the second attempt), and 4) very well (when all three faces are identified in the first attempt). However, the results did not allow further characterization of the group that did poorly, which contained most farmers (57.4% of farmers were classified as doing badly with 20.9% classified as regular). To allow more detail, the group of farmers that did badly was sub-divided in four additional groups according to the number of faces that they were able to identify. This resulted in seven groups of farmers, from worst (not having identified any face) to best (having identified all faces in the first attempt). However, the number of years working with pesticides did not have any significant effect when age was controlled in the cumulative regression model ( $p=0.621$ ).<sup>81</sup> Consequently, the short memory test was not included in the results of the study.

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<sup>81</sup> The farmers' performance on the memory test was significantly associated with age as older people tended to obtain worse results than younger interviewees ( $p=0.001$ ). However, this association may be explained by age and not by chronic exposure to pesticides. In effect, the number of years working with pesticides was not associated with the results of the memory test if age was controlled for. The age of the farmer, which was also correlated to his education level, may have acted as a bias factor in the context of Quilloac and San Rafael.

Selected items also included potential confounding factors that may trigger the same symptoms such as alcohol consumption, and other lesions or diseases.<sup>82</sup> In addition, I developed my own set of questions on human exposure to pesticides based on suggestions by community leaders, experts and literature on occupational health (Arcury et al., 2006; Hoppin, Adgate, Eberhart, Nishioka, & Ryan, 2006; McCauley et al., 2006; Quandt et al., 2006; Yassi et al., 2001a).<sup>83</sup> First, in interviews and questionnaires, I asked for work behaviour including the use of pesticides (type, frequency, amount per year), type of clothing worn when working, hand washing procedures at work (including frequency), and the use of personal protective equipment (Quandt et al., 2006; Yassi et al., 2001b). Related to household behaviours, I asked about use of work clothes at home (time, frequency), bathing behaviour after work, storage of pesticides and clothing worn at work, and laundry practices for work clothes. Related to labour, I asked about type of task (fieldwork, mixing, application), and use of hygiene facilities. Related to the household, I also asked about the total number of residents and the total number of farm-workers and acreage (Hoppin et al., 2006; Quandt et al., 2006). Other survey questions were developed for this study, based on the literature and the conceptual framework described above. Details are shown in Appendices 2 and 3.

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<sup>82</sup> A confounding factor is a variable that introduces a distortion in the relationship between two other variables of interest. (Rothman, Greenland, & Lash, 2008: 57-59, 129-132).

<sup>83</sup> While the original Pentox® instrument contained items about human exposure to pesticides, I developed my own set of questions for this study. The main reason was that the exposure questions from the Pentox® instrument were not fully applicable to the household-based agricultural production practiced in Quilloac and San Rafael as they were designed for productive units with formal employment such as floriculture farms in the Andes.

*5.4.1.1.3. Survey Data Management.* Data from the completed survey was coded by the candidate and entered in a SAS® database for data analysis (version 9.1). The data set was reviewed for transcription errors by the candidate and the community partner. Data transformation was limited to the following: 1) all weights for agricultural products were transformed to pounds (120 pounds for sacs and 30 pounds for baskets), 2) in some cases in which the interviewed gave a range (e.g., for the number of sacs or baskets of a particular product or the number of pesticide applications by cycle), the midpoint of the range was used, 3) when a single selection question had more than one answer, the record was marked as missing, 4) commercial names for pesticides were transformed to scientific names, and 5) common names for pests were also transformed to scientific names.

Records with missing values in the respective variables of interest were excluded for the analysis procedures (listwise deletion). Listwise deletion is a common approach to missing data under the assumption that the probability of missing data does not affect the association among the variables involved in the analysis. Furthermore, even when there is not complete certainty about this assumption, listwise deletion produces robust estimates for regression analysis (Allison, 2001).

The survey also asked specific questions about other household members (migrants and residents). In these cases, the perspective of the person who answered the survey about the other members was managed in separated databases.<sup>84</sup>

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<sup>84</sup> For analysis, in addition to including the community as strata, the household was identified as a cluster.

*5.4.1.1.4. Survey data analysis.* Exploratory descriptive statistics were calculated for all data. Descriptive information for the most relevant data is shown in Chapters 6, 7 and 8. Estimates for each community independently and combined were calculated. To obtain overall descriptive statistics such as means, standard deviation, and frequency percentages, the weight of each stratum (community) was calculated by using the inverse of the division of the sample size by community size (relative weights for observations for Quilloac = 1/ (117/396), for San Rafael = 1/(72/136 )). The strata weights were used to calculate weighted statistics according to strata. The SURVEYFREQ and SURVEYMEANS procedures were used in SAS<sup>®</sup> (SAS, 2004, pp. 4183- 4239, 4313-4361). In addition to weighted means, five percent-trimmed means were calculated for numeric variables when outliers were identified in numeric variables. Trimmed means help to eliminate distortions created by extreme values (Daniel, 2005, p. 166).

With the objective of exploring the significance of observed correlations, bivariate and multivariable associations were explored by regression analysis.<sup>85</sup> In all cases, assumptions were checked before building regression models. After an initial descriptive exploration with tables and charts, regression models were built for bivariate and multivariate analysis. No regression models were built when ordinal and nominal variables (response or explanatory) had categories with a frequency lower than five observations.

In addition, my approach for the construction of regression models was a progressive, as a new variable was included at each time. The variables that were not significant for an alpha level of 0.05 were excluded from the model. One exception occurred when the effect of a potential confounding variable needed to be tested. When more than two variables were significant in the model, interaction between the variables was tested. However, if the interaction was not

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<sup>85</sup> My use of regression models did not aim to obtain predictive values.

significant, the interaction factor was excluded. When two explanatory variables were highly associated between themselves, only one of the variables was included in the model to avoid misleading estimates due to co-variation. Regression models were weighted by community with the assistance of the SURVEYLOGISTIC and SURVEYREG procedures in the SAS® (SAS, 2004).<sup>86</sup>

Weighted logistic regression was used to explore association for dependant dichotomous variables and one or more independent variables (nominal, ordinal or numeric). Three types of logistic regression were adopted according to the type of response variable. Binary logistic regression was used to explore association for dependant dichotomous variables (categorical). For other categorical variables, generalized logistic regression was used. In addition, a cumulative logistic model was used when ordinal data had a homogeneous distribution (Ananth & Kleinbaum, 1997). However, in most cases, distribution for ordinal data showed skewed distributions that clustered observations in one or more categories (e.g. perceptions of symptoms or degree of participation in agriculture). In such cases, the assumptions of proportionality for cumulative logistic regression were weak. Hence, ordinal categories were collapsed into fewer options, and binary logistic or generalized regression was used (Bender & Grouven, 1998). Ordinal data were never treated as numeric information for regression analysis since this approach could produce misleading results (Hastie, Botha, & Schnitzler, 1989).

Odds Ratio (OR) estimates were obtained from the logistic regression models. The OR is the comparison of the probability that a result of interest occurs against the probability that it does not. The ratio is often expressed as a decimal number in which a value higher than 1 shows a higher probability of having an event, while an OR lower than 1 shows a lower probability. An

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<sup>86</sup> For analysis of information about other household members (residents and immigrants), in addition to including the community as strata, the household was identified as a cluster.

OR of 1 shows that the variables in analysis are not associated (Bland & Altman, 2000; Davies, Crombie, & Tavakoli, 1998). With the assistance of SAS ®, OR estimates are reported with 95% Wald confidence intervals (SAS, 2004).

Weighted multiple linear regressions models were also developed when the response variable was numeric. However, in the majority of cases, the numeric variables in this research showed a skewed distribution. Hence, the preferred approach was to categorize numeric variables in two or three groups according to the histogram of distribution. Next, logistic regression models were built as indicated above.

In addition to regression modeling, multiple correspondence analysis was used as a complementary tool for describing and summarizing sets of variables for sources of household income, trust in organizations and institutions, access to social resources (resource generator), the use of personal protective equipment, and relative frequency of symptoms potentially related to pesticide use (from the Pentox® instrument). A correspondence analysis is an exploratory data technique that has been described as a type of principal component analysis for categorical and non-linear data. It shows robust results even when parametric assumptions are not kept (Greenacre & Blasius, 2006, pp. 5-6). Multiple correspondence analysis is a common analytic technique for qualitative data in France and Japan (Blasius, Greenacre, Groenen, & van de Velden, 2009). It was, for instance, used by Bourdieu in his analysis of taste and social class in France (Bourdieu, 1984). In recent years, its popularity for applications in public health sciences in North America has increased (Guinot et al., 2001; Kakai, Maskarinec, Shumay, Tatsumura, & Tasaki, 2003; Sourial et al., 2009).

The objective of a correspondence analysis is to represent the maximum possible variance (inertia) of variables in rows and columns of contingency tables in a plane of usually two dimensions. A correspondence analysis is based on the chi-square distribution. Also similar to the chi-square test, the marginal relative frequencies in the real distribution are compared with the theoretical distribution in the hypothetical case there was no association among variables (null hypothesis). The marginal relative frequencies are obtained (masses), and differences between observed and expected relative frequencies are calculated (centering). The differences are standardized to a chi-square distribution, and a number of small independent dimensions are identified in order to explain the maximum possible variance (inertia). In the graphical representation of the multiple correspondence analysis that is implemented in this project, the two most important dimensions that explain the variance of the variables are represented in a two dimensional plot (Greenacre & Blasius, 2006; Lebart, Morineau, & Warwick, 1984, c1977.).

Multiple correspondence analysis was performed from raw data by using the PROC CORRESP procedure in SAS®, and specifying the options for multiple correspondence analysis (MCA) and the TABLES statement (Dickinson & Hall, 2008; SAS, 2004). A WEIGHT statement within the correspondence procedure was included to take into account the relative weight of each observation according to its community strata (SAS, 2004). Categories that had very low frequencies were grouped to avoid distortions in the analysis as they could contribute too much to the variance (Greenacre & Blasius, 2006, p. 20). A plot chart was obtained by using a macro (%PLOTIT) function in SAS® to get a visual representation of the main two dimensions according to the percentage of variance that they explained (Dickinson & Hall, 2008; SAS, 2004). Variables that were associated in one or more dimensions tended to cluster in the plot chart (this allowed the identification of potential clusters of association among the variables). In this project, multiple component analysis was used for three reasons: 1) to describe potential

associations and aggregation among variables without previously hypothesized correlations, 2) to suggest some hypotheses that were later tested with regression models, and 3) as the first step for a cluster division that allowed for summarizing of a number of variables (see below).

The results from the multiple correspondence analysis were used as a base for a cluster classification of the variables for sources of household income, trust in organizations and institutions, and access to social resources (resource generator). The results of the correspondence analysis were taken as the first stage of a cluster analysis in a three stage process suggested by Ludovic Lebart et al (1993; 1984, c1977.), who have highlighted the complementarities between the two approaches and the potential for analysis of qualitative, ordinal or numeric data. First, a correspondence analysis allowed for a graphical description of potential clusters and the identification of a reduced number of dimensions for classification. Second, a Ward cluster analysis was conducted, taking the main dimensions from the correspondence analysis as the key input. A Ward method distributes the overall variance among clusters, tending to produce clusters homogenous in size.<sup>87</sup> However, the fact that the correspondence analysis dimensions were used (instead of the original observations) allowed for a more logical classification of the data when the original description did not suggest similar size clusters. Third, the final classes were defined according to the criteria of the researcher, and initial description of the clusters (Lebart et al., 1984, c1977). This analysis was conducted in the SAS® software, following an approach described by H. George Wang, Robert Owen, Cornelio Sánchez-Hernández, and María Romero-Almaraz (2003). The coordinate output of the correspondence analysis (PROC CORRESP), described above, was used as the input for the PROC CLUSTER procedure (specifying METHOD = WARD). The PROC TREE procedure

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<sup>87</sup> Similar to the Ward cluster analysis, the dimensions obtained by a multiple correspondence analysis are also based on the percentage of variance that they explain (called inertia in correspondence analysis). This favours the compatibility of the two techniques as they are based on a similar principle of variance (Lebart, Morineau, & Warwick, 1984, c1977).

was then used to obtain a dendrogram (a tree diagram showing the hierarchical agglomeration of clusters), and to consolidate an adequate division of the clusters that matched the initial description in the multiple correspondence analysis (SAS, 2004). New variables resulting from cluster groupings were included in the database.

**5.4.1.2. Ethnographic methods.** Ethnographic techniques such as in-depth interviews, observation and document reviews were used to gain a better understanding of community members' habitus within the field of agriculture. For this component, I used ethnographic techniques and resorted to cultural interpretation. My approach to cultural interpretation was guided by Bourdieu's perspective, which sees meaning and praxis as embedded in a context and co-dependent on the subject's position in a determinate field (Bourdieu, 1980b). However, my use of ethnographic techniques did not center on culture or cultural policy interpretation, which has been described as a key characteristic of ethnographic traditions (Willis & Trondman, 2000; Wolcott, 1990). Hence, while building on some aspects of ethnographic work, this component of my research could be better characterized as a descriptive study that 'borrowed' ethnographic techniques for particular objectives (Wolcott, 1987, 1999). I focused on perceptions and practices that were related to agricultural activities and community organizations, and the extent to which habitus was related to the structural elements in the field of agriculture in the communities of Quilloac and San Rafael in several field trip visits between April 2007 and February 2009.

*5.4.1.2.1. About the interaction between subjects and researcher.* My use of ethnographic techniques exerted an unavoidable symbolic violence in my role as a researcher (Bourdieu, 1999b, p. 611). I attempted to describe meaning according to the subjects' narratives (emic perspective), and my standpoint as an investigator (etic perspective). In the former, I made an effort to verify and receive feedback about my understanding of the subject's perceptions and practices. However, in addition to aiming to understand, I made an effort to explain perceptions according to my perspective. As mentioned above, this approach builds upon Bourdieu's notion that a respondent's perspective is not a completely real representation of his social reality because it is biased by his social position (Bourdieu, 1999b, 2003).<sup>88</sup> Following Bourdieu (1999b; 2003), the unavoidable symbolic violence intrinsic to the research can be reduced by process of 'reflexivity', which entails a reflection about the nature of the social relationship between researcher and subjects. This reflection is relational because it focuses more on the nature of the researcher/subject relationship than on an autobiographical account by the researcher (Bourdieu, 1989). In this section, I describe some of the elements that characterized my relationship with the subjects of this research and some strategies for reducing the violence of my description.

The starting point for my field work was my community partner, Rafael Alulema, who I met while I was a teaching assistant to the Masters Program in which he studied. Alulema is a community member, farmer, professor at the Intercultural Training Institute, founding member of the Association of Indigenous Agronomists and an active collaborator with other organizations in the communities. Alulema facilitated the initial discussions that gave shape to this proposal, and introduced me to the main organizations in the communities.

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<sup>88</sup> According to this perspective, the gap between understanding and explaining is blurred. Attempting to better understand the position of the subject requires simultaneously an effort to explain the subject's social position in society, based on theoretical and practical considerations (Bourdieu, 1999b: 613).

While my partnership with Alulema was fundamental to this study, it also entailed some challenges that must be explained. First, my role as his teaching assistant could have led to an inequitable power relationship. Conversely, Alulema's support was indispensable for the acceptance of my work in the communities. Our approach was to make explicit our decision-making process, commitments, and tradeoffs, and to engage a broader network of support for in favour of Rafael's interest. Consensus was needed for common decisions about project activities. However, any decision about Alulema's studies needed to be made in consultation with his research supervisor and/or other research advisors. Furthermore, we made explicit our tradeoffs. Alulema needed methodological assistance for his academic work, while I needed his experience and support for my work in the communities. Our backgrounds were also complementary as I came from a public and environmental health background in the academy, and Alulema was trained in agronomy and intercultural education, and had vast experience in community organization.

This approach allowed us to complete our individual projects as part of a larger cooperation effort, achieving more research and action objectives than either of us would have done individually. Nevertheless, a second challenge was my potential bias towards Alulema's perspective, given his importance in the larger effort. To face this risk, we agreed to have independent sampling for interviews and observations, which allowed me to contrast the perspective of community members and stakeholders outside of Alulema's close network against Alulema's perspective. We also had periodic meetings to discuss agreements and disagreements

about our analysis. This allowed us to make our interaction as explicit as possible, while facilitating the challenge of our preconceptions.<sup>89</sup>

In my field work, I also had support and collaboration from most of the community organizations in Quilloac and San Rafael. Tables 5.2 and 5.3 summarize key aspects of community organizations and other institutions in Quilloac and San Rafael. My initial and main organizational partner was the Association of Organizations, a second level organization that grouped community and farmer associations in 13 communities, including Quilloac and San Rafael.<sup>90</sup> I also worked in close agreement with the Association of Agronomists, the Financial Cooperative, the two largest land cooperatives in the communities, and the leadership of community assemblies. I also had the opportunity to meet and interview stakeholders from other organizations and institutions, such as City Hall, the local branch of the Ministry of Agriculture and Livestock, the Women's Organization, an International Cooperation Development Project for rural areas, the Bilingual Education Institute, the local hospital and the owner of the main agricultural warehouse for farmers in communities. However, my main interaction was with the Association of Organizations, the Financial Cooperative and the Association of Indigenous Agronomists, which were identified as the three most relevant organizations for developing alternatives for pesticide harm reduction. Having their support facilitated my description of their activities and my access to community members. However, having them as my main partners in the communities also had some consequences.

- 1) After a couple of months in the communities, I realized that I had not done a good job of contacting female community leaders. Men had most of the leadership positions in the main

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<sup>89</sup> In addition to the quest for symmetry in a research relationship, the interaction should imply a double socio-analysis that allows for the testing and transformation of all parts in the research (Bourdieu, 1999b: 611). For instance, the interview is conceived as a transformative exercise because it should challenge previous assumptions by both the researcher and the subject (Bourdieu, 1999b: 614-615).

<sup>90</sup> A map of community organizations is presented in Chart 7.1 in Chapter 7.

organizations. I interviewed two leaders from the Women's Organization, but I did not develop the same type of trust and interaction that I had established with male leaders from other organizations. One of the entries in my field diary explored the possibility of my gender as a factor inhibiting my interaction with female leaders. However, my interaction with women who did not occupy leadership positions in organizations was fluid and easy. An alternative hypothesis was that there had been some tension between some female and male community leaders. My interaction with the main male leadership may have limited my capacity to interact with some of the female leaders. However, in general, I did not have enough information to explain my limitations in interacting with female leaders.

2) I had more interaction with community members who were close to the main organizations than with people who did not have frequent contact with the associations. I developed some strategies for contacting farmers out of the organizational network. In particular, I used community events and open spaces such as the market place for additional subject invitations. As this regards, the random survey was very informative counterbalance by offering valuable information about the full diversity of the community. They showed that a number of farmers had below average contact with community organizations (this is discussed in Chapters 7 and 8).<sup>91</sup> Overall, the sampling selection for my ethnographic interviews was biased towards people closer to the organizations.

In addition to stakeholders and members of Quilloac and San Rafael communities, I had the opportunity to interview some additional informants who helped me to gain a better perspective about my area of study. In particular, I interviewed a senior researcher from the International Potato Centre who explained many alternatives to pesticide use that the centre had developed in

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<sup>91</sup> As the analysis of the database was conducted with anonymous data, it did not allow further contact with farmers based on their answers. In addition, the terms of the informed consent for the interviews clearly stated that interviewees were not going to be contacted for further questions regarding their answers.

other regions of Ecuador. In addition, I also interviewed Luciano Martinez, an internationally recognized rural sociologist at the Latin American School of Social Sciences in Quito. Dr. Martinez provided valuable insights for this study. Furthermore, I visited and interviewed stakeholders from an organic production initiative in a neighbouring community.

Complementing my direct data collection, as a research assistant in a University of British Columbia-led partnership to promote research capacity in environmental health in Ecuador, I participated in a number of seminars and field visits with recognized Ecuadorian and international scholars. These activities included discussions and field observations of environmental challenges in the Ecuadorian context (e.g., in banana production and floriculture), of indigenous health, and of an analysis of other areas such as mining production in Ecuador.

**Table 5.2 Grassroots farmer and indigenous organizations in Quilloac and San Rafael, 2007-2008**

<b>Org. (year)</b>	<b>Details</b>
2 Community Assemblies – 1 per community (1930's)	Community level organizations for conflict resolution and planning in a given geographical area. Their origins can be traced back to pre-colonial times. At the time of the field trip, community assemblies had a pro-bono elected governing body formed mainly by a president, a secretary and a treasurer. They are selected by election for a term of one year. When issues emerge, community members are called for general meetings. It is expected that at least one household member participates. In addition, they can promote mingas, which are meetings for communal work. Households that do not participate in mingas are fined.
2 Land Cooperatives: 1 per community (1960's)	Originating with land reform in 1964, they are based on the western cooperative structure. They also have a directive body that is elected by members for a one year term. However, different from the assembly, members are affiliated by payment of membership rights. While not all members of a community belong to a land cooperative, members of a community can affiliate to cooperatives from other areas. Land cooperatives distribute land when it is available. According to land distribution, they group the farmers and help to plan and coordinate projects such as irrigation and rural development. For instance, in association with the Agronomists Association, the Quilloac land cooperative had just finished an irrigation system that covered an underserved sector of the community.
The Association of Cañari Farmers and Indigenous Organizations (1970's)	This is a second level organization because it groups community assemblies from 15 communities and 4 land cooperatives. Its origins can be traced back as an attempt to coordinate the increased organizational density in the period of the land reform. In 1970's and early 1980's, the association was reorganized to increase its technical capacity for projects such as the construction of the main irrigation system. It has two main roles in the communities. First, it is a political organization whose activities include conflict resolution and planning and coordination of agricultural activities. Members of the political directive are elected for terms of one year. Second, the organization has a technical function that provides technical assistance in agriculture, training and micro-credits. However, their more important technical role is to control the irrigation system that they build, covering most communities in the area. It also has a demonstrative farm for activities such as integrated pest management. The technical functions are usually operated by 5 to 10 technicians that worked full time.
The Association of Indigenous Agronomists (1980's)	Professional association of agronomists (technicians and professionals) dedicated to planning, execution and technical assistance on development projects for agricultural and livestock production. As a professional organization, its membership depends on affiliation, usually with a fee. It has 16 active associates. The president is elected among the members for a term of one year. However, most of the projects are executed by a technical coordination committee whose number of members varies according to the projects under execution. The association has a supermarket located in the urban centre, which provides support for the commerce of some farmer products. It has built some small irrigation sub-systems for some communities. It also has a demonstration farm for activities such as integrated pest management.
The Farmer Association and Financial Cooperative (1990's)	Originating as an agricultural development initiative linked with seed production, in 2007 it was a solid financial institution for farmers. It offered savings, credit and micro-credit services. In addition, it contained a grain processing mill. It also had a trade program that packed products with a label for promotion in supermarkets. Furthermore, it had 2 demonstration farms for activities such as integrated pest management. Membership was by affiliation to the association, even though any member of the communities could access their financial services. The direction was based on a business model with a general manager and sub-directors for particular programs. These positions tended to be stable. In 2007, it initiated a Farmer Field School with children of the communities to train them in pesticide-free agriculture. It was also promoting the trade organization.
The Women's Association (1990's)	A community level women's organization which generates several projects for women's welfare, including some development projects and promotion of entrepreneurship. It groups close to 45 women and 15 men from Quilloac and San Rafael and other area communities. The governing body, including a president, a secretary and a treasurer, is elected by the members. The association also has connections with other women's organizations from other communities. It has promoted training for pesticide-free production by combining different crops into one harvest (Chacra andina). It is also promoting other productive activities such as tourism and handicrafts.
Trade Group (2000's)	Recently created, it groups close to 60 farmers, mainly from Quilloac and San Rafael, with the goal of eliminating intermediaries and trading their products directly at the urban centre. One of their main objectives is to position themselves as organic producers.

**Notes:** Org = organization; (year) = year of origin. Source: Field notes and interviews.

**Table 5.3 Other relevant organizations for the communities of Quilloac and San Rafael, 2007-2008**

<b>Organization (year origin)</b>	<b>Details</b>	<b>Origin</b>
Town Hall	Cañar Town Hall had 1 urban and 11 rural areas that included the two communities of study. The 2005-2009 municipal report, corresponding to the time of the field trip, had a marked emphasis on urban infrastructure ("Annual operative participative plan. Canar Town Hall. Administration, 2005-2009," 2007). However, city hall also coordinated with the Spanish Cooperation Project in the planning and execution of some alternatives for rural development such as the development of a program for developing sustainable livestock production in the ecosystems at the top of the mountain. In 2008, during the final days of the field trip, the first indigenous mayor was elected. All indigenous organizations supported a platform that tried to integrate rural and urban agendas.	State - local level
Spanish Cooperation Project (2007)	This is an international cooperation project that had a budget close to US\$6 million for execution from 2007 to 2010. The proposal originated through advocacy by a recently formed migrant association in Spain. The idea was to increase development in the region to avoid migration. The main partner in Cañar was the Town Hall. However, the project was directed by Spanish agents. In 2007, they focused on 12 areas that included negotiation with other organizations, territorial planning, promotion of rural production, including livestock production, and marketing studies for local crops ("Proyecto de Codesarrollo Canar - Murcia anuncia actividades para este agno.," 2007; "Se presento del proyecto de CODESARROLLO Canar Murcia," 2007).	Spanish Cooperation Agency
Local Branch Ministry of Agriculture and Livestock of Ecuador	The Ministry of Agriculture and Livestock Production in Ecuador has a local branch in Cañar.	State - national level – local branch
National Autonomous Institute of Agriculture and Livestock Research – INIAP (1959- with interruption in the region in the 1990's and 2000's )	The national state institute for research on technologies for agricultural production. It has been fundamental for developing projects for increasing agricultural production, including many alternatives based on the Green Revolution. Its local projects were cut back during the early 1990's. During the final months of the field trip, during the administration of Ecuadorian President Rafael Correa, the institute had started to establish projects in the area once again.	State - national level
Centre for Regional Economic Reconversion for Azuay, Cañar and Morona Santiago (1960's)	This decentralized state institute promotes the development of regional level productive projects in agriculture, livestock production and ecosystems management. The main office is located in the city of Cuenca, but there is a branch for agriculture and livestock research within the boundaries of the communities of study. In the final months of the field trip, the government of Rafael Correa decided to change its rationale towards a more centralized planning structure.	State - regional level
Bilingual Institute of Technical Education (1985)	Part of the bilingual education system controlled by Ecuadorian First Nations, this is a training institute for future teachers in their schools. It contains basic training in agronomy as part of its program.	State - indigenous organizations
Technical college	Catholic high school with technical training. It has a program, equivalent to a bachelor level, to train technicians in agronomy.	Private - Catholic
UPCCC (1960's)	This is the provincial association of indigenous and farmer organizations. It is a political organization affiliated with the National Indigenous Confederation of Ecuador. It also supports affiliated local organizations, such as the Association of Organizations in the communities of study, in particular projects.	Indigenous

Source: Field notes, document review and interviews.

*5.4.1.2.2. On theory and experience.* Data collection and analysis were conducted in concert with the literature review. While I started my field work with some questions based on general theoretical assumptions about social capital, community capacity and health promotion, most of my specific arguments were developed based on my preliminary findings. Analysis of data from preliminary ethnographic techniques, in particular interviews and observation, was fundamental for guiding the literature review developed in Chapters 2, 3 and 4. This corresponds to Bourdieu's (1999) suggestion about the key role that theory has in understanding and explanation. Empirical and theoretical problems in research should be addressed simultaneously (Bourdieu, 1999b). For instance, in interviews, there was flexibility to adapt the data collection as more specific hypotheses emerged.

*5.4.1.2..3. Feedback from subjects.* My description did not attempt to be a faithful description of the subject's perspective. However, I adopted a series of strategies to reduce the symbolic violence that my account entailed. In my meetings with stakeholders and community partners, I engaged in active discussions to better identify discrepancies between my partial results and their perspective. In general, community leaders agreed with my description. For instance, in one of my final meetings presenting preliminary results to members of the key organizations, one of the leaders expressed that he was in ninety percent agreement with my main conclusions. However, there were some areas of discrepancy that emerged on several occasions:

- 1) There was disagreement about the importance of agricultural activities in the economic and organizational structure of the communities. Some leaders thought that their ancestral agricultural tradition was the pivotal activity for the future of their culture, organization and

economy. However, other leaders believed that agriculture was losing ground to other practices such as migration and remunerated work in urban centres (although some were confident that modern agricultural practices could bring back peasantry to the centre of their communities). I tended to agree with the later, but I remained less optimistic about the potential for a transformation of agricultural activities.<sup>92</sup> In Chapter 8, I describe in more detail my observations about this discrepancy.

2) There was agreement about the existence of a crisis of human resources in agriculture in the communities. However, there was disagreement about the extent to which this implied limitations for adopting sustainable and safer agricultural practices. Some community members were confident that organic and alternative crop technologies did not necessarily lead to a higher demand for human resources in the crops. I believed that contextual factors such as the limitations of the market for agricultural products and the prevalence of smallholdings limited the capacity of organic or traditional agriculture to return the investment of human resources required for farming. In my view, these contextual factors led to the adoption of multiple employments by community members.

3) My interviews and discussions with community leaders suggested a higher impact from international migration on agricultural practices than the one that I found in the survey. This is discussed further in Chapters 7 and 8. My interpretation was that international migration was an important factor affecting the communities, but it worked in parallel with other household

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<sup>92</sup> Community leaders were, in general, more optimistic than I was regarding to the role of their organizations in the construction of alternatives to pesticide use in the context of a sustainable agriculture in the communities. In Chapter #, I describe some of the structural constraints that support my pessimism. While these challenges were expressed in local circumstances, their driving forces went beyond the local context of community leaders. Nonetheless, there were other dimensions to this discussion. First, community leaders were used to being political players in regional and national organizations that aimed to transform the challenges. Their participation was founded on the confidence of change. Second, community members in Quilloac and San Rafael had a different perception of time. While I accompanied them for some years, they see their struggle in terms of decades and centuries. Furthermore, their traditional sense of time is not as linear as mine. It is cyclical. The Andean culture is confident that in the long-term, prosperity and empowerment will return to their people.

income strategies such as urban employment. However, international migration had a higher symbolism and visibility for community members.

*5.4.1.2.4. Details about the use of ethnographic techniques.* Three ethnographic techniques were used: 1) semi-structured interviews, 2) observations, and 3) document reviews.

First, I conducted 46 semi-structured interviews with local stakeholders and community members (18 farmers, 20 members of local community organizations, 5 members of state and non-grassroots institutions and 3 interviews of stakeholders from other community settings). Stakeholders were identified by two strategies: 1) by means of public signs, directories and documents in the community, and 2) by snowball sampling. Farmers were identified by 1) public invitation in community assemblies and gathering places (with previous consent by local authorities), and 2) by snowball sampling. At the time of the interviews, participants were asked for suggestions about other stakeholders or farmers whose inclusion as subjects in the research may have been important. Contacts were initiated by the researchers to avoid potential social pressure by other community members. In all cases, the sampling approach was designed to account for emerging categories of stakeholders (state or community stakeholders, relevant organizations for agricultural practices, participation in relevant events, etc.) and emerging categories of farmers (type of household structure, type of crop and production, etc.). Nonetheless, the classification of interviewees according to categories was not rigid as subjects usually shared several roles and characteristics simultaneously. A saturation criterion guided the purposive sampling strategy. When interviews did not provide new data about a particular matter, the category was considered saturated and no further sampling was pursued. Interviews were audio-recorded for further analysis.

Second, I conducted two main types of observation activities. I made regular walkabouts in the communities to gain a better perspective on community dynamics and agricultural practices. I also attended public gatherings and events (such as regular visits to the market places). My notes were recorded in a field journal, and pictures of public signs and open spaces were taken (pictures with community members were not included for ethical reasons).

Third, I reviewed grey literature and documents from community organizations when consent was provided. This included, for instance, the review of institutional reports and publications. It also included the review of a database with 10 years of records of the irrigation channels for the area. Although this database was used by the organizations for administrative purposes, it had vital information on the structure of land property in the communities.

Finally, I analyzed all recorded information with Nvivo®. In order to avoid interpretation mistakes, coding was conducted in Spanish, the original language of the interviews. Only excerpts of the interviews that were relevant for the written report were translated from Spanish to English.

**5.4.1.3. Participatory action research component.** My research approach had some elements of participatory action research. In my preliminary research design, the participatory action research component, aiming to build a sustainable collective action strategy for pesticide health risk reduction, occupied a more central role in my research approach. In fact, this proposal was based on initial discussions with community leaders who had expressed concern about the need for finding alternatives in reducing the health risks incurred from pesticides. It also established clear action commitments that were discussed, planned and executed with community leaders (see Table 5.4). However, my research design differed from a participatory action research approach in a central aspect highlighted by several authors (Cundill, Fabricius, & Marti, 2005; Hagey, 1997; O'Fallon & Dearry, 2002): Although I consulted all components of the research process with community leaders, I had control of the design, data collection, final analysis, and synthesis described in this document. Therefore, rather than being participatory action research, my research design included some components of collaborative action research focused on specifics of particular activities described in Table 5.4.

The participatory action research components were conducted parallel to other activities. Partial results from other components of the research were used to inform decisions. Decision-making and reflexive mechanisms such as periodic team evaluation were carried out with members of the main organizations (Association of Organizations, The Association of Agronomists and the Financial Cooperative, and Community Assemblies). Three full meetings with leaders from all organizations were carried out. However, no formal research committee was established. The structure of a potential community research board was initially discussed with community members, but it was not feasible because it would have disrupted participants' previous commitments. Community leaders and organizations already had busy agendas with their own activities and schedule of meetings. Periodic meetings with all the main stakeholders

were not feasible. In general, the number of collective meetings was reduced in order to prioritize the distribution of activities and to avoid an interference with other activities that the participants were involved in. To overcome this limitation, I adopted a strategy of separate meetings and discussions with leaders from diverse organizations when relevant decisions needed to be made. While this process took more time on my part as I needed to check for agreement with different stakeholders through several meetings, it was more appropriate for community leaders. The proposal's objectives and main strategies were discussed with members of the main organizations and general community assemblies. For particular activities and specific objectives, individual meetings with flexible degrees of participation were carried out.

The commitment to action components which would benefit the communities was clearly expressed by members of the community assembly, farmers, and leaders as one of the conditions for this research. The summary of intervention activities developed or supported by my research project after consultation with community members is described in Table 5.2. The progress in the development of the initiatives was the subject of collective analysis with community leaders and the main reflections were integrated as additional data in the analysis of the ethnographic component. Overall, our relative success in promoting a number of activities had its roots in the capacity of the organizations to promote action (details are discussed in Chapter 7). All activities were planned in cooperation with my main community partner, Rafael Alulema, and other community leaders.

The participatory action research component project consisted only of the initial phase of diagnosis, coordination and implementation of a strategy of pesticide health risk reduction. This research focused on short term strategies such as the integration of educative efforts. However, elements of a full strategic implementation, including policy advocacy and setting up an

integrated pest management system needed a longer time-frame. Thus, my project did not commit to a full implementation or evaluation of such strategies. Furthermore, while some of the action components which emerged from the discussions originated in this project, I also supported activities that community leaders had planned before and that were aligned with our discussions. Community leaders in Quilloac and San Rafael had been active promoters of activities for promoting agriculture for decades, and they had long-term plans that went beyond the scope of the current research. My input is just a single time fraction in a long-term effort by the Cañari peoples.

