

The rural agribusiness development and environmental conservation in highland areas of Peru

An analysis of the current and future situation of organic
farming in three districts of the Lurin River Basin

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Abstract

Rural agro-industry gives added value to peasant's agricultural production. In Peru, many small farmers from highland areas are linked in this activity as a means of subsistence. These farmers, since ancient times, have performed all their field activities in balance with nature. In fact, the rural agribusiness has mostly been developed under agroecological principles.

The main objective of this thesis the description of the characteristics of rural agribusiness and how this activity based on agroecology contributes to the conservation of the environment in the highland areas of Peru. The situation of rural agribusiness is reviewed from the global and local context of organic agriculture. It has also been taken the region of Lurin River Basin as a case study, where environmental, productive, marketing and institutional characteristics are described. Moreover, a study of the current and future situation using the scenario methods, and an analysis of sustainability is carried out for an organic farmers' organization called "Association of Ecological Producers of the Lurin River Basin 'Monticelo'".

Results of this thesis indicate that rural agribusiness in highland areas of Peru, specifically in the Lurin River Basin, is crucial sector it contributes to food security and generating income for rural families, conserve biodiversity and farmers' traditional knowledge has been used to address emerging issues of climate change. However, the main problems facing small producers are productivity, technology, marketing and organization.

In the scenario analysis it has been identified that "*Organic-point of sale*" scenario can become a marketing point of eco-business efficiently, which could increase sales and improve the quality of life for farmers and for the environmental conservation.

In conclusion, being closely linked to ecological farming practices, rural agribusiness is an important tool that contributes to the welfare of rural small farmers and environmental conservation.

Keywords: Rural agribusiness, agroecology, environmental conservation, small-farmers.

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1. Introduction

Rural agribusiness is an activity that implies many small producers in vulnerable areas since ancient times. According to the Food and Agricultural Organization of the United Nations, in Latin America there are over five million rural agro-industry productive units and about fifteen million people are linked to this activity.

The rural agribusiness has mostly been developed under the organic farming's principles, conducting several activities as the soil conservation, efficient water use, no use of agrochemicals, among others. Additionally, organic farming involves economic and social components, because to sell processed products improves better income for the farmers, making a positive contribution to combating poverty. Therefore, rural agribusiness is an important development sector for many rural families, and is also an important contribution to environmental conservation.

For many small farmers in Peru, rural agro-industry is important because it contributes significantly to food security, generate income and develop in balance with nature. Most production units are handcrafted, traditional or subsistence and others have been developed to meet the demands of population growth in some cities, and operate in a familiar environment on a small scale and using local resources.

This thesis describes the characteristics of rural agro-industry and how this activity based on agroecology contributes to environmental conservation in the highlands of Peru. For this purpose we review the global and local context of organic agriculture and the role of agribusiness to sustainability, food security, biodiversity and climate change. It has taken the Lurin river basin as study area, for which findings are described environmental, productive, commercial and institutional. Moreover, a study of the current and future situation using the scenario methods, and an analysis of sustainability is carried out for an organic farmers' organization called "Association of Ecological Producers of the Lurin River Basin 'Monticielo'".

2. Aim and Objectives

The main objective of this thesis is to describe the characteristics of rural agro-industry and how this activity based on agroecology contributes to the conservation of the environment in the high land areas of Peru. Therefore, the strengths and limitations of rural agro-industry and its impact on environmental conservation have been identified and described. For this it has taken the experience of small farmers in the Lurin River Basin as a case study, where its environmental, productive, commercial and institutional characteristics are detailed on this field in order to create a holistic understanding.

Finally, a study on the current and future situation using the scenario methods, and a sustainability analysis is carried out for the three districts of the organic farmers' organization called "Association of Ecological Producers of the Lurin River Basin 'Monticelo'", in order to develop and evaluate scenarios based on its current situation.

3. Literature review

3.1. Rural agribusiness

3.1.1. What is the rural agribusiness?

Agribusiness in general is the branch of industry that transforms the products from agriculture, livestock, forestry and fisheries wealth in processed products, through a set of unit operations such as postharvest, selection, processing, packaging and storage.

The agribusiness is an economic activity that relates the agricultural production with the industry processing. Products manufactured (processed) are targeted to a specific market, integrating processes ranging from the provision of raw materials and inputs until to marketing the final product. Agribusiness development is directly related with the degree of integration along the production chain (FAO, 2006).

For the *United Nations Industrial Development Organization-UNIDO*, agribusiness development integrates vertically all processes from production in the field to the final consumer. Vertical integration means that all stages of production must be planned and organized in order to meet a proven demand in the market (Zapata, 2001).