**Table 5.4 Details of collaborative activities promoted in Quilloac and San Rafael for reducing health risk related to pesticide use, 2007-2008.**

Activity	Objectives	Description	Target	Community Partners
<b>Radio Show</b>	<ul style="list-style-type: none"> <li>- To prevent cases of accidental pesticide poisoning in children</li> <li>- To promote proper use of pesticides</li> <li>- To promote adequate storage and disposal of pesticides</li> <li>- To strengthen organizational capacity</li> </ul>	<ul style="list-style-type: none"> <li>- 10 months</li> <li>- Saturdays: 6am</li> <li>- In Kichwa</li> <li>- Provincial level coverage</li> <li>- Contents negotiated with leaders</li> <li>- Conducted by technicians from the organizations</li> </ul>	<ul style="list-style-type: none"> <li>- Adults taking care of children</li> <li>- Farmers with better practices to use pesticides.</li> </ul>	<ul style="list-style-type: none"> <li>- Technicians and leaders from The Association of Agronomists, The Financial Cooperative and The Association of Organizations</li> <li>- Co-funded by The Association of Agronomists, and The Financial Cooperative</li> </ul>
<b>Workshops with Farmers</b>	<ul style="list-style-type: none"> <li>- To promote proper use of pesticides <ul style="list-style-type: none"> <li>o Disposal of pesticides</li> <li>o Human safety</li> <li>o Use of local materials for effective protection</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- 5 interactive workshops with farmers (approx 30 farmers per workshop)</li> <li>- Workshops use theatre and demonstrations of the construction of protective equipment with materials easily available in the area</li> </ul>	<ul style="list-style-type: none"> <li>- Farmers from both communities, including trade groups, the Quilloac land cooperative, and community assemblies</li> <li>- In 2 communities</li> <li>o Trade group</li> <li>o Land cooperatives</li> <li>o Technicians</li> </ul>	<ul style="list-style-type: none"> <li>- Planned and coordinated with leaders from The Association of Agronomists, The Financial Cooperative and The Association of Organizations</li> <li>- Technicians from the organizations were also trainers in the workshops</li> <li>- Participation of Faculty members from the University of Cuenca in some of the workshops</li> <li>- The owner of the main warehouse provided materials for training</li> </ul>
<b>Education Materials</b>	<ul style="list-style-type: none"> <li>o To promote: 1- proper pesticide use; 2- adequate disposal of pesticides, and 3- human safety</li> </ul>	<ul style="list-style-type: none"> <li>- Flyers in Kichwa and Spanish with graphical instructions for farmers</li> </ul>	<ul style="list-style-type: none"> <li>- Clients main agricultural warehouse</li> </ul>	<ul style="list-style-type: none"> <li>- The owner warehouse was supportive and a key partner in the proposal</li> <li>- Leader organizations contributed to the design</li> </ul>
<b>Support for a Farmers' Marketing Group for Pesticide-free Products</b>	<ul style="list-style-type: none"> <li>- To promote clean production</li> <li>- To grow and commercialize pesticide-free products</li> <li>- Direct trade</li> </ul>	<ul style="list-style-type: none"> <li>- Training and planning sessions with farmers</li> <li>- Facilitated contact with researchers at the Cuenca University</li> <li>- Facilitated access to information on market strategies</li> </ul>	<ul style="list-style-type: none"> <li>- 80 farmers</li> <li>- 2 communities</li> </ul>	<ul style="list-style-type: none"> <li>- Financial cooperative</li> <li>- Trade group</li> <li>- Researchers <ul style="list-style-type: none"> <li>o Training</li> <li>o Planning workshops</li> <li>o Networking</li> </ul> </li> </ul>
<p><u>Notes:</u> All activities were planned in cooperation with my community partner, Rafael Alulema, and different community leaders.</p> <p>Source: Field Trip Notes</p>				

**5.4.1.4. Review of Hospital Discharge and Medical Records.** Discharge records from 1998 to 2008 at the local hospital, ‘Luis F. Martinez’, in the town of Cañar in Ecuador were reviewed in order to identify cases of pesticide poisoning. The hospital is a local health centre that covers urban and rural areas of the municipality of Cañar, including the communities of Quilloac and San Rafael. It has four medium level care wards (medicine, paediatrics, gynaecology and surgery) and an emergency unit that was the main institutional level response for cases of acute pesticide poisoning in rural areas of the municipality. In addition to hospital discharge records, hospital medical records for cases of accidental poisoning of children 11 year old or younger and control cases were reviewed in order to identify the main caregiver at the time of the emergency.

The information collected from hospital discharge records regarded diagnosis, area of residence, age, gender, month and year of admission, and resulting fatalities. The diagnosis was confirmed by reviewing the medical records. The data was used to construct an 11 year timeline of cases of accidental poisoning. The cases were categorized by gender, age, month, and area of origin (described in Chapter 6).<sup>93</sup>

To explore the hypothesis that childcare structures were associated with accidental poisoning, 57 identified cases of poisoning in children 10 years old or younger from 1999 to 2008, and 57 matched controls with a different diagnosis (matched by age and month/year of admission to the hospital) were selected for a matched-case control study. A case was defined as a child 10 years old or younger that had been discharged from the hospital with a confirmed diagnosis of accidental poisoning by pesticides or an unknown substance that may have been a pesticide. Controls were children 10 years old or younger, admitted in emergencies with a diagnosis not suspected of being poisoning. Controls were matched by age as follows. For

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<sup>93</sup> Urban and rural origin was usually described. Unfortunately, the records did not contain reliable information about the community of origin.

children 3 years old or younger, the age of the child in the matched case could be no more than 1 year younger or older. For children over 3 years of age, controls were within 2 years of age. Controls were also selected from the same admission month to avoid the effect of seasonal variations in childcare. Potential controls were identified and randomly selected on a case by case basis. A criterion for exclusion of a control was having a pathology of slow evolution (children diagnosed with chronic conditions such as tumours, masses, or leporine lips, sometimes admitted to surgery through emergency). The reason was that the chronic nature of the illness favoured the presence of parental childcare at the moment of admission.<sup>94</sup>

In addition to age, month of admission and diagnosis, other data recorded from the medical records were 1) if the caregiver who took the child to the hospital was one of the parents or another relative (this indirect indicator for type of childcare at the moment of the emergency was the best indicator available in the records),<sup>95</sup> 2) gender, and 3) socioeconomic strata (when available, an important confounding factor). For ethical reasons, in no circumstance was the identity of the patient recorded. Neither the patients nor any related subject were not contacted. Logistic regression models were built to explore variable associations and to obtain odds ratios. Matched pairs were identified as clusters in the SURVEYLOGISTIC procedure in SAS® (SAS, 2004).

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<sup>94</sup> Diagnosis for the control group included acute respiratory diseases (43.9%), acute diarrhoea (43.9%), seizures (5.3%), acute abdominal pain (3.5%), and trauma (1.8%).

<sup>95</sup> As only 11 individuals had data regarding immigration cases in the family, an indirect indicator was explored. The only indicator that was recorded with accuracy was the type of childcare at the moment of admission. This was classified as parental and non-parental childcare.

## **5.5. Ethical considerations**

The research protocol was approved by the Behavioural Research Ethical Board at the University of British Columbia in Vancouver, Canada (Id number: H07-00198). There was not a comparable board in the institutions involved in the research in Ecuador.

This research adopted good ethical practices for research with aboriginal communities, according to the Canadian Tri-Council Policy Statement. First, the indigenous community was a partner in the research, as described in the participatory action research component. This included their involvement in the early stages of the project. The design was elaborated in constant consultation with community members to assure that it addressed concerns from the community. In addition, research reports were discussed with members of the community to ensure their agreement in the release of the communication. In such reports, I made explicit the existence of various perspectives and the points of view regarding the results of the members of the community.

I informed prospective subjects and institutions in the research that they were free to participate or withdraw from the project at any time without any consequences for previously agreed upon and pre-existing entitlements. I included the possibility of withdrawal in an informed consent form that was discussed with community leaders and participants in formal interviews, and surveys. For formal interviews and detailed observation where records are involved, informed written consent was sought. However, oral consent was more common (as approved by the ethics protocol). The reason for oral consent was that the community had an oral tradition, and a written document was perceived as a risk or a threat. In any case, informed consent included information about the objectives, methodology, and identity of the researcher and of the research in which the individual was expressly invited to participate. In addition, I

included information about the nature of the participation and description of research procedures. When members of the community or similar communities were involved as research assistants in activities such as data collection, I paid according to Ecuadorian salary standards.

This research did not anticipate any major harm for the participants. First, this research did not involve harm to health. Social harm due to the possibility of disclosure of personal information was minimized. During field work, electronic data such as transcriptions and databases were safely stored in a personal computer with security codes for the files and the operative system. Data in hard copy was stored in a secured file during field trips and analysis. The use of identifying information was avoided. When used, all identifying information was codified with a key that was stored in a separate file. Once the research is finished, data will be stored in a secure cabinet at the University of British Columbia in Vancouver.

Written reports do not contain any identifiable information regarding people involved in the research. However, participant community organizations requested their names and the community names will be included in some of the products (in particular, credits in this report, radio shows and educative materials).

## **Chapter 6: Results on participation in agriculture, current pesticide use and problems with pesticide handling**

In this chapter, I present the results related to Specific Objective 1: to better understand diverse patterns of human exposure to pesticides in agricultural practices, and to identify problems with pesticide handling by inhabitants of Quilloac and San Rafael. First, I describe agricultural practices to identify the scope of pesticide use in the communities. Pesticides were used with more intensity in potatoes, which were the most widespread crops in the communities. While farmers had little knowledge of the type of pesticides used, I could identify some products such as carboruran and methamidophos, which are highly toxic. In the second part of the chapter, I identify characteristics of community members with the highest levels of participation in agriculture, and subsequently more contact with pesticides. I emphasize the fact that vulnerable groups were the most likely to participate in agriculture. People with lower education (who were usually the eldest) were more likely to have more participation in agriculture. In addition, households with less land and less income were more likely to have higher participation in agriculture. In the third section, I describe protective practices, and evidence suggestive of problems with pesticide handling (from the work practices, symptoms and accidental childhood poisoning). The adoption of protective practices, such as wearing gloves and glasses, was mostly poor. Farmers who had recently applied pesticides were significantly more likely to have symptoms such as diarrhea and nausea. In addition, I describe a peak of accidental poisoning in children from 2001 to 2004, which may have been associated with non-parental childcare in a period of economic hardship and high migration rates in the communities.

## **6.1. Crop production and pesticide use**

Table 6.1 shows some of the characteristics of survey respondents by community. Table 6.2 summarizes the main socio-demographic characteristics of households in both communities. In this section, I describe the main crops harvested in the community and explore the use of pesticides in their production.

Potatoes, peas and corn were by far the most common harvested products in the communities. Potatoes were harvested in 92.3% of households, peas in 83.4% and corn in 63.6%. Other products were not cropped in more than 20% of the households.<sup>96</sup> For the most frequent products, potatoes, peas and corn, the most common practice was to have one harvest per year. However, close to a 20% of households in both communities had two annual harvests of potatoes and peas.<sup>97</sup> The production confirmed that potatoes, peas and corn were, in order, the most important crops in the sample households. The total annual production of potatoes in the sampled households was 567.000 lb (365.520 lb in Quilloac and 201.480 lb in San Rafael), 537.360 lb for peas (Quilloac: 334.020 lb/year, San Rafael: 203.340 lb/year), and 160.740 lb for corn (Quilloac: 93.060 lb/year, San Rafael: 67.680 lb/year). Other products had a total annual production lower than 60.000 lb.

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<sup>96</sup> The weighted percentages of households cultivating other products were onions (16%), lettuce (14.1%), grass (15.9%), cabbage (12.4%), cauliflower (12.4%), cilantro (11.7%), carrots (8.2%) and garlic (8.7%). In general, households making more than US\$300/month had a lower frequency of products such as potatoes, carrots, cilantro, lettuce, cauliflower and grass. For example, all 14 households that harvested carrots made less than US\$300/month. Other variables such as number of hectares, having emigrant household members or other sources of income were not significantly associated with harvesting particular products.

<sup>97</sup> Garlic, carrots and cabbage are also commonly harvested only once a year. Other product such as onions, lettuce, grass, cauliflower and cilantro are often harvested two or more times a year.

**Table 6.1. Age, gender, marital status, education level, main occupation and degree of participation in agriculture of the household leader, Quilloac and San Rafael, 2007**

Variable	Community				All		p*	
	Quilloac		San Rafael					
	mean	Std	mean	Std	W mean	SE		
<b>Age†</b>	45.71	27.72	43.84	20.89	45.2	1.17	0.684	
<b>Gender*</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>W %</b>		
<b>Male</b>	69	59.48	29	40.85	98	54.74	ref	
<b>Female</b>	47	40.52	42	59.15	89	45.26	0.018	
<b>Marital Status</b>								
<b>Single</b>	6	5.17	7	9.86	13	6.37	0.159	
<b>Married /Common-Law Partner</b>	88	75.86	56	79.87	144	76.63	ref	
<b>Divorced or Separated*‡</b>	1	0.86	1	1.41	2	1.00	0.010	
<b>Widowed* ‡</b>	21	18.10	7	9.86	28	16.00		
<b>Education Level</b>								
<b>None</b>	40	35.09	25	35.21	65	35.12	ref (ord)	
<b>Primary School</b>	39	34.21	31	43.66	70	36.65	0.892	
<b>High School*</b>	26	22.81	8	11.27	34	19.83	0.014	
<b>College or University*</b>	9	7.89	7	9.86	16	8.40	0.030	
<b>Main Occupation§</b>								
<b>Occupation: Agriculture</b>	78	68.42	50	71.43	128	69.19	0.667	
<b>Occupation: Non-Agriculture</b>	36	31.58	20	28.57	56	30.81	ref	
<b>Degree of Participation in Agriculture</b>								
<b>Never‡</b>	3	2.61	3	4.29	6	3.03	ref	
<b>Infrequently‡</b>	33	28.70	27	38.57	60	31.20		
<b>Often*</b>	11	9.57	20	28.57	31	14.39	0.004	
<b>Always*</b>	68	59.13	20	28.57	88	51.38	<0.001	

Notes: Std=standard deviation; SE= standard error; Ref= reference value; Ord = ordinal coding in logistic regression model (individual models for each variable). Further analysis is described below; n= frequency/number; W= weighted by community (stratata); p = significance

\* Significant p for a 0.05 alpha level with all the other variables in the model held constant. ‘Gender’, ‘Education Level’ (‘High School’ and ‘College or University’) and ‘Degree of Participation in Agriculture’ were significantly different between the two communities. The differences in levels of participation in agriculture between communities were not explained by gender differences. ‘Gender’ and ‘Degree of Participation in Agriculture’ were not associated with each other.

† Weighted percentages by age group: 18 to 29 years old = 18.0%, 30 to 44 = 34.0%, 45 to 59 = 32.3%, and 60 years old or older = 15.6%.

‡ ‘Divorced or Separated’ and ‘Widowed’ were combined for the logistic regression model. For ‘Participation in Agriculture’, ‘Never’ and ‘Infrequently’ were combined for the logistic regression model.

§ In general, most of the people who answered the survey identified farming as their main occupation (68.5%), followed by other jobs such as a professional or technician (13.0%), other unskilled occupations in areas different from agriculture (11.69%), and students (6.8%).

Source: Household Survey

**Table 6.2. Socio-demographic characteristics of the households, Quilloac and San Rafael, 2007**

	Community				All		p	
	Quilloac		San Rafael					
	mean	SE	mean	SE	W mean	SE		
<b>Number of People Living in Household</b>	4.41	0.17	4.41	0.22	4.41	0.14	0.546	
<b>Number of Couples Living in House</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>W%</b>		
<b>1</b>	78	69.64	53	76.81	131	71.48	ref	
<b>2</b>	26	23.21	13	18.84	39	22.10	0.665	
<b>&gt;=3</b>	8	7.14	3	4.35	11	6.43	0.722	
<b>Number of Household Members Living Out of Cañar</b>								
<b>0</b>	60	51.72	33	46.48	93	50.39	ref	
<b>1</b>	19	16.38	15	21.13	34	17.59	0.284	
<b>2</b>	12	10.34	9	12.68	21	10.94	0.803	
<b>&gt;=3</b>	25	21.55	14	19.72	39	21.08	0.641	
<b>Monthly Household Income (US\$)</b>								
<b>&lt;300</b>	84	83.17	50	86.21	134	83.91	ref	
<b>300-&lt;600<sup>+</sup></b>	15	14.85	7	12.07	22	14.18	0.805	
<b>600-&lt;1000<sup>+</sup></b>	2	1.98	1	1.72	3	1.92		
<b>Hectares of Land that the Family Cultivates<sup>†</sup></b>								
<b>0</b>	1	0.86	2	2.82	3	1.36	0.537	
<b>&gt;0-&lt;0.5</b>	38	32.76	24	33.80	58	33.02		
<b>0.5-&lt;1</b>	28	24.14	23	32.39	35	26.24		
<b>1-&lt;5</b>	49	42.24	22	30.99	57	39.38		
<b>&gt;=5</b>	0	0.00	0	0.00	0	0.00		
<b>Hectares of Land that the Family Owns<sup>†</sup></b>								
<b>0</b>	2	1.75	5	7.04	7	3.12	0.557	
<b>&gt;0-&lt;0.5</b>	28	24.56	20	28.17	48	25.49		
<b>0.5-&lt;1</b>	17	14.91	14	19.72	31	16.15		
<b>1-&lt;5</b>	59	51.75	28	39.44	87	48.58		
<b>5-&lt;20</b>	8	7.02	4	5.63	12	6.66		
<b>&gt;=20</b>	0	0.00	0	0.00	0	0.00		
<b>All</b>	116	100.0	71	100.0	187	100.00		

Notes: None of the variables shown in the table showed significant differences between the communities.

<sup>†</sup>= Variables included numerically in the logistic regression model. When included as categorical variables, results did not change significantly.

W= Weighted by community strata.

SE= Standard error of the mean.

Ref= Reference value for comparison of categorical variables in the logistic regression model.

+ = Combined in the logistic regression model due to low frequency.

Source: Household Survey

Pesticides were more frequently applied to potato crops than to any other product. Table 6.3 shows the number of pesticide applications per harvest. Eighty six point nine percent of potato growers applied pesticides. Most of them applied pesticides three times per crop. Peas were the second most common target of pesticide use, but farmers tended to apply pesticides only once or twice per harvest. The majority of farmers did not apply pesticides to other crops.

**Table 6.3. Percentages of number of pesticide applications per harvest for different products, Quilloac and San Rafael, 2007**

Product	Number of applications/ crop cycle						n
	No pesticide	1	2	3	4	$\geq 5$	
	w%	w%	w%	w%	w%	w%	
Potatoes	13.09	1.85	11.33	60.42	11.80	1.53	166
Peas	44.35	32.81	17.55	4.08	1.22	-	156
Corn	62.66	27.32	7.43	1.58	1.01	-	121
Carrots	58.79	41.21	-	-	-	-	18
Cauliflower	67.63	27.17	5.19	-	-	-	25
Lettuce	69.04	23.86	2.54	4.56	-	-	29
Cilantro	74.39	25.61	-	-	-	-	24
Cabbage	62.06	29.89	2.88	5.16	-	-	26
Onions	70.99	20.99	8.02	-	-	-	32
Garlic	58.22	30.31	11.47	-	-	-	18
Grass	89.68	10.32	-	-	-	-	27

Notes: W% : percentages weighted by strata size (community). A hyphen (-) denotes zero percent.  
Source: Household Survey

The number of applications of pesticides in potato crops was highly correlated with the number of people in the household. In effect, a logistic regression showed that, among people who grew potatoes, households with less than 3 members were 8.8 times more likely than larger households to apply pesticides 3 times or more ( $p= 0.005$ ).<sup>98</sup> By contrast, the number of times

<sup>98</sup> A linear regression model between the variables showed similar results with  $p=0.007$  and an estimated regression coefficient of -0.12, suggesting an inverse proportionality between number of household members and number of pesticide applications for potatoes.

pesticides were applied to potatoes was not associated with family income, the level of income received from agriculture, income clusters, having resorted to international migration, or hectares harvested or owned by the household.

As shown in Table 6.4, most of the interviewees did not know the name of the pesticide they applied to their crops. The table shows that in most households, mancozeb, profenofos, carbofuran and cyhalothrin were the most common substances applied to crops.<sup>99, 100</sup> The most common pests that the farmers described in their crops were phytophthora infestans (25.8%), premnotypes vorax (16.7%) and whiteflies (hemipterans) (13.7%).<sup>101</sup> A good number of farmers did not identify the pests (33.16%). However, farmers were more able to identify pests than the chemicals they used to treat them.<sup>102</sup>

Interviewees indicated that the most common reason for deciding to apply pesticides was their observation of the crops (82.2%) and the soil (16.9%). These reasons were followed by the weather (rains, 8.4%), advice from another person (7.4%) and the time of the cycle (3.3%). The time of the irrigation did not seem to have a clear role in the decision to apply pesticides, as close to one third of the interviewees applied pesticides before irrigating their crops, another third of interviewees applied after irrigation, and the final third applied before and after irrigation.

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<sup>99</sup> According to farmers, potatoes were the product most commonly associated with these chemicals, except for manconzeb which was most commonly used on peas.

<sup>100</sup> The list was also consistent with the results from a census of agricultural warehouses that one of the community partners conducted in 2007, given the high number of farmers who did not know the type of pesticide used (Alulema, 2008). Warehouses in the municipalities were asked for their 5 most common products, and the results showed that mancozeb was reported by 85% of households, followed in order by profenofos (60%), carbofuran (45%), propineb (40%) and cyhalothrin (35%).

<sup>101</sup> Other pests that were mentioned by less than 2% of farmers were oídium sp.,epitrix sp. s. crobipalpula solanivora, puccinia striiformis, agrotis ipsilón, myzus persicae, potato yellow vein virus, lyriomisa sp., and gastropoda.

<sup>102</sup> As happened with the name of the pesticides and, to some extent, with the identification of pests, in most cases, farmers did not remember the dose of the pesticide that they used (51.5%). The dose for different products was not known either. In general, for all products, the most common answer was that one bag of the product was diluted in a 100 litre tank of the application pumps. The second most common answer was that bag of product was diluted in a 200 litre tank for application.

**Table 6.4. Frequency and percentage of households using particular types of pesticides on their crops**

Pesticide	WHO Toxicity Classification	Frequency	W %
<b>Unknown</b>	-	117	62.69
<b>Mancozeb</b>	Unlikely Hazardous	26	13.87
<b>Profenofos</b>	Moderately Hazardous	12	6.58
<b>Carbofuran</b>	Highly Hazardous	9	4.93
<b>Cyhalothrin</b>	Moderately Hazardous	11	4.80
<b>Sulfluramid</b>	Moderately Hazardous	6	3.29
<b>Terbutylazine</b>	Slightly Hazardous	5	2.64
<b>Methamidophos</b>	Highly Hazardous	4	2.57
<b>Propineb</b>	Unlikely Hazardous	3	1.93
<b>Plants (natural)</b>	-	2	1.00
<b>Others (n=1)</b>	-	1	0.64
<b>Total</b>		187	>100

**Notes:** WHO = World Health Organization. Toxicity classification: Ia -Extremely Hazardous, Ib-Highly Hazardous, II -Moderately Hazardous, III- Slightly Hazardous, and U -Unlikely Hazardous (WHO, 2010). See Chapter 4 for more detail.

W%: percentages weighted by strata (community). The percentages add up to more than 100% since they are not mutually exclusive.

Common and commercial names were coded as their main active component for constructing the table.

Source: Household Survey

In spite of the fact that observation of the crops was the most decisive factor for determining when to fumigate, the main reason reported for deciding which the pesticide to use was the time of the crop cycle (55.5%). Only 32.7% selected chemicals according to the type of pests affecting the crops, while 11.4% relied on advice of another person.<sup>103</sup>

The main source of information that farmers had about pesticides was by far the warehouse owner/clerk (89.8%). Furthermore, 87% of the interviewees in both communities were clients of one particular warehouse, whose owner was the main source of information for both communities. Other sources of information were very low. 4.6% of farmers indicated that they

<sup>103</sup> There was a significant association between members of a cluster of 29 households whose income partially depended on non-agricultural work and their own agriculture (Cluster B in Chapter 8). 72.9% of interviewees from this cluster selected chemicals according to the crop cycle, while only 51.7% of members of other clusters did so ( $p=0.0445$ ;  $OR=2.5$ ). No other variables, including clusters of social resources, number of people in the household, having emigrant household members, land tenure or land cropped, household income or educative level of the interviewee, were significantly correlated with the decision about type of pesticide to use. This will be discussed again in Chapter 8.

learned from their own experience, and only 1.5 % sought advice from a relative or friend. The percentages of other sources of information, such as advice from a member of an organization (technician), or publicity, were no higher than 1%. No association was found between the main source of information about pesticides and other variables such as educative level of the interviewee, household hectares of land cropped, level of income, clusters of household income or clusters of social resources.

To sum up, potato crops were at the same time the main product of the region and the main recipient of pesticides. This was important because two of the most frequent chemicals used for potato production were highly toxic. Farmers seemed to have limited sources of knowledge about alternatives to the use of these chemicals. This was exemplified by the importance of a single vendor as the main source of information and the difficulties that peasants had identifying specific products used on their crops. Few significant associations were found between the type of crop, the use of pesticides and other variables such as education level, income level or number of hectares. An exception was the number of household members. Members of households with more less than three people tended to apply pesticides more frequently per crop cycle. A cluster of households whose source of income tended to focus on a combination of non-agricultural income and their own crops also tended to apply pesticides more often than the rest. Clusters of household income are discussed in detail in Chapter 8

## **6.2. Participation in agriculture by individuals and households and identification of the person who most frequently applied pesticides**

In this section, I am going to focus on individual and household level characteristics, and the extent to which they were associated with the perceived degree of participation in agriculture (individual or household). Given that few associations were found between individual or household characteristics and the type and frequency of pesticide used in agriculture, characterizing different levels of participation in agriculture was important for suggesting potential patterns of contact with pesticides. At an individual level, I argue that the individual's education level was the variable most closely correlated with individual participation in agriculture. As the oldest community members tended to have the lowest levels of education, elders were among the most actively involved in agriculture. At a household level, I describe the extent to which the poorest households were the most likely to have high levels of participation in agriculture. In addition, households with less land tended to be divided into two extreme groups: they had either the highest or the lowest degrees of participation in agriculture. Further, the person who most frequently applied pesticides tended to be male and have high levels of participation in agriculture (usually the interviewee).

**6.2.1. Individual participation in agriculture.** The degree of participation in agriculture was associated with the education level of the person who answered the survey. People with high school, college or university education had significantly lower chances than people with no education or just primary school education of often or always participating in agriculture ( $OR=0.30$ ,  $p=0.003$  when controlling for age). Nevertheless, it is important to highlight that for

all adult age groups there was some degree of participation in agriculture. In fact, only five people in both communities indicated that they had never participated in agriculture.<sup>104</sup>

Regarding age, older groups had higher percentages of often or always participating in agriculture (18-<30 years old: 52.3%, 30-<45: 63.8%, 45-<60: 76.0%, and >60: 75.2%). However, the association between age and participation in agriculture was not significant when education level was held constant ( $p=0.597$ ). There was co-variation between age and education level. Age was significantly associated with education level as for every increase of 10 years of age, chances of a lower level of education increased 2.6 times ( $p=<0.001$  with gender and participation in agriculture held constant). The gender of the interviewee was not associated with the degree of participation in agriculture.<sup>105</sup>

Similar to interviewees, for other adult household members other than the interviewee, age was also correlated with higher levels of participation in agriculture. For every increase in age by 10 years, other household residents had a 1.4 times increase in the probability of always or often participating in agriculture than never or seldom participating ( $p=0.002$ ). Gender was not associated with the main occupation of the other household members being different from the interviewee. No significant association was found between participation in agriculture and

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<sup>104</sup> As expected, people whose main occupation was farming tended to have higher percentages of participation in agriculture. As a result, education level and age were also correlated with main occupation. While none of the people who had technical or professional education indicated farming as their main occupation, 63 out of 64 people with no formal education were mainly farmers ( $p=<0.0001$ , with gender and age held constant). In addition, the main occupation of the person who answered the survey was significantly associated with age. Only 7 out of 84 people 45 years or older had a main occupation different from farming. However, all types of main occupation (farmer, non-farmer, no formal job training, professional or technician, or student) had a majority of people with at least some participation in agriculture.

<sup>105</sup> Women's odds of having a professional or technical level main occupation were 0.173 lower than men's odds ( $p=0.0381$ ). However, there were not significant gender differences for farmers, non-skilled workers and students. Similarly, there were not significant gender differences for degree of participation in agriculture.

occupation for other household members. No information about education level was available for other adult household members.<sup>106</sup>

To summarize, people with lower levels of formal education, who also tended to be older, worked more as farmers and participated more in agriculture. However, people from both genders, all age groups and all education levels had important levels of participation in agriculture.

**6.2.2. Household characteristics and participation in agriculture.** Table 6.5 shows the distribution of the degree of household participation in agriculture. This estimate combines the reported participation in agriculture of all members of the household 18 years old or older. In this section, I argue that the household degree of participation in agriculture is correlated with hectares of land owned and household monthly income.

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<sup>106</sup> Other household members less than 18 years of age were mainly reported as students, although they also had some degree of participation in agriculture when over 5 years old.

**Table 6.5. Household average of participation in agriculture by adults, Quilloac and San Rafael, 2007**

Household Participation in Agriculture	Community				All	
	Quilloac		San Rafael			
	n	%	n	%	n	W%
<b>0-1&gt; (Low)<sup>+</sup></b>	1	0.93	3	4.29	4	1.83
<b>&gt;1-2 (Medium - Low)<sup>+</sup></b>	26	24.30	22	31.43	48	26.21
<b>&gt;2-3 (Medium - High)</b>	25	23.36	30	42.86	55	28.58
<b>&gt;3-4 (High)</b>	55	51.40	15	21.43	70	43.39
<b>Total</b>	107	100.00	70	100.00	177	100.00

Notes: A distribution histogram of the variable shows a 3 modal shape along the categories medium and high in the table.

W%: percent weighted by strata.

+ Combined for logistic regression model due to low frequency.

Similar to what happens in individual adult participation; Quilloac's households have a higher degree of participation in agriculture than San Rafael's. Households in Quilloac are 3.4 times more likely than those in San Rafael to have high levels of participation in agriculture among adult members ( $p=0.003$ ).

Source: Household Survey.

First, Table 6.6 shows that households which owned less than one hectare had two subgroups: some of them had the highest percentages of high participation in agriculture, while others clustered around low and medium-low participation in agriculture. Conversely, the highest numbers of households with one hectare or more had a medium-high degree of participation in agriculture. In fact, households that owned less than one hectare had between four and five times the likelihood of having extremely high or extremely low levels of participation in agriculture ( $p<0.01$  for both cases).

**Table 6.6. Household adult participation in agriculture averaged by hectares of land owned and harvested by household, Quilloac and San Rafael, 2007**

Hectares Owned*		Household Participation in Agriculture				
		0-1 †	>1-2 †	>2-3	>3-4	All
<b>0-&lt;1</b>	<b>n</b>	2	25	14	41	82
	<b>W%</b>	1.71	30.21	13.34	54.74	100.00
<b>1-&lt;5†</b>	<b>n</b>	1	20	37	25	83
	<b>W%</b>	1.42	22.06	41.75	34.77	100.00
<b>5-&lt;20†</b>	<b>n</b>	1	2	4	4	11
	<b>W%</b>	6.04	21.66	38.54	33.75	100.00
<b>All</b>	<b>n</b>	4	47	55	70	176

Notes: W% = weighted row percent; n= frequency; †Categories combined for logistic regression model. \*Significant for a logistic regression model following Odds Ratio estimates:

Odds Ratio Estimates (OR)				
Effect		p	OR	95% Wald Confidence Limits
Land Owned	Part. Agri.			
<b>0-&lt;1 vs &gt;=1</b>	<b>0-2 vs &gt;2-3</b>	0.001	4.13	1.77 9.67
<b>0-&lt;1 vs &gt;=1</b>	<b>&gt;3-4 vs &gt;2-3</b>	<0.001	4.90	2.21 10.86

Source: Household Survey

Second, household income and household degree of participation in agriculture were associated. It is important to highlight that more than 80% of households in both communities had a monthly income lower than US\$300. However, while 30.7% of households with a low or medium-low degree of participation made US\$300 or more, only 15.2% of households with medium-high and 9.6% of those with high participation in agriculture made the same amount. In effect, households making less than US\$300 had 4 times the probability of having a high level of participation in agriculture, compared to households making more than US\$300 ( $p=0.016$ ). The associations of household monthly income and land ownership with participation in agriculture existed when any of the former variables was held constant in the model. Other variable, were not significant.

To summarize, both communities had a prevalence of medium-high or high degrees of household participation in agriculture. In general, household participation in agriculture was

correlated with income and the number of hectares owned. Households which owned less than one hectare were simultaneously the ones with the most and least participation in agriculture. Further, the households with more participation in agriculture also had a greater chance of having lower income. As discussed below, the less educated (who were usually the eldest) and particularly people belonging to the poorest households (and a subgroup of the ones with less land) were the most likely to have the highest levels of participation in agriculture, and therefore, more contact with pesticides.

**6.2.3. Who applied pesticides?** The member of the household who most frequently applied pesticides was the person who answered the survey (Table 6.7). When asked for people who had applied pesticides at least once during the year, the percentages were very similar to what is shown in Table 6.6. In fact, the 95% confidence limits of the percents (of people who most frequently applied pesticides and people who did so at least once during the year) were overlapping except in the case of daughters (in 7.2% of the households, a daughter had applied pesticides at least once during the year).

The Person Who Most Frequently Applied Pesticides +	Community				All	
	Quilloac		San Rafael			
	n	%	n	%	n	W %
<b>Interviewee</b>	69	63.89	37	62.71	106	63.61
<b>One of the Sons</b>	18	16.67	5	8.47	23	14.75
<b>Another Family Member</b>	10	9.26	7	11.86	17	9.87
<b>The Spouse</b>	8	7.41	6	10.17	14	8.05
<b>Crop Partner</b>	1	0.93	3	5.08	4	1.90
<b>Employee</b>	1	0.93	1	1.69	2	1.11
<b>One of the Daughters</b>	1	0.93	.	.	1	0.71
<b>All</b>	108	100.0	59	100.0	167	100.00

Notes: W% = weighted row percent; n= frequency; +Compared to community, p=0.880 (not significant). Frequency Missing = 12  
Source: Household Survey

Table 6.8 shows other characteristics of the household leaders who most frequently applied pesticides, compared to those who do not. Only gender and participation in agriculture were significantly associated with the person who most frequently applied pesticides. Regarding gender, men applied pesticides more often than women. In effect, the person who most frequently applied pesticides in the household was a man in 85.3% of cases ( $p<0.001$ ).<sup>107</sup> The other variable that was significantly associated with being the person who applied pesticides more frequently was the level of participation in agriculture ( $p=0.040$ , OR= 2.38). No other variables in the table showed significant association.

<sup>107</sup> This was also illustrated by the higher frequency of sons than daughters in this role as shown in Table 6.6.

**Table 6.8. Gender, marital status, education level and level of participation in agriculture of household leaders who applied pesticides more frequently vs. leaders who do not, Quilloac and San Rafael, 2007**

Characteristics	The Person Who Most Frequently Applied Pesticides			
	Interviewee		Other Person	
	W Mean	SE	W Mean	SE
<b>Age (Years)</b>	44.5	1.64	48.5	2.05
<b>Gender*</b>	<b>n</b>	<b>W %</b>	<b>n</b>	<b>W %</b>
<b>Male</b>	71	85.26	12	21.66
<b>Female</b>	30	38.27	47	61.73
<b>Marital Status</b>				
<b>Single</b>	7	52.82	6	47.18
<b>Married /Common-Law Partner</b>	89	71.38	37	28.62
<b>Divorced or Separated</b>	1	64.18	1	35.82
<b>Widowed</b>	9	32.87	17	67.13
<b>Education Level</b>				
<b>None</b>	32	50.78	29	49.22
<b>Primary School</b>	41	72.70	16	27.30
<b>High School</b>	20	62.50	12	37.50
<b>College or University</b>	11	78.34	4	21.66
<b>Degree of Participation in Agriculture*</b>				
<b>Never</b>	1	39.09	2	60.91
<b>Infrequently</b>	27	52.77	26	47.23
<b>Often</b>	15	58.59	10	41.41
<b>Always</b>	58	71.51	21	28.49

Notes: W= weighted by community strata; n= frequency; SE= standard error.

\* Significant in the logistic regression model with odds ratio estimates (other variables did not show a significant association) :

Response (Person)	Effect	p	OR	95% Confidence Limits
Interviewee/ Other	Gender : Male/Female	<0.001	10.73	4.72 - 24.41
Interviewee/ Other	ParticAgr: Often or Always/ Infrequently or Never	0.040	2.38	1.04 - 5.43

Source: Household Survey

The person who answered the survey had an average of 22.17 years working with pesticides with a standard error of 0.99. 61.1% of the interviewees had 20 years or more working with pesticides (33.3% had 30 years or more). Only 15.9% of interviewees had less than 10 years working with pesticides. Regarding other variables, the number of years applying pesticides was only significantly associated with the age of the person who answers, with a regression coefficient beta of 0.49 and with p<0.001. There was no association with gender.

Summarizing, the person who applied pesticides most frequently tended to have an average of 22 years working with chemicals, be male and have high degree of participation in agriculture. Further, those having a high degree of participation in agriculture tended to be the less educated (usually the eldest) and come from the poorest households according to their level of income. Some of them also belonged to the households with less land.

### **6.3. Practices of pesticide application**

This section describes the most common protective practices in the use of pesticides. Emphasis is given to the use of protective equipment such as gloves and waterproof clothing. In general, protective practices were rarely adopted.

Forty three percent of farmers answered that they stored pesticides for future use. The preferred place to store the chemicals was inside the house in a separated room (59.6%), followed by outside the house in an open space (23.8%). Other places inside the house were used in 8.1% of cases, while a closed place outside the residence was the preference in 7.8% of cases. Only five out of one hundred and eighty (5/180) interviewees reported buying the chemical products with groceries.

Most of the households had their own pesticide application pump.<sup>108</sup> Similar to chemical storage, the most common place to store the pump was inside the house in a separated room (70.6%), followed by outside the house in an open place (14.4%). Only 7.0% of the farmers stored their application pump outside the house in a closed space. When a farmer did not own an

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<sup>108</sup> The most common pesticide pump used in the area was a back pack pump.

application pump, borrowing was the most common practice (73.1%). Renting the pump was the option in 17.1% of cases, and payment in-kind was used by 6.4% of the farmers who did not have a pump.

The pumps were washed after each pesticide application by 96.7% of farmers. 62.2% of farmers washed their equipment in the crop. Other places to wash the pump were in the river or irrigation channel (16.4%) or at home (15.2%). It is important to highlight that 87.3% of farmers who washed the equipment threw the residual water in the ground. The residual water was thrown into the irrigation channel by 7.5% of interviewees and into the drainage system by only 3.3% (the sewage system had very low coverage in the communities).

Regarding the final disposal of the pesticide receptacle, burning was declared a common practice by 64.9% of farmers. Disposing of receptacles in fences or under rocks was also a common practice (41.2%). 16 out 171 farmers frequently buried the receptacles in the ground. Less common was disposing of receptacles in crops (7.0%) and water channels (2.73%).

Table 6.9 shows the frequency of use of protective equipment during the application of pesticides. Except for boots, most interviewees did not use protective equipment. Very similar percentages were found for the use of protective gear in the preparation of the application. In addition, the most common practice when preparing the chemicals was to use a tank or bucket (92.6%). The pump was used by 5.7% of farmers. The great majority of farmers used a stick to mix the pesticides (91.2%). There were no significant differences in the use of protective equipment between interviewees that were the most common applicators of pesticides in the household and people who were less common applicators.

**Table 6.9 Frequency of use of protective equipment during the application of pesticides, Quilloac and San Rafael, 2007**

Equipment	Frequency		Total
	n	W %	n
<b>Boots</b>	119	63,22	178
<b>Long Sleeved Shirt</b>	66	32,56	178
<b>Gloves</b>	22	12,44	178
<b>Waterproof Clothes</b>	19	10,12	178
<b>Mask</b>	15	8,32	178
<b>Scarf</b>	10	4,44	178
<b>Glasses</b>	5	3,07	178
<b>No Protective Equipment</b>	47	30,18	178

Notes: W %: percent weighted by sampling strata (community); n= frequency.  
Source: Household Survey

Consistent with the low frequency of use of protective equipment, most farmers answered that they got wet with chemicals when pesticides were applied (61.4%). After the application, most farmers washed themselves (87.1%) and changed their clothes (68.0%). The clothing used to apply pesticides was most commonly washed by the spouse of the person who applies (82.3%). Consequently, as the interviewees that most frequently applied pesticides were men (85.3%), women were more commonly in charge of washing the contaminated clothes.

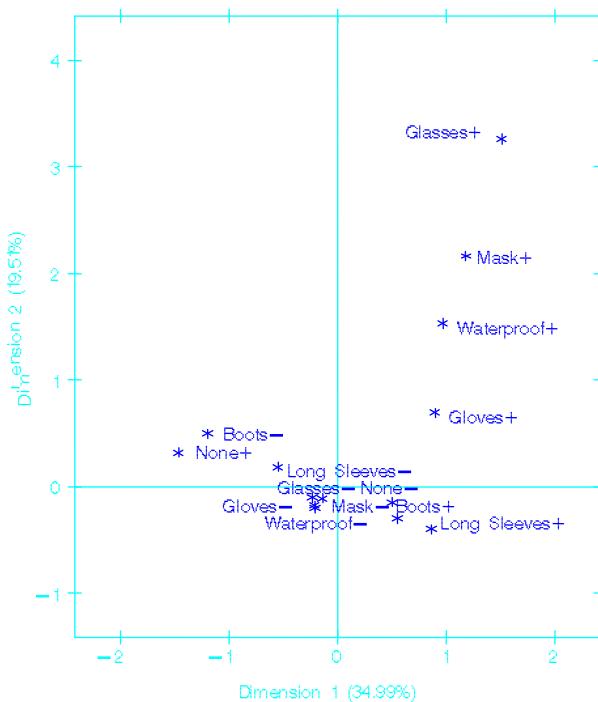
Not using protective equipment, using long-sleeved shirts and using boots had a significant association with being wet after the application of pesticides. First, farmers who answered that they did not use any protective gear were 2.4 times more likely to get wet during the application of pesticides ( $p=0.013$ ).<sup>109</sup> However, farmers who used long-sleeved shirts were 2.6 times more likely to get wet when applying pesticides ( $p=0.010$ ), and farmers who used boots were 2.0 times more likely to get wet ( $p=0.047$ ). Using boots and long-sleeved shirts are highly correlated with each other as 96.5% of people who used long-sleeved shirts also used boots ( $p<0.001$ ).

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<sup>109</sup> The gender of the interviewee was significantly associated with not using any protective equipment or using boots and long-sleeved shirts. Men were 2 times more likely than women to use long-sleeved shirts ( $p=0.0299$ ), and 2.9 times more likely to use boots ( $p=0.0016$ ). Conversely, women were 2.1 times more likely to use no protective equipment at all ( $p=0.0388$ ). However, in general, gender was not significantly correlated with getting wet after the application ( $p=0.1651$ ). No other type of protective equipment was associated with gender.

In general, three clusters of farmers could be identified according to their use of protective equipment when applying pesticides: 1) farmers who tended not to use any protective equipment at all, 2) farmers who tended to use mainly long-sleeved shirts and boots, but no other equipment, and 3) farmers who used other types of protective equipment. These clusters are illustrated in Figure 6.1 which shows the graphical description of a correspondence analysis of the use of different protective equipment.

**Figure 6.1 Correspondence analysis of the use of protective equipment and getting wet during the application of pesticides, Quilloac and San Rafael, 2007**



Notes: \* denotes the position of the observation, + denotes a positive answer, - denotes a negative answer. The following conventions also apply: Waterproof = waterproof clothing, Long Sleeves = long sleeved shirts.

Source: Household Survey

People who often or always participated in agriculture were less likely to use protective equipment compared to people who never or infrequently participated ( $p=0.004$ ,  $OR=2.4$ ). No other variables, including the interviewee's educative level, age, main occupation, social

resources cluster, or knowledge of pesticides, were associated with getting wet or using any type of protective equipment ( $p>0.05$ ).

Summarizing, farmers tended to have relatively poor protection in the use of pesticides. One of the most common alternatives, long-sleeved shirts, was clearly insufficient as it was correlated with getting wet after the application. It is important to highlight that the most vulnerable people, the ones who have the highest degree of participation in agriculture, were significantly less likely to use protective equipment. The storage of the chemicals and equipment was frequently inadequate.

#### **6.4. Health and problems with pesticide handling.**

In previous sections, I have described community members most likely to be exposed to pesticides. I also identified that, while protective practices were generally poor, the most frequent pesticide users were less likely to adopt protective measures. In this section, I provide additional data suggesting further evidence of problems with pesticide handling by farmers in Quilloac and San Rafael. I focus on two aspects. First, I describe the extent to which people who had applied pesticides in the seven days prior to the survey were more likely to report symptoms such as diarrhea and nausea. Second, I discuss a peak of accidental poisoning cases in children.

**6.4.1. Symptoms and problems with pesticide handling.** Having had recent ‘nausea or vomiting’ and ‘episodes of diarrhea’ in the seven days prior to the survey was significantly associated with having applied pesticides in the same period of time. Table 6.10 describes the distribution of all potential acute symptoms for 49 farmers who had applied pesticides in the 7 days prior to the survey (26.3%), compared to 134 who had not (73.7%).<sup>110</sup> Tables 6.11 and 6.12 summarize most potential confounding factors that were tested in the regression models (characteristics of farmers and the use of protective equipment respectively). In addition, people who had recently used pesticides did not differ from others in terms of frequency of alcohol use ( $p>0.05$ ), having had a disability that limited mobility or sensibility ( $p= 0.494$ ), or having a neurological problem ( $p= 0.076$ ). The final regression model for feeling nauseated or vomiting and having applied pesticides in the seven days prior to the survey is presented in Table 6.13. The model for diarrhea is shown in Table 6.14. Farmers who had applied pesticides recently were 3.7 times more likely to have had episodes of diarrhea in the week before the survey.<sup>111</sup> It is also important to highlight that older farmers were also more likely to have diarrhea within seven days of using pesticides (see Table 6.14).

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<sup>110</sup> People who applied pesticides in the seven days before the survey were 4.0 times more likely to be the person who applied pesticides most frequently in the household ( $p=0.0012$ ).

<sup>111</sup> Older farmers were also more likely to have diarrhea within seven days of using pesticides. However, the association between diarrhea and having used pesticides did not disappear when controlling for age.

**Table 6.10. Distribution of some acute symptoms according to having or not having applied pesticides in the seven days prior to the survey, Quilloac and San Rafael, 2007**

Symptoms Seven Days Prior to the Survey		Having Applied Pesticides in the Past Seven Days				All	p		
		Yes		No					
		n	W %	n	W %				
Frequent Headache	Yes	14	40.33	29	32.85	43	34.87		
	No	19	59.67	56	67.15	75	65.13		
Nausea or Vomiting for No Reason <sup>†</sup>	Yes	15	27.45	21	16.66	36	19.49		
	No	34	72.55	113	83.34	147	80.51		
Diarrhea*	Yes	9	17.15	8	6.31	17	9.13		
	No	39	82.85	126	93.69	165	90.87		
Stomach Spasms or Cramps <sup>†</sup>	Yes	15	28.55	23	16.87	38	19.93		
	No	34	71.45	111	83.13	145	80.07		
Salivation and Spitting	Yes	6	12.74	16	12.62	22	12.65		
	No	43	87.26	118	87.38	161	87.35		
Dizziness (Without Drinking)	Yes	9	18.01	25	17.46	34	17.61		
	No	40	81.99	109	82.54	149	82.39		
Sweating for No Reason	Yes	6	13.06	18	14.13	24	13.85		
	No	42	86.94	115	85.87	157	86.15		
Skin Reddening or Rash	Yes	6	13.84	12	9.07	18	10.32		
	No	43	86.16	122	90.93	165	89.68		
Lack of Breath	Yes	6	11.94	14	10.06	20	10.55		
	No	42	88.06	120	89.94	162	89.46		
Shaky Hands	Yes	7	13.03	24	17.75	31	16.51		
	No	42	86.97	110	82.25	152	83.49		
Numb Hands	Yes	3	5.34	10	7.30	13	6.79		
	No	45	94.66	124	92.70	169	93.21		
Eye, Nose or Throat Irritation	Yes	21	44.59	49	36.00	70	38.26		
	No	28	55.41	85	64.00	113	61.75		
Bad Temper	Yes	14	29.36	40	28.80	54	28.95		
	No	35	70.64	94	71.20	129	71.05		
Feeling Weak	Yes	13	26.87	37	26.14	50	26.33		
	No	36	73.13	97	73.86	133	73.67		
Loss of Dexterity in Hands	Yes	5	10.25	18	12.54	23	11.94		
	No	44	89.75	115	87.46	159	88.06		

Notes: As the number of people who answered that they 'Always' had had the symptoms was too low to allow for any analysis, they were coded together with the category 'Sometimes' to form the category 'Yes'. Furthermore, seizures or spells were not included in the table because they were reported for only 3 individuals. Only 3 people reported other symptoms such as stomach ache and muscular pain.

\* Significant for an alpha level <=0.05.

† Borderline to a significant alpha level <=0.1. As a result, they will be analyzed with more detail. Other variables were not suggestive of a potential association.

Source: Household Survey

**Table 6.11. Age, gender, marital status, education level, main occupation and degree of participation in agriculture of farmers according to whether or not they had applied pesticides in the seven days prior to the survey, Quilloac and San Rafael, 2007**

	Having Applied Pesticides in the Past Seven Days				<b>p</b>	
	Yes		No			
	<b>W Mean</b>	<b>Std</b>	<b>W Mean</b>	<b>Std</b>		
<b>Age</b>	46.7	2.00	44.8	1.45	0.452	
<b>Gender<sup>†</sup></b>	<b>n</b>	<b>W%</b>	<b>n</b>	<b>W%</b>		
<b>Male</b>	31	66.18	65	50.97	0.077	
<b>Female</b>	18	33.82	69	49.03	ref	
<b>Marital Status*</b>						
<b>Single*‡</b>	1	1.39	12	8.29	0.011	
<b>Married /Common-Law Partner</b>	44	90.85	97	71.90	ref	
<b>Divorced or Separated*‡</b>	1	1.39	1	0.89		
<b>Widowed*‡</b>	3	6.37	24	18.93		
<b>Education Level</b>						
<b>None</b>	18	34.92	47	36.04	ref	
<b>Primary School</b>	21	43.49	46	33.54	0.201	
<b>High School</b>	7	15.23	26	21.07	0.594	
<b>College or University</b>	3	6.37	13	9.34	0.616	
<b>Main Occupation</b>						
<b>Agriculture</b>	38	77.01	88	67.00	ref	
<b>Non-Agriculture</b>	11	22.99	43	33.00	0.491	
<b>Degree of Participation in Agriculture</b>						
<b>Never‡</b>	1	2.55	4	2.78		
<b>Infrequently‡</b>	14	30.11	45	31.43		
<b>Often</b>	8	13.66	22	14.48	0.903	
<b>Always</b>	25	53.68	62	51.31	0.787	

Notes: W= weighted by strata; Ref= reference value; Ord = ordinal coding; Std= standard error; n= frequency/number

Percentages are column percents.

\* Significant p for a 0.05 alpha level. Marital status, despite being significant, had very little variability to be included in a regression model (some cells showed a frequency lower than 5 cases).

† Borderline to a significant alpha level <=0.1. As a result, they will be analyzed in more detail.

Other variables are not suggestive of a potential association.

‡ ‘Single’, ‘Divorced or Separated’ and ‘Widowed’ were combined for the logistic regression model. Similarly, in ‘Participation in Agriculture’, ‘Never’ and ‘Infrequently’ were combined for the logistic regression model.

Source: Household Survey

**Table 6.12. Distribution of pesticide handling practices in farmers who had applied pesticides in the seven days prior to the survey, Quilloac and San Rafael, 2007**

Pesticide-Related Practices	Having Applied Pesticides in the Past Seven Days				p (OR)	
	Yes		No			
	W Mean	Std	W Mean	Std		
<b>Years of Pesticide Use</b>	24.6	2.09	21.3	1.11	0.163	
<b>Boots</b>	<b>n</b>	<b>W%</b>	<b>n</b>	<b>W%</b>		
Yes	38	73.71	80	59.11	0.116	
No	11	26.29	48	40.89		
<b>Long Sleeved Shirt</b>						
Yes	21	37.98	45	30.71	0.399	
No	28	62.02	83	69.29		
<b>Gloves</b>						
Yes	5	12.45	17	12.51	0.968	
No	44	87.55	111	87.49		
<b>Waterproof Clothing*</b>						
Yes	11	21.89	8	5.79	(OR:4.5)	
No	38	78.11	120	94.21		
<b>Mask</b>						
Yes	5	11.35	10	7.24	0.419	
No	44	88.65	118	92.76		
<b>Glasses</b>						
Yes	2	4.98	3	2.38	0.427	
No	47	95.02	125	97.62		
<b>No Protective Equipment*</b>						
Yes	7	16.33	40	35.51	(OR:0.3)	
No	42	83.67	88	64.49		
<b>Wetted by Pesticides</b>						
Yes	36	71.93	76	57.85	0.139	
No	12	28.07	54	42.15		

Notes: W= weighted by strata; Ref= reference value; Std= standard error;  
n=frequency/number; OR: odds ratio for significant associations (yes vs. no in all cases);  
Percentages are column percents.  
\* Significant p for a 0.05 alpha level.

Source: Household Survey

**Table 6.13. Odds Ratio estimates for a logistic regression model for feeling nauseated or vomiting in the seven days prior to the survey, having applied pesticides in the same period, gender, and having had a lesion in the past, Quilloac and San Rafael, 2007**

Response (Stomach Spasms or Cramps )	Effect	p	OR	95% Wald Confidence Limits	
Yes vs No	<b>Having Applied Pesticides in the Seven Days Prior to the Survey</b> Yes vs No	0.048	2.51	1.01	6.26
Yes vs No	<b>Gender</b> <b>Female vs Male</b>	0.001	4.22	1.74	10.19
Yes vs No	<b>Lesion</b> <b>Yes vs No</b>	0.001	4.16	1.87	9.27

Notes: p= significance level for alpha <0.05; OR= odds ratios.

The table shows all variables included in the final multivariable logistic regression model. No other variables were significantly associated with recently feeling nauseated.

**Table 6.14. Odds Ratio estimates for a logistic regression model for having diarrhea in the seven days prior to the survey, having applied pesticides in the same period, and age, Quilloac and San Rafael, 2007**

Response (Diarrhea in the Seven Days Prior to the Survey)	Effect	p	OR	95% Wald Confidence Limits	
Yes vs No	<b>Having Applied Pesticides in the Seven Days Prior to the Survey</b> Yes vs No	0.025	3.67	1.18	11.48
Yes vs No	<b>Age</b>	<0.001	1.05	1.03	1.08

Notes: p= significance level for alpha <0.05; OR= odds ratios; 95% CL= 95% Wald Confidence Limits.

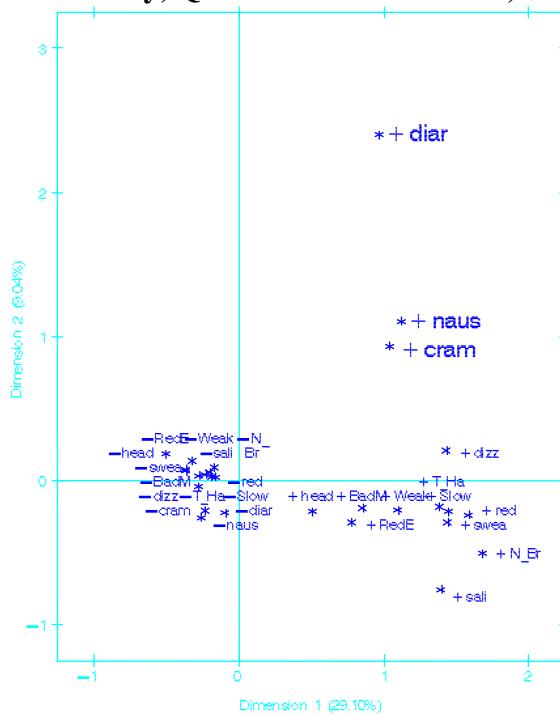
Notes: The table shows all variables included in the final multivariable logistic regression model. The logistic regression model included age and having used pesticides in the seven days prior to the survey. Age was included as a numeric variable.

The education level of the farmer was suggestive of an association because only 1 out of the 17 the farmers who had diarrhea had a high school degree or higher. However, the low frequency count did not allow for the inclusion of the variable in the model. No other variables were significantly associated with diarrhea.

Having had nausea or vomiting and diarrhea were also highly correlated with each other ( $p<0.001$ ,  $OR= 12.0$ ), suggesting that the same group of people were vulnerable to suffer from these symptoms. This is illustrated by Figure 6.2, which shows a correspondence analysis of

symptoms experienced in the seven days prior to the survey.<sup>112</sup>

**Figure 6.2 Correspondence analysis of symptoms felt in the 7 days prior to the survey, Quilloac and San Rafael, 2007**



Notes: The following conventions apply: + denotes having a symptom, - denotes its absence, , and \* denotes the position of the observation. The variables are coded as follows: Frequent Headache = '+head', Nausea or Vomiting for No Reason = '+naus', Diarrhea = '+diar', Stomach Spasms or Cramps = '+cram', Salivation and Spitting = '+sali', Dizziness (Without Drinking) = '+dizz', Sweating for No Reason = '+sweat', Skin Reddening or Rash = '+red', Lack of Breath = '+N\_Br', Shaky Hands = '+T\_Ha', Numb Hands = '+S\_Ha', Eye, Nose or Throat Irritation = '+RedE', Bad Temper = '+BadM', Feeling Weak = '+Weak', Loss of Dexterity in Hands = '+Slow'. To improve visibility, the font size for some variables is larger.

Consistent with the correlation data with having applied pesticides, the chart shows that diarrhea, stomach spasms or cramps, and nausea or vomiting, had a different distribution from other symptoms or their absence. Furthermore, it also suggests that these three symptoms were highly correlated with each other.

Source: Household Survey

To sum up, the association between suffering from diarrhea and nausea and having applied pesticides in the 7 days prior to the survey is suggestive of problems with pesticide handling in the communities. It is worth mentioning that these acute symptoms tended to occur simultaneously and that elders and women were more likely to suffer from them.

<sup>112</sup> Having had cramps or spasms was also highly correlated to diarrhea and vomiting. People who had nausea were 5.1 times more likely to have had stomach spasms or cramps ( $p=0.0001$ ). Farmers who had diarrhea had a 6.7 fold risk of also having had stomach spasms or cramps ( $p=0.0006$ ).

**6.4.2. Pesticide related cases in discharge records of the regional hospital: accidental poisoning in children.** From 1998 to 2008, there were a total of 285 cases of acute pesticide poisoning seen at the emergency services of the local hospital that covers rural and urban areas where the communities of study are located.<sup>113</sup> The total number of days of hospitalization that the cases required was 632, for an average of 2.22 days per case (standard deviation: 1.75).<sup>114</sup> There were no gender differences in the number of cases as 51.6% were men and 48.4% were women. Although cases were present all year round, the months of October, November, December and January had a higher number of cases (43.7% in these 4 months). This section describes the trends of cases of poisoning registered in the hospital discharge records. It identifies a peak of accidental poisoning in children 10 years old or younger, which were confirmed by reviewing their medical records, separating suicides and other causes from the accidental childhood poisonings.

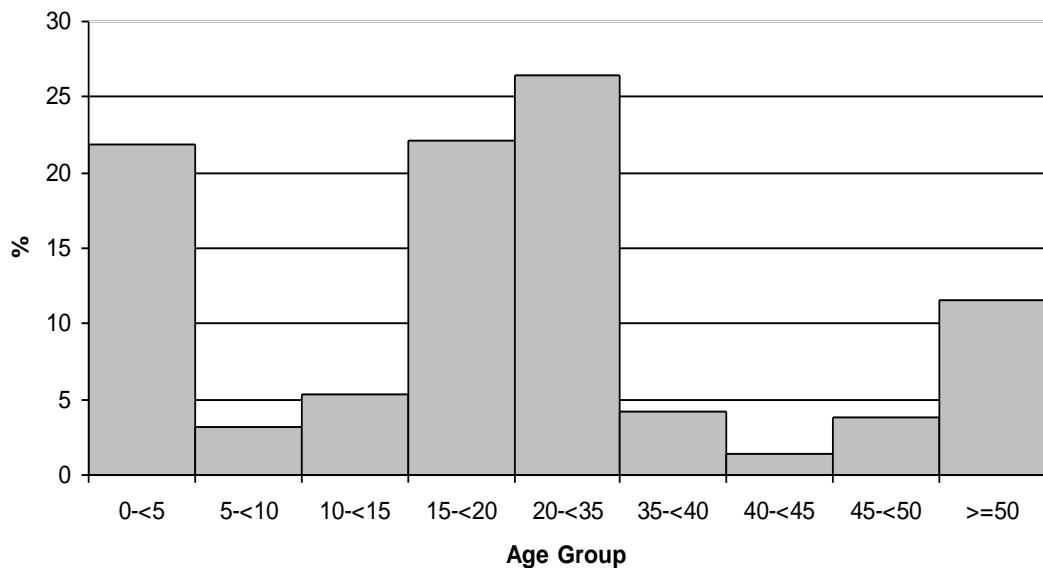
Figure 6.3 shows that the cases of pesticide poisoning from all causes were higher in two age groups: younger than 5 years of age and from 15 to 35 years of age. Among people over 10 years of age, 83.8% were clearly diagnosed as suicide attempts, while another 12.5% were associated with alcohol consumption. No gender differences were identified. In addition, all 14 deaths by pesticide poisoning were by persons 17 years or older. No deaths were registered for cases of pesticide poisoning in children 10 years old or younger.

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<sup>113</sup> Data did not allow the classification by community of origin. The diagnosis included confirmed or suspicion of pesticide poisoning at the moment of discharge. The diagnosis in children was verified in the medical records.

<sup>114</sup> If a case of acute pesticide intoxication occurred in the household, a majority of interviewees answered that they did not know what to do (58.3%). 32.4% sought help from the local health centre or local hospital. Help from a relative was used by 7.2% of farmers. The least frequent alternative was to look for a local healer, with only 2.0%. The type of help sought in a case of intoxication did not show any significant association to household income, educative level or the cluster of social resources ( $p>0.05$ ).

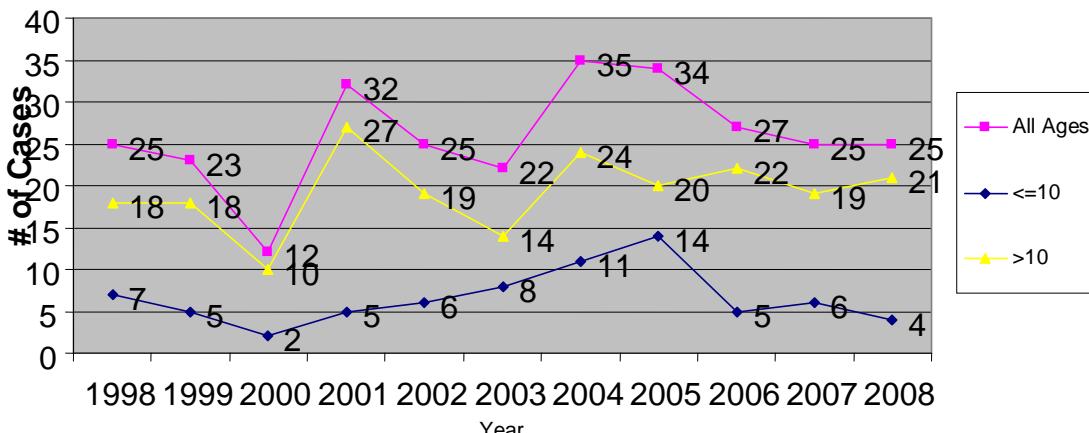
**Figure 6.3 Histogram of cases of acute pesticide poisoning by age group,  
Luis F. Martinez Hospital, Cañar Municipality, 1998 to 2008**



Source: Discharge Records, Luis F. Martinez Hospital

Figure 6.4 shows the time series of cases of pesticide poisoning, comparing people 10 years old or younger with others. The figure shows that people older than 10 years had a peak of 27 cases in 2001, a figure that oscillated with an average close to 20 cases every year. By contrast, the number of cases of poisoning in children 10 years old or younger was higher for 2003, 2004 and 2005 than in other years (even when excluding 2000, which is atypically low for all cases, the regression model showed  $p=0.002$ ,  $r\text{-square} = 0.73$  for the other years).

**Figure 6.4. Number of cases of poisoning treated in the emergency room of Luis F Martínez Hospital, all ages, over 10 years old, and children 10 years old or younger, 1998 - 2008**



Source: Discharge Records Luis F Martínez Hospital, 1998 - 2008

When interviewed, health workers from the hospital and local leaders suggested two feasible hypotheses to explain cases of poisoning by pesticides in the communities. For young adults and teenagers, increased rates of suicide may have been related to a lack of affection and guidance in families distressed by migration or multiple employments. In the case of younger children, international migration and multiple employments may also have threatened traditional childcare roles in the family. This was associated with the perception that farmers left pesticide residue in open spaces or disposed of pesticide receptacles in inadequate ways. These factors may have allowed for accidental poisoning (although it was less severe since the dosage was lower).

According to one of the pediatricians in the hospital:

"In both age groups [children and teenagers/young adults], there is a common denominator, which is the family disintegration. The disintegration of the family affects [those groups] in different ways. In the group of children younger than 5 years, in particular, because of the lack of supervision, negligence, lack of supervision on the activities of the child, lack of knowledge about prevention of accidents at home. This is a problem that has not been addressed in the rural areas of Ecuador. On the contrary, in the group of teenagers, 12 year old or older, there are other added circumstances. For

instance, the same family disintegration which causes that the child becomes a teenager as an independent person, without the acknowledgement of parental authority, without a figure of authority. This is coupled with the increase of acquisitive power by households [...] which determines more access to drugs or alcohol.” Interview with hospital pediatrician

This quote was consistent with the perception by most of the interviewees that traditional family roles were altered due to phenomena such as emigration. According to interviews with community members, the rate of international migration increased from 2000 to 2005, the year in which some emigrants returned to Ecuador for reasons such as increased controls by international authorities<sup>115</sup>. Talking about the role of gender for women and emigration in the communities, one of the female leaders said:

“[Migration] has changed above all the issue that women are with much more work, right? For some time, they have to see the children, they have to do the laundry, they have to cook, they have to iron, they have to take care of the family unit and the [sic] as well as productive unit, right?” Interview with community leader

To explore the hypothesis that childcare structures were associated with accidental poisoning in children 10 years old or younger, 57 cases of poisoning that occurred from 1999 to 2008 were compared with controls that had a different diagnosis, matched by age and month/year of admission to the hospital. However, no significant association was found between having parental or non-parental childcare at the moment of admission ( $p=0.144$ , OR: 2.2). There were no other cases with enough information or other quality indicators for exploring the hypothesis suggested by the interviews.

To conclude, more studies adopting analytical designs are needed to demonstrate causality in the hypothesis explored in this chapter. However, the evidence described in this chapter suggests problems with pesticide handling and supports the priority allocated by community organizations to the search for safer alternatives to pesticide use. This is even more important since pesticide

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<sup>115</sup> More details about the patterns of migration in the communities are described in Chapter 8.

related harm was more likely to affect the most vulnerable. First, it affected children who were victims of accidental poisoning. Second, farmers who had applied pesticides recently had more symptoms of diarrhea and nausea. Farmers and people with more participation in agriculture were mostly the less educated and, simultaneously, were the elders. Furthermore, households with lower incomes and less access to land were more likely to have higher estimates of participation in agriculture. Overall, Pesticide exposure and associated health effect was more frequent in some of the most vulnerable members of the community: elders with low education level and from poor households and young children.

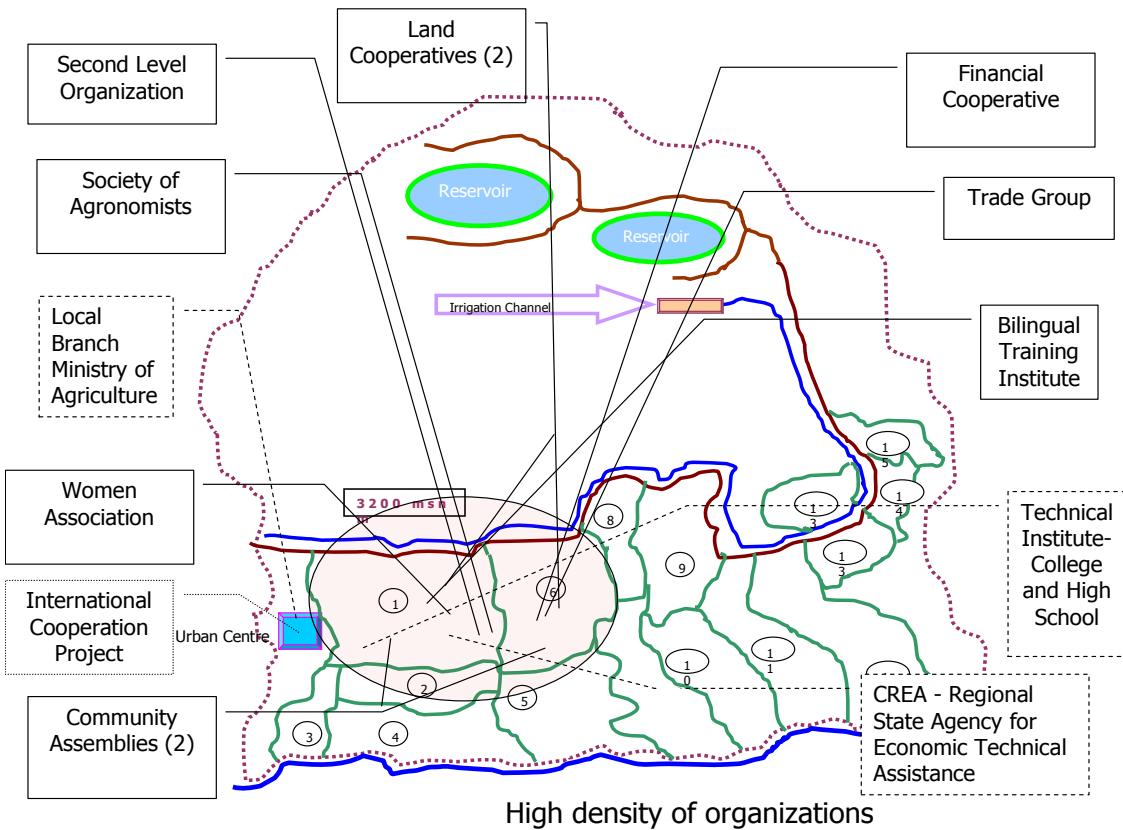
## **Chapter 7: Results on challenges in the field of agriculture and the capacity of small farmer organizations to reduce pesticide risk**

In 2007, Quilloac and San Rafael, with no more than 4000 inhabitants altogether, had a high organizational density as illustrated in Figure 7.1. Even though most of the organizations had an area of influence that went beyond Quilloac and San Rafael, both communities had been an organizational centres for the Cañari Peoples.<sup>116</sup> This chapter aims to better understand structural factors determining the capacity of small farmer organizations to promote healthier and environmentally friendlier agriculture (Specific Objective 2). First, I argue that despite some ambiguity, building safer and sustainable alternative solutions to pesticide use was central to the agenda of community organizations. Next, I focus on their capacity. I affirm that the community organizations had built knowledge and technical capacity for transforming agricultural practices. Part of this effort aimed to fill a gap left by the reduction of some state programs in the late 1980's and 1990's. However, this endeavor was insufficient as several challenges limited the community organizations' capacity to develop sustainable action. I describe three main barriers: 1) the lack of resources and support, 2) insufficient market access for their products, and 3) the prevalence of smallholdings in the communities. All three barriers were beyond the scope of action that was reasonable to expect from local level community organizations. The challenges were reflected by the small number of community members and the small number of households with access to social resources. A large number of households had little trust in the capacity of their organizations to improve the quality of life in the communities.