Therefore, agribusiness is a system that integrates agricultural activities (production / rearing) with industrial activity (conversion or processing) based on the market (marketing) (Zapata, 2001).

Concept of rural agribusiness or rural agro-industry (RAI):

The RAI is a new field relatively, so that there is no unique concept or definition. According to the United Nations Organization for Food and Agriculture Organization, rural agribusiness is "*an activity that allows increase and retain in rural areas, the added value of production in rural economies, through the implementation of post-production stages, such as selection, washing, sorting, storage, preservation, processing, packaging, transportation and marketing of agricultural, marine and forest products*" (FAO, 2000).

For the *Agribusiness Association of Australia*, rural agro-industry includes companies involved in the food and fiber production and seed supply, agrichemicals, farm machinery, processing, distribution, and marketing (AAA, 2010).

The added value to primary production increases the economic value of the final product and also allows that this increase remain in the production area, contributing to local development.

THE RAI is characterized by the processing of various agricultural products in the same area of production, and it is done by producers themselves, usually in family units. The RAI enables each region to produce distinctive products, taking advantage of the ecological diversity of the area (Benavides et al, 1996).

Rural agro-industry plays an important role in local development. It contributes to increases farmers' incomes, creates employment and improves social structures through the strengthening of technical capacities, production, organization and marketing (Da Silva, 2009).

Most of the agribusiness units respond to traditional and cultural practices, often without external intervention, and generally as a means of subsistence. The principal traditional (artisanal) products are dairy products and processed fruits. On the other hand, there are another kinds of products developed with external intervention, which are processed to explore their production and marketing potential (FAO, 2006; Chavez, 2003).

3.1.2. Types and models of rural agribusiness

3.1.2.1. Types of rural agribusiness

Agriculture and livestock in rural areas have a high degree of heterogeneity in each area, so RAI is also heterogeneous (MINAG-IICA, 2006). The complexity of rural economies is reflected in the different types of RAI, which can be classified in several types, depending on their origin, organization, type of technology used, the size and articulation with other components (Riveros et al, 2009).

According to its **origin**, the RAI can be traditional or induced; in terms of **organization**, processing units can be individual, familiar or associative; depending on the **type of technology** used, rural agribusiness can be classified into artisanal, semi-industrial and industrial (Riveros et al, 2009).

The **size** of the rural agribusiness units are usually small, but in some cases can form large complexes; and in the articulation with other components, RAI concerns not only the process of raw materials for products but also intermediate processes or by-products (Riveros et al, 2009).

3.1.2.2. Models of rural agribusiness

There are at least two groups of rural agribusiness models. The first group relates to the production of raw materials and processing (direct, indirect and commercial), and a second group relates to the transformation level (level 0, level 1 and level 2) (Riveros, 2009; Zapata, 2001).

In the first group, the ***direct model*** is the direct relationship between primary production and processing, where the producer-processor produces the final product; the ***indirect model*** is where the primary production and a part of processing is done together, but is not generated a final product for the consumer; and ***commercial model*** is where the primary production as a whole is intended to market as raw material (Riveros, 2009).

In the second group, the ***transformation level zero (0)*** indicates that the raw materials are preserved without undergoing changes in its structure; at a **level of transformation (1)**, a part of raw materials are processed; and in the ***level of processing two (2)***, farm products are processed to final products (Zapata, 2001).

3.1.3. Rural agribusiness in Peru

In Peru, there are many small rural agro-industries, and they are located in highland areas over three thousand meters above the sea level. Some are artisanal, traditional or subsistent and others have been developed to meet the demand of growing populations in some cities (Chavez et al, 2003).

Each of Peru's regions have valuable resources to strengthen the agribusiness sector. However, governmental and companies' actions in this area are few, perhaps because the rural agro-industry usually is developed in small-scale.

The rural agro-industry in Peru is heterogeneous, each area and each item faces a different way (Chavez et al, 2003). The important point is that its activities are conducted in balance with nature. However, marketing is still empirical, which is a problem to sell products on the market (CAC, 1989).

3.1.3.1. Importance of rural agribusiness in Peru

The rural agribusiness is important for Peru because it is a sector, which involves thousands of farmers, who through their agricultural activities generate development for their families and their localities.

RAI operates in a family environment, small-scale and using local resources. It is very important to emphasize the role of women, who have gained important skills in food processing and in many localities they are responsible for managing the production units.

RAI is linked to smallholder farming (Benavides et al, 1996), that occupies approximately 85% of cultivated land with extensions less than ten hectares, of which 75% are developed under five hectares (Zapata, 2001). Benavides (1996) noted that it is surprising how the magnitude of some crops have grown in recent years, many of which have a high potential for agribusiness.