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<sup>116</sup> Details about these organizations are provided in Tables 5.3 and 5.4 in Chapter 5. Both tables enumerate the most important organizations for this analysis. However, the list is not exhaustive. For instance, an association of users of a stream of water (separated from the main irrigation channel) recently formed.

**Figure 7.1 Organizations related directly or indirectly to agricultural production, Quilloac and San Rafael, 2007**



Notes: The pink circle shows the two communities subject to this study. Green lines are the geographical borders between different communities. Complete lines indicate organizations that are controlled by community members, while dotted lines illustrate organizations that do not depend on community members. The later includes government institutions and international agencies.

Source: Community map with permission by the Association of Organizations. The list of organizations is product of field notes, document reviews and interviews. The numbers in the communities separated by green lines were part of the original chart to indicate the number of communities. They can be ignored.

## **7.1. Pesticide-harm reduction in the agenda of community organizations.**

Before discussing with some detail the capacity of community organizations, I explored the question of whether or not community leaders were committed to using their resources for building safer and sustainable agricultural practices. The short answer to this question was yes. The symbolic construction of an indigenous identity, which saw first nations as cohabiting with the ecosystem, was an additional asset that facilitated the leaders' mobilization for building alternatives to pesticide use. However, this identity competed with other visions such as the technological and economic hope offered by the Green Revolution. An environmentally friendly and healthier alternative would only be effectively promoted by offering adequate solutions to overcoming barriers such as the lack of adequate support, unfavourable market policies and smallholdings.

Pesticide use is embedded in an agricultural development model associated with the Green Revolution. As such, the capacity of grassroots organizations to develop safer agricultural practices had also been, for a long, time based on the perspective of the Green Revolution. By promoting agricultural production within the dominant vision of the Green Revolution, farmer organizations had also contributed to consolidating the practices of pesticide use in the region. For instance, the Financial Cooperative had, until 2007, a warehouse for distribution of pesticides. The owner of the main warehouse for the communities was also affiliated to the Society of Agronomists. From 1997 to 1998, the Association of Organizations promoted the production of tomatoes in warehouses, which initially had an intensive use of pesticides that later was discouraged by the same organizations. Some organizational leaders also worked in the promotion of pesticide use within the frame of some community development projects in the

past. As in many other communities, pesticides have also been a resource for promoting agricultural production.

Nonetheless, the leaders of all organizations had a serious commitment to promoting safer alternatives for agricultural development. Not surprisingly, the original idea for a study on pesticide use in the communities came from the Association of Organizations. In recent years, all organizations had promoted projects for either safer management of pesticides or the elimination of pesticide use on crops. For instance, from 2001 to 2003, in collaboration with the National Autonomous Institute of Agriculture and Livestock Research (INIAP), the organizations carried out more than 20 Farmer Field Schools to train farmers in alternatives to intensive pesticide use.<sup>117</sup> The Financial Cooperative actively promoted the consolidation of the Trade Group whose objective was to create a market for pesticide-free products in the urban centre. The Women's Group also trained members for pesticide-free agriculture. The Association of Organizations blocked in 2002 an attempt by one of the main Ecuadorian chemical companies to promote pesticide use in the communities. The Association of Agronomists, the Association of Organizations and the Financial Cooperative had pilot farms in which several pilot strategies for reducing or eliminating pesticide use from crops were tested.

In general, the symbolic construction of an indigenous identity, representing a runa (human being) in harmonious relationship with the pachamama (mother earth), played an important role in putting pesticide harm reduction on the agenda of community organizations. This construction of an indigenous identity that is part of the environment did not deny the existence of symbolic

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<sup>117</sup> This is a participative training methodology in which the farmers are accompanied in the development of their crops. The effectiveness of Farmer Schools is contested. In an evaluation of this methodology in another province in Ecuador, it was shown to be a powerful tool for reducing health impacts of pesticides if it is used in contexts where there is consensus about the development objectives (Tracy, 2007). See Chapter 3 for more detail.

conflicts.<sup>118</sup> At times this vision could compete, for instance, with an economic development perspective. However, the existence of an ecological symbolic construction facilitates the adoption of environmentally friendly perspectives by social players. The symbolic construction of indigenous people being friendly with the environment is powerful cultural capital in the communities. For instance, the owner of the main warehouse for the communities agreed to partner in some of our training activities for farmers because he was an indigenous member of the communities. As such, he wanted to be associated with the vision of an aboriginal cohabitation with the environment.<sup>119</sup>

## 7.2. Community organizations' capacity: challenges in the field

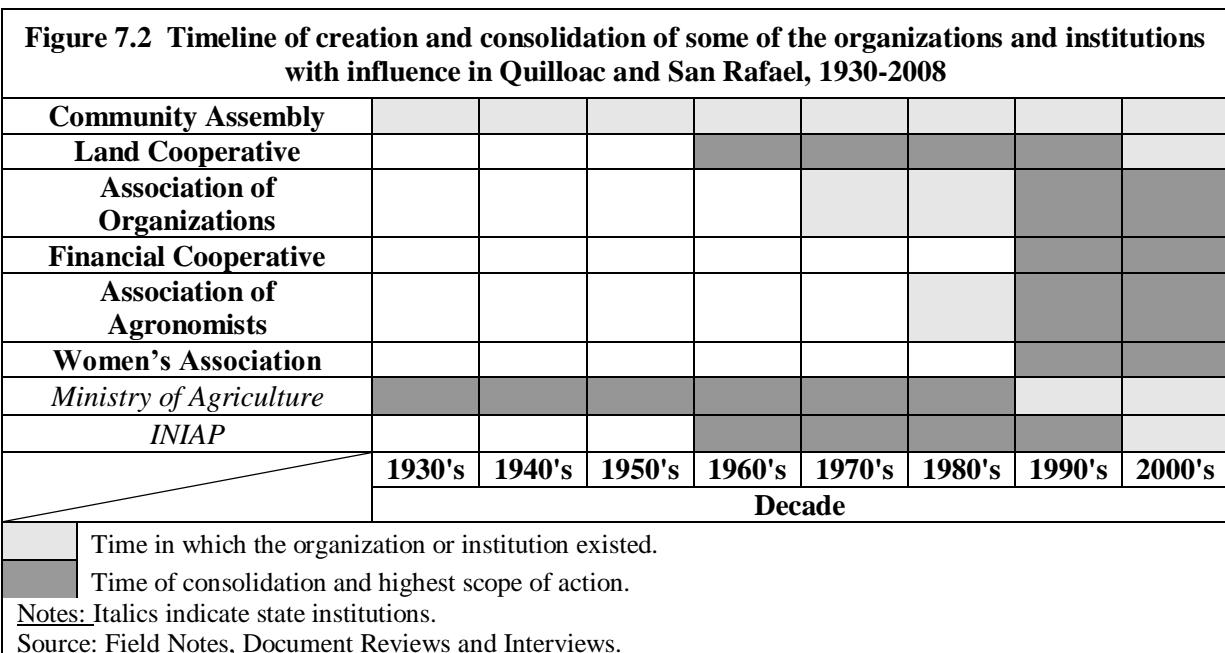
Figure 7.2 shows that most of the grassroots organizations emerged or consolidated during the late 1990's and 2000's. This was the period in which the limited Ecuadorian state support that existed during previous decades was reduced as part of the structural adjustment policies. This process left a social space that was colonized by indigenous organizations in Ecuador (Breton, 2001; Clark, 1997; North, 2003; North & Cameron, 2003). For instance, many of the technicians from the communities, who worked for state institutions such as the INIAP in the past, now worked with the grassroots organizations. Figure 7.2 shows the timeline of reduction of some of the state institutions as was documented for the area of study. Regarding the reduction in state support, one of the technicians at the local branch of the Ministry of Agriculture and Livestock illustrated this process:

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<sup>118</sup> In general, it is similar to Bourdieu's concept of heterodoxy in which conflicting visions of reality are competing for hegemony in a given society (Bourdieu, 1980c).

<sup>119</sup> Some implications of this symbolic construction for organizational strategies are discussed in Chapter 8.

“This is one of our problems [at the Ministry of Agriculture and Livestock - MAG], the lack of resources. I tell you: in our provincial direction, where all the personnel of the MAG works, because there are local directions in all provinces in the country, here in Azogues, some years ago, there were more than sixty technicians and administrative personnel. The modernization of the state came, we never knew what role the MAG had... Now in Cañar there were just two workers... in the provincial direction, at this moment, we are fifteen employees; among the fifteen, we are seven technicians and eight administrative people” Technician at the local branch of the Ministry of Agriculture and Livestock



Community organizations consolidated in their effort to fill the gaps left by state organizations. The conformation of many organizations, such as the land cooperative, occurred under the influence of the state or agencies external to the communities.<sup>120</sup> However, previously established indigenous traditions were also part of the foundations of their organizations (in

<sup>120</sup> Land cooperatives were created to conform to the requirements of the land reform in 1964 to access land. The Association of Agronomists was initially promoted by a professor in the technical training institute with some of their first technicians. Many of these initiatives, however, were consolidated by channeling efforts already in place in the communities.

particular the older organizations).<sup>121</sup> Table 7.1 summarizes some managerial aspects of some of the main organizations working in areas related to pesticide control.<sup>122</sup> Regardless of their traditional origin, in 2007, all the main organizations were already run and controlled by community members (see Figure 7.1 and Table 5.2).<sup>123</sup>

The conjunction of grassroots community organizations in Quilloac and San Rafael had an impressive number of assets that could be important for promoting alternatives to pesticide use and agricultural development in general. The participative action component of my field work encompassed a number of initiatives (Table 5.4) that built on the communitarian organizational assets such as the expertise of human resources for training activities, facilities for our meetings, and their co-funding of some activities such as a radio show. Some of the assets of the largest grassroots organizations in the communities are illustrated in Figure 7.3. Gained with a great effort, these resources included key strategic advantages for agricultural development such as a sound financial cooperative, a grain processing and packing centre, a supermarket in the urban centre and a consolidated irrigation system.<sup>124</sup> In this section, I describe three challenges that limited the capability of community organizations: 1) the lack of resources and support, 2)

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<sup>121</sup> For instance, the Association of Organizations was an effort by the communities to coordinate the organizations that emerged in the land reform. However, it was restructured in the 1980's and 1990's under the influence of a European cooperation and a state project that supported the construction of the main irrigation system. In the mid-1990's the indigenous association assumed complete control of the irrigation system. In another example, the community assemblies were officially established by the state in 1930's. However, there were informal community assemblies before the 1930's.

<sup>122</sup> All organizations had combined to some extent traditional and modern managerial aspects in their organizations. For instance, there was a strong tradition of community consultation for projects and decisions. Leaders from all organizations shared a serious discourse of community service and work for the farmers' welfare. However, newer groups such as the Association of Agronomists and the Financial Cooperative tended to have a more business-like and technical approach to management.

<sup>123</sup> A suggestive indicator of the extent to which an organization was perceived as traditional was its capacity to call for mingas, which were meetings for communal work that had an ancestral origin. When a household did not have any representation in a minga, the promoting organization had the authority to impose a fine. The capacity to call for mingas was only acknowledged by the older organizations: the two community assemblies, the two land cooperatives, and the association of Cañari organizations. Newer organizations such as the agronomists association and the financial cooperative did not have the capacity to call for mingas.

<sup>124</sup> See Table 5.2 for more detail.

insufficient market access for products, and 3) the prevalence of smallholdings in the communities.

**Table 7.1. Organizational structure, target population for services and main funding sources in some of the main farmer and indigenous organizations, Quilloac and San Rafael, 2007-2008**

	<b>Membership</b>	<b>Target Population for Services</b>	<b>Decision Making</b>	<b>Management</b>	<b>Main Funding Sources</b>
<b>Association of Organizations</b>	- All community members at a political level	- All community members (15 communities)	- Community meetings	- Directors elected in community meetings - Stable technical staff hired by directors	- Fees irrigation system - Projects funded by private donors and state agencies
<b>Financial Cooperative</b>	- Affiliated (close to 20 members)	- All community members (15 communities)	- Meetings of affiliated members - Meetings with target communities for particular projects	- Stable management team accountable to members	- Financial services - Contributions by affiliated members - Projects funded by private donors and state agencies
<b>Association of Agronomists</b>	- Affiliated (close to 20 members)	- All community members (15 communities) - Project based	- Meetings of affiliated members - Meetings with target communities for particular projects	- President elected by affiliated members - Stable technical coordination - Technicians hired on project bases	- Projects funded by private donors and state agencies - Contributions by affiliated members - Supermarkets draw some profit
<b>Land Cooperative</b>	- Affiliated (not all community members)	- Only affiliated members	- Meetings of affiliated members	- Directors elected in community meetings	- Projects funded by private donors and state agencies - Contributions by affiliated members - Farming guinea pigs
<b>Community Assembly</b>	- All community members	- All community members (15 communities)	- Community meetings	- Directors elected in community meetings	- None

Source: Interviews and Document Review.

**Figure 7.3 Some assets owned by community organizations, Quilloac and San Rafael, 2007-2008**



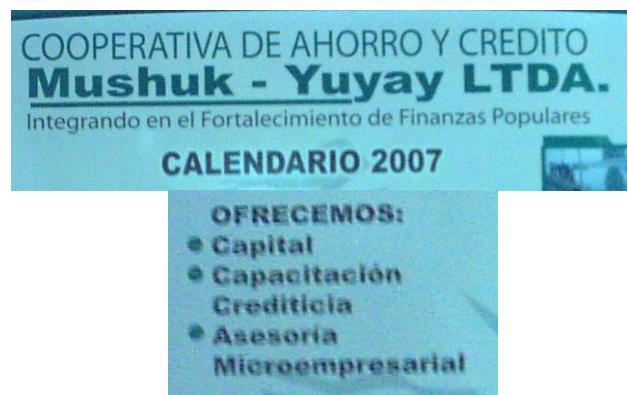
**Distribution Centre - Main Irrigation Channel - Association of Organizations**



**Grain Mills and Packing Facilities in the Financial Cooperative**



**Excerpt from Promotional Poster for Supermarket, Society of Agronomists**



**Excerpts from Promotional Poster - Financial Cooperative**

Source: Field Work

**7.2.1. Limited access to resources.** In this section, I describe how only three of the organizations had access to enough resources to provide a stable offer of services to farmers. Even with these three, capacity for investment in and development of new projects was limited and contingent on state or cooperation funds, which were fragmented and discontinuous. Furthermore, what limited access to resources that the organizations had was reflected in their incapacity to retain human resources. Despite having been able to keep a number of skilled personnel, valuable human resources had left the organizations as the job offers were not competitive in the labour market.

**7.2.1.1. Financial resources.** In general, the three largest institutions, in terms of financial resources, were the Association of Agronomists, the Financial Cooperative and the Association of Organizations. In general, they had an economic stability that allowed them to provide some basic services. When I suggested the idea of exploring funding options for a radio show to raise awareness about accidental cases of children being poisoned by pesticides, the Association of Agronomists and the Financial Cooperative offered matching funds to support the idea. The Association of Organizations did not have the financial means at that moment. However, all three organizations contributed with skilled human resources for developing the radio show. Overall, they concentrated the majority of assets in the communities. Other organizations, however, did not have reliable funding sources. Some details about the main sources of funding by organizations are shown in Table 7.1.

Nonetheless, the organizations' margin of profit and capacity for investment was relatively small. For instance, the Financial Cooperative had had success with their financial services and was planning for a second branch in another of the communities. Even though the creation of the

financial services had started in 1996 as a savings fund, it was only in 2005 that they grew to become a cooperative. In 2007, the Financial Cooperative had approximately 1600 clients, 90% of them from the 15 communities of the Cañar area. Their cash flow was stable, but the margin of profit and reinvestment was relatively small. For example, in 2004, they had to ask for US\$10,000 from a funding agency and additional funds from international cooperatives in order to purchase the equipment for the mill processing centre. As of 2007, this processing centre was not yet profitable.

The Association of Agronomists had a higher dependency on funding from projects. In my first interview with them in early 2007, they were in a difficult financial situation. The funding for some of their projects had ended, while their supermarket had just started to break even after their initial investment. In late 2007, they had secured funding for a couple of years from other projects and the Spanish Cooperation Agency. This had allowed them to hire again some of their technicians and to have access to some resources such as the matching funds that they offered for our radio show.

The Association of Organizations depended mostly on the fees from the irrigation system for their regular activities. However, in recent years they had had to increase the fees several times to match their operating costs. For investment, they relied mostly on funding from cooperation projects and credit. For example, in the final days my field trip, the Association of Organizations had approved funding for an international cooperation project to promote sustainable production in the ecosystems at the peak of the mountains neighboring the communities, fundamental for maintaining water supply for their irrigation channels.

On some occasions, given the lack of other financial resources, community organizations had managed to seek non-conventional resources for developing some projects. However, these

alternatives were exceptional and difficult to replicate. For example, the Association of Agronomists could not get enough credit for the approximately US\$60,000 that they had initially budgeted for establishing their supermarket. As a result, they asked some of their emigrant members to invest part of their remittances in the project. In 2007, the idea of asking emigrants for more resources for other projects was not possible since they were still waiting for the financial results of their first investment.

In general, all organizations depended on funds from state or cooperative agencies in order to have some capacity to develop intervention and development projects such as the promotion of a pesticide-free chain of agricultural production. Most of their projects had been either completely funded or co-funded by state or cooperation agencies. For instance, the Ecuadorian Peoples' Progress Fund (FEPP) in the city of Cuenca supported the Financial Cooperative in the establishment of their initial savings fund. CARE International (originally known as the Cooperative for American Remittances to Europe) provided funds for the Association of Agronomists first nursery. The Association of Agronomists, in collaboration with one the land cooperatives, built for 2007 a new irrigation channel in one of the community sectors with funding from the Development Project for Indigenous and Afro-Ecuadorian Peoples (PRODEPINE). The Association of Organizations had an agreement with the Ecuadorian Ministry of Social Inclusion to develop a sustainability project for water conservation in the top of the surrounding mountains. The same ministry also funded a project for production of fresh vegetables that was led by the Financial Cooperative.

However, funding from projects is unstable and insufficient for building sustainable alternatives for agricultural development. For instance, once the INIAP retired from the area, the lack of financial resources was the main reason to stop Farmer Field Schools. The INIAP left

trained local personnel who could not be used to maintain this training alternative. Each Farmer Field School experience cost close to US\$1,000, funds that the organizations did not have. One of the organization leaders described the situation thus:

“The organization does not have enough resources. Probably what is missing are projects, our projects. But, for example, we submit projects, and the instability of the country - there are changes in direction. In the latest government, I think that the minister was changed like five times. ... [it could be better in other countries]... for instance here, to receive US\$6,000, one has to wait two years. They come to check whether we are doing well or not, and they charge US\$330 for insurance... If we had been any other type of people, we had already left [the organization]” Interview member of community organization

**7.2.1.2. Human resources.** When programs such as the INIAP retired from the communities, the other organizations were able to offer alternatives for a number of trained staff that had been laid off in the process. In 2008, each one of the three largest organizations had at least one member of their directive bodies with a Master’s degree. In another example, by promoting our intervention activities, I had the opportunity to learn from members of the organizations about pesticide management and alternative crop production. They developed technical components of the curriculum for workshops, educative materials and the radio show. They also had a rich capacity to adapt their technical expertise to their local context. For instance, in one of the workshops with farmers, they demonstrated how to manufacture homemade protective equipment from inexpensive materials such as plastic bottles.

In spite of this capacity, the number of professionals with training in business and planning was insufficient, while technical level agronomists tended to be the most common type of human resources in the organizations. In 2004, one the few leaders that had a Master’s degree in

business identified in his thesis work that there were few professionals with training in management, planning, and marketing. Furthermore, while having very capable technical personnel, the organizations did not have the capacity to keep professional human resources in leadership positions (Quinde, 2004).

In some organizations such as the community assemblies and the land cooperatives, leadership positions were not remunerated in 2008. This built on a tradition of pro-bono work and mutual help from the 1950's and 1960's. However, with the increase of market-based labour in rural areas in Ecuador, this tradition was insufficient to attract some of the best human resources. Some organizations had already made an effort to improve the labour conditions for their leadership:

"We have started to discuss that the leadership needs to be completely remunerated. That is the way, how else? Before, in times of the reform, the leaders worked without a [sic] pay, but they had, what, they had people who helped them everyday. In the harvest they had, for instance, assistance. There was a pay in workforce, there was a [sic] pay in products... Thus, people told the leader to go to advocate, and they took care of the rest. That was the way. However, now, with the migrations, there was a change; it became monetary. In this case, in my second term in the presidency, I had a salary." Interview former president of the Association of Organizations

Despite this effort, there was a gap between the salary that community organizations could offer to professional community members and the income that they could receive in urban centres or other countries. In 2007, no candidates presented themselves at the initial invitation to run for the position of president in two of the organizations (one of the community assemblies and the Association of Organizations). Some leaders had to be encouraged to run for position. In effect, a significant number skilled personnel had left and were still leaving from the communities and their organizations. For instance, close to half of the original members of the Association of Agronomists had left for other countries. Between 2007 and 2008, the Association of Organizations laid off their technical coordinator because of cuts to their

operational budget. The accountant from this organization left his position because he had been offered a better paid job in the provincial capital. Some of the highest salaries that the organizations could offer were no more than US\$500/month, which was not competitive with salaries from urban centers for similar training requirements. Discussing his experience after one of the projects funded by a European cooperation agency, one of the leaders asked:

“In what state did they leave us? The same partner who managed the part of accounting and credit left for Spain. Thus, it was not that easy... In my case, I was technician, and after that, I was coordinator. I can not tell that I am making money. Sometimes, one has also to see the way to support the family.” Interview member of community organization

Another account illustrative of the limitations in terms of human resources and financial capital was the development of a micro-business for selling baked goods out of quinoa, a traditional Andean cereal. Between 2005 and 2006, the Association of Organizations ran a promising initiative to produce and distribute quinoa cookies and muffins. The products were developed by two food science students from the University of Cuenca. The idea was to allow some farmers to have a new market for their grain, while offering a healthy product for local people. The organization brokered distribution agreements with schools and local supermarkets. In order to develop this initiative, the Association of Organizations had negotiated infrastructure support from the Town Hall. In addition, they applied and got approval for a credit of US\$3000 for supplies and equipment. The production was successful for close to one year. However, the Association did not have enough human resources to maintain steady production. The association’s staff had to take time from their work and leisure activities to maintain the business. As local farmers were not certain of demand, they did not harvest quinoa locally. As a result, when producing, the association had to buy quinoa from other provinces. In 2006, production stopped indefinitely, leaving a negative credit balance. In 2007, the organization was still looking for financial resources to be able to fund staff for production.

In summary, despite the fact that community organizations had been able to secure important assets in their struggle for a sustainable future for their communities, their capacity was limited. In order to develop projects and proposals for safer and sustainable agriculture alternatives, community organizations depended on funding from state and international cooperative donors. However, this type of funding was limited and fragmented. In general, it did not allow the organizations to harness the capacity of all human resources that were available in the area. They had difficulties retaining professional and skilled workers in leadership positions. Furthermore, the diversity of agendas of donor agencies and the lack of continuity that characterized this type of funding made it difficult for existing personnel to harness the potential of the symbolic capital represented by an indigenous identity that privileges a harmonic relationship between humans and the environment.

**7.2.2. Land distribution and smallholdings.** In Chapter 4, I described the structure of land distribution in Ecuador, identifying a very inequitable distribution of property. In addition, I discussed that an important number of farmers, in particular in the Ecuadorian ranges, had smallholdings. Smallholdings limit the capacity of farmers to survive, while making it more difficult for farmer organizations to harness their capacity for developing safer and sustainable agricultural practices. This is even more important when taking into account the findings described in Chapter 6 that indicate that households with less than one hectare of land were more likely to have extremely high or extremely low levels of adult participation in agriculture. In this section, I will explore in more detail the structure of land distribution in the communities to better understand the magnitude of the challenges that smallholdings present to community organizations. Based on findings from the household survey, I argue that land distribution in Quilloac and San Rafael was inequitable. However, I state that the main characteristic of the communities' land structure was the prevalence of smallholdings and small farming units. Furthermore, there was a marked trend towards further miniaturization of the property. This tendency created additional barriers to the organizations' capacity for controlling their productive process towards safer agriculture alternatives.

The land distribution in Quilloac and San Rafael in 2007 was inequitable, although this inequity was lower than the Ecuadorian average. As shown in Figure 7.4., among the 187 Quilloac and San Rafael households included in the survey, 26.8% of the area was owned by only 6.7% of households (which had between 5 and 20 hectares of land).<sup>125, 126</sup> By contrast, the 44.8% of households with less than 1 hectare controlled 9.6% of the surface area.<sup>127</sup>

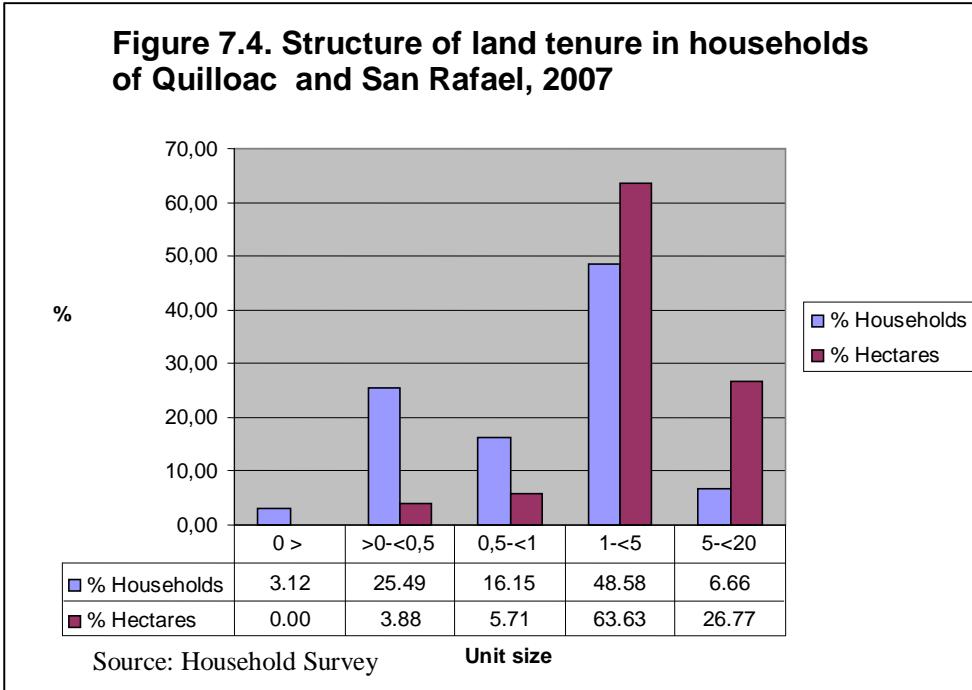
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<sup>125</sup> In San Rafael, the concentration of land is higher than in Quilloac as just 5.6% own 27.3% of the land, compared with 7% that own 26.5% in Quilloac. Some details of this distribution are described in Chapter 6, Table 6.3.

<sup>126</sup> All percentages from the household survey are weighted by community strata.

<sup>127</sup> These inequities were important because they were associated with the degree of participation in agriculture. When compared with the rest of the community, the 44.8% with less than 1 hectare of land was precisely the group

Nonetheless, when compared with the national structure of land distribution, Quilloac and San Rafael had a better than average distribution of land. In Ecuador, 6.4% of units larger than 50 hectares controlled 60.4% of the agricultural land (INEC-SICA, 2000).



Despite inequities, the main characteristic of land distribution in Quilloac and San Rafael in 2007 was the prevalence of smallholdings. Among the 187 Quilloac and San Rafael households included in the survey, close to 45% owned less than 1 hectare. In general, the trimmed means of land ownership showed an average of just 1.31 hectares per household.<sup>128</sup> None of the households in the survey had more than 20 hectares of land. This meant that all households were

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that had between 4 and 5 times the likelihood of having extremely high or extremely low levels of participation in agriculture ( $p<0.01$  for both cases).

<sup>128</sup> Trimmed means were used to avoid distortions of the upper 5% of extreme values. In general, the average number of hectares owned per household was 1.56 (95% Confidence Limit (CL): 1.30-1.82). The average number of hectares per household in Quilloac was 1.65 (95% CL: 1.31-1.98), which is slightly higher than the average in San Rafael, 1.29 hectares (95% CL: 0.91-1.67). The differences between Quilloac and San Rafael were not significant in a linear regression model. DO YOU MEAN 95% CL? STANDARDIZE

classified as either small farmers or farmers with smallholdings.<sup>129</sup> According to community elders, when the land was distributed in the agrarian reform, the maximum area that a household could buy was 4 hectares. People from other communities and former landowners had access to more land.

Furthermore, the problem of smallholdings was increasing in Quilloac and San Rafael, as well as in most of the communities of the area. Table 7.2 shows A comparison between 1997 and 2007 in the average size of the land units affiliated with the irrigation system. The table shows that, in general, the land units in the area had decreased. Moreover, land units in San Rafael had decreased an average of 0.11 hectares in a period of 10 years. This was a faster decrease than the average of other Cañari communities. By contrast Quilloac had a lower decrease in the size of its land units. When asked about these trends, staff members suggested that the main reason may have been that Quilloac's land cooperative had more land to distribute for a longer time than the cooperative in San Rafael. However, the last pieces of land available in Quilloac were distributed in 2007.

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<sup>129</sup> Small holdings are understood as productive units with 5 or fewer hectares. Small farmers in the strictest sense have more than 5 hectares but less than 20. This corresponds to what has been described by M. Chiriboga for the Ecuadorian case UNCLEAR WHAT YOU MEAN HERE (Chiriboga, 1997). However, it has also been suggested that farmers with 1 hectare or less should be classified as farmers without land (Martinez, 2007).

**Table 7.2. Average of surface area of land units in fourteen communities according to the registry of the irrigation system, Association of Organizations, Cañar, 1997-2007**

Community	Average Hectares		<u>Difference</u>
	1997	2007	
Shayacrumi	1,09	0,65	-0,44
Chaglaban	1,01	0,67	-0,34
La Posta	0,41	0,22	-0,20
San Rafael	0,52	0,41	-0,11
Cuchucun	0,27	0,18	-0,09
Jirincay	0,33	0,23	-0,09
Yuracasha	0,54	0,45	-0,09
Shizho	0,44	0,36	-0,08
Chuchucan	0,95	0,88	-0,07
Quilloac	0,33	0,31	-0,02
Ayahuayco	0,41	0,40	-0,01
Correuco	0,29	0,34	0,05
Yanachupilla	0,65	0,71	0,06
Santa Maria	0,39	0,83	0,44
Total	0,43	0,35	-0,09

Notes: Red denotes reduction in average size. Communities ordered according to magnitude of change.

Some communities had a positive difference. A explanatory factor is the increase in the surface area of the irrigation system which was expanded in those communities.

Source: Comparison Databases for Irrigation System from 1997-2007

The main reason for the accelerated reduction in size of land units that some communities had was the tradition of inheritance. In Cañari communities, land is divided in equal pieces among all children of a household regardless of age or gender. In effect, according to the survey, among the households that had land, the most important form of acquisition was inheritance (71.3% in both communities). Land purchase or acquisition of land by cooperative followed at 39.4% and 34.3% respectively. No significant differences were found between the communities.

The problem of smallholdings surpassed the capacity of community organizations. The land cooperatives in the communities had already exhausted their capacity to distribute land among the affiliated members. Community organizations did not have the financial resources or

political capital for promoting land distribution in their communities. Furthermore, the fact that most of the households in the communities were smallholders or small farmers was suggestive that the solution to land tenure problems in the communities was not in their realm.

The predominance of small land units in the communities had repercussions in the organizations' approach to supporting productive systems and alternatives for reducing pesticide related harm. One of the leaders indicated that reduced land units may be an advantage for reducing pesticide use because they prevent a widespread implementation of monocrops (single product harvests in large areas). However, the same leader also pointed out that it was more difficult to coordinate farmers to develop a productive alternative. In effect, the head of an organic processing initiative in one of the neighboring municipalities stated that they had avoided the problem because they were able to coordinate their group of farmers. Nonetheless, he also questioned the feasibility of implementing organic production if farmers were not organized. In their case, an organic farm required a margin of land beyond the crop limits in order to be certified. If neighbours did not coordinate their efforts, it was difficult to leave such a margin in very small land units. In our participative experience, the atomization of units and housing made it difficult to reach farmers for activities such as the survey or invitations to workshops. In addition to these difficulties, community organizations were challenged to provide productive assistance to small units. For these reasons, authors such as Manuel Chiriboga (1997) question the economic viability of units with 5 hectares or less.

**7.2.3. Unfavourable market changes and competitiveness.** The following quote was recorded from the local radio station:

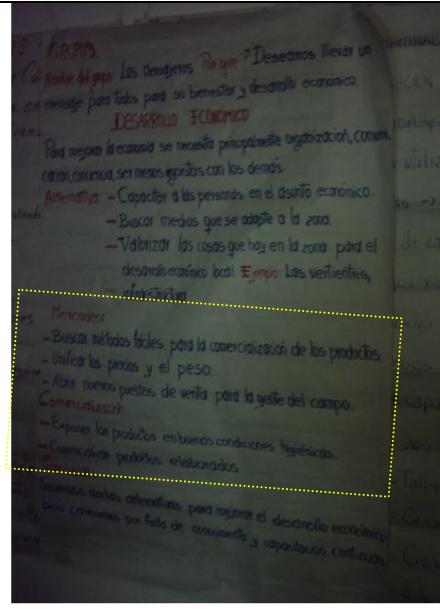
“[The intermediaries] did not allow direct consumers to take the product. Instead, they imposed their price and monopolized the product. Let’s make a call for the authorities to exert control at the potato market of our town on Sundays. Yesterday, there were clashes even between consumers and intermediaries, and we were told that no control authority arrived. It is a request then [for the police] to work on Sundays in the potato market to prevent intermediaries from monopolizing the product, and then the real consumers having to pay high prices.” News broadcast, Radio Ingapirca, Monday, November 11<sup>th</sup>, 2007, Cañar

This quote represents a common conflict for regarding control of the local market for agricultural products. Farmers had tried to sell their product directly so that consumers could get a better price. Intermediaries had reacted and confronted farmers and consumers. The fact that the only alternative that the broadcaster indicated was a strong call for police presence is suggestive of the difficulties for local players in finding local solutions. In another illustration from our own participative action activities, we helped an emerging trade group to develop a vision of pesticide-free products for the future. However, one of the farmers’ main interests was to be able to trade directly to obtain better prices for their products. The group had already started to have conflict with intermediaries. While embedded in a local context, these conflicts between local players had roots at other levels. In Ecuador, small farmers produced almost exclusively for local markets. In Chapter 4, I discussed the extent to which state policies from 1980’s in Ecuador privileged the free market and an export driven model that favoured large producers. A reduced market share stressed the inefficiencies of traditional trade niches in which more than 50% of the transactions were controlled by intermediaries. Small farmers were left with inadequate assistance for overcoming their competitive disadvantages (Chiriboga, 1997, 2004). In this scenario, price competition tends to discourage pesticide-free production. In this section, I will describe the local experience of this process. Farmer organizations in the

communities were already making efforts to overcome these difficulties, improve productivity, and secure new markets. However, given the lack of adequate policies at the regional and national level, this is an overwhelming task in which they have to compete with other producers.

The reduction of the market niche for traditional products affects traditional farmers. Access to good markets for their products was one of the main concerns that farmers expressed. Figure 7.5 shows the importance that farmers gave to access to good markets for their products. The chart is the summary of a discussion group promoted by one of the community organizations as part of the elaboration of their strategic plan. It shows several key aspects of the farmers' perception. First, it showed the importance that marketing and trade had for the farmers' perception of economic development. Second, it clearly expressed the need for new markets for farmers. Third, it highlighted the need for creating added value by processing products before reaching the market. Fourth, it reflected the tension with intermediaries as the farmers requested standardization of prices and weights. Farmers were suspicious that intermediaries could alter their weights to reduce the price of the products.

**Figure 7.5 Summary of group discussion on economic development in a community planning workshop facilitated by the Association of Organizations and the Provincial Indigenous and Farmer Organizations as part of their strategic planning process, 2007**

	<p><b>Economic Development</b></p> <p>In order to improve the economy we need mainly organization, communication, conscience, to be less selfish.</p> <p><b>Alternatives</b></p> <ul style="list-style-type: none"> <li>- Training people in economic issues</li> <li>- Search for alternatives that are adequate for the area</li> <li>- Value things that are in the area currently for the local economic development. For example: the water streams, infrastructure</li> </ul> <p><b>Marketing</b></p> <ul style="list-style-type: none"> <li>-Look for easy methods to market products</li> <li>-Standardize prices and weights</li> <li>-Open new selling points for people in rural areas</li> </ul> <p><b>Trade</b></p> <ul style="list-style-type: none"> <li>- Show products in a hygienic and appealing condition</li> <li>- Market processed products</li> </ul> <p><b>Conclusion</b></p> <p>We have many alternatives that can improve economic development but we lack knowledge and continuous training.</p>
<p><b>Notes:</b> The text on the right is the translation of the flip chart paper on the left. The text highlighted in the yellow square is bolded on the translation.</p> <p>First, this text showed the importance that marketing and trade had for the farmers' perception of economic development. Marketing and trade concerns occupied two out of three subheadings and five out of nine items for economic development in the communities; they also occupied more than one third of the paper. Second, it clearly expressed the need for new markets for farmers. Third, it highlighted the need for creating added value by processing products before they reach the market. Fourth, it reflected the tension with intermediaries by asking for a standardization of prices and weights. Farmers were suspicious that intermediaries could alter their weights to reduce the price of the products. In addition, the figure highlights the importance that farmers gave to organizational support and training. It is also worth highlighting that the use of pesticides did not appear in the summary. It may be suggestive of the secondary place of pesticides in relation to economic development.</p> <p><b>Source:</b> Field Trip</p>	

However, intermediaries, and in particular small intermediaries, were also affected by changes in markets. In my visit to the potato market, I could identify that many intermediaries were also indigenous Cañari members of the communities. The following excerpt from one of my interviews with an intermediary was representative of their perception:

"Before they [the consumers] bought more; I don't know why; ... the town is larger, but they buy less. I do not know what happens." Interview with intermediary at the potato market place

This description may be indicative of a real loss of market share by traditional intermediaries. It is also possible that given the tensions in the marketplace, intermediaries did not acknowledge the full dimension of their business. However, their description is consistent with a process of transformation in Ecuadorian markets that had been described by some authors. In Ecuador, chains of supermarkets had almost doubled their number from 1998 to 2004 (Zamora, 2005). The urban centre in Cañar had newly established supermarkets and several mini-markets that offered the same products. The increased tensions that farmers and intermediaries experienced may be suggestive of their fight for control over a reduced niche for traditional business.

The emergence of market changes such as supermarkets was also indicative of the need for changes in the productive system. The volume of supply required and the technical specifications that supermarkets asked for represented a challenge for small farmers (Reardon et al., 2003; Zamora, 2005). These include, for instance, different standards for hygiene, post-harvest handling and packaging. Not surprisingly, Figure 7.4 shows that farmers showed the need for assistance in post-harvest processing. An illustrative experience occurred from 2004 to 2005. A company from Quito contacted one of the organizations offering a relatively good price for quinoa if the farmers agreed to sell them their next harvest. Farmers were very receptive to the idea. Once in Quito, the harvest was rejected because the product was not as clean and processed as they expected. The harvest had to be sold at half the promised price.

In an interview with one of the project leaders at the International Potato Centre office in Quito, she indicated that potatoes were not a competitive product for exportation. One of the main reasons was that neighbouring countries, such as Colombia and Peru, were also potato producers with very competitive productivity. The International Potato Centre in Quito focused

their marketing efforts on the local market. However, productivity in areas such as Cañar was very low compared with provinces such as Carchi in northern Ecuador. In effect, in 2007, the Ecuadorian government estimated that the Cañar province produced an annual average of 9.3 metric tons per hectare, whereas the productivity in the province of Carchi was 12.3 metric tons per hectare (SICA, MAGAP, & SDEA, 2008). Some local varieties had a slightly higher price at the market place. However, when potatoes from Colombia, Peru or northern Ecuador were brought, they were favoured because of their lower price.

Furthermore, whether or not a product was pesticide-free was not a clear competitive advantage in local markets. Aspects such as price, flavour and quality were more important for local consumers. For instance, potatoes from Carchi were produced with a more intensive use of pesticides than in Cañar. This was known by many consumers and intermediaries at the local market. However, when potatoes from Carchi were brought to Cañar, they took a great part of the market, indicating that degree of pesticide use was not a competitive factor for consumers.

In spite of these challenges, community organizations persisted. Based on their past experience and capacity, the organizations explored alternative markets and developing adequate products. Most of these options were pesticide-free or less intensive in pesticide use. For instance, the marketing study that supported the development of the supermarket managed by the Association of Agronomists targeted fresh vegetables, which were harvested with very little pesticide use. Their study indicated that there was an unsatisfied demand for fresh vegetables in town. The Association of Agronomists took advantage of this opportunity for promoting pesticide-free production in their supermarket, based on the supply from some local farmers. By contrast, potatoes, the most pesticide-intensive crop in the communities, were not prioritized because the supply in town surpassed the demand. As a result, the supermarket projected, for

instance, a volume of close to 400 kilograms/week of cabbage, while the projected weekly flow of potatoes was just 95 kilograms (AAIC, 2003; Quinde, 2004).

As the local market, even for in-demand products, was limited for the region, community organizations were also exploring other national markets. Similar to the Association of Agronomists, the Financial Cooperative had conducted a market study to support the development of their grain mill and processing centre. In addition to the local market, the institution was targeting markets in urban centres in the coastal region of Ecuador. They had also targeted products that were less intensive in pesticide use than potatoes.

In spite of these efforts, community organizations still fell short of developing safer and sustainable agricultural alternatives for most farmers. First, the market niches that the organizations were trying to conquer with their efforts were still too limited to offer an alternative to the majority. For instance, even though the grain mill and processing centre were still in an early phase, they were only cooperative business with 20 families in 2008. Similarly, the supermarket had a limited capacity to cover the farmers' need for markets. For instance, the supermarket's projected demand for cabbage for one year was supplied by just 90 households from communities in the area.<sup>130</sup> Second, conducting international marketing was out of reach for community organizations. The development of market studies and business plans for their current initiatives had been an onerous effort for the organizations' limited human and financial resources. Making such an effort for exploring international markets was still unmanageable.

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<sup>130</sup> The supermarket's projected demand for cabbage in 2008 was 20,800 kg/year (400 kg/week, 52 weeks). As described in Chapter 6, my survey showed that households in Quilloac and San Rafael had a cabbage production median of approximately 109 kg /harvest (240 lb/harvest). Assuming a mode of 2 annual harvests, this resulted in a median of 218 kg/year per household. As a result, 95 households with a median production were enough to supply the projected demand of cabbage by the supermarket.

A third reason was that the organizations were also in competition with a great number of similar associations in the Ecuadorian Andes. In effect, given analogous conditions in the region, other community organizations were competing for the same resources and markets. In 2007, I attended a workshop for marketing certified organic products in one of the neighbouring municipalities. Supported by international cooperative funds, the initiative had been very successful so far in certifying close to 150 farmers in their communities as organic producers. The marketing advantage that the organic label offered had allowed them to conquer some market niches in which the pesticide-free products were valued. They were open to invite some farmers from our area of study if the market conditions allowed. However, this initiative was targeting the same markets as the grain mill and processing centre (mostly urban centres in the coast). Furthermore, they had tried to get access to the market in Cañar, but the Town Hall had prevented them. In addition, their line of products was also similar to the ones organizations from Quilloac and San Rafael had prioritized, in particular green vegetables.

The market changes in the communities were supported by regional and national state policies that were beyond the scope of action of farmers and their organizations. Increased and sustained support from state and cooperation agencies was needed. Furthermore, financial and technical assistance for supporting small farmer organizations' effort to build a sustainable agriculture was limited. If adequate and coherent support was offered, many of these alternatives were likely to reduce pesticide use in the area. Government institutions had a role and a responsibility to provide adequate support and favourable policies for allowing small farmers in the region to make an adequate transition to new and promising agricultural activities. This was the case in the past, and it was relevant in 2008.

To conclude, the following account illustrates the argument:

"Here, for instance, there was ...with the Ministry of Agriculture, in 1978 ... 1980, more or less, a processing centre for cereals. They had wheat and barley. Here, in San Rafael, there are two storehouses, two large storehouses, next to the school. What happened? This area was called the barn of the Austro [south Ecuadorian ranges]. ...They processed here, with the farmer organizations; they took [the product] to Guayaquil, where they had the largest milling centre, the National Mills. At some point, the government subsidized the National Mills to bring Canadian wheat. And, of course, the Canadian wheat is of better quality and all; but you have there other advantages because you have insurance, many opportunities, research, and all. Then, the wheat with higher quality comes, and with a lower price...the same government was guilty of these things. I do not oppose importations. What I refer to is the way it treats the micro-businesses, the little industry. Instead of supporting their growth, they are smashed, one can say. To conclude, the processing centre closed approximately in 1982." Interview with technician from the local branch of the Ministry of Agriculture<sup>131</sup>

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<sup>131</sup> For an academic discussion of international policies for wheat trade and their effects in developing countries, see Derek Byerlee (1987).

### **7.3. Interaction with organizations, access to social resources and trust**

With great effort, community organizations in Quilloac and San Rafael had built a solid number of assets that had allowed them to conquer part of the space that government institutions had left in the midst of structural adjustment policies. However, the limited access to resources and overwhelming challenges such as smallholdings and poor access to good markets for agricultural production had prevented community organizations from building sustainable alternatives for their communities. Based on the household survey, I am going to describe in this section the contact between household members and community organizations. In general, household members had little access to social resources such as free assistance and credit for their crops. One exception was a particular cluster of 28 people who tended to have more access to all types of social resources as well as more contact with the three largest organizations. This group also tended to be more educated than the rest of the interviewees. By contrast, farmers with the highest percentages of participation in agriculture were less likely to have had contact with the main community organizations.<sup>132</sup> In parallel, the farmers' trust in the capacity of community organizations to improve their quality of life was limited.

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<sup>132</sup> Chapter 6 describes the extent to which elders with lower education levels were more likely to have higher levels of participation in agriculture. People coming from the lowest income families and having less land were also more likely to have higher participation in agriculture.

**7.3.1. Contact between community members and organizations.** In spite of the efforts made by community associations to assist farmers, in general, most interviewees in the household survey had little or no contact with their organizations. Table 7.3 shows that the community assembly and land cooperatives were, in this order, the organizations with the most contact with interviewees. Coincidentally, they were also the most traditional organizations.<sup>133</sup>

**Table 7.3. Frequency of contact of the interviewees with anyone from community organizations and institutions, Quilloac and San Rafael, 2007**

Community	Organization or Institution				All n
	Never	Infreq.	Often	Always	
	W%	W%	W%	W%	
<b>Community Assembly</b>	26.91	24.58	28.03	20.48	184
<b>Land Cooperative</b>	42.39	25.96	12.58	19.07	187
<b>Association of Organizations</b>	58.16	22.69	15.49	3.66	186
<b>Financial Cooperative</b>	64.31	21.67	10.03	4.00	184
<b>Association of Agronomists</b>	87.84	7.48	3.39	1.29	185
<b>City Hall</b>	90.10	8.61	1.29	0.00	186
<b>Spanish Cooperation Project</b>	93.12	6.24	0.64	0.00	186
<b>CREA</b>	93.76	5.59	0.64	0.00	186
<b>Ministry of Agriculture and Livestock</b>	95.34	4.66	0.00	0.00	186
<b>Women's Association</b>	96.06	3.30	0.64	0.00	186

Notes: W%: Weighted percent. The categories are organized from lowest to highest percentages of no contact (Never).

Source: Household Survey

Contact with the three financially largest organizations was associated with the interviewees' individual agriculture participation, their education level and their household's monthly income, as shown in Table 7.4. It is important to highlight that people who most frequently participated in agriculture had 0.264 times fewer chances of having at least some contact with these organizations. On the contrary, people having the highest education levels and belonging to households making more than US\$300 had significantly higher odds of having at least some contact with any of the three more solid organizations.

<sup>133</sup> Comparing between communities, the only significant differences were shown by community assembly and the second level organizations. Basically, people from Quilloac had 2.7 times more chances than those from San Rafael of at least having some contact with their community assembly ( $p=0.0114$ ). On the contrary, Quilloac's residents had 0.3 times fewer chances than San Rafael's of having at least some contact with the Association of Organizations ( $p=0.0013$ ).

**Table 7.4. Odds Ratio estimates for having at least some contact with Association of Organizations, the Financial Cooperative or the Association of Agronomists according to education level, household income and individual participation in agriculture, Quillaoac and San Rafael, 2007**

Response	Effect	p	OR	95% Wald Confidence Limits	
Contact (Yes vs. No) *	Individual Participation in Agriculture (Often or Always vs. Infrequently or Never)	0.001	0.26	0.12	0.58
Contact (Yes vs. No) *	Household Income (>= 300 vs. < 300)	0.001	7.11	2.22	22.82
Contact (Yes vs. No) *	Education Level (High School, College or University vs. None or Primary School)	0.007	2.80	1.33	5.91

Notes: OR= Odds Ratio; P= alpha level probability for a significance 0.05.  
 \*Significant association: the logistic models were independent from each other because the frequency count was too low for a multivariable model. However, the association between participation in agriculture, education level and participation in agriculture are described in Chapter 6. People who had the highest percentages of participation in agriculture tended to be the poorest, and the least educated. They also were the eldest. However, the age of the interviewees was not significantly associated with their contact with the three most solid organizations (p=0.090).  
 Source: Household Survey

**7.3.2. Access to social resources.** In addition to contact with organizations, interviewees were asked about the relative number of people who would be able to provide them with some social services for free. The results are presented in Table 7.5. In general, the most accessible resource was labour for their crops. Access to other resources was more difficult for the majority of the people. In order, it was easier to get advice about pesticide management than to get money without interest. The most difficult resource was help with legal problems or advocacy. In general, it was easier to receive labour from relatives or acquaintances in town than from people out of town. For other resources, it was easier to get help from relatives than from friends, regardless their location.

**Table 7.5 Access to people who would be able to provide social services for free, Quilloac and San Rafael, 2007**

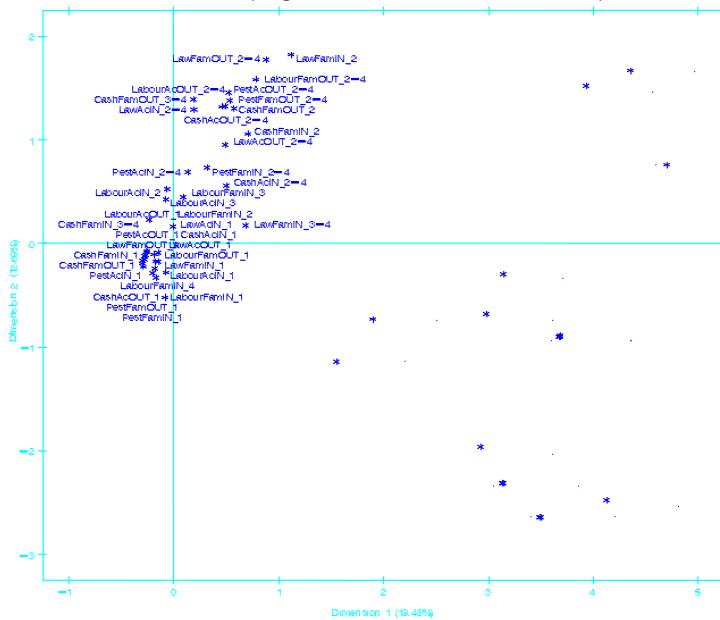
<b>Who Would Work in Your Crop for Free?</b>								
	<b>Relatives</b>				<b>Acquaintances</b>			
	<b>In Cañar</b>		<b>Out of Cañar</b>		<b>In Cañar</b>		<b>Out of Cañar</b>	
	<b>n</b>	<b>W%</b>	<b>n</b>	<b>W%</b>	<b>n</b>	<b>W%</b>	<b>n</b>	<b>W%</b>
<b>No One</b>	46	24.6	157	85.8	123	68.2	158	88.6
<b>A Few</b>	95	51.7	19	11.2	47	24.6	20	11.4
<b>Several</b>	33	16.8	4	2.67	12	6.1	-	-
<b>Many</b>	12	6.9	1	0.37	2	1.0	-	-
<b>Total</b>	186	100	181	100	184	100	178	100
<b>Who Would Teach You About Pesticide Management?</b>								
<b>No One</b>	130	69.5	149	80.2	154	84.7	162	90.0
<b>A Few</b>	52	28.9	27	16.5	24	12.9	15	9.2
<b>Several</b>	2	1.01	3	2	3	1.7	1	0.7
<b>Many</b>	1	0.65	2	1.33	1	0.7	-	-
<b>Total</b>	185	100	181	100	182	100	178	100
<b>Who Would Lend You Money for Free?</b>								
<b>No One</b>	147	77.9	149	80.7	160	86.9	163	91.1
<b>A Few</b>	31	18.2	27	16.6	20	11.1	12	6.9
<b>Several</b>	4	2.61	3	2.01	2	1.3	3	2.0
<b>Many</b>	2	1.3	1	0.67	1	0.7	-	-
<b>Total</b>	184	100	180	100	183	100	178	100
<b>Who Would Help You to Advocate for Policies Affecting Your Crops at a Local Level?</b>								
<b>No One</b>	162	87.7	159	86.5	167	93.2	158	89.3
<b>A Few</b>	15	8.36	18	11.5	9	4.8	17	10.4
<b>Several</b>	6	3.34	2	1.34	3	2.0	1	0.4
<b>Many</b>	1	0.65	1	0.67	-	-	-	-
<b>Total</b>	184	100	180	100	179	100	176	100

Notes: W%: weighted percent; a hyphen (-) denotes zero.

Source: Household Survey

Figure 7.6 shows a correspondence analysis for different levels of access to different types of social resources. The analysis shows two clusters that were characterized as follows: 1) the first cluster with 146 interviewees with a tendency to have no access to any type of resources, And 2) the second cluster with 28 farmers who had higher access to at least some people who would facilitate resources.

**Figure 7.6 Correspondence analysis of access to different types of social resources, Quilloac and San Rafael, 2007**



Notes: the variables in Table 5.6 were coded to eliminate cells with low counts. The isolated points are observations with missing values.

Source: Household Survey

Clusters of access to resources were significantly associated with having more contact with the three largest organizations: the Association of Organizations, the Financial Cooperative and the Association of Agronomists. The odds ratios are shown in Table 7.6. For instance, while close to fifty percent (weighted percent=53.8%, n=10/20) of people with at least some contact with the Association of Agronomists belonged to the cluster with better access to social

resources, only thirteen percent (weighted percent=12.8%, n=18/135) of the farmers who did not have access to the organization belonged to the cluster with more access to social services. People with at least some contact with any of these three organizations had 2.7 times more chances of having better access to social resources ( $p=0.040$ ). When controlled for education, the association between the three most stable organizations and access to social resources showed an odds ratio of 1.9; however, it was not significant ( $p= 0.167$ ). Contact with other organizations such as land cooperatives and community assemblies was not associated with having better access to social resources.

**Table 7.6 Odds Ratio estimates for having some trust in diverse organizations to improve community's quality of life according to having some contact, Quilloac and San Rafael, 2007 \***

<b>Response (Cluster Access to Social Resources) (Yes vs. No)</b>	<b>Effect (Contact) Some vs Never</b>	<b>p</b>	<b>OR</b>	<b>95% Wald Confidence Limits</b>
Land Cooperative	Land Cooperative	0.102	2.15	0.86      5.37
Community Assembly	Community Assembly	0.143	2.37	0.75      7.52
Financial Cooperative *	Financial Cooperative	0.024	2.70	1.14      6.38
Association of Agronomists *	Association of Agronomists	<0.001	9.43	3.25      27.35
Association of Organizations *	Association of Organizations <sup>†</sup>	0.009	3.29	1.35      7.99

Notes: OR= Odds Ratio; P= alpha level probability for a significance 0.05.  
\*Some organizations were not included in the table because, despite showing a similar trend, their frequencies for contact were too low for the logistic model. These were: the Women's Association, the Ministry of Agriculture, the CREA and the Spanish International Cooperation Project. Independent logistic regression models were built for each association since there was some level of covariance between the contacts with them (a group of farmers with simultaneous contact with several organizations). When interviewees who had had at least some contact with either the Association of Organizations, the Financial Cooperative or the Association of Agronomists were grouped, they had 2.7 times higher odds of having better access to social resources ( $p=0.040$ ). Regression models were constructed individually for each variable because there was overlap between variables.  
Source: Household Survey

In addition to the contact with the main organizations, the interviewee education level was also significantly associated with having higher access to social resources ( $p= 0.001$ , OR= 4.5). While 33.3% (n=15/34) of the interviewees who had education levels of high school or higher belonged to the cluster with higher access to resources, only 10.6% (12/111) of the farmers with lower education belonged to the group that had privileged access to resources. This association

was significant even when adjusted for contact with the three more solid organizations. No other variables were found to be significantly associated with clusters of access to social resources (gender of the interviewee ( $p=0.560$ ), age ( $p=0.977$ ), household income ( $p=0.562$ ) hectares of land owned by the household ( $p=0.953$ ), or individual participation in agriculture ( $p= 0.345$ )).

Summarizing, a cluster of 28 interviewees tended to have better access than other community members to social resources such as help with their crops, advice about pesticide use or financial support. This group also tended to have higher education levels than the others. In addition, this group of people with the best access to social resources and the best education tended to have more contact with the three more financially stable community organizations: the Association of Organizations, the Financial Cooperative or the Association of Agronomists. This is relevant because contact with most of the organizations was relatively low (except for community assemblies and land cooperatives). Furthermore, lower contact with organizations was significantly associated with a higher individual participation in agriculture, a lower education level, and a lower household income.

**7.3.3. Trust in organizations.** Figure 7.7 shows a correspondence analysis of the interviewees' perception of trust in different organizations for improving the quality of live in the communities. The results are suggestive of the existence of three clusters of covariance (Chi-square variance). First, there was a group of 129 out of 185 farmers who tended not to trust any organization (except, in some cases, the community assembly and the land cooperative, the most traditional organizations). Second, there was a group of 46 farmers who tended to trust the three financially largest organizations (in this cluster, there was a group of 28 farmers that had at least a little trust in all three organizations). This group also tended to trust the land cooperative and the community assembly, as the first group did. Third, a group of just 10 out of 185 farmers also tended to trust other organizations.

The perception of the interviewees of the trustworthiness of diverse organizations is positively correlated to the frequency of contact with those organizations. For instance, farmers who had contact with any of the three most financially stable organizations had 6.0 times higher probability to belonging to the second cluster of people who tended to trust only in these three organizations ( $p=0.001$ ).

**Figure 7.7 Correspondence analysis of trust in different organizations and institutions with influence, Quilloac and San Rafael, 2007**



Notes: The dotted ellipses suggest potential clusters. The following conventions apply: ‘-’ denotes very little trust, ‘+’ denotes at least some trust, ‘Assoc Org’ = Association of Organizations, ‘Land Coop’ = Land Cooperatives, ‘Financ C’ = Financial Cooperative, ‘Assoc Agro’ = Association of Agronomists, ‘Assembly’ = Community Assembly, ‘MAG’ = Ministry of Agriculture, ‘Women Org’ = Women’s Organization, ‘CREA’ = Regional Economic Re-conversion Centre, ‘Int Coop p’ = Spanish Cooperation Project, ‘Prov Ind Org’ = Provincial Indigenous Organization, ‘Nat Ind Org’ = National Indigenous Organization, ‘Town Hall’ = Town Hall, ‘Nat Gov’ = National Government.

Source: Household Survey

In addition to their contact with the institutions, the farmers’ perception of the trustworthiness of the organizations was associated with the cluster of people who had better access to social resources and the best education level. First, the 28 farmers that had at least some trust in the Association of Agronomists, the Financial Cooperative, and the Association of Organizations were 3.9 times more likely to belong to the cluster of those who had better access to social resources ( $p=0.057$ ,  $n=9/19$  vs.  $17/129$ ).<sup>134</sup> No other variables were associated with this group (gender -  $p=0.310$ -, age -  $p=0.119$ -, individual participation in agriculture -  $p=0.932$ -, household land property -  $p=0.775$ -, and household income -  $p=0.137$ ).

<sup>134</sup> 19 out of 28 farmers were from Quilloac, and 9 out of 28 were from San Rafael.

To summarize, although community organizations had had an important growth in recent years, they still had significant limitations in offering sustainable alternatives for farmers. A conjunction of challenges such as lack of resources, the prevalence of smallholdings, and limited access to adequate markets were beyond the scope of action of community organizations and led to their limited capacity to provide support for the majority of farmers. However, a minority group that tended to have simultaneously more contact with the largest organizations and higher levels of education had, on average, a better social position to access a series of social resources that were available in the communities. Other community members had little contact with or trust in the organizations. To be able to develop sustainable and safer alternatives for agriculture in the communities, farmer organizations would need to overcome barriers that go beyond the current scope of action of farmer organizations. They are at the mercy of different levels of government and cooperative agencies with the capacity to provide adequate support.

## **Chapter 8: Results on household and organizational adaptation strategies affecting community capacity**

**Figure 8.1 Saint Anthony of Padua, a European Catholic saint as seen at the entrance of the Cañar Municipal Church, Cañar, Ecuador, 2007**



**Notes:** Cañari people are deeply Catholic, and Saint Anthony is their main religious icon. The saint icon in this photo has been decorated with traditional clothing.

Source: Field Trip

The image in Figure 8.1 is illustrative of the adaptive capacity of the Cañari people. The statue is of a Roman Catholic saint whose worship was a part of the Spanish colonization process of Latin America. The people in Quilloac and San Rafael have adopted this saint as their patron.<sup>135</sup> The worship of Saint Anthony of Padua was part of the communities' adaptation to the violent transformation of their culture during Spanish colonization and the early republic. However, by dressing the European medieval saint with traditional Cañari clothing, they transform the icon, including it as part of their ancestral tradition. The resulting image is neither

<sup>135</sup> The Cañari people are deeply religious and predominantly Catholic. For instance, in the installation meeting of the 2007 directive board of one of the land cooperatives to which I was invited, the ceremony started more than one hour late in spite of the fact that the facilitator, all board members, and most of the farmers were already present. I was told that the meeting could not start without the catechist, who was delayed.

the original Catholic representation nor an ancestral icon. It is both. This statue is a powerful symbol of the capacity of the Cañari people to adapt to new field conditions. The Cañari are ancestral peoples with strong traditions that have survived centuries of difficulties. With the strength of this spirit of survival, farmers and their organizations are constantly building new adaptive strategies. In Chapter 7, I described the extent to which the structure of the field of agriculture in Quilloac and San Rafael limits the capacity of community organizations to provide adequate support for farmers in the eventual adoption of safer agricultural practices. I focus on the challenges offered by inadequate access to land, markets and state support. Given these difficulties, even the great effort that community organizations have made to strengthen their capacity has not been enough. In this chapter, I explore in more detail some additional challenges regarding the construction of habitus by households and community organizations. The objective is to better understand the extent to which individual and organizational adaptation strategies may have affected the community capacity for developing healthier agriculture alternatives (Specific Objective 3).

I am going to argue that divergent adaptive strategies by households and community organizations (in addition to the potential contribution of education and income level presented in Chapter 7) have further contributed to marginalizing some of the most vulnerable groups of farmers, who have had little contact with their organizations. First, I am going to describe strategies developed by community organizations. I will highlight that the need to compete for the scarce resources available for community organizations has further limited the potential of these organizations for collaboration. In addition, I will explore the hypothesis that the community organizations' focus on agriculture (understood as part of a cultural capital that draws from ancestral traditions) did not respond to the needs of a number of households that combined non-agricultural occupations with high participation in agriculture. Almost all

households tended to practice agriculture at some level as part of their ancestral tradition. However, they were also resorting to survival strategies that did not necessarily have agriculture as their main focus, contrary to the vision projected by most organizations. This diversity of household survival strategies led to additional challenges in the community organizations' efforts to improve agriculture and reduce pesticide-related harm. In particular, there were limitations in the availability of human resources for agriculture.

## **8.1. Perceptions, habitus and strategies by community organizations**

**8.1.1. Farmer organizations: between competition and cooperation.** In order to build safer and sustainable agricultural practices, community organizations in Quilloac and San Rafael faced overwhelming challenges such as inequitable land distribution, poor market access and a lack of adequate support for their initiatives. Amidst these difficulties, community organizations managed to gain some capacity for maintaining a limited number of services for supporting agricultural practices in their communities. However, the scarcity of resources also forced them to oscillate between the need to compete against each other for a limited niche of resources and the opportunity to collaborate with other organizations when the conditions were appropriate. This process added additional difficulties for organizations since it made it difficult to efficiently use the already scarce resources.

Farmer organizations in Quilloac and San Rafael had to compete with each other because these organizations usually shared niches of practice and funding sources. Figure 8.2 shows the types of services provided by four of the largest organizations in Quilloac and San Rafael in 2007. Despite some degree of specialization, the main organizations in the communities had

some redundancy of services offered to the same target communities. These services had competed in the past. For instance, the Financial Cooperative started in the 1990's as a seed production initiative. Simultaneously, the Association of Organizations also started a seed production program for the same products. The Financial Cooperative was more successful in the limited market, forcing the Association of Organizations to shut down their effort. In another example in 2007, both the Association of Agronomists and the Financial Cooperative had plans for organizing groups of producers with a similar business model in the same area. Another illustration is the construction in 2007 and 2008 of an irrigation system for an underserved area by one of the land cooperatives and the Association of Agronomists, despite the fact that the Association of Organizations was the main provider of irrigation services in the communities.

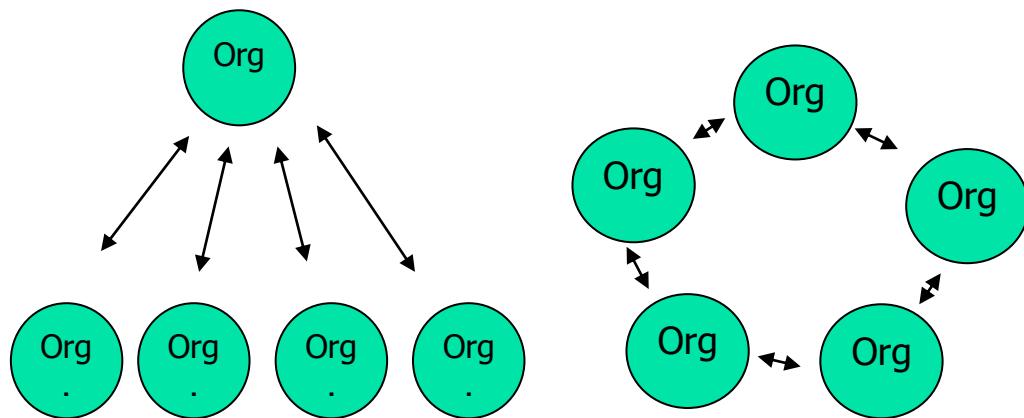
<b>Figure 8.2 Types of services provided by the Association of Organizations, the Financial Cooperative, and the Association of Agronomists , Quilloac and San Rafael, 2007</b>							
	Irrigation	Credit	Pilot Farms	Technical Assistance	Micro-Business	Food Processing	Marketing
<b>Association of Organizations</b>							
<b>Financial Cooperative</b>							
<b>Association of Agronomists</b>							

Source: Interviews and Document Review

One dimension of the competition between organizations was the conflict between traditional and new associations as the latter appeared to occupy a growing space in the community. This conflict was most prominent during the 1990's, coinciding with the period in which new organizations emerged. For instance, during the 1990's some of the new professional leaders from emerging organizations criticized traditional organizations. They questioned the capacity of non-professional leaders. Even though it was less intense, this conflict between traditional and emergent organizations was still present in 2007. Figure 8.3 shows the

representation of two conflicting inter-organizational models according to a leader of one of the non-traditional organizations. The two models were emblematic of the struggle between different community organizations to control the limited political scenario in the communities of study. The models were also consistent with Bourdieu's (1980b; 1986) description of the extent to which the struggle by different social players for the appropriation of different forms of capital, in this case the cultural capital of recognized organizational leadership, is one of the central elements in a social field.

**Figure 8.3 Graphic representations of two competing models of inter-organizational governance in Quillaoac and San Rafael according to a community leader**



Notes: While drawing in a notebook the two illustrations, the interviewee explained that some traditional organizations preferred the governance model on the left, in which a top-down structure articulates different initiatives. However, members of non-traditional organizations, such as the one to which the interviewee belonged, preferred a horizontal model of coordination (right) in which all members were equally important.

Source: Field trip and interviews

The competition among organizations went beyond the conflict between traditional and non-traditional groups. The struggle to control scarce resources and forms of capital in the communities was an important dimension of the relationship between all organizations. In 2007, there were professional leaders who had occupied positions in both traditional and non-traditional organizations. In spite of this rotation, competition among organizations still existed. For instance, when funding from a Spanish Cooperation Project started to flow, there were many

discussions about which organizations should control some of the resources. Complaints about egotism and jealousy among community leaders were common during the interviews. One of the community leaders expressed tensions around competition for human resources thus:

“The problem number one is the competition, …the competition among talents…among human talents…here in the area. We have, for instance, a lawyer … a physician,… we have agronomists, third level agronomists [engineers]; we have medium level agronomists [technicians]; we have anthropologists; teachers we have, like, to give away; we have a civil engineer. Thus, each one of them starts to compete because, … it is logical. I understand; … they have done an effort, a sacrifice, and there is a need to recoup. The objective of a professional person is aiming to improve his conditions, in addition to the service to the community. We can’t deny it. I have my objective to improve, to provide a service, but also to have something. Thus, these people are in different institutions, development institutions. We have even people on third and fourth level [with graduate education]. Thus, this is a big problem for us. I do not know how to look for a system for reaching unity, for unifying the talents.” Interview community leader

In spite of this rivalry, community organizations have made an effort to coordinate some activities. This collaboration was easier when conditions were appropriate. For instance, because the funding for the training workshops that we developed as part of our action component was granted, we had collaboration by all the main community organizations at some level. There was indeed cooperation under favourable circumstances. For example, the supermarket owned by the Association of Agronomists was the destiny of a good part of the grains processed by the Financial Cooperative. The Financial Cooperative obtained credit records from the irrigation system of the Association of Organizations to create credit approvals for their clients. In 2008, all the organizations supported an indigenous candidate who went on to be elected as the first ever aboriginal mayor in town. During the 2000’s, the three main community organizations secured somewhat stable income and gained specialization in some services; cooperation had increased. Some leaders participated in meetings together. However, collaborative efforts were still fragile if they needed to compete for any form of capital. A community leader and elder indicated:

“The issue is like this, I tell you. In terms of the [common] struggle, we are all together. But the problem is when there is the opportunity to lead projects. There, there is problem. Why? Then, I can tell you, one could be because of personal interest, while other because of professional jealousy, for instance. Many leaders control the money, then, they will not give all the criteria [decision power] to [one organization]. Then, we are friends up to this point....” Organization leader and community elder

To sum up, community organizations in Quilloac and San Rafael oscillated between competition and cooperation for developing their activities. The scarcity of resources in the communities favoured the adoption of strategies of competition. One dimension of this rivalry was expressed in tension between traditional and non-traditional organizations, in particular in the period when emergent associations started to compete for an operational niche in the communities. However, another very important dimension of the conflicts was the organization members’ struggle for controlling the limited forms of capital available in the communities.

**8.1.2. Farmer organizations: competing visions for projecting an agricultural tradition into the future.** The following quote was translated from translated from the website of the National Ecuadorian Indigenous Organization.

“The knowledge and practices of ancestral or indigenous medicine, the management of agricultural cycles, and the relationship with the environment are the life itself for indigenous peoples. Consequently, the CONAIE is starting to promote the actions needed for strengthening and applying our knowledge, rights so that they are respected as such” (CONAIE, 2009Section: What is CONAIE?).