3.1.3.2. Agro-industrial production in Peru

The agribusiness production is dispersed and unfortunately there are no national registry data. The Agriculture Ministry figures and data are only based on modern agribusiness, large industrial units, which even do not include the companies with five or fewer workers (Benavides et al, 1996).

The diversity of rural agribusiness depends on each area or each region, as crops grown (or raised) and according to the market it is directed to. Processed products are intended for four types of markets, which may be local consumption and sale, local and regional sales, interregional sales and exportation.

The data reported by the National Statistics Institute (INEI) and the Ministry of Labour, Industry and Tourism (MITINCI), indicate a sustained growth for a group of crops and stagnation for others. Agribusiness GDP shows only positive trends in recent years (INEI, 2010; MITINCI, 2010; Benavides et al, 1996).

Most rural agribusiness have been performed in the mountains, followed by the jungle and to a lesser magnitude in some coastal areas. The mountain region is diverse in its geography, demography and culture; therefore there is a differentiated production in each zone, which is influenced for the type of raw materials, artisanal processes and the demand growth in intermediate cities (Benavides et al, 1996)

There are some areas of production for the international market, which have been developed under the initiative of small producers, who have organized themselves into associations and have made strategic alliances with commercial agents. The principal products for exportation are fruit and vegetables, coffee and cocoa, grains and legumes, herbs and Andean grains (Benavides et al, 1996; Meyhuay, 2005; Riveros, 2007).

3.1.3.3. Institutional framework to support rural agro-industry (RAI)

In general, there are several institutions to support the agribusiness (see Appendix 1). This view has been supported in a document of Food and Agriculture Organization of the United Nations (FAO), which assets that the support is given to small businesses through training, technical assistance, credit and consultancy services (FAO, 1996).

However, there are no concrete results in supporting rural agribusiness, because it has been found a weak organization and little coordination between institutions (Benavides et al, 1996; FAO, 2006).

The government through some ministries try to support rural agribusiness initiatives. The Ministry of Agriculture, the Ministry of Labour, Industry and Tourism, the Ministry of

Social Development Women and the Ministry of Environment have programs to promote agriculture and rural agribusiness; however, they have not been achieved expected results yet.

Private companies have usually focused their participation in priority to agricultural exports from the coastal areas, so there is a little action to develop rural agro-industry.

Nongovernmental organizations (NGOs) are perhaps the only ones who have been working actively in different rural areas of the country. Most of the successful experiences have been promoted, financed and implemented with the aid from NGOs.

3.1.3.4. Legal framework for rural agribusiness in Peru

The Food and Agriculture Organization of the United Nations (2002) strongly argues that many Latin American countries do not have a legal framework to promote rural agribusiness development. This is because policies do not include small farmers, which, coupled with the lack of research, technical assistance, technology and credit, difficult entry into different markets to generate income (Benavides et al, 1996).

In Peru, the legal framework about rural agribusiness seek to reduce poverty, generate employment, promote investment and modernize the rural economy. However, as Benavides et al (1996) point out, if the laws are not adequate to the needs of small farmers or small businesses it cannot achieve development in the rural world. Appendix 2 shows a list of the main legal provisions relating to the RAI in Peru.

3.1.3.5. Rural agribusiness and market

Chavez et al (2003) and Vera (1987) argue that agribusiness heterogeneity is closely related to the access to the market. Each area and each group of producers face differently, depending on the type of goods offered and by geographic region and target market.

Chavez et al (2003) observe that inside and outside of the country, there are distinct market niches for products of rural agribusiness with great potential to be exploited. However, a study executed by the FAO Regional Office for Latin America and The Caribbean (2002) mentions that the marketing in rural agribusiness is empirical and the challenge for small producers is innovatively addressing the problems encountered in the product sales.

Benavides et al (1996) note that the market for rural agribusiness has been affected by the liberalization of prices of agricultural products and inputs that occurred in 1990, which limited the governmental in the food price control, led to the entry of imported products and, in a free market policy, prices are set by the market.

Ravello (2008) argues extensively that the marketing is a key point in agribusiness, because the sale of a product generates income and proceeds with activities throughout the production chain. The main difficulties are lack business organization and little bargaining power of small producers. Given the difficulties of formalization to be inserted into the markets, sales have been done in the same area of production, to intermediaries and to some regional customers.

The organization of producers is an important point that has allowed them to group themselves into associations, cooperatives and small businesses and has given them to insert in different regional markets and competitive spaces such as supermarkets. Some producers have managed to enter export channels through the line of organic products, fair trade, certification, and quality labels, among others (Ravello, 2008; Chavez et al, 2003).