This quote was part of the construction of a collective identity that has contributed to empowering aboriginal peoples in the Ecuadorian Andes in the last few decades. In this context, the aboriginal peoples were described mostly as farmers with ancestral wisdom and with a harmonious interconnection with the environment. This vision had a symbolic power with practical benefits for members of local indigenous organizations. By participating in the

collective development of an indigenous identity, leaders gained recognition. They were acknowledged as having a desired perspective for the communities; a perspective that valued their background. They also had a discourse that was recognized by aboriginal and non-aboriginal leaders. Community leaders in Quilloac and San Rafael also tapped into this process to develop a vision for their communities. However, this traditional identity also competed with, and simultaneously was fed by, a visualization of a modern farmer who was connected with the global market and used frontline technologies. In this section, I am going to describe the extent to which indigenous organizations were embedded in the middle of these contrasting visions for their communities. Both visions, a modern farmer and a traditional peasant, coexisted in the symbolic universe of organization members. On occasion, the two perspectives were opposed. However, they were also simultaneously adopted in a, still incomplete, synthesis effort. In either case, a particular vision of a community member who mainly focused on agricultural practices was privileged.

The traditional vision was part of a habitus that emerged during the decades in which the field of agriculture was structured to favour indigenous peasantry (end of the hacienda system and the early years of the land reform). The modern vision was part of a habitus that has emerged in symbolic efforts by farmers to adapt to changes in a field of agriculture in which integration to national and international markets and competitiveness were important. While there have been some efforts to integrate the alternative visions, they are not fully compatible (see below). However, while competing on occasion, neither of these visions alone was sufficient to explain the nature of a field of agriculture that is continuously changing.

The history of traditional and non-traditional agricultural organizations has been intimately interwoven with their peoples' agrarian production. For instance, the Provincial Organization of

Indigenous and Farmer Organizations was officially recognized in the early 1970's under the name Provincial Union of Agriculture, Production and Marketing Cooperatives. During this time, supporting agricultural practices was still the main focus of the vast majority of services provided by organizations in Quillaoac and San Rafael. In addition, the vision of traditional agricultural identity was also associated with forms of reciprocity such as the prestamanos and the mingas. Consequently, leaders actively promoted an indigenous identity that was linked to their agricultural traditions:

“[We need to] start to revalue local knowledge that is empowered by our society. Many of our customs have been rooted in the peasants; however, with all this process, this value has being lost. Now, the question is: how to recover this value?” leader community organization

On occasion, however, the agricultural background of the communities was visualized in modern terms. This involved ideas of embracing modern crop techniques, marketing strategies, entrepreneurship and micro-business creation. Perspectives about the adoption of pesticides, related to the technologies of the Green Revolution, were ambiguous. They were included as part of broader modern technological packages on some occasions because they were a resource for improving marketing and production. A number of the leaders who were agronomists promoted pesticide use as part of the technological process. However, the main concern was to take production up to a competitive level. For instance, agronomists had tried different genetically modified potato seeds that increased production while being more resistant to pests.

These two visions of a traditional farmer and of a modern indigenous farmer were contrasting. While most members of community organizations tended to oscillate between the two versions, some new leaders tended to favour a modern vision of agriculture as opposed to the traditional perspective of traditional leaders. This tension was not unique to leaders in

Quilloac and San Rafael. Referring to the national context, a reputed Ecuadorian sociologist interviewed for this project indicated that:

“The CONAIE [Ecuadorian National Indigenous Confederation], precisely, has not been able to see this process. The CONAIE is stuck back in an indigenist discourse that implies that the aboriginal peoples can do by themselves everything, that they want a country...etc, ..and unfortunately this is not the reality. All this territory, because this is a territory, is linked to the market. Here, they are indigenous, in their culture, but they have an everyday life with the market. This is a cross-cutting issue. This is an element that they need to discuss. They can not just say that the market erodes reciprocity networks because all this is a process of transformation of societies. One cannot keep a community frozen because it is indigenous, hoping to maintain all the traditional relationships intact. The most probable outcome, in the best scenario, would be that they can integrate to the market without breaking up internally. This would be a great success.” Interview with Luciano Martinez, Ecuadorian Sociologist (PhD), Faculty member at the Latin American School of Social Sciences (FLACSO)<sup>136</sup>

Organization members in Quilloac and San Rafael often expressed both perspectives (traditional and modern) simultaneously, in an effort to synthesize. The growing desire for implementation of pesticide-free techniques offered a potential platform for conciliation. An illustrative example was the presentation document of the Association of Organizations (TUCAYTA, 2006). The document described five main organizational objectives with elements from both perspectives: 1) to promote a sustainable utilization of the environment, 2) to promote the application of ecological and micro-business technologies for agricultural production, 3) to promote intercultural community participation, 4) to improve the relationship between human and ecosystems in order to promote ancestral indigenous knowledge and wisdom, and 5) to generate added value to recover and preserve Andean technologies in agriculture (TUCAYTA, 2006, p. 1).<sup>137</sup> However, this effort was not complete as contradictions frequently emerged.

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<sup>136</sup> In addition, Luciano Martinez argues that the local territory is a more important analytic category than identity for better understanding the possibilities of rural communities in the modern era (For a more detailed discussion about his perspective see Martinez, 2007; Martínez, 2004).

<sup>137</sup> Other examples may be mentioned. For instance, the supermarket of the Association of Agronomists and the Group of Trade promoted by the Financial Cooperative favoured the inclusion of pesticide-free products in their inventory. The promotion of pesticide-free products was also part of the objectives of the grain processing centre at the Financial Cooperative and the quinoa cracker production at the Association of Agronomists.

There was no clarity, for instance, about the extent to which ancestral Andean technologies were appropriate for the demands of modern markets.

Summarizing, leaders from community organizations in Quilloac and San Rafael had engaged in a symbolic effort for conciliating modern and traditional visions of their agricultural tradition. While these visions competed for the symbolic market, leaders had also made an effort, still incomplete, to synthesize modern and traditional visions of agricultural practices. In either scenario, leaders of community organizations in Quilloac and San Rafael described a community in which inhabitants focused mainly on agriculture as their key survival strategy.

## **8.2. The construction of household survival strategies: multiple sources of income**

Table 8.1 shows the distribution of households' reliance on different forms of income. It is important to highlight that households did not rely on one single source of income. Overall, income from crops and animal production was the most important in both communities. However, other sources such as employment in agriculture and remittances were also of relevance, particularly in the community of San Rafael. Both of these sources of income were significantly higher in San Rafael than in Quilloac.

**Table 8.1 Percentages of dependency on diverse sources of household income by community,  
Quilloac and San Rafael, 2007**

Community	Dependency on Diverse Sources of Income				Total
	Nothing	Some	Most	All	
	%	%	%	%	
Own Crops	24.10	68.38	5.23	1.30	186
Animal Production	27.29	70.77	1.94	0.00	185
Employment in Agriculture*	64.70	33.90	1.40	0.00	182
Non-Agricultural Employment	78.70	16.36	2.98	1.96	183
Remittances*	64.63	30.35	4.36	0.65	183
Handicrafts	87.08	11.53	0.73	0.66	183
Other Sources	79.02	12.81	7.43	0.74	154

Notes: <sup>w</sup>Weighted percent.; \* Significant differences between communities in logistic regression models.

Households from San Rafael had 2.7 times high odds of receiving at least some income from remittances, and 3.5 times higher likelihood of receiving at least some income from employment in agriculture ( $p<0.001$  in both cases). No other significant differences between communities were found. Separate models were constructed for each variable due to the potential co-variation between the different sources of income. Furthermore, since the frequencies of 'Some', 'Most' and 'All' were small for most variables, they were combined into a category called 'Some or More' and compared to 'Nothing'.

Source: Household Survey

Table 8.2 shows a cluster analysis that is suggestive of the existence of six types of households. The distribution of clusters showed that the most common strategy was to combine some income from agricultural practices with other sources (clusters A, B, D, and E). All income clusters had more than 60% of households with levels at high or very high for participation in agriculture.

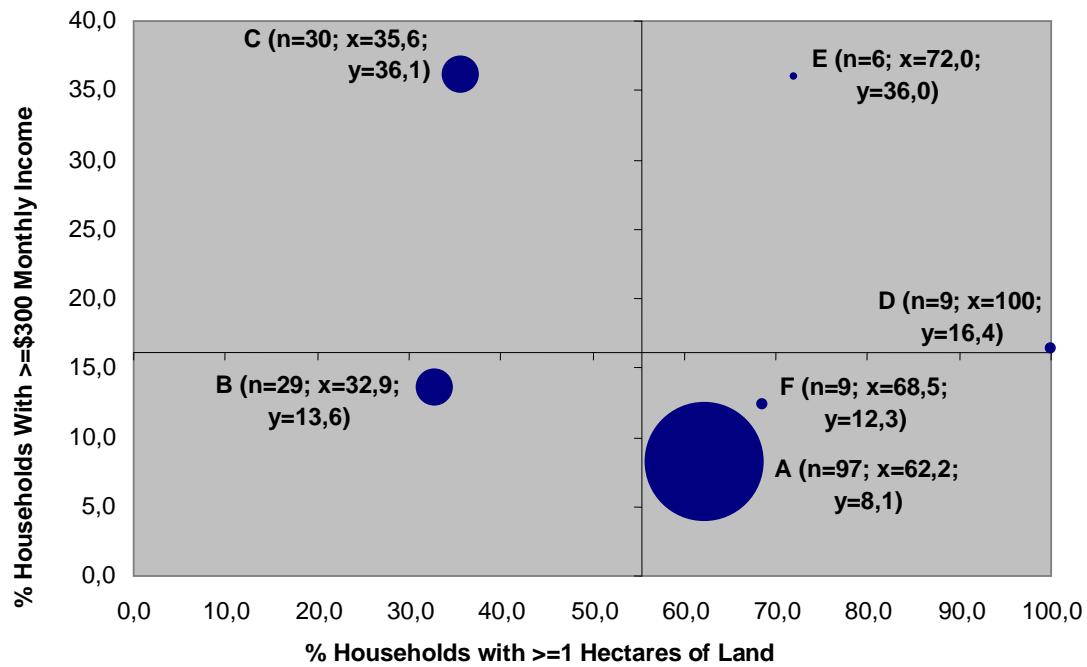
**Table 8.2 Profile of six household clusters according to their reliance on different sources of income, Quillaoac and San Rafael, 2007**

<p><b>Cluster A: Households dependent on multiple types of agricultural work (97):</b> This is the largest cluster with 97 households. Most of them combine some income from crops (87) or animal production (92). Close to half of them also receive some income from employment in agriculture (44). 37 of them also receive some income from remittances, being the largest group of remittance receivers across clusters. 11 of them also receive some income from handicraft production. Only one of these households had some income from non-agricultural employment or other sources of income.</p> <p>The percentage of households with a monthly income lower than US\$300 was 91.9% [CL 85.4% – 98.4%].</p> <p>Even though they are similar in their income profile, it is important to highlight that close to half of the households (n=39) had less than one hectare of land (37.8%) [%CL 27.8 – 47.8%].</p>
<p><b>Cluster B: Households partially dependent on non-agricultural work and own agriculture (29):</b> 29 households that receive some income from non-agricultural employment. Close to half of them also received some income from animal production (15) or some income from crops (20). 11 of them also received some income from remittances. 11 of them also received some income from agricultural employment. A few households also received other sources of income (4) or income from handicrafts (1). The percentage of households with a monthly income lower than US\$300 was 86.4% [CL 73.3% - 99.5%]. The percentage of households with less than 1 hectare of land was 67.1% [CL 49.5% – 84.7%].</p>
<p><b>Cluster C: Multiple source entrepreneurs/Low agriculture households (30):</b> This group of 30 households is the most difficult to characterize, with a higher internal group variance. They tend to combine diverse sources of income with lower reliance on crops. Most of them tend to receive at least some of their income from non-agriculture (21). Only 8 out of 30 also had some income from crops, and 8 of 30 had some income from animal production. Only 4 out of the 30 were employed in agriculture. 8 of them had some level of income from handicrafts (6 level 2; 1 level 3 and 1 level 4). 6 of them also had some income from remittances.</p> <p>The percentage of households with a monthly income lower than US\$300 was 63.9% [CL 45.3% - 82.5%]. The percentage of households with less than 1 hectare of land was 64.4% [CL 46.4% – 82.4%].</p>
<p><b>Cluster D: Highly remittance dependent households (9):</b> Nine households that receive income at level 3 or 4 from remittances. Most of them also receive at least level 2 of income from crops and animal production. 6 of them also receive level 2 from crop income and 1 of them receives level 3 from crop income. 4 of them also receive level 2 of income from agricultural employment.</p> <p>The percentage of households with a monthly income lower than US\$300 was 83.7% [CL 54.2%– 100.0%]. The percentage of households with less than 1 hectare of land was 0% [CL 0% – 0%].</p>
<p><b>Cluster E: Households highly dependent on non-agricultural work (6):</b> Six households characterized for receiving level 3 or 4 of income from non-agricultural employment. They are the only ones who receive such a high level of income from this source. Most of them also receive some income from crops (5) or animal production (4). 2 of them receive income from agricultural employment.</p> <p>The percentage of households with a monthly income lower than US\$300 was 64.0% [CL 24.1% - 100%]. The percentage of households with less than 1 hectare of land was 28.0% [CL 0% – 63.5%].</p>
<p><b>Cluster F: Highly agriculturally dependent households (9):</b> All 9 households in this group had levels high and very high of reception of income from crops (9 out of 11). 3 of the 9 were also the only households that indicated that they received high or very high levels of income from animal production. This group also contained 2 out of the only 3 households that received levels high or very high of income from employment in agriculture. Only two of these households depended on remittances (low level) or low levels of other sources of income. Only one of these households depended on low levels of handicraft production. None of them resorted to non-agricultural employment.</p> <p>The percentage of households with a monthly income lower than US\$300 was 87.7% [CL 64.9% - 100%]. The percentage of households with less than 1 hectare of land was 31.5% [CL 0.5% – 62.5%].</p>
<p>Notes: CL: 95% confidence limit.</p> <p>Source: Household Survey</p>

In spite of the fact that all income clusters had important levels of participation in agriculture, income clusters A, B and F had higher percentages of households with high or very high levels of participation in agriculture. Together, these three clusters had 2.3 times higher odds of having a household with high or very high adult participation in agriculture ( $p=0.028$ ).

Figure 8.4 provides a graphic representation of the relative position of household income clusters according to land tenure and monthly earnings. Significantly, the clusters that had the highest percentages of high participation in agriculture were also the poorest. Households belonging to the high participation clusters (A, B and F) had 0.2 times lower odds than families from the other clusters of making US\$300 or more in a month ( $p=0.002$ ). In addition to income, some families tended to be marginalized in terms of land property. In particular, cluster B, households whose combined income from non-agricultural work and agriculture, tended to have low income and limited land property. Furthermore, in 39 out of 97 (37.8%) households from cluster A, families who tended to combine different forms of income from agriculture with other sources of income, were also among the most marginalized in terms of land property in addition to income.

**Figure 8.4 Clusters of household income according to their percentages of land tenure and monthly household income, Quilloac and San Rafael, 2007**



Notes: The cross-cutting axes signal the overall average for the population in terms of percentages of households with 1 hectare of land or more (55.4%), and percentages of households making more than US\$300 a month (16.1%). In addition, the size of the blue dots is a scale representation of the size of the clusters.

Households belonging to clusters A, B or F had 0.224 times fewer odds than households from any of the clusters C, D, or E of making US\$300 or more in a month ( $p=0.0018$ ).

Regarding land property, households from clusters B or C had 0.266 times fewer odds than other groups of owning 1 hectare or more of land ( $p=0.0001$ )

Source: Household Survey

The distribution of clusters also showed that international migration was a strategy that complemented other forms of income, agricultural and non-agricultural. In general, 49.0 % of households in both communities had at least 1 member living out of town (Quilloac: 47.4%, San Rafael: 53.5%,  $p=0.4224$ ). 86 out of 93 households that had emigrant members had at least 1

international migration case (92.5%).<sup>138</sup> However, only 9 households were highly dependant on remittances for their income.

Parallel to the existence of a diversity of household strategies, 62.4% of interviewees disagreed or somewhat disagreed with the statement that community members were united, while 79.1% of people disagreed or somewhat disagreed with the statement that inhabitants shared the same values.<sup>139</sup> Land property was the only variable significantly associated with perceptions about unity. 75.9% of people from households with less than 1 hectare of land disagreed or somewhat disagreed with the idea that the community was united. In contrast, only 51.8% of people from households with 1 or more hectare of land had the same perception ( $p=0.0137$ ).

In the times before the land reform, peasants may have been more inclined to collaborate with each other. They were partners in the crop, and collaboration helped to protect them from the hard work imposed in the hacienda by the landowner. After the reform, households had a small piece of land and the previous partner was slowly becoming the competitor for more land or market shares. This transformation has been described by Martinez (2003; 2004). In my survey, prestamanos (a non-monetary interchange of workforce) was practiced in only 30.2% of households. Furthermore, households with international immigrants never participated in prestamanos in 76.1% of cases, compared to 61.5% of households that had not resorted to

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<sup>138</sup> Compared with other households, families that resorted to international migration were 2.1 times more likely to have 1 hectare or more of land ( $p=0.0178$ ). Conversely, household international migration was not associated with family income ( $p=0.8431$ ), hectares of land harvested ( $p=0.5462$ ), household adult participation in agriculture ( $p=0.4124$ ), or number of people in household ( $p=0.7332$ ). Except for income from remittances, no other form of household income was significantly associated with international migration.

<sup>139</sup> Perception of common values and unity in the communities are highly correlated to each other. 73.3% of the people who agreed or somewhat agreed that values were shared also perceived their communities to be united ( $p=<0.0001$ ; OR= 6.98).

international migration ( $p=0.039$ , OR: 0.5).<sup>140</sup> In an interview, one farmer, a woman from a household composed of three women (an elder and her two daughters) who had multiple occupations, expressed that nobody wanted to practice prestamanos with them. They did not have anything to offer in exchange. The following account by a community elder also helps to illustrate this dimension of cultural change:

“Well, [neighbours and friends] nowadays do not want to help; prestamanos, no. If you have, little minga, prestamanos no in these days... Now, in the labour, manual labour, probably in a celebration, people [would]. Nowadays, there is nothing of that. [Before, the people] had the custom of doing a little minga, one only had to give little force, a little of food. Now there is nothing like that.” Community elder talking about the times before the land reform

Practices of pesticide use were embedded among the changes in the farmers’ habitus. Peasants used their knowledge about their crops and pest control as a competitive advantage against other farmers. The point is illustrated by one of the owners of a distribution house:

“Some [farmers] already know; they are already using [organic techniques], but they have this as their own knowledge; they do not share. ... Let me tell you one case. There is a person that controls [pests] with guano [organic fertilizer]; ...I told him [how to fumigate with it]... There was another man, who curious, asked: what are you fumigating with? [The answer was:] I am fumigating with Curacron [a traditional pesticide]” Interview with owner agricultural warehouse.

To sum up, households in Quilloac and San Rafael had resorted to a multiplicity of strategies for securing their survival. The households’ reliance on different sources of income is suggestive of diverse patterns of family strategies for securing income. While most households still resorted to some level of agricultural income, households in Quilloac and San Rafael had diversified their

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<sup>140</sup> The fact that international migration was correlated with lower rates of practice of prestamanos is also suggestive of this codetermination based on cultural changes. New group strategies such as international migration were also transforming the field of agriculture in the communities and reinforcing further transformation in behaviour. The extent to which international migration can weaken traditional collaboration has been described in other communities in the Ecuadorian ranges (Walmsley, 2001). Household income, land property and household adult participation average were not associated with participation in prestamanos.

income to cope with the challenges that the field of agriculture held. In parallel, community organizations had made a symbolic effort to project their ancestral agricultural tradition into the future. Their efforts tended to visualize community members as focused on agricultural practices.

### **8.3. Contrasting strategies from households and community organizations regarding agricultural practices**

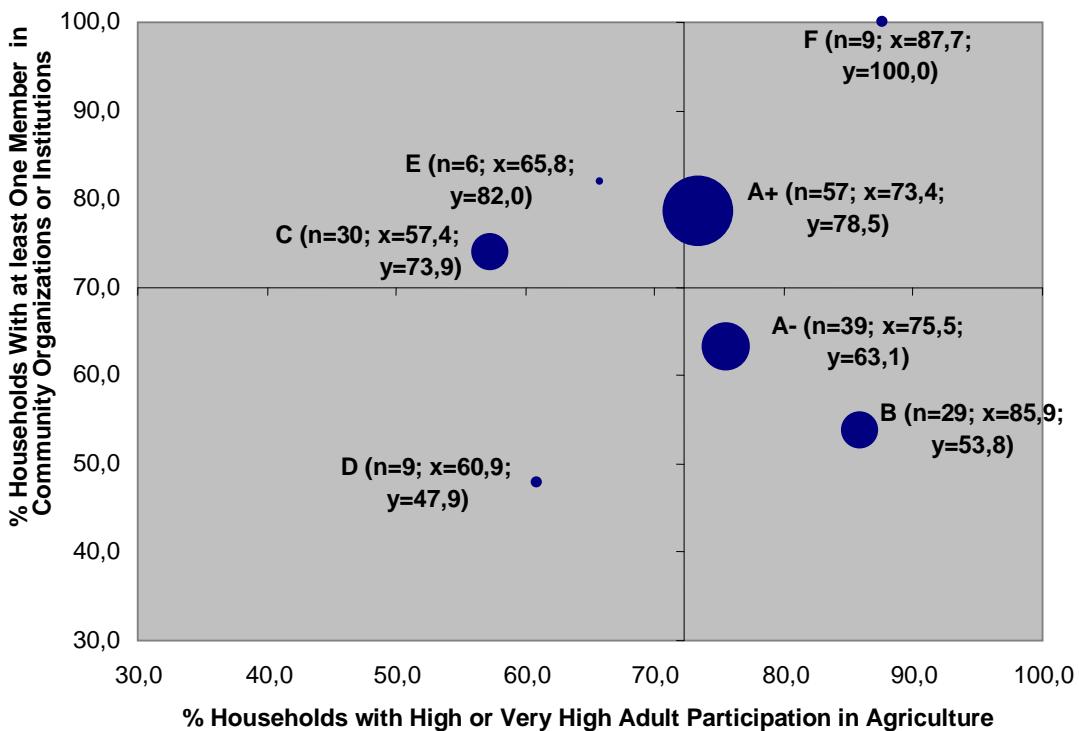
To survive in an agriculture field that provided little access to resources, community organizations and households have utilized a multiplicity of strategies. In this section, I explore the implications of these diverse strategies for interaction between organizations and households in Quilloac and San Rafael. Community organizations were able to have at least some contact with a significant number of households and farmers. Elements such as lower education levels, less land property and reduced income may have been associated with having better access to organizations. However, among the clusters with less access to community organizations were some of the most vulnerable families. In particular, a cluster of households which participated in a combination of agricultural and non-agricultural work (cluster B) had lower access to organizations than other groups with comparable income, land property and education. Two hypotheses are presented. First, the need to resort to multiple kinds of employment forced households with an already limited workforce to move beyond the agro-centric scope of action of community organizations. Second, some farmers had started to prioritize the investment of their scarce resources into areas other than agriculture. This contrasted with the agro-centric vision of the community organizations.

Figure 8.5 shows a graphic representation of the distribution of income clusters according to the percentage of participation in agriculture and family members' affiliation to any community organization. In general, households had a high average of membership in community organizations (69.9%). Community organizations also had above average coverage of 66 out of 134 households that had the highest rates of participation in agriculture (cluster F and the households from cluster A that had 1 hectare of land or more). However, the other 68 households with high rates of participation in agriculture had below-average coverage by organizations. In particular, households from clusters B and the members of cluster A having less than 1 hectare of land (indicated as A-) had 0.4 times fewer chances of having any relative with membership in any organization ( $p=0.015$ ). The chart is suggestive of the fact that community organizations did not have the capacity to reach the most vulnerable households.<sup>141</sup>

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<sup>141</sup> Cluster D, which was formed by highly remittance dependent households, did not have high rates of participation in agriculture. This may explain their low membership in organizations that focused mostly on agricultural services.

**Figure 8.5 Clusters of household income according to their percentages of high participation in agriculture and membership in community organizations, Quilloac and San Rafael, 2007**



Notes: The cross-cutting axes signal the overall average for the population in terms of having high or very high household participation in agriculture (72.2%), and the average percentage of households having at least one relative as a member in any community organization (69.9%). In addition, the size of the blue dots is a scale representation of the size of the clusters. Cluster A has been divided in two: the label 'A+' indicates households with at least 1 hectare of land, and the label 'A-' signals the households with less than 1 hectare of land. Households belonging to clusters A+, C, E or F had 2.9 times higher odds than families from any of the other clusters (A-, B, or D) of having any relative associated with any of the community organizations ( $p=0.0023$ ). Clusters A, B and F had 2.3 times higher odds of having a household with high or very high adult participation in agriculture ( $p=0.028$ ).

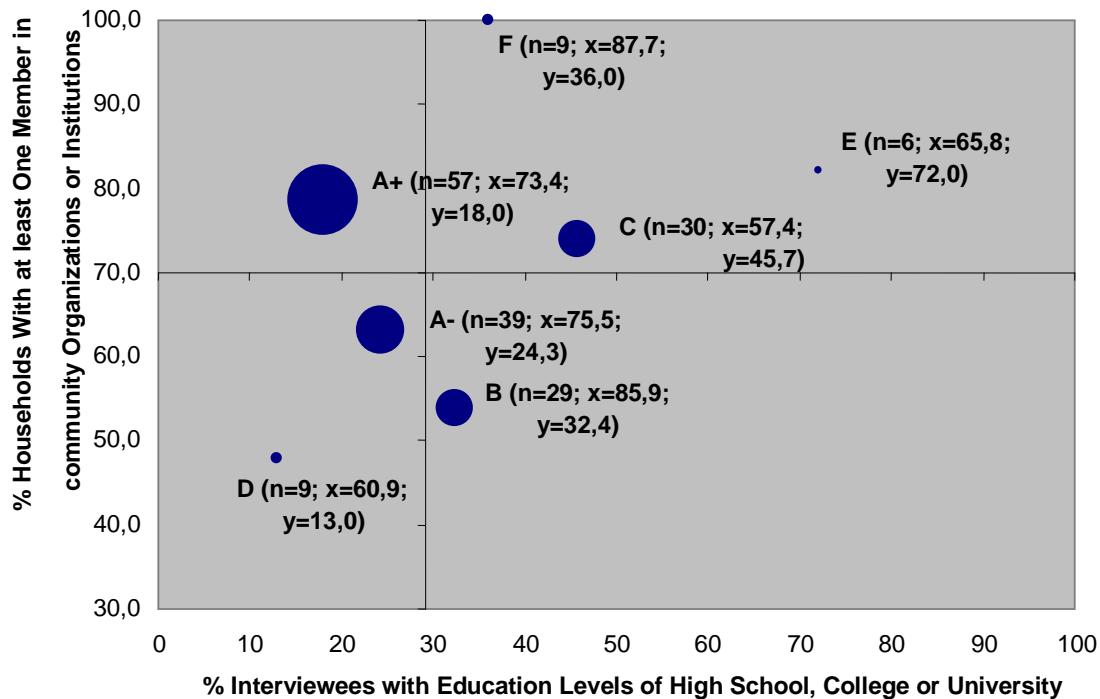
Source: Household Survey

Households from cluster B, which combined income from non-agricultural labour and agriculture, had consistently the lowest access to resources from community organizations in terms of membership and contact. For instance, households from cluster B had 0.4 times lower odds than the rest of having at least one relative as a member of any community organization ( $p=0.043$ ). Interviewees from cluster B also had the lowest percentages of contact with the three most solid organizations (41.8%).

Despite the fact that households from cluster B tended to be below-average in terms of land tenure and monthly income, these factors did not seem to fully explain their relatively low access to community organizations. The subgroup of households from cluster A having less than 1 hectare of land had higher percentages of access to community organizations than the households from cluster B. In addition, households from cluster B had a similar level of income than the subgroup of cluster A with less than 1 hectare of land. However, their membership to community organizations was lower.

The education level of the person who answered the survey, as described in Chapter 7 as one of the factors associated with high contact with community organizations, did not fully explain the low access that cluster B had. Figure 8.6 shows the percentages of interviewees with education level of high school or higher according to cluster and percentages of household membership to community organizations. Education level of the interviewee may have been associated with higher access to community organizations by household for clusters C or E, despite their lower participation in agriculture. Cluster F also had above-average numbers of interviewees with high education levels. However, the percentage of interviewees from cluster B was higher than those from cluster A. In spite of this, households from cluster A, regardless of their land tenure, had better levels of access to community organizations. Individual contact with the three main organizations showed a similar distribution.

**Figure 8.6 Clusters of household income according to membership in community organizations and education level of the interviewee, Quilleoac and San Rafael, 2007**



**Notes:** The cross-cutting axes signal the overall average for the population in terms of number of having education levels of high school or higher (29.1%), and the average percentage of households having at least one relative as a member in any community organization (69.9%). In addition, the size of the blue dots is a scale representation of the size of the clusters. Cluster A has been divided in two: the label 'A+' indicates households with at least 1 hectare of land, and the label 'A-' signals households with less than 1 hectare of land.

Households belonging to clusters A+, C, E or F had 2.9 times higher odds than families from any of the clusters A-, B, or D of having any relative as a member associated with any of the community organizations ( $p=0.0023$ ).

Interviewees from clusters B, C, E, or F had 2.9 times higher odds than interviewees from clusters A or D of having education levels of high school or higher ( $p=0.0029$ ).

Source: Household Survey

The key characteristic of cluster B was that all households received at least some income from non-agricultural labour. Although this group had some of the highest rates of participation in agriculture, their main focus was divided between agricultural and non-agricultural activities. This again contrasted with the main vision of a farmer mainly focused in agricultural practices as described by most of the community leaders.

The organizations had already started to make efforts to confront the diversity of adaptive strategies practiced by the inhabitants. For instance, in the 1999 development plan, one of the organizations estimated that close to 40% of the households' income came from sources different than agriculture (TUCAYTA, 1999). However, the same document also highlighted that the indigenous farmer had inherited a holistic agrarian tradition that had adapted to the Andean environment. In general, although farmers from cluster B had high levels of participation in agriculture, they did not fit the dominant vision of the peasant as projected by community organizations. Other groups such as clusters C and E had also moved away from the organizations' agricultural vision. However, they had better access to resources, such as education, land or income, which favoured their contact with community organizations. The fact that farmers from cluster B did not fit in either traditional or modern visions of peasants, in addition to their marginalized position in terms of income, education and land tenure, favoured their low access to services from community organizations.

The availability of workforce is central to the clash between the identity perspective usually adopted by the leadership and the diversity of strategies of households in the communities, such as cluster B. The case of one of the leaders of the Financial Cooperative who was also elected by his community assembly some years ago may be illustrative. Once in the assembly, he tried to take advantage of the opportunity to promote some of the productive projects that had been

discussed in the organizations. He aimed to coordinate the households' crop supply to satisfy a high demand for some particular products. Building on his strong business background, he tried to optimize the production of multiple smallholdings. However, when farmers were asked for more commitment to their quotas and standards of production, they reacted against the plans and rejected the proposal. Having a higher time demand for the crop would have forced farmers to abandon their other activities.

The reduction of available manpower for the crops offered an additional challenge for pesticide control. Crops were still plentiful, but the time to take care of them was increasingly scarce. In the survey, families with more members tended to apply pesticides fewer times. Among potato growers, households with 3 or more members were 8.8 times more likely to apply pesticides fewer than 3 times (compared to households with 1 or 2 members,  $p= 0.0048$ ).<sup>142</sup> A farmer may have been able to visit his crop less frequently, and every visit was shorter. A plausible reason was that peasants were also sharing the time for their crop with other occupations that provided income. Discussing the institutional experience of the Farmer Field Schools, one of the local leaders explained:

“Sometimes in the middle of the training, some farmers want to retire. ... It shouldn't be that way. At least the crop cycle should go to the end. [Interviewer: Why do they want to retire?] Most of the times, it is because of the workforce. For instance, if we want a good crop, as it is a demonstrative crop, it has to be well done. For example, some people, good farmers, due to migration, have been left one or two. They do not have manpower. Others for instance have professional sons who work in other institutions; thus, they do not have workforce.” Interview technician community organization

In this scenario, however, the availability of workforce for pest control may be reduced. Pesticides offered feasible alternative as they required only three to four visits to the fields, allowing farmers time for other work. Some other techniques for pesticide control required a

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<sup>142</sup> No other variables were associated with the number of pesticide applications (family income, the level of income received from agriculture, income clusters, having resorted to international migration, or hectares harvested or owned by the household). More details are presented in Chapter 6.

more intensive use of human labour. In the survey, interviewees from income cluster B (partially dependent on non-agricultural work and their own agriculture) tended to rely less on observation of the crops to decide about pesticide use. They were 2.5 times more likely than members of other clusters to select chemicals according to the time of crop cycle ( $p=0.045$ ).<sup>143</sup> This was suggestive of their lack of time to observe the crops and the need to schedule pesticide application when had the opportunity.

Farmers also tended to use organizational resources on non-agriculture based income strategies that were more promising than traditional farming. For instance, the Financial Cooperative had had to assist many farmers who had resorted to usury for funding international migration. Leaders of the Financial Cooperative feared that farmers may have lost their land to money lenders from outside of the communities. Consequently, they provided low credit to farmers. Some farmers used these resources directly for strategies not related to agriculture. When asked about the funding sources for sending his relatives to the United States and Spain, one of the farmers answered:

“Well, the sons borrowed money. In [the Financial Cooperative], they had some time there, so they borrowed [the money]. ... for Spain, it wasn’t as much money, so they borrowed [the money]. When they arrived, they ended up paying. ... I have a situation in these days because my daughter is in the United States. Her sister in-law was also going there. My daughter then told [me] to go to borrow money to the Financial Cooperative, some US\$4,000. As my daughter told me, I borrowed the US\$4,000. For US\$2,000 ... as my daughter was already working, she sent US\$2,000 [out of the US\$4,000]. However, she [the sister in-law] returned some months ago. I do not know what they are going to do now. I do not know what to do. I tell you, we may need to sell a piece of land.”

Interview with farmer

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<sup>143</sup> No other variables, including clusters of social resources, number of people in the household, having emigrant household members, land tenure or land cropped, household income or education level of the interviewee, were significantly correlated with the decision about type of pesticide use.

Summarizing, limited access to resources has forced community organizations to oscillate between collaboration (with the potential of maximizing efforts) and competition against each other. However, despite their limitations, community organizations in Quilloac and San Rafael have been able to keep at least some contact with most farmers. Elements such as higher land tenure, education level and income facilitated access to organizations. As a result, some clusters of households with lower than average participation in agriculture but with good education levels, more land and higher income had good access to community organizations. By contrast, some of the most vulnerable households, which had higher than average levels of participation in agriculture, were in a disadvantageous position to contact members of community organizations. In addition to land property, education and income, other factors may have contributed to further alienating vulnerable households. The agro-centric vision favoured by leaders of community organizations may have limited their capacity to answer to farmers who had moved away from peasantry. Two processes were identified. First, the need for some households to resort to multiple forms of employment limited the manpower available for agriculture. This was of particular concern for a cluster of households that had to combine non-agricultural employment and subsistence agriculture. Second, households had started to privilege investment in areas other than agriculture.

## **Chapter 9: Discussion and conclusions**

The main objective of this thesis is to better understand what role small farmers, their organizations and other social players in the communities of Quilloac and San Rafael can play in reducing environmental and health risk associated with pesticide use in agriculture. In this chapter I will summarize the results of my study and discuss their implications. First, I present an overview of the main findings, contrasting them with relevant literature. Second, I discuss the main strengths and limitations of my research. Third, I examine potential implications and future directions for research and action. Fourth, I present a concluding discussion to highlight the main arguments of this work.