3.2. Traditional farming and agroecology

3.2.1. Traditional farming

Traditional farming is based on traditional knowledge and skills of farmers in indigenous communities, transmitted from generation to generation in order to ensure food security and establishing a truly culture that integrates the local communities with the local means where they live (FAO, 2009; Del Campo & Navarro, 2001).

Traditional farming is a cultural legacy that uses typical systems in a particular place. Each geographic area and the community have special characteristics that have been configured to the same culture over time.

Traditional farming uses techniques and simple tools, and coexists with livestock. Agriculture serves as a food source for livestock and livestock contributes its waste as compost or fertilizer. Generally these activities have been developed in small scale as a means of subsistent.

According to a report from the University of Chile - Faculty of Agronomy (1999), about 60% of cultivated land in the world corresponds to traditional systems and subsistent adapted to local conditions. Farmers have inherited a valuable ancient knowledge that has allowed them to survive over the centuries, even in difficult environmental conditions and without technological dependence or use of agrochemicals.

A key feature of traditional farming is its diversity. Farmers develop associated crops, which are complementary to each other. For example, under the fruit trees have been planted some vegetables that benefit from the shade and the leaves from trees; corn together with legumes, etc.

A recent study by FAO (2009) argues that farmers, indigenous and local communities use their traditional knowledge to help not only food security but also to preserve agricultural biodiversity, landscape and diverse livelihoods in a wide range of ecosystems, including the most fragile and hard.

In conclusion, traditional farming involves thousands of farmers around the world who use the ancient knowledge with a deep understanding of the local ecosystem, keeping the plant and animal diversity through time. However, these practices could be improved through the application of modern knowledge and technologies.

3.2.2. Agroecology

Agroecology is a scientific discipline focused on the study of agriculture since an ecological perspective, based on premises larger than conventional farming. Its aim is to analyze farming processes and their interrelationships as a whole, raising principles and methods that incorporate environmental, technical, socioeconomic and cultural dimensions (FAO, 2000; Altieri & Nicholls, 2000).

The principles and methods of agroecology allow to analyze, design, manage and conserve agricultural ecosystems sustainably. In general, farming processes have been analyzed only from an economic perspective, without social or environmental considerations (Altieri & Nicholls, 2000; Sevilla & González, 1993).

Altieri & Nicholls (2000) argue extensively that the great aim of agroecology is agro-ecosystem optimization, which involves biological, energy and productive efficiency. It is directed not only to maximize production of some goods, but an entire ecosystem and their complex interactions between people, country, soil, water, solar energy, plant and animal species, etc.

The systemic approach of agroecology considers all factors aimed at the preservation of biodiversity, optimizing the use of local resources, use of traditional knowledge, proper reutilization of organic waste to produce organic fertilizers, among others (FAO, 2009; Altieri 1999).

The emergence of agroecology dates from the decade of the seventies, where many traditional farming units were recognized as major systems of natural resource management, especially in developed countries. From there, its importance was growing until the nineties it was recognized as a scientific discipline with a conceptual framework and a defined methodology for holistic study of agro-ecosystems.

Agroecology uses and integrates modern knowledge with traditional wisdom, oriented to production that has not have negative effects on society and environment.

Agroecology is not a closed discipline, but rather that feeds, interact and evolve with other disciplines to contribute to sustainable development (Martinez-Alier, 2009; Altieri, 1999).

Agroecology is a dynamic science that interacts with agricultural sciences, ecology, sociology, anthropology, geography, ecological economics and political ecology in search of social and technical solutions of stable production, adapted to the environmental and social, especially of the marginalized sectors (Sevilla and Gonzalez, 1993).

Martínez (2000) analyzes deeply agroecology relations with other sciences. He argues that agroecology is an open science and multidisciplinary product of a constant "social

construction" and co-evolution between humans and nature, according to the relationship humans have with the material and energy flows in a particular agro-ecosystem.

According to Altieri & Nicholls (2000), agroecology emphasizes an approach of "ecological engineering" which consist of assembling all components of the agroecosystem, so that processes and temporal/spatial interactions between these components result in performance derived from internal sources, recycling of nutrients and organic matter, and trophic relationships between plants, insects, pathogens, among others, highlighting synergies such as biological control mechanisms.

Therefore, the processes and interactions of agroecology allow a balance in the ecological relationships in the agroecosystem depending on their degree of resilience and synergies. Altieri & Nicholls (2000) argue that an ecosystem approach gives three agro-ecological interactions: integration and diversification, complementarities and synergies (see Table 1).

Table 1: Integration and synergies in agro-ecosystems, (adapted from Altieri & Nicholls, 2000: 17).