With focus on health equity, my findings show that the most vulnerable people (elderly farmers with low education levels from poor households) had the least contact with community organizations and the least access to community resources. A strained household workforce that needed several income sources, was likely to increase farmers' reliance on pesticides (and to increase the risk to children who, left with reduced childcare, could accidentally poison themselves). Furthermore, some agriculture-focused strategies adopted by community organizations were likely to further marginalize some vulnerable families that combined their farming with non-agricultural activities. In this study, I also provided a contextual analysis that identified important limitations to the capacity of small farmer organizations: inequitable land distribution, unfavorable national and international market policies, and limited support from state. I argue that these barriers need to be addressed in order to harness the capacity of small farmer organizations towards effectively reducing the health and environmental impacts of pesticides. My results also support the importance of my use of Pierre Bourdieu's (1980a) work in approaching community capacity-building as social relationships among diverse state and

community stakeholders with different access to social resources and co-determined by global and local contexts.

## **9.1. Overview of main results by specific objective**

### **9.1.1. Specific objective 1: Diverse patterns of human exposure to pesticides in agricultural practices, and problems with pesticide handling by inhabitants of Quilloac and San Rafael.**

**Similar to other Andean communities, farmers in Quilloac and San Rafael had turned to an extensive use of pesticides to protect their crops.** This study found that pesticides were mostly used in potato production to attack pests such as *Premnotrypes vorax* (“Gusano Blanco”, labelled here as PV) and *Phytophthora infestans* (“Lancha”- labelled here as PI). The use of highly hazardous chemicals such as carbofuran and methamidophos was concerning. The use of pesticides in these two communities was similar to use in other areas in Ecuador. For instance, in Carchi, another Andean region in Ecuador, mancozeb, used to attack PI, was the primary fungicide accounting for 80% of fungicide use. Carbofuran, used against PV, accounted for 50% of insecticide use (Crissman, Cole, & Carpio, 1994). These toxicants have also been reported to be commonly used in other crops in Mexico and Costa Rica (Partanen et al., 2003; Rendon von Osten, Epomex, Tinoco-Ojanguren, Soares, & Guilhermino, 2004). However, the number of pesticide applications per potato harvest in Quilloac and San Rafael was lower than had been described in other communities in Ecuador. For instance, while the majority of farmers in Quilloac and San Rafael had between two and four applications per cycle, an average of seven applications per harvest were found in Carchi (Crissman, Yanggen, & Espinosa, 2003; Crissman et al., 1994). This contrast may be explained by differences in the productive systems between the two provinces. Farmers in Carchi have an average of 6 hectares of land and their potato

production is highly oriented to national markets (Crissman et al., 2003, p. 27). In Quilloac and San Rafael, there was a trimmed average of 1.3 hectares per household, and a good part of the production was destined for self-consumption.

In Quilloac and San Rafael, the knowledge and adoption of safety practices were in general poor. Deficient safety practices were associated with higher farmer exposure to pesticides. For instance, not using protective equipment or using long-sleeved shirts had a significant association with being wet with pesticides after the application (dermal exposure). Furthermore, most farmers did not know the details about the substances they used, and their main source of information was a particular vendor. Rafael Alulema (2008) also highlighted the potential environmental risks of poor pesticide handling in Quilloac and San Rafael. Of particular concern were the poor disposal of pesticide receptacles and the evidence of contamination of the main water channels. Quilloac and San Rafael's farmers' knowledge and use of pesticides matched other studies reporting poor adoption of safety measures in Latin America and other low and middle income regions (Crissman et al., 2003; Hurtig et al., 2003; Jors et al., 2006; Khan, Shabbir, Majid, Naqvi, & Khan, 2010; Ntow, Gijzen, Kelderman, & Drechsel, 2006; Palis, Flor, Warburton, & Hossain, 2006; Recena, Pires, & Caldas, 2006; Singh & Gupta, 2009).<sup>144</sup>

People with more participation in agriculture were also among the most socio-economically vulnerable groups: farmers with the lowest education levels who were usually elderly and members of the poorest households. As people with high participation were also 2.4 times less likely to use protective equipment ( $p=0.004$ ),<sup>145</sup> these farmers were also presumably the most exposed to pesticides. An association between low education levels and high pesticide exposure

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<sup>144</sup> In Carchi, the main source of information was the farmer's experience and not the vendor (Crissman et al., 2003).

<sup>145</sup> Other variables such as education level, age, gender or household income were not associated with protective equipment use. Women were found to use long-sleeved shirts or boots less frequently. However, long-sleeved shirts were not protective, as most farmers using them tended to get wet. There were no gender differences the use of protective practices or getting wet.

has been discussed in the literature (Arcury, Estrada, & Quandt, 2010), although some academic studies have found varying results (Samanic, Hoppin, Lubin, Blair, & Alavanja, 2005). In relation to age, the literature tends to concentrate on young adults, who frequently take care of pesticide use in other communities with formal farm employment (Gonzalez-Andrade, Lopez-Pulles, & Estevez, 2010; Gunier, Harnly, Reynolds, Hertz, & Behren, 2001; Ismail, Rohlman, Abdel Rasoul, Abou Salem, & Hendy, 2010), while fewer studies have reported the association between older farmers and high pesticide exposure (Del Prado-Lu, 2007).

The poorest households (often those with the smallest land holdings)<sup>146</sup> were also the ones with the highest reported degrees of participation in agriculture. Households making less than US\$300/month had four times higher odds of having high levels of participation in agriculture ( $p=0.016$ ). These findings were consistent with reports from other studies suggesting that low income can perpetuate high pesticide use (Tinoco-Ojanguren & Halperin, 1998; Wilson & Tisdell, 2001).

Within this context of high participation in agriculture by the poorest and the eldest peasants, the extent to which households needed to strain their manpower to secure multiple income sources was likely also an important factor for higher pesticide use. This was supported by the finding that, among people who grew potatoes, households with fewer than 3 members were 8.8 times more likely than smaller households to apply pesticides 3 times or more ( $p=0.005$ ).<sup>147</sup> While other variables such as family income, the level of income received from agriculture,

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<sup>146</sup> Households with less than 1 hectare were divided between those with the highest and the lowest percentages of participation in agriculture. A cluster analysis of income sources confirmed that the two groups of households having below average percentages of land tenure had resorted to non-agricultural activities. However, while one of these two clusters tended to secure higher income and not to participate in agriculture, the other tended to have poorly remunerated non-agricultural employment and still needed high participation to produce their small crops. Including this latter cluster, below average percentages of household income was one of the main characteristics of the three clusters of households with the highest percentages of high participation in agriculture.

<sup>147</sup> A linear regression model between the variables showed similar results with  $p=0.007$  and an estimated regression coefficient of -0.12, suggesting an inverse proportionality between number of household members and number of pesticide applications for potatoes.

clusters of household according to source of income, having resorted to international migration, or hectares harvested or owned by the household were not associated with pesticide use, survey data also showed significant evidence that a cluster of households whose source of income tended to focus on a combination of non-agricultural work and their own crops also tended to apply pesticides more often. The extent to which households had to strain their human resources to secure a minimum income was also a recurrent theme in interviews and field observation.

Strained household manpower may also have played an important role in additional evidence of problems with pesticide handling in Quilloac and San Rafael's agriculture: 1) acute symptoms such as diarrhoea, which were more frequent in the elderly and farmers who had applied pesticides in the 7 days prior to the survey, and 2) cases of accidental acute poisoning in children, requiring hospitalization. First, farmers who had applied pesticides in the 7 days prior to the survey had 3.7 times higher odds of having had diarrhea in the same period ( $p=0.025$ ). The logistic regression model also showed that the elderly, who are the most likely to be exposed as they were left to care for crops, also tended to have a higher frequency of diarrhea ( $p<0.001$ ). Other potential confounding factors such as education, other health problems or the use of alcohol were not correlated. Having had nausea or vomiting in the same period was also associated recent pesticide use, although the p-value was borderline ( $p=0.048$ , significance level  $=0.05$ ). A descriptive design and the survey tools such as the ones used in this study can not demonstrate evidence of health outcomes from pesticide exposure. However, these results provide further evidence of problems with pesticide handling in Quilloac and San Rafael. Diarrhea and nausea have been reported in the literature as frequent symptoms of acute poisoning by pesticides used in the area, such as profenofos (AERU, 2010b; Ecobichon, 2001; EPA, 2000), carbofuran (AERU, 2010a; EXTOXNET, 1996), terbuthylazine (WHO, 2003), and methamidophos (Ecobichon, 2001). These findings provided further evidence on the extent to

which the problems with pesticide handling were more severe among the most vulnerable community members.

A major health concern was the incidence of cases of poisoning requiring hospitalization of children. Cases of acute confirmed or suspected pesticide poisoning in the region clustered in two age groups: children, and adolescents or young adults. Consistent with the literature (Aardema et al., 2008; Cole, Carpio, & Leon, 2000; Vijayakumar & Babu, 2009), most cases of poisoning of people older than 15 years were associated with suicide attempts. By contrast, young children tended to experience accidental poisoning, which is also a frequent report in other Latin American communities (Aydin et al., 2002; Badakhsh, Lackovic, & Ratard, 2010; Crissman et al., 2003, p. 117; Eddleston & Phillips, 2004; Recena et al., 2006; Rosmawati & Shaari, 2008). This occurrence of accidental poisoning in children was not surprising because a significant number of farmers in Quilloac and San Rafael stored pesticides and equipment in unsafe places.

However, this fact did not fully explain a peak of cases found in 2003, 2004, and 2005 in children 10 years old or younger. The coinciding peak in emigration in the communities, and data from interviews, strongly suggests that during this time there was a crisis of traditional childcare structures, although results from my case study did not confirm this hypothesis. The potential association is an original contribution of this project that needs to be highlighted. Migration in families has been associated in the literature with crises of traditional childcare and other health problems in children, in particular mental health problems (Camacho & Hernández, 2007; Carballo & Mboup, 2005; Hall, 2005). However, a potential correlation between migratory patterns and accidental poisoning was not found in my literature review. The description of a hypothesis about the extent to which the parents' emigration from farming communities could

lead to increased risks of accidental poisoning in children is a contribution of this project as regards to the specific connections between global social determinants of health and the welfare of local communities.

Summarizing, the importance given to pesticide-risk reduction in the agenda of community organizations in Quilloac and San Rafael is supported by this study. Of particular concern for health equity was the research evidence about occurrence of the highest rates of exposure in some of the most marginalized peoples: elderly farmers with low education levels from poor households, and young children. Difficult socio-economic conditions that forced households to strain their workforce to secure a minimum income may also have been important determinants of these health vulnerabilities.

**9.1.2. Specific Objective 2: structural factors determining the capacity of small farmer organizations to reduce pesticide-related risks.** In a courageous and well-intended effort, community organizations managed to offer a number of resources to community members with whom they had contact. However, farmers with the highest participation in agriculture had 0.26 times fewer odds of having at least some contact with community organizations ( $p<0.01$ ). These farmers, who were vulnerable in terms of income, education and access to social capital, were also the ones with the highest percentages of high participation in agriculture. Less vulnerable people, with higher education levels and income, had higher access to community resources such as advice on pesticide use, manpower for their crops and financial assistance.

My results described three critical challenges to the capacity of community organizations to reduce the environmental health inequities related to pesticide use in agriculture: 1) limited

access to support and resources, 2) inequitable land distribution with a prevalence of smallholdings, and 3) unfavourable conditions for market competition, which provided little incentive to reduce pesticide use. These challenges are related to regional, national and international structures that are beyond the capacity of local organizations. Small farmers and their organizations were in a disadvantageous position to affect change within these three levels of structural power.

These findings were consistent with academic literature identifying access to markets, support and land as conditions for safer agricultural practices. For instance, insufficient access to markets, land and adequate resources or support have been described as factors favouring pesticide-related risks in South Africa (Rother, Hall, & London, 2008). In the Bolivian and Ecuadorian Andes, Anthony Bebbington (1997) has also described the need for adequate institutional support and high market demand in order to promote sustainable rural development experiences. Myles Oelofse et al. (2010) identify market accessibility and adequate productive support as needed conditions for the adoption of organic agriculture in studies in China and Brazil. The need for state-led governance of private markets was also identified as a condition for promoting low-pesticide vegetable production systems in Vietnam (Van Hoi, Mol, & Oosterveer, 2009). State financial and productive assistance has also been shown as fundamental for sustaining organic production in the European Union (Offermann, Nieberg, & Zander, 2009; Sauer & Park, 2009). The need for flexible government support for the implementation of locally-adequate and safer productive technologies and adequate policies for reducing incentives for pesticide use had also been described as complementary to community level strategies for the promotion of safer and local sustainable agriculture in Carchi (Cole, Sherwood, Crissman, Barrera, & Espinosa, 2002; Sherwood, Cole, Crissman, & Paredes, 2005).

**9.1.3. Specific Objective 3: Individual and organizational adaptation strategies affecting community capacity for reducing pesticide-related vulnerabilities.** Households in Quilloac and San Rafael turned to a multiplicity of strategies to secure their survival. Six household income clusters were identified: 1) households dependent on multiple types of agricultural work, 2) households partially dependent on non-agricultural work and own agriculture, 3) multiple source entrepreneurs and low agriculture households, 4) households highly dependent on remittances, 5) households highly dependent on non-agricultural work, and 6) households highly dependent on agriculture. This process of diversification has been described by some scholars in Latin American studies (Breton, 2005; Giarracca, 2001; Martínez, 2004). A new rural space is diverse. Farmers are no longer traditional peasants as they seek multiple kinds of employment and sources of income. Multiple connections between rural and urban spaces are exploited. In Quilloac and San Rafael, this diversity did not match the agriculture-based perspective that predominated in community organizations. The leaders' habitus had been constructed in the context of changing field conditions, and was now incongruent with the diversity of the field of agriculture.

A central result associated with the multiplicity of strategies adopted by community organizations and households was the exclusion of some of families with some of the highest percentages of participation in agriculture. In particular, in spite of having one of the highest percentages of high participation in agriculture, the cluster of households partially dependent on non-agricultural work and their own agriculture had 0.4 times lower odds of having at least one family member as a part of any of the community organizations ( $p=0.043$ ). This gap was not fully explained by education level of the interviewee or household income level.

A plausible hypothesis for this process was the limitation in manpower of families who had to strain their human resources in non-agricultural employment and their own crops in order to secure their minimal income. Members from this cluster were 2.5 times more likely to select chemicals according to the time of the crop cycle ( $p=0.045$ ). In general for all clusters, members of households with fewer than 3 people also tended to apply pesticides more times per harvest ( $p=0.005$ ). Further, approximately 50% of families had at least one household member out of the country. The scarcity of manpower for either traditional or modern agriculture was a recurrent theme in interviews. This scarcity was one of the reasons that the development of Farmer Field Schools was difficult because farmers left the training to attend to other livelihood activities. Limited work force has been reported as a barrier to the adoption of safer agricultural practices (de Jong & Van Zoest, 2001 and Leferink & Adriaans, 1998 according to Goewie, 2003; Valkila, 2009). Francisco Quinde (2004) has previously identified that agricultural work does not generate a competitive source of income in the region.

Household members have little incentive to commit more energy and resources to potential plans for an agriculture-centred vision of the communities, as is usually promoted by farmer organizations. Amidst a field of agriculture that is characterized by limited access to resources, community leaders tended to oscillate between competition and collaboration according to the availability of the scarce resources for their operations. As a part of this struggle to control field resources, community leaders had also built upon an agrarian vision of their communities that helped them to gain recognition with a sector of community members and other stakeholders. Community leaders tended to adopt peasantry-focused strategies that were likely to further marginalize some vulnerable families who combined their farming with non-agricultural activities. Victor Breton (2005) had already described the extent to which the predominant descriptions of indigenous identity found in rural development projects in Ecuador and adopted

by many of the indigenous leaders did not facilitate the inclusion of the diversity of the communities in Ecuador.

In general, my findings support the work of some authors who have suggested that Bourdieu's approach to the forms of capital and field theory could complement studies in health and social capital by employing a more powerful tool for analysing social equity (Buzzelli, 2007; Kim & Kim, 2009; Wakefield & Poland, 2005; Wong, 2007). What makes Bourdieu's view very suitable for understanding determinants of health inequities is his emphasis on different forms of capital and the extent to which different groups and individuals build strategies for accessing resources. For instance, in applying Bourdieu's approach to social capital to study an initiative for social participation in mental health services in southern England, Catherine Campbell, Flora Cornish, and Carl Mclean (2004) found that marginalized African-Caribbean groups faced significant barriers in accessing the social resources necessary for their successful participation. In Australia, Katy Osborne, Fran Baum and Anna Ziersch (2009) used Bourdieu's approach to the forms of capital to describe the extent to which women's participation in community groups could exacerbate gender inequities and affect their mental health because some women had difficulty adapting to the requirements of organizations.

**9.1.4. Specific Objective 4: Strategies for harnessing community capacity to reduce environmental and health risks associated with pesticide use in Quilloac and San Rafael.**

My findings suggest some local-level action alternatives that could complement ongoing efforts by community organizations by focusing on health equity. A major challenge is the development of inclusive strategies for groups of farmers and households that, having high participation in agriculture, had below average access to community organizations and resources. At a household level, community organizations could purposely target low-income families with some of their programs. At an individual level, communication initiatives facilitating the information access for the least educated members of the community, usually the elderly, may be of great benefit for farmers' training on appropriate pesticide use. Community leaders need to make significant efforts to change their vision of peasantry in light of new conditions in the field of agriculture and habitus developed by community members in their struggle. This could help to promote some strategies that, while not related to their agricultural scope, could benefit some marginalized farmers. For instance, community organizations could advocate the local government for the improvement of the transportation between rural and urban areas, which could benefit farmers who have to share their limited time between their crops and other non-agricultural occupations. Another example would be the development of community childcare strategies to help in the prevention of accidental pesticide poisoning. The inclusion of childcare in the agenda of community organizations may also contribute to the inclusion of women in mainstream decision-making.

In addition to community and grassroots organizations, a great part of the responsibility for change lies in the realm of local state institutions and other local stakeholders. For instance, the improvement of transportation to the rural areas is a responsibility of City Hall. The indigenous mayor elected in 2008 had plans to improve transportation and services in rural areas. Likewise,

another area for municipal concern is the disposal of pesticide receptacles and residues. My study partner, Rafael Alulema (2008), has already described the inadequate disposal of residues from pesticide use. Residual water was thrown into the ground or into water channels, while receptacles were found abandoned in the crop. However, solutions to these problems would require better sewage systems in rural areas and a program for adequate collection and disposal of receptacles. Another area in which local authorities could play a bigger role is the regulation of practices by pesticide-vendors, identified as the farmers' main source of information on pesticides. Institutions such as City Hall are in a better position to coordinate local productive strategies towards sustainable and safer agricultural production.

Besides local potential, one of the most important implications of my results is a call to take into account regional, national and international codeterminants of the local capacity of farmers and their organizations. The structural conditions that limited the capacity of farmers in Quilloac and San Rafael were driven by regional, national and international dynamics. Farmers and their organizations had scarce resources to overcome challenges such as inequitable land distribution, lack of access to markets and little state support. Limited access to markets, for instance, is related to long-term national and international policies (as discussed in Chapters 4 and 7). In general, regardless of their local focus, community-based initiatives that aim to health-related risk should consider at least two dimensions of analysis. First, they need to take into account the international, national and structural factors of marginalization and processes that increase health risk. Second, they should consider multiple levels of action involving state support and adequate policies. This is consistent with scholarly evidence about the extent to which public health interventions that focus mostly on vulnerable groups, leaving aside systemic causes of vulnerabilities, are not completely appropriate for reducing health inequities (Frohlich & Potvin, 2008). In terms of pesticide risk reduction, the need for national and international policies, such

as a greater regulation of pesticides, has been highlighted (Sherwood, Crissman, & Cole, 2002). My findings also support current scholarly efforts which highlight that, while local community capacity-building is important in assisting vulnerable groups, the global determinants of health inequities need to be taken into better account (Labonte & Laverack, 2008). .

## **9.2. Strengths and limitations of the research**

Limitations of my findings are divided between issues relevant for my overall approach and potential concerns regarding specific methodological components. The discussion about potential limitations of the study is organized into two categories: general issues, and additional considerations regarding the quantitative components of the study. Some issues regarding other components have already been discussed in the methodology section (Chapter 5).

**9.2.1. General limitations.** My findings are based on a case study design whose results may not be easily generalized to other communities. The complex scenario described for Quilloac and San Rafael entailed a multiplicity of variables and determining factors that may evolve differently in other communities of small farmers. To reduce this limitation, I have made an effort to place the communities of study in a regional, national and international context. I have also done an extensive consultation of literature and other academic sources to be able to describe the particularities of Quilloac and San Rafael and to understand the extent to which their experience can be helpful to other communities. Within these limitations, the results derived from these communities inform the discussion of global processes in which many communities of small farmers in Latin America and other regions are embedded.

A second limitation of this research has to do with the timeline of my narrative and subsequent events in Ecuador. Although most of my data collection took place during the initial stages of Rafael Correa's presidency, my narrative does not aim to assess the potential development that his reforms may have brought. The historic period of my account focuses on the decades that precede Correa's election, and does not discuss his policies which, at the time of this study, were still in the process of development. For instance, the election of the constitutional assembly took place in September 2007, and data collection for my household survey occurred in October and November of the same year. In my ethnographic data, some of the early events of his government were discussed. Full of hope, farmers and indigenous organizations supported Correa in the initial April 2007 election plebiscite that promised constitutional changes. During the September 2007 election of delegates to the National Constituent Assembly, the support of organizational leaders was divided between the major indigenous political party in Ecuador (PACHAKUTIK) and Correa's political organization (PAIS), which finally elected a majority of representatives in the area. In 2008, national indigenous authorities distanced themselves from the presidency of Correa in a process that has been described by Jorge Leon-Trujillo (2010). In the mayoral election in December 2008, dissatisfied with Correa's government, the majority of local indigenous leaders in the municipality of Cañar supported a candidate from Pachakutik, who faced a candidate from PAIS and went on to win the election.

Other scholars have already started to discuss Correa's mandate, whose implications are still contested terrain in the academic debate. For instance, Eduardo Gudynas (2009) has highlighted the opportunities in Correa's new constitution for promoting environmental policies and the extent to which this constitution emphasizes environmental values rooted in indigenous traditions. However, the author also discussed the contradictions of the government's

development agenda based on exploitation of natural resources and conventional agriculture promoted by subsidies to pesticides. Leon-Trujillo (2010) discusses the extent to which the growing tensions between Correa's government and the national indigenous organizations are related to concrete divergences about the mechanisms for promoting social inclusion, equity and sustainable development. The tensions have been expressed in divergences regarding the levels of autonomy of indigenous authorities and disputes about the control of natural resources such as mineral and oil deposits. The author suggests that the dispute has been increased by indigenous leaders, who do not fully acknowledge the transformation of their own societies, and by a government that has closed pathways for political dissent. In this regard, other authors have suggested that Correa's government has resorted to plebiscitary mechanisms to centralize government, reduce institutional mechanisms of participation and marginalize opposition (Conaghan & de la Torre, 2008; Conaghan, 2008).

A third limitation of my general study design is its inadequacy for claiming causal determination. In particular my household survey, central for supporting some of the hypothesis in this work, was transversal. As a result, survey results cannot describe the time sequence of events and establish if the association between two or more variables is explained by the effects of one of them, but neither can they completely exclude confounding factors that could explain the association between two or more variables. The study suggests therefore some associations and correlations, such as the association between recent application of pesticides and diarrhea, which cannot be claimed as causal associations. More research is needed. However, for broader social variables, ethnographic techniques and participatory components were rich in suggesting some potential hypotheses. These are narratives from a particular perspective and not causal determinants.

A fourth general limitation of my design is related to my approach to human exposure to pesticides and potential health outcomes. In general, I am confident that my description provides a fair assessment of the distribution of human exposure to pesticides and identifies some plausible health associations. Nonetheless, my approach did not use many of the epidemiological tools common in pesticide risk analysis. For instance, I did not measure pesticide doses in cases of human exposure. Also, the health outcomes used in the survey were limited to acute health symptoms. These items were based on perception, and were not verified by a medical practitioner. In general, while I believe that my approach adequately achieved my objectives, I am aware that an adequate assessment of pesticide-related risks and health outcomes would need a different type of study design.

**9.2.2. Additional limitations of quantitative components.** Some additional limitations regarding the quantitative components should be mentioned. Regarding the sampling strategy of the household survey, as households were the primary sampling unit, the sample is not representative of the communities' inhabitants. Therefore, individual level conclusions may not be valid for the entire population of the community. However, given the households' distribution of labour, it is arguable that the interviewees were the people most likely to be farmers and to have contact with pesticides. Our sampling strategy asked for the person at home who made decisions because the household leader had been the person responsible for the use of pesticides in other areas of Ecuador (Crissman, 2003). Ethnographic data previous to the survey supported the sampling selection of the person who made decisions. In the survey, the person who answered was asked to provide information about other members of the household. These allowed for a better understanding of the characteristics of other people. The person who answered the survey was more likely to consider himself<sup>148</sup> a farmer than he was to describe other family members thus. The interviewee was usually a man who considered that he had a higher degree of participation in agriculture than other members of his household. In 63.7% of cases, the interviewee also considered himself to be the member of the household who most frequently applied pesticides. Hence, the sampling strategy is likely to provide a good description of farmers, their productive practices and their use of pesticides.

A second limitation of the quantitative components is related to the measurements used in the household survey. The instrument relied on self-reported answers that were not validated against objective measures. Of particular interest were items that used Likert-type questions for assessing individual perceptions in terms of an ordinal scale (e.g., from the best to the worst). Some of these questions, such as participation in agriculture, relative level of income from

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<sup>148</sup> I use the male pronoun in this discussion because nearly all of the farmers surveyed were male.

different sources, trust in institutions, access to social resources and frequency of acute symptoms, were fundamental for supporting my arguments. While these types of questions are common to social and public health research, they had the potential to not reflect a ‘real’ concept since the interpretation of items in the scale may vary among respondents. For instance, two farmers with a similar percentage of hours in agricultural work may have had different responses in the scale of degree of participation. However, the results from frequency distributions and correspondence analyses of these questions showed that similar items tended to cluster, suggesting a single underlying concept and good reliability. In addition, the results showed associations with other variables that were plausible from a theoretical perspective.

Third, in this research, individual perceptions of degree of participation in agriculture (and those for the household) were used as gross indicators of higher exposure to pesticides. The assumptions underlying this use may lead to a measurement error since the two concepts were not the same. For example, people with high degrees of participation in agriculture may have not been the ones who applied pesticides more frequently. In Carchi, for example, some farm owners applied pesticides directly in spite of the fact that most of the other farming activities were performed by employees (Crissman et al., 2003; Crissman et al., 1994). In another situation, farmers with higher degrees of application may also have better than average adoption of protective practices. However, in Quilloac and San Rafael, the results supported the assumption that higher participation in agriculture was related to higher exposure to pesticides. Farmers who applied pesticides were, in general, the farmers with higher reported levels of participation in agriculture. Only a handful of farmers used effective protective practices. Furthermore, the use of protective practices was inversely correlated to the perceived degree of participation in agriculture. The more a farmer participated in agriculture, the less likely he was to use effective protective equipment.

Fourth, some questions for health symptoms, agricultural practices and pesticide use were susceptible to recall bias as they asked for past events or situations, which may have not been remembered properly by the interviewee. In effect, the results showed that questions regarding the type of pesticide used and details about concentrations of chemicals did not register a good answer rate. Questions regarding health symptoms, by contrast, showed a good answer rate. Nonetheless, some farmers may have forgotten particular symptoms.

Fifth, cultural capital was represented by only one indicator in the household survey (education level of the interviewee). It would have been preferable to have multiple indicators. In other contexts, some authors have used multiple dimensions such as taste indicators, education background of the parents, religion, and frequency, diversity and spending in cultural activities (Kim & Kim, 2009; Veenstra, 2007). An additional limitation of having only one indicator was that the survey did not have an equivalent household level indicator for social capital. As a result, an individual level measure such as education level had to be included in regression models for household characteristics such as income clusters, in spite of the risk of introducing additional errors to the results. In the survey design, considerations regarding the appropriateness of other indicators for the context and the complexity of the survey limited the number of indicators to be used. Education level was the most common, valid and reliable indicator and showed itself to be important for some of the central hypotheses of this work. In addition, data from ethnographic techniques provided additional information about multiple dimensions of cultural capital in the communities.

A sixth limitation to my work is that the case-control study with hospital records had poor availability of quality indicators for most the variables. The most reliable variable was the diagnosis, which was adequately registered in hospital discharge records and corroborated in

clinical records. However, there was no adequate indicator for parental childcare at the moment of hospitalization. Although the person who took the child to the hospital was the best available indicator, many records did not have adequate information. In addition, information about household characteristics such as family structure, socio-economic status, migration history and community of origin, was fragmentary and inconsistent.

The description of my data analysis approach and some of my strategies for responding to limitations are detailed in Chapter 5. An additional problem that presented itself in the formulation of regression models was the existence of multicollinearity in data from the household survey. Multicollinearity occurs when two or more independent variables in a regression model are associated with each other. This can lead to wrong estimates for odds ratios or correlation coefficients (Morrow-Howell, 1994). Multicollinearity occurs in a multiplicity of scenarios in the household survey data. For instance, education level, age and participation in agriculture are correlated with each other. In another illustration, household income and household participation in agriculture were also correlated. Education level and having contact with community organizations were also correlated. My preferred approach to dealing with multicollinearity in this study was to leave the most significant variable in the regression model, and to remove the other related variables (Morrow-Howell, 1994). In these cases, results on the multiple associations between variables were also reported in order to give an adequate description of the subjects according to the objectives of this study.

Despite its limitations, my study allowed me to test several hypotheses related to my main objectives. I am confident that the propositions that I defend are valid for the communities of Quillaoac and San Rafael between April 2007 and February 2009. Based on literature reviews and interviews, I also made an effort to develop an informed perspective about the relative position

of my subjects' in terms of embedded layers of regional, national and international context. Moreover, this study also built on solid strengths. First, it had a rich diversity of quantitative and qualitative data sources. Triangulation of the results provided a good basis for the argument and a multi-dimensional description of the issues. The use of ethnographic techniques complemented and helped to improve the survey component. Second, the use of ethnographic techniques also allowed for a better description of organizational, household and personal strategies regarding agriculture and the use of pesticides. It also provided a better description of the dynamic processes undergone in the communities. Third, the household survey was conducted by a random sample representative of the households in the communities. Fourth, the study followed ethical guidelines that were consistent with the culture and struggle of the Cañari peoples. Fifth, the action components provided support for the efforts that community organizations were undertaking to build safer alternatives to traditional agriculture for their farmers. My conclusions also provided a number of elements for analysis, in terms of equity and vulnerabilities of particular groups, which were previously unknown to community leaders. Sixth, my theoretical approach, based on the work of Bourdieu (1980b; 1986), proved valuable for identifying structural and experiential challenges to the reduction of pesticide-related harm in the communities. Seventh, my results contribute to the academic literature in at least three areas of interest: social determinants of health inequities, the global debate on environmental health, and the health consequences of multiple interconnections between local and global contexts.

### **9.3. Considerations for future research**

Further studies are needed to document causality hypotheses for health problems suggested in this work. First, the identification of a potential pathway for cases of accidental pesticide poisoning in children, which could be triggered by a crisis in childcare structures in a period of high migration, needs to be documented. Because hospital records used in my case-control study did not provide reliable information sources, other strategies such as interviews with parents could be used.

Second, further work needs to be done to study and prevent the alarming number of suicides attempts by young adults and adolescents the communities. The use of pesticides for suicide by farmers has been documented in studies in various contexts (Aardema et al., 2008; Eddleston & Phillips, 2004; Hawton, Ratnayeke, Simkin, Harriss, & Scott, 2009; Litchfield, 2005; Peter, Jerobin, Nair, & Bennett, 2010; Recena et al., 2006; Stallones, 2006; Vijayakumar & Babu, 2009). In Carchi, for instance, the rates of suicide are above the national average (Cole et al., 2000). In Cañar, the effects of the complex socioeconomic hardships experienced by peasant families on mental health and the design of effective prevention strategies require further work.

A third health causality hypothesis that needs further examination is the chronic effects of pesticide use. The fact that the short-term memory screening tests used in this study did not register any association with the long term use of pesticides does not mean that farmers could not suffer from other consequences not yet demonstrated.

In terms of local action for developing safer alternatives to pesticide use, the effectiveness and sustainability of the action activities undertaken in this research require proper evaluation (see Table 5.4 in Chapter 5). For instance, the radio show was designed in collaboration with

community leaders to promote safer practices of pesticide use, with a focus on raising awareness about the risk of accidental poisoning in children. Other examples of actions undertaken that need evaluation are the participative design of the workshops with farmers, and the educational materials. Farmers and leaders provided positive feedback about these actions in interviews. However, there is no certainty about the extent to which the activities achieved their intended goals. From another perspective, the promotion of a group of farmers who wanted to trade pesticide-free products was initiated with an open invitation to all families. However, the extent to which some farmers were marginalized because of their below-average contact with community organizations also needs to be examined.

## **9.5. Conclusions**

This work aims to better understand the capacity of small farmers, their organizations and other social players in the Ecuadorian indigenous communities of Quilloac and San Rafael to reduce environmental health risks associated with pesticide use in agriculture. Based on my findings, I argue that important contextual barriers, such as inequitable land distribution and smallholdings, unfavorable national and international market policies that discourage efforts to reduce pesticide use, and limited state support for small farmers and their organizations, need to be addressed by national and international stakeholders in order to harness the capacity of local small farmer organizations.

In general, small farmers from these communities have a weak position in the field of agriculture that has persisted for a long time and through different developmental phases in Ecuador. Furthermore, the prevalence in recent decades of neo-liberal policies which promoted free-trade, export driven agriculture and a reduction in state support, contributed to making the

position of small farmers worse (Larrea & North, 1997). As competitors in the field of Ecuadorian agriculture, small farmers and their organizations have little chance to make a successful transition towards safer forms of agriculture. Indeed, they have little chance of surviving over time. Compared for instance to large producers and capital-intensive agriculture such as floriculture, small farmer organizations have little control of forms of capital that would allow them to transform agriculture into a safer practice. Overcoming health inequities also entails a more active role for civil society and government entities at different levels (Blas et al., 2008). This includes public policies that clearly address the root causes of health inequities and favour the development of safer alternatives for small farmers. It is not enough however to call for more state involvement since the credit and technical assistance offered by the Ecuadorian state has been biased in favour of big producers. What is needed is a different type of land distribution, better access to markets and efficient state support for small farmers.

Despite these difficulties, in the Andes there are some examples of successful productive experiences of small farmers. Some of these farmers have been doing well in adopting safer productive practices. However, I agree with Anthony Bebbington (1997, 2001) who suggests that these examples have possibly been due to particular circumstances, such as having international partnerships or strategic products and markets, which have allowed small farmers access to networks and resources. By drawing on this support, small farmers have been able to reach new markets with new products. However, these experiences can only be explained by local circumstances and cannot be generalized (Bebbington, 2001). Small farmers need appropriate technologies, strong institutional support and access to appropriate markets (Bebbington, 1997). As several authors have pointed out, the general dynamic of the field of agriculture offers challenges that are difficult to overcome by small farmers who are compelled

to look for other strategies, such as becoming labour workers or emigrants (Carvajal, 2006; Garcia, 2006; Martínez, 2004; North, 2003).

Faced with the challenges of agricultural production, small farmers have turned to family strategies such as emigration and multiple forms of employment in urban centres. This is consistent with the notion of a new rurality, which has been characterized as the adoption of multiple forms of employment by farmers, closer connections between urban and rural centres, the emergence of new types of work and the emergence of new actors such as NGOs in the scenario of rural development (Breton, 2005; Giarracca, 2001). This is accompanied by the development of new habitus such as the adoption of urban patterns of prestige (e.g., new housing styles) (Martínez, 2004).

In the context of new conditions in the field of agriculture, my findings also identify specific social mechanisms that could increase health inequities related to pesticide use, in spite of great efforts by community organizations. In particular, the need to strain human resources to secure a minimum income through multiple forms of employment and migration has generated a crisis of human resources for families that now have reduced time for their crops and increased reliance on pesticides. Members of households with fewer people applied pesticides more times. The elderly from poor households were left to care for crops and experienced more problems with pesticide handling and symptoms. Children experienced increases in accidental pesticide poisoning cases that coincided with a period of high farmer migration to find work. In addition, divergent strategies by community organizations and an important number of households were likely to further marginalize some vulnerable families as leaders focused on agriculture while many families had diversified their income and maintained consumption crops with low workforce and high pesticide use.