Interaction	Characteristics
Levels of integration and diversification in agro-ecosystems	<ul style="list-style-type: none"> - Mixed annual crops (polyculture and rotations). - Addition of fruit trees and forestry (agroforestry). - Addition of animals (cattle mixed crop-livestock mixtures, etc.). - Integration of aquaculture (fish ponds, etc.). - Adding support vegetation (green manure, <i>mulch</i>, medicinal plants, etc.). - Incorporation of genetic diversity (multiline mixtures of varieties or races, etc.).
Complementarities in agro-ecosystems	<ul style="list-style-type: none"> - Exploration of roots at different depths in the soil profile. - Utilization of nutrients and moisture differential. - Using differential intensities of light and humidity. - Adaptability differential soil and microclimatic heterogeneity. - Differential susceptibility or tolerance to pests, diseases and weeds.
Synergies in agro-ecosystems	<ul style="list-style-type: none"> - Creation of favorable or unfavorable microclimates. Production of chemical components required to stimulate and suppress undesirable components (agrochemicals, repellents, etc.). - Production and nutrient mobilization (mycorrhizae, nitrogen fixation, etc.). - Production of biomass for food, green manure or <i>mulch</i>. - Share that recover and recycle nutrients. - Provision of ground cover for soil and water conservation. - Promotion of beneficial insects and antagonists by adding diversity and organic matter. - Promotion of soil biology by adding organic matter and root excretions.

3.2.3. Organic or ecological farming

There are several definitions of organic agriculture. For the purpose of this work it has been taken the definitions given by Food and Agriculture Organization (FAO), International Federation of Organic Agriculture Movements (IFOAM), United States Department of Agriculture (USDA) and National Commission of Organic Products of Peru (CONAPO). The following describes each of these concepts.

- **Food and Agriculture Organization. Codex Alimentarius Commission**

“Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system” (FAO, 1999).

- **International Federation of Organic Agriculture Movements**

“Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved” (IFOAM, 2008).

- **United States Department of Agriculture**

According to USDA National Organic Standards Board (NOSB) definition, April 1995:

- *“Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony.”*
- *“‘Organic’ is a labelling term that denotes products produced under the authority of the Organic Foods Production Act. The principal guidelines for organic production are to use materials and practices that enhance the ecological balance of natural systems and that integrate the parts of the farming system into an ecological whole.”*
- *“Organic agriculture practices cannot ensure that products are completely free of residues; however, methods are used to minimize pollution from air, soil and water.”*
- *“Organic food handlers, processors and retailers adhere to standards that maintain the integrity of organic agricultural products. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people.” (USDA, 2007).*

- National Commission of Organic Products of Peru (CONAPO)

The CONAPO does not specifically describe the concept of organic agriculture, but it does make for an organic product:

“It is consider ORGANIC PRODUCT all products originated in an agricultural production system or in its processing uses technologies in harmony with the environment and respecting the cultural integrity, optimizing the use of natural and socio-economic resources, in order to ensure a sustainable agricultural production” (CONAPO, 2002: 3).

From the above concepts, it could be argued that organic farming is a production system that promotes the care and conservation of biodiversity, biological cycles and soil biological activity, which is achieved through practices that avoid the use of products chemically synthesized as fertilizers, insecticides, herbicides, hormones and organisms genetically modified (FAO, 1999; CONAPO, 2002; Chavez et al, 2003).

In summary, organic agriculture is an integral system of production management based on specific regulations and the use of locally available resources such as solar energy, biological nitrogen fixation, biological pest control, use of organic fertilizers, among others, with the aim of achieving sustainable agroecosystems from ecological, social and economical point of view (FAO/OMS, 2001; UCR et al, 2000).

3.2.4. The World of Organic Agriculture

This section describes the current status of organic agriculture in the world, drawing on the studies and publications by International Federation of Organic Agriculture Movements (IFOAM), Research Institute of Organic Agriculture (FiBL) and Foundation Ecology & Agriculture (SÖL). First, it has taken as its starting point the global context of the organic agriculture. Second, it is describe the organic production in Latin America. Finally, it is describe the organic production in Peru.

3.2.4.1. Global Organic Agriculture

According to the latest publication of FiBL & IFOAM about *"The World of Organic Agriculture 2010"*, more than 35 million hectares of agricultural land in the world are managed organically certified according to organic standards.

It has been noticed that more than one third of the world's organic agricultural land is in Oceania (35%), followed by Europe and Latin America (where in both areas growth was strongest). Likewise, eight countries have more than 1 million hectares of organic agricultural land and six countries/areas have more than 10 percent organic land.

Throughout this process there are over 1.4 million organic producers (FiBL & IFOAM, 2010a).