The potential for increased health inequities, in spite of community efforts, has implications for research on community capacity-building and health equity. Despite numerous well-intended efforts by community leaders, farmers with the highest participation in agriculture had less contact with community organizations. These farmers also tended to be some of the most vulnerable in the communities: elderly workers with low education from poor households. This gap is a reminder that notions of local community-building need to approach community members in their complexity as distinct social players with differential access to social resources. Marginalized communities, even small and traditional communities such as Quilloac and San Rafael, are diverse and their capacity is built upon social relationships that are asymmetric. Promoting the engagement in health projects of community members, understood as homogenous, can lead to overlooking some of the most marginalized people (Labonte, 2004). My use of Bourdieu's field theory builds on previous approaches to community empowerment in health promotion (Labonte & Laverack, 2001; Wallerstein, 2002) and provides a valuable tool for mapping community stakeholders' differential access to cultural, social and economic capital, and their related health vulnerabilities.

To be part of an equity reduction strategy, local community capacity-building efforts need to take into account at least two conditions. First, the reduction of health gaps requires an assessment of the structural processes that generate them in the first place (Frohlich, Ross, & Richmond, 2006). I agree with Margaret Whitehead and Jennie Popay (2010), who highlight the need to evaluate equity dimensions of international and national macro-level policies. The power dynamics that generate inequalities at local, but also at national and international levels, should also be confronted (Labonte, 2008; Labonte & Laverack, 2008; Marmot, Allen, & Goldblatt, 2010; Whitehead & Popay, 2010). Second, when involving marginalized groups in action, public health practitioners should be able to provide them with adequate assistance for overcoming the

challenges that they face. Otherwise, marginalized groups will be left with the burden of changes that are beyond their scope (Ugalde, 1985). Health inequities can be increased in the process because the effort can put extra demand on already scarce resources, and the most vulnerable can be left alone facing conditions that marginalize them (Osborne et al., 2009).

Finally, the emergence in Latin America of social movements that have defended the rights of small farmers offers an important political alternative that I will highlight. In effect, similar to the indigenous movements in Ecuador, in other countries such as Brazil, peasant movements have raised awareness about the need for everything from changes in the field of agriculture to changes in the political agenda. This has been called ‘The Via Campesina’ (The Peasant’s Way) (McMichael, 2006). Immanuel Wallerstein has highlighted the importance of this type of struggle in promoting a more equitable world system in an era of crisis (Wallerstein, 1997). I agree. The farmers’ grassroots movements have a transcendental political importance that can promote favourable changes in the field of agriculture. In countries such as Ecuador and Bolivia, for instance, social movements have promoted constitutional changes that aim for better conditions for small farmers. These types of movements also offer the possibility for channelling local grassroots support to promote the global changes required for global health changes (Labonte & Laverack, 2008). However, their political importance is accompanied, at least in the Ecuadorian case, by being in too weak a position in the social structure to bring about technical change about at the local level. My approach described important contextual barriers such as inequitable land distribution, limited state support and unfavourable market policies that need to be addressed by national and international stakeholders in order to harness the capacity of local organizations.

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## Appendix 1: Operationalization of variables for household survey

	<b>General Object</b>	<b>Particular Object</b>	<b>Category</b>	<b>Variable/description</b>	<b>Type</b> <sup>149</sup>	<b>L</b> <sup>150</sup>
1.	Demographics	Community	Community	Community	Char	I
2.	Demographics	Ethnicity	Ethnicity	Ethnic identity	Char	I
3.	Demographics	Household Composition	Age of other household members	Age of other household members (multiple answer) - Average by household (gender, occupation and participation in agriculture) Tabulated in separated database	Num	I/ H
4.	Demographics	Household Composition	Family Structure	Family ties to emigrant members (single choice for each member) - percentages Tabulated in separated database	Char	I/ H
5.	Demographics	Household Composition	Household gender structure	Gender of other household members (multiple answer- open question) - Average by household (age group, occupation and participation in agriculture) Tabulated in separated database	Char	I/ H
6.	Demographics	Household Composition	Number of couples	Number of couples living in the house	Num	H
7.	Demographics	Household Composition	Number of people	Number of people living in the household	Num	H
8.	Demographics	Marital Status	Marital Status	Marital status	Char	I
9.	Demographics	Age	Age	Age of the person who answered	Num	I
10.	Demographics	Gender	Gender	Gender of the person who answered	Char	I
11.	Field	Cultural Capital/Strategies	Cultural Capital	Education Level	Char	I
12.	Field	Economic Capital	Income	Monthly household income (US\$) (single choice among ordinal categories)	Char	H
13.	Field	Economic Capital	Property	Hectares of land that the family owns	Num	H
14.	Field	Economic Capital	Property	The land was inherited	Char	H
15.	Field	Economic Capital	Property	The land was bought	Char	H
16.	Field	Economic Capital	Property	The land was obtained by means of a cooperative	Char	H
17.	Field	Economic Capital	Property	The family does not own the land; it is rented or traded by crop or labour	Char	H

<sup>149</sup> Type of data: Char= Character variable (Nominal or Ordinal variables- except otherwise noted, ordinal variables were treated as nominal data); Num= numeric variable. The information corresponds to type of analysis conducted (not coding).

<sup>150</sup> Level of unit of analysis: I= individual attribute (of the interviewee); H= household; I/H = individual attribute of other members of the household (analysed in a different database for individual attribute –I- or summarized in a household indicator if included in the main data base -H)

	<b>General Object</b>	<b>Particular Object</b>	<b>Category</b>	<b>Variable/description</b>	<b>Type<sub>149</sub></b>	<b>L<sub>150</sub></b>
18.	Field	Economic Capital	Property	The land was obtained by other means	Char	H
19.	Field	Economic Capital	Property	Farmers with own application pump	Char	H
20.	Field	Economic Capital	Property	How the application pump is gotten	Char	H
21.	Field	Social Capital	Access to Social Resources/Bonding/Bridging	Resource generator- (adapted by using Likert scales from 1-4 instead of numbers) Networks from inside (bonding) or outside town (bridging)/ by type of resource	Char	I
22.	Field	Social Capital	Access to Social Resources/Clusters	Cluster Access to Social Resources (obtained by correspondence and cluster analysis of all questions in resource generator)	Char	I
23.	Field	Social Capital	Access to Social Resources/Degree of access	Resource generator- (adapted by using Likert scales from 1-4 instead of numbers). Four social resources (advice about pesticide management, free labour in crops, money without interest, and lobbying-advocacy in legal issues)	Char	I
24.	Field	Social Capital	Access to Social Resources/Strength of network	Resource generator- (adapted by using Likert scales from 1-4 instead of numbers) Family members or acquaintances by type of resource	Char	I
25.	Field	Social Capital	Networks / Frequency Contact	Frequency of contact with anybody from diverse organizations (Likert scale 1-4) by organization	Char	I
26.	Field	Social Capital	Networks / membership	Members of different organizations in the household (yes /no) by organization/ Multiple choice	Char	H
27.	Field	Social Capital	Networks / membership	Household member participates in any organization (all organizations) (yes/no)	Char	H
28.	Habitus	Agricultural Practices	Agricultural practices / Pest by crop	Name of pests by crop / open question	Char	I
29.	Habitus	Agricultural Practices	Crop productivity	Tons/hectares- Productivity was calculated taking the annual production of each observation transformed into metric tons and dividing it by the number of hectares cropped by household - calculated by crop	Num	H
30.	Habitus	Agricultural Practices	Crop yield by harvest	Pounds of product by harvests/ # 120-pound sacks or # of Baskets (30 pounds)/ by product/ several products	Num	H
31.	Habitus	Agricultural Practices	Crop yield by harvest/Crop	# 120-pound sacks or # of Baskets (30 pounds) by product/harvest - All transformed to pounds (several products)	Num	H

	<b>General Object</b>	<b>Particular Object</b>	<b>Category</b>	<b>Variable/description</b>	<b>Type<sub>149</sub></b>	<b>L<sub>150</sub></b>
32.	Habitus	Agricultural Practices	Crop yield by year	Pounds of product by year/ Pounds of product by harvests multiplied by number of harvest in a year/ several products	Num	H
33.	Habitus	Agricultural Practices	Harvests/Crop	Number of harvests in one year / by crop (several indicators)	Num	H
34.	Habitus	Agricultural Practices	Human Exposure/ Indirect	Average participation agriculture in household adults. The degrees of participation in agriculture of different adult household members were averaged for a household participation average. The indicator was categorized in ranges	Char	.
35.	Habitus	Agricultural Practices	Human Exposure/ Indirect	Degree of Participation in agriculture of other household members (ordinal from 1-4) - Tabulated in separated database	Num/ Char	I/ H
36.	Habitus	Agricultural Practices	Human Exposure/ Indirect/ participation in agriculture	Degree of participation in agriculture (Likert scale 1-4)	Num	I
37.	Habitus	Agricultural Practices	Origin of potato seeds	Potato seed is bought or kept from previous crops (multiple choice- several techniques of seed conservation)	Char	H
38.	Habitus	Agricultural Practices	Pesticide use	Days from the last pesticide application to the harvest	Num	I
39.	Habitus	Agricultural Practices	Pesticide use	Moment of pesticide application in relation to the irrigation (after, during, before)	Char	I
40.	Habitus	Agricultural Practices	Pesticide use / Human Exposure	Getting wet when the pesticide is applied	Char	I
41.	Habitus	Agricultural Practices	Pesticide use / Human Exposure	Person who washes fumigation clothing	Char	I
42.	Habitus	Agricultural Practices	Pesticide use / Protective practices	Frequency to wash the pesticide pump	Char	I
43.	Habitus	Agricultural Practices	Pesticide use / Protective practices	Place where the pump is washed	Char	I
44.	Habitus	Agricultural Practices	Pesticide use / Protective practices	Place where the residual water from the pumps go to	Char	I
45.	Habitus	Agricultural Practices	Pesticide use / Protective practices	Washing after applying pesticides	Char	I
46.	Habitus	Agricultural Practices	Pesticide use / Protective practices/ Application/ Protective equipment	Use of protective equipment to apply pesticides (mask, gloves, glasses, waterproof clothing, long-sleeved shirt, boots, other, nothing) Multiple choice	Char	I

	<b>General Object</b>	<b>Particular Object</b>	<b>Category</b>	<b>Variable/description</b>	<b>Type<sub>149</sub></b>	<b>L<sub>150</sub></b>
47.	Habitus	Agricultural Practices	Pesticide use / Protective practices/ Disposal recipients	Disposal of recipients ( burned, hidden, in crop, in water sources, others) Multiple choice	Char	I
48.	Habitus	Agricultural Practices	Pesticide use / Protective practices/ Preparation/ Protective equipment	Use of protective equipment to prepare pesticides (mask, gloves, glasses, waterproof clothing, long-sleeved shirt, boots, mixing stick, other, nothing) Multiple choice	Char	I
49.	Habitus	Agricultural Practices	Pesticide use/ Protective practices	Difference between fumigation and everyday clothing	Char	I
50.	Habitus	Agricultural Practices	Pesticide use/ chronic exposure/ years of use	Number of years working with pesticides	Num	I
51.	Habitus	Agricultural Practices	Pesticide use/ in last week	Having applied pesticides in the last 7 days	Char	I
52.	Habitus	Agricultural Practices	Pesticide use/ in last year	The interviewee has applied pesticides at least once this year	Char	I
53.	Habitus	Agricultural Practices	Pesticide use/ Non- relatives who apply in household	Non- relatives who had applied pesticides at least once this year (multiple choice-employees, associates, others)	Char	H
54.	Habitus	Agricultural Practices	Pesticide use/ number of applications by crop	Number of applications by crop	Num	H
55.	Habitus	Agricultural Practices	Pesticide use/ number of applications by year	Number of applications by crop by year (calculated from number of crops/year and number of applications by crop)	Num	H
56.	Habitus	Agricultural Practices	Pesticide use/ person who applies the most	The person who most frequently applies pesticides in the crop (including relatives and non relatives)	Char	H
57.	Habitus	Agricultural Practices	Pesticide use/ Protective practices/ Preparation	Recipient used to prepare pesticides	Char	I
58.	Habitus	Agricultural Practices	Pesticide use/ relatives who apply in household	Relatives who had applied pesticides at least once this year (multiple choice-)	Char	H
59.	Habitus	Agricultural Practices	Pesticide use/ type of pesticide	Name of pesticide by pest/ Open Question (potatoes, peas, corn and others)	Char	I
60.	Habitus	Agricultural Practices	Pesticide use/Decision-making	Who advises about the pesticide to use	Char	I
61.	Habitus	Agricultural Practices	Pesticide use/Decision-making/ reason to apply	Reason to apply pesticide (multiple choice- time, observation, routine, advice, other)	Char	I

	<b>General Object</b>	<b>Particular Object</b>	<b>Category</b>	<b>Variable/description</b>	<b>Type<sub>149</sub></b>	<b>L<sub>150</sub></b>
62.	Habitus	Agricultural Practices	Pesticide use/Purchase	Most frequent agricultural warehouse to buy pesticides	Char	I
63.	Habitus	Agricultural Practices	Pesticide use/Storage	Pesticides stored for future use	Char	H
64.	Habitus	Agricultural Practices	Pesticide use/Storage	Number of days the pesticide is stored for future use	Num	H
65.	Habitus	Agricultural Practices	Pesticide use/Storage	Place to store the pesticide	Char	H
66.	Habitus	Agricultural Practices	Pesticide use/Storage	Storage place for the application pump	Char	H
67.	Habitus	Agricultural Practices	Pesticide use/Storage/Knowledge	Knowledge of plants to control pests (yes/no) Which one?	Char	I
68.	Habitus	Agricultural Practices	Pesticide use/Storage/Knowledge	How are pesticides transported from the warehouse to household	Char	I
69.	Habitus	Agricultural Practices	Pesticide use/Times/Crop	Number of times of pesticide application by harvest/ by crop	Num	H
70.	Habitus	Agricultural Practices	Practice of agriculture	Agricultural practices in the household (yes/no)	Char	H
71.	Habitus	Health care practices	Behaviour	Behaviour in case of pesticide intoxication	Char	I
72.	Habitus	Perceptions	Common Values	Perception about community members sharing the same values (Likert scale 1-4)	Char	I
73.	Habitus	Perceptions	Trust in organization for improving Quality of life	Trust perception (Likert scale 1-4) by organization- several organizations	Char	I
74.	Habitus	Perceptions	Unity	Perception about community members being united (Likert scale 1-4)	Char	I
75.	Habitus	Strategies	Agricultural Practices/ land use	Hectares of land that the family crops	Num	H
76.	Habitus	Strategies	Agricultural Practices/ land use	Hectares of land owned minus hectares of land harvested	Num	H
77.	Habitus	Strategies	Income Source	How much of the family income comes from the crop	Num	H
78.	Habitus	Strategies	Income Source	How much of the family income comes from livestock	Num	H
79.	Habitus	Strategies	Income Source	How much of the family income comes from employment in agriculture	Num	H
80.	Habitus	Strategies	Income Source	How much of the family income comes from non-agricultural employment	Num	H
81.	Habitus	Strategies	Income Source	How much of the family income comes from handicrafts	Num	H
82.	Habitus	Strategies	Income Source	How much of the family income comes from remittances	Num	H
83.	Habitus	Strategies	Income Source	How much of the family income comes from other sources	Num	H

	<b>General Object</b>	<b>Particular Object</b>	<b>Category</b>	<b>Variable/description</b>	<b>Type<sub>149</sub></b>	<b>L<sub>150</sub></b>
84.	Habitus	Strategies	Main occupation	Main occupation of the person who answered (open question)	Char	I
85.	Habitus	Strategies	Main occupation	Occupation of other household members (open question- several questions) - Percentages( by age, gender, participation in agriculture) Tabulated in separated database	Char	I/ H
86.	Habitus	Strategies	Migration	Number of family members living out of Cañar	Num	H
87.	Habitus	Strategies	Migration/ emigrants in household	Having household members out of the community (yes/no)	Num	H
88.	Habitus	Strategies	Migration/ age of emigrants	Current age of emigrants from the household - Tabulated in separated database	Num	I/ H
89.	Habitus	Strategies	Migration/ Family ties	Family ties to emigrant members (single choice for each emigrant member) - Tabulated in separated database	Char	I/ H
90.	Habitus	Strategies	Migration/ gender of emigrants	Gender of emigrants from the household (single choice fro each migrant member) - Tabulated in separated database	Char	I/ H
91.	Habitus	Strategies	Migration/ International	Having family members living out of Ecuador (yes/no)	Char	H
92.	Habitus	Strategies	Migration/ Number of emigrants by household	Number of household members out of the community	Num	H
93.	Habitus	Strategies	Migration/ occupation of emigrants	Main occupation of emigrant from the household (single choice for each emigrant member)- Tabulated in separated database	Char	I/ H
94.	Habitus	Strategies	Migration/ receiving location	Place of residency of emigrants from the household - Tabulated in separated database	Char	I/ H
95.	Habitus	Strategies	Migration/ type of receiving location	National or international migration (single choice for each migrant member) - Tabulated in separated database	Char	I/ H
96.	Habitus	Strategies	Migration/Nation al and International	Family members living out of Cañar (yes/no)	Char	H
97.	Habitus	Strategies	Reciprocity Practices/mingas	Participation of household members in mingas (Likert scale 1-4)	Char	H
98.	Habitus	Strategies	Reciprocity Practices/prestam anos	Use of prestamanos for the crop (Likert scale 1-4)	Char	H
99.	Habitus	Strategies	Sources of Income/ Clusters	Cluster Sources of Income (obtained by correspondence and cluster analysis of all questions in sources of income)	Char	H

	<b>General Object</b>	<b>Particular Object</b>	<b>Category</b>	<b>Variable/description</b>	<b>Type<sub>149</sub></b>	<b>L<sub>150</sub></b>
100.	Health Outcomes	Acute Poisoning	Symptoms	Frequency potential symptoms in the last 7 days (Likert scale 1-3) by symptom (frequent headache, nausea or vomiting for no reason, diarrhoea, stomach spasms or cramps, salivation and spitting, dizziness without drinking, sweating for no reason, skin reddening or rash, lack of breath, shaky hands, numb hands, eye, nose or throat irritation, bad temper, feeling weak, having lost hand ability)	Num	I
101.	Health Outcomes	Chronic Poisoning	Visual Memory (Short-term memory)	Memory test- final- Number of faces identified- Number of attempts – An ordinal scale from 1 (worst) to 7 (best). The codification was modified from the original guidelines, which identified a 4-level ordinal scale. This 4-level scale did not provide enough information about the population.	Num	I
102.	Health Outcomes	Confounding Factor	Alcohol consumption	Frequency of alcohol consumption	Char	I
103.	Health Outcomes	Confounding Factor	Previous Accident	Having had an accident or lesion that limits movement or sensibility	Char	I
104.	Health Outcomes	Confounding Factor	Previous Accident	Having been told by the doctor or healer to have a neurological problem	Char	I

## **Appendix 2: Survey of farmers (English translation)**

Survey No\_\_\_\_\_ Surveyor\_\_\_\_\_ Date (dd/mm/yy)\_\_\_\_\_

### **To the house leader:**

1. Oral Consent- Information
  - a. Have you been told about and understood the subject information and consent form?
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
  - b. Have you had sufficient time to consider the information provided and to ask for advice if necessary.
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
  - c. Have you had the opportunity to ask questions and have had satisfactory responses to your questions?
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
  - d. Do you understand that all of the information collected will be kept confidential and that the result will only be used for scientific objectives?
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
  - e. Do you understand that your participation in this study is voluntary and that you are completely free to refuse to participate or to withdraw from this study at any time without changing in any way the quality of care that I receive?
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
  - f. Do you understand that you are not waiving any of your legal rights as a result of signing this consent form?
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
  - g. Do you understand that there is no guarantee that this study will provide any benefits to you?
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
  - h. Have you been told that you will receive a dated and signed copy of this form?
    - i. Yes
    - ii. No (Then, stop the survey; provide proper information; and follow up after 24 hours)
2. Do you freely consent to participate in this study?
  - a. Yes
  - b. No (Then, stop the survey)

**PLEASE, EXPLAIN TO THE SUBJECT THAT HE OR SHE IS FREE TO AVOID ANSWERING ANY QUESTION WHICH HE OR SHE DOES NOT WISH TO.**

## Demographics

3. Do you identify yourself as
  - a. Cañari?
  - b. Mestizo?
  - c. Other? \_\_\_\_ which one? \_\_\_\_\_
4. What is your marital status?
  - a. Single
  - b. Married
  - c. Living with a stable partner
  - d. Separated
  - e. Divorced
  - f. Widowed
5. What is the highest level of education you have completed?
  - a. None
  - b. Elementary School
  - c. High School
  - d. Bachelor or University degree? ... What major? \_\_\_\_\_
6. Do you have family members living out on Cañar?
  - a. Yes
  - b. No (go to question 8)
7. Please describe if any family member is living outside of the community

	Family Tie (E.g. Spouse, children, brothers,... etc)	Age (Years)	Gender M- Female H- Male	Abroad or in Ecuador? Abroad- F In Ecuador- P	Where does s/he live? (name of the community)	Occupation
1			M <input type="checkbox"/> H <input type="checkbox"/>	F <input type="checkbox"/> P <input type="checkbox"/>		
2			M <input type="checkbox"/> H <input type="checkbox"/>	F <input type="checkbox"/> P <input type="checkbox"/>		
3			M <input type="checkbox"/> H <input type="checkbox"/>	F <input type="checkbox"/> P <input type="checkbox"/>		
4			M <input type="checkbox"/> H <input type="checkbox"/>	F <input type="checkbox"/> P <input type="checkbox"/>		
5			M <input type="checkbox"/> H <input type="checkbox"/>	F <input type="checkbox"/> P <input type="checkbox"/>		
6			M <input type="checkbox"/> H <input type="checkbox"/>	F <input type="checkbox"/> P <input type="checkbox"/>		

(Please, continue at reverse of page if more space is needed)

8. Please, describe the people living in the household, excluding the ones already mentioned in the previous question (7)? (including yourself)

	Family tie (e.g. spouse, children, brother, mother, none...etc.)	Age (years)	Gender M- Female H- Male	Main occupation (e.g. farmer, construction worker, student, employee...etc)	How much help with the crops do they offer?			
					Never	little	often	Always
1	<b>Youself</b>		M <input type="checkbox"/> H <input type="checkbox"/>		1	2	3	4
2			M <input type="checkbox"/> H <input type="checkbox"/>		1	2	3	4
3			M <input type="checkbox"/> H <input type="checkbox"/>		1	2	3	4
4			M <input type="checkbox"/> H <input type="checkbox"/>		1	2	3	4
5			M <input type="checkbox"/> H <input type="checkbox"/>		1	2	3	4
6			M <input type="checkbox"/> H <input type="checkbox"/>		1	2	3	4
7			M <input type="checkbox"/> H <input type="checkbox"/>		1	2	3	4

9. Please, tell us how many couples live in the household (e.g: married son or daughters, single mother, married brothers....etc) \_\_\_\_\_(number)

#### Socioeconomic conditions

10. How much is the household income monthly (US\$)

- a. No answer
- b. Less than 300
- c. 300-600
- d. 600-1000
- e. more than 1000

11. Please, indicate the percentages according to the source of this income

Source	Nothing	some	A lot	everything
a. Crops	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
b. Animal production	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
c. Employment in agriculture	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
d. Employment different from agriculture ...Which one(s)?	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
e. Handicrafts	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
f. Remittances	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
g. Other....which ones?	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

12. In total, how much hectares of land do the family crop? \_\_\_\_\_ Hectares (use decimal notation to express fractions. For instance, half an hectare= 0.5 hectares)
13. In total, how much hectares of land do the family own? \_\_\_\_\_ Hectares (use decimal notation to express fractions. For instance, half an hectare= 0.5 hectares)
14. How did the family obtain the piece (s) of land? (multiple answer allowed)
- Inherited
  - Bought
  - Cooperative
  - It is not owned. It is rented, A medias o partir (a form of rent in exchange of work)
  - Other ...which one \_\_\_\_\_ ?

### Description of crops

Product	15. How many harvests of the following products do you have in one year? (please, mark 0 if none)	16. How many "bags" (of approx. 120 kg) or baskets do you produce by harvest?	17. How many times per crop cycle do you apply pesticides
Potato		Bags	
Peas		Bags	
Corn		Bags	
Carrots		Baskets	
Cauliflower		Baskets	
Lettuce		Baskets	
Coriander		Baskets	
Cabbage		Baskets	
Onions		Baskets	
Garlic		Baskets	
Herbs		Baskets	
<b>Others... Which ones</b>		Baskets	

18. What type of potato do you crop? (multiple answer allowed)

a. Jubaleña b. Bolona c. Gabriela d. Esperanza e. Chola	f. Roja (red) g. chauchas h. Other....Which one? i. Ninguna
---	--

19. Which type of potato do you prefer?

- a. Native
- b. Improved
- c. None (go to question 20)

20. Why do you prefer this type of potatoes?

- a. Better sale price
- b. Better resistance to the Lancha (pest)
- c. Better resistance to the White Worm
- d. Better taste
- e. Faster to cook
- f. Other reasons ....Which ones? \_\_\_\_\_

21. How do you get the potato seed? (multiple answer allowed)

- a. Bought
- b. Preserved from previous crops
  - i. How do you preserve the potato seed (multiple selection allowed)
    - 1. Dark room
    - 2. Pile
    - 3. Bags
    - 4. Silo Verdeador (Greening place)
    - 5. Other....Which ones\_\_\_\_\_

22. How do you prepare the field for the crops? (multiple selection allowed)

- a. To rot the ground
- b. To apply fertilizer
- c. To plow
- d. Recruzada
- e. To sprinkle
- f. Others...Which ones? \_\_\_\_\_

23. How do you know that you have to do pest control? (multiple answer allowed)

- a. Watching the weather (e.g. the rain)
- b. Watching the ground
- c. Watching the crop
- d. As a routine from time to time
- e. Because the neighbors do it
- f. Because someone tells you
- g. Other....which one? \_\_\_\_\_
- h. None of the above

24. How do you select the pesticides to use?

a. According to the crop cycle (e.g. first, second...applications)	c. According to someone's suggestion
b. According to the identified pests	d. Other...What? _____

25. When you do not know, who suggests you which pesticide to use?

- a. Owner of an agricultural warehouse

- b. Neighbor
- c. Technical assistants at the Tucayta (Association of Organizations)
- d. Technical assistants at other organizations... which ones? \_\_\_\_\_
- e. Radio advertisements
- f. Others (please explain) \_\_\_\_\_

26. Please, tell us the most common pesticide that you use

a) Name of the pesticide  (Please, ask for the pest in the next column if the pesticide name is unknown)	b) pest (or what is the identified problem in the crop)	c) How many times per crop cycle	d) How much per application <u>(please, provide details of units or types of recipients)</u>	e) Please, mark the crop in which it is most used (circle)
				Potato- Corn- Peas- Other
				Potato- Corn- Peas- Other
				Potato- Corn- Peas- Other
				Potato- Corn- Peas- Other
				Potato- Corn- Peas- Other
				Potato- Corn- Peas- Other

27. In what agricultural warehouse do you usually buy the pesticides?

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28. How many days after the pesticide application do you harvest? \_\_\_\_\_ days

29. Regarding your crop's irrigation, when do you apply pesticides?

- a. Before the irrigation
- b. After the irrigation
- c. Both
- d. None of the above

30. Do you storage pesticides?

a. Yes⇒	31. ¿How much time do you keep the pesticides? ↓ 32. ¿Where do you keep the pesticides? a. Out of the house in an open space b. Out of the house in a covered place c. In the house in a separated room d. In the house in other place...where? _____ e. Other place ....where? _____	_____days _____months
b. No ↓ <b>Go to question 33</b>		

33. Do you know any plants that could be helpful for pest control

- a. No
- b. Yes.... What? \_\_\_\_\_  
\_\_\_\_\_

34. How do you take the pesticides from the warehouse to the house?

- a. With the groceries
- b. Separated from the groceries
- c. Other....What? \_\_\_\_\_

35. Do you have pesticide application pump?

a. Yes⇒	36. Where do you keep the application pump?  a. Out of the house in an open space b. Out of the house in a closed place c. In the house in a separated room d. In the house in other place...where? _____ e. Other place ....where? _____
<b>Go to question 38</b>	
b. No⇒	37. ¿How do you get the pump? a. You borrow it b. You rent it c. You pay in goods for it d. Other... What? _____

## Social Capital and Resource Generator

38. Do you use prestamanos for your crop?	a. Never	b. little	c. a lot	d. always
39. Do you or anyone from your household attend to mingas?	a. Never	b. little	c. a lot	d. always

40. In order to improve the quality of life in your community, how much trust would you have in the following institutions

	Nothing	A little	Some	A lot
a. Your land cooperative (San Rafael, Quilloac?)	1	2	3	4
b. Your community assembly	1	2	3	4
c. Cooperative Mushuk Yuyay	1	2	3	4
d. Association of Cañari Agronomists	1	2	3	4
e. Tucayta	1	2	3	4
f. Association of Cañari Women	1	2	3	4
g. UPCC	1	2	3	4
h. CONAEI	1	2	3	4
i. City Hall	1	2	3	4
j. Ministry of Agriculture	1	2	3	4
k. CREA	1	2	3	4
l. Spanish Project (coodesarrollo)	1	2	3	4
m. National government	1	2	3	4

41. How many relatives do you know who would for free?

	Relatives in Cañar (mark with X)				Relatives out of Cañar (mark with X)			
	None	A few	Some	Many	None	A few	Some	Many
a. teach you about pesticide management	1-	2-	3-	4	1-	2-	3-	4
b. help you with the physical work in your crop	1-	2-	3-	4	1-	2-	3-	4
c. lend you money for your crops	1-	2-	3-	4	1-	2-	3-	4
d. help you to change or deal with a law (policy) that affects your crops	1-	2-	3-	4	1-	2-	3-	4

42. How many friends (outside the family) do you know who would for free?

	Relatives in Cañar (mark with X)				Relatives out of Cañar (mark with X)			
	None	A few	Some	Many	None	A few	Some	Many
a. teach you about pesticide management	1-	2-	3-	4	1-	2-	3-	4
b. help you with the physical work in your crop	1-	2-	3-	4	1-	2-	3-	4
c. lend you money for your crops	1-	2-	3-	4	1-	2-	3-	4
d. help you to change or deal with a law (policy) that affects your crops	1-	2-	3-	4	1-	2-	3-	4

43. Are you or any of the members of the household members of the following: (multiple option)
- Quilloac cooperative
  - San Rafael cooperative
  - Asociacion Mushuk Yuyay
  - Association of Women
  - Association of Cañari Agronomists
  - Tucayta (association of organizations)
  - NGO's (non governmental organizations)...which ones? \_\_\_\_\_
  - Other associations... Which ones? \_\_\_\_\_
  - None

44. How often do you have contact with any one from the following institutions?

	Never	rarely	A lot	always
a. Your land cooperative (San Rafael, Quilloac?)	1	2	3	4
b. Cooperativive Mushuk Yuyay	1	2	3	4
c. Association of Cañari Agronomists	1	2	3	4
d. Association of Cañari Women	1	2	3	4
e. Tucayta	1	2	3	4
f. UPCC	1	2	3	4
g. CONAEI	1	2	3	4
h. City Hall	1	2	3	4
i. Ministry of Agriculture	1	2	3	4
j. CREA	1	2	3	4
k. Spanish Project (coodesarrollo)	1	2	3	4
l. National government	1	2	3	4

45. Do you think that people in the community share the same values?

a. Disagree	b. Somehow disagree	c. Somehow agree	d. Agree
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46. Do you think that people in the community are united?

a. Disagree	b. Somehow disagree	c. Somehow agree	d. Agree
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## Pesticide application

	47. ¿Who has applied pesticide at some point this year? (multiple answer-mark X)	48. ¿Who is the person who is the most in charge of the pesticide application for your crop? (Just one- mark X)
a. Yourself		
b. Your spouse		
c. Any of your daughters		
d. Any of your sons		
e. Other relative... ¿who? (what ties)		
f. Associated by part (por partida)		
g. Employee		
h. Other.... ¿Who? _____		
i. Nobody		

49. Have you applied pesticides in the last 7 days?

- a. Yes
- b. No

50. How long have you worked with pesticides? \_\_\_\_\_ years

51. How often do you wash the pump?

- a. After every application ⇒
- b. Sometimes... ⇒

- c. Never ↓ (go to question 54)

52. Where do you wash the pump after the application?

- a. In the field
- b. In the house
- c. In the river
- d. In the channel
- e. Other....where? \_\_\_\_\_

53. ¿Where do the residual water from the pump go?

- a. Ground
- b. Irrigation channel
- c. Sewage system
- d. Other...where?

54. Once the pesticide is used, what do you do with the recipient? (multiple answer allowed)
- a. burned
  - b. Hidden in the rocks or fences
  - c. It is left in the crops
  - d. Thrown to the channel, river or water streams
  - e. Thrown to the water reservoir
  - f. Other... What? \_\_\_\_\_
55. In what recipient do you prepare the pesticide mix?
- a. In buckets
  - b. In the same pump
  - c. In kitchen bowls
  - d. In the bowl to prepare Chicha (a traditional drink)
  - e. Other... What? \_\_\_\_\_
56. When you prepare the pesticides for application, do you use? (multiple selection allowed)
- a. Mask?
  - b. Gloves?
  - c. Protective glasses?
  - d. Waterproof clothes?
  - e. Long sleeved shirt?
  - f. Boots?
  - g. A stick to mix the preparation?
  - h. Other... What? \_\_\_\_\_
  - i. Nothing
57. When you apply the pesticides, do you use? (multiple selection allowed)
- a. Mask?
  - b. Gloves?
  - c. Protective glasses?
  - d. Waterproof clothes?
  - e. Long sleeved shirt?
  - f. Boots?
  - g. Other... What? \_\_\_\_\_
  - h. Nothing
58. When you apply the pesticides, do you wet with the preparation? (multiple allowed)
- a. Yes
  - b. No
59. Do you wash yourself after the application?
- a. yes
  - b. no

60. Is there any difference between the pesticide application clothes and the dairy clothes?
- Yes
  - No
61. Who does the laundry for the pesticide application clothes?
- Spouse
  - Daughter or Sons
  - Employees
  - Other...Who? \_\_\_\_\_

## Health

62. If anyone is intoxicated by pesticides, where do you go for assistance?
- Family
  - Local healer
  - Local health post
  - Hospital
  - Other...where? \_\_\_\_\_
  - No one
63. how often do you drink alcoholic beverages
- everyday
  - One or two days per week
  - Every two weeks or more
  - Seldom
  - Never
64. Have you ever had an accident or lesion that limits your movement or sensibility?
- Yes
  - No
65. Have you ever been told by the doctor or healer that you have a neurological problem?
- Yes
  - No

66. The condition that best describes what you felt in the last 7 days: (mark X- do no leave blank rows)

	No	Sometimes	All the time
a. Frequent headaches:			
b. Nausea or vomiting for no reason:			
c. Diarrhea			
d. Stomach spasms or cramps:			
e. Salivating and spitting:			
f. Dizzy (without drinking):			
g. Sweating for no reason:			
h. Skin reddening or rash:			
i. Lack of breath:			
j. Shaky hands:			
k. Numb hands:			
l. Eye, nose or throat irritation:			
m. Bad temper:			
n. Feeling weak:			
o. Have lost hand ability:			
p. Seizures or spells:			
q. Please, indicate any other symptom of interest			

67. **Memory** Look closely at each detail in the three following faces, for 30 seconds:



... now look closely at the group of faces on the page and find the three faces you saw, pointing them out to the interviewer) (4 attempts).

**FIRST ATTEMPT**

**THIRD ATTEMPT**

**SECOND ATTEMPT**

**FOURTH ATTEMPT**



Comments (use the back of the page if needed)

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END OF SURVEY