In addition to certified organic agricultural land (including in-conversion areas) there are 0.4 million hectares of organic aquaculture areas, 31.1 million hectares of organic wild collection and bee keeping areas and 0.3 million hectares of further non-agricultural land (FiBL & IFOAM, 2010a; Organic-world, 2010a).

Figure 1 describes the organic agricultural land in the world, where the greatest share of the global organic surface area is in Oceania (34.7%), followed by Europe (23.4%) and Latin America (23%).

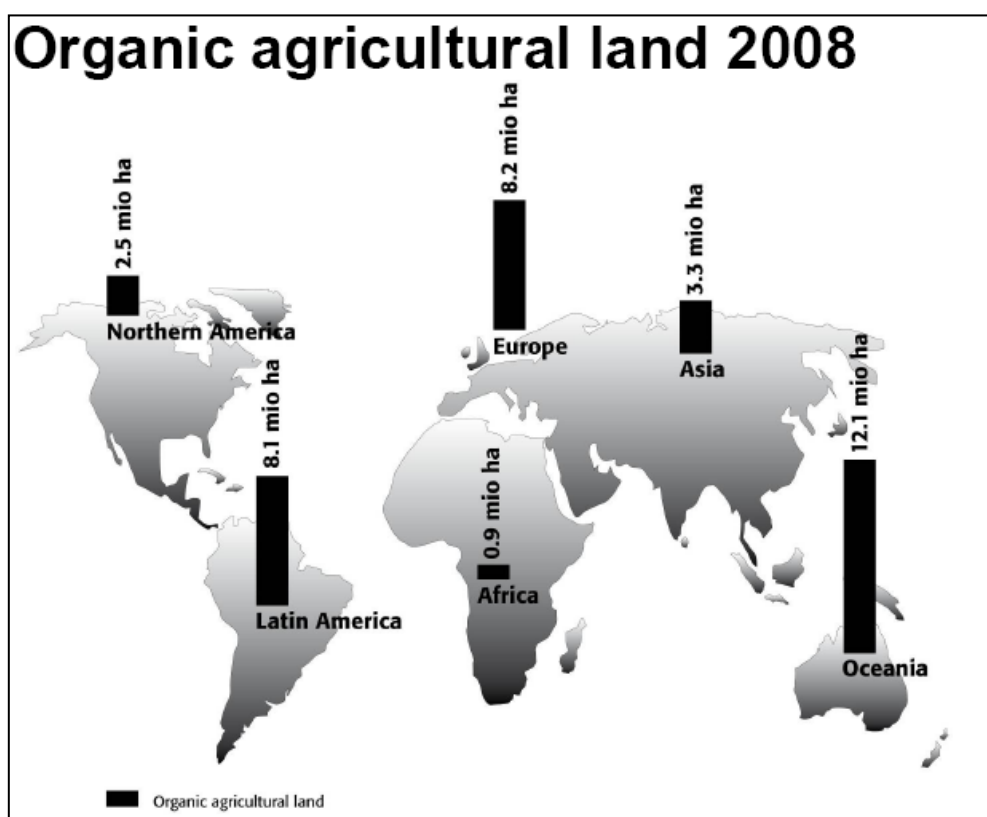


Figure 1: The organic agricultural land in the world, (adapted from FiBL & IFOAM, 2010a: 8).

During the last decade, the proportion of organically compared to conventionally managed land has had a greater growth in Europe and Latin America. Globally, the organic area has grown by nearly 24 million hectares, compared with consolidated data in 1999 (Figure 2), which means a growth of more than 300% for the period 1999-2008. On every continents the organic area has grown considerably, being Oceania/Australia the region with the largest area organically managed (IFOAM, SÖL and FiBL, 2008, 2009, 2010a).

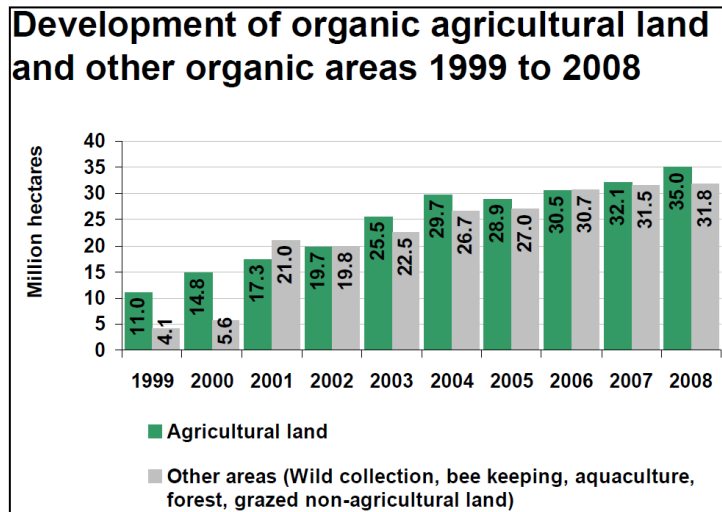


Figure 2: The organic agricultural land in the world, (adapted from FIBL & IFOAM, 2010a: 18).

Figure 3 shows organically managed agricultural land by geographical region, including in-conversion areas.

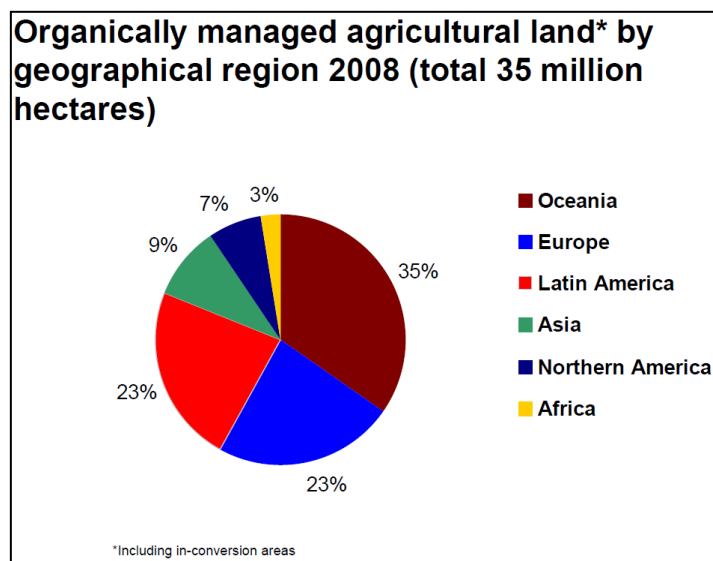


Figure 3: Organically managed agricultural land by geographical region (adapted from FIBL & IFOAM, 2010a: 15).

Recent studies of IFOAM, SÖL and FiBL (2007, 2008, 2009, 2010a) about organic agriculture in the world, contain important information of the countries with the greatest amount of organic agricultural land (Figure 4). The country with the most organic agricultural land is Australia, which has 12.02 million hectares (mha), followed by Argentina (4.01mha), China (1.85mha), United States of America (1.82mha) and Brazil (1.77mha).

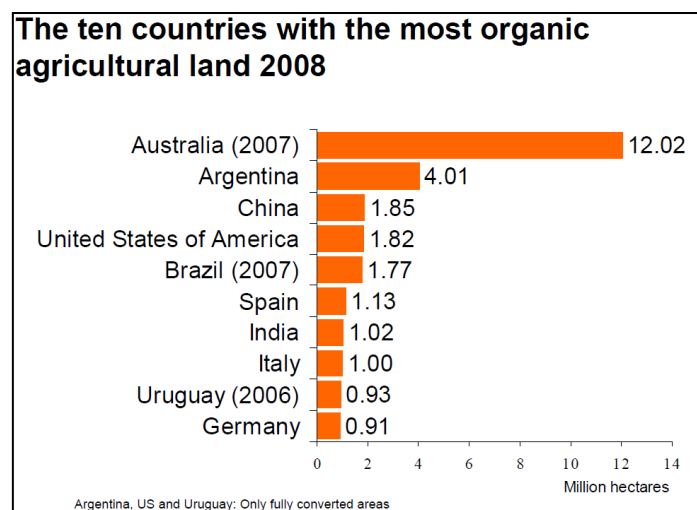


Figure 4: The ten countries with the most organic agricultural land, (adapted from FIBL & IFOAM, 2010a: 16).

The countries where has been recorded the highest growth of organic agricultural land (Figure 5) are Argentina, with total growth of 23 million hectares, followed by the Falkland Islands, with more than 400 000 hectares, Spain, China and the U.S. Peru appears in tenth place with a growth of organic agricultural land over 40 000 hectares.

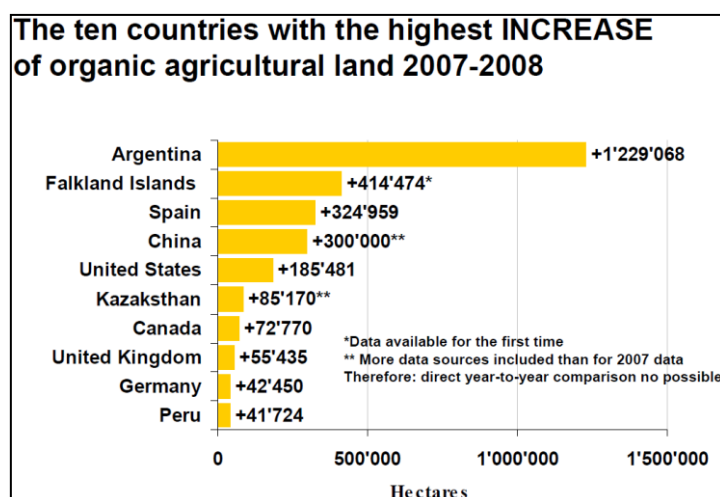


Figure 5: The ten countries with the highest increase of organic agricultural land 2007-2008, (adapted from FIBL & IFOAM, 2010a: 19).

Figure 6 shows the organic producers by geographical region, where the region with the largest number of producers is Africa (34%) followed by Asia (29%), Latin America (19%) and Europe (16%). The regions of Northern America and Oceania had the lowest number of producers (1% each), but Oceania is the region with the highest amount of area organically managed.

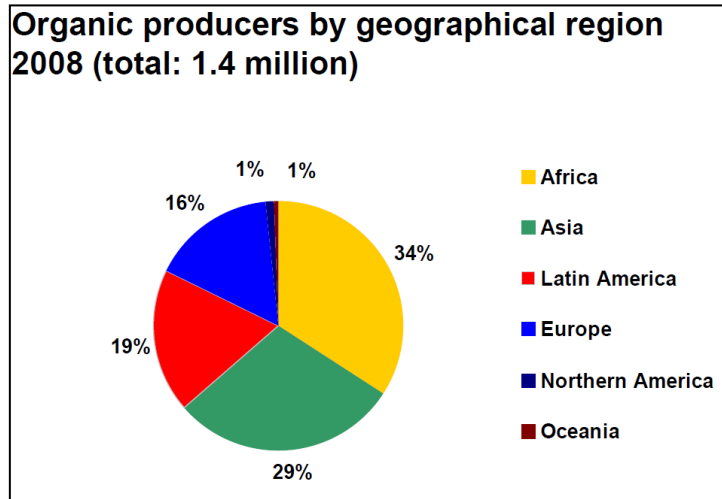


Figure 6: Organic producers by geographical region 2008, (adapted from FiBL & IFOAM, 2010a: 23).

Figure 7 presents the ten countries with the largest numbers of organic producers 2008. In the first place is India, with a total of 340 thousand producers, followed by Uganda (180 746), México (128 862), Ethiopia (101 899) and Tanzania (85 366). Peru appears in the sixth place with 46 230 farmers.

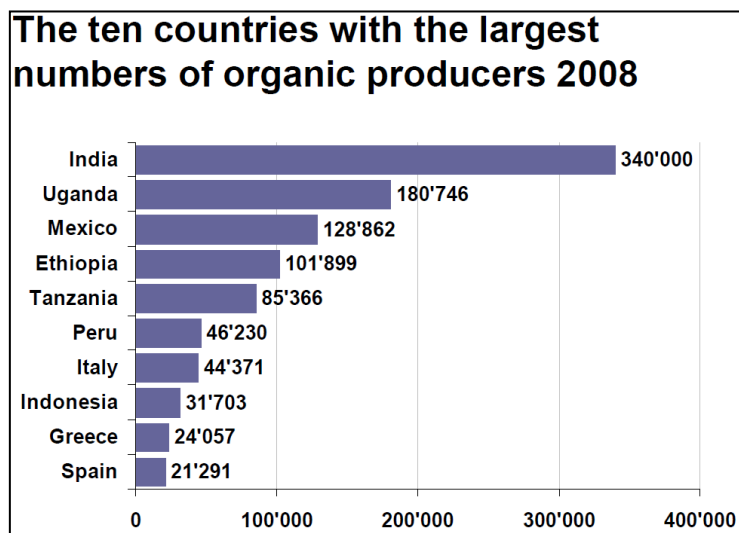


Figure 7: The ten countries with the largest numbers of organic producers 2008, (adapted from FiBL & IFOAM, 2010a: 24).

Market

Global demand for organic products is in a positive way and it is very solid. It has been estimated that total sales have grown by over five billion U. S. Dollars annually. The demand for organic products is concentrated in North America and Europe, which together represent about 97% of global income. The main producers and exporters are Australia, Latin America and Asia (FiBL & IFOAM, 2009).

According to the presentation "The Global Market for Organic Food & Drink" by Organic Monitor (2010), the organic market is led by the United States of America with U.S. \$ 50.9 billion, followed by Europe (U.S. \$ 23) and Asia (U.S. \$ 950). Total sales have grown nearly 235% since 1999.

The ten countries with the largest markets for organic food (Figure 8) are United States of America, Germany, France, United Kingdom, Italy, Canada, Switzerland, Austria, Denmark and Sweden (Organic Monitor, 2010).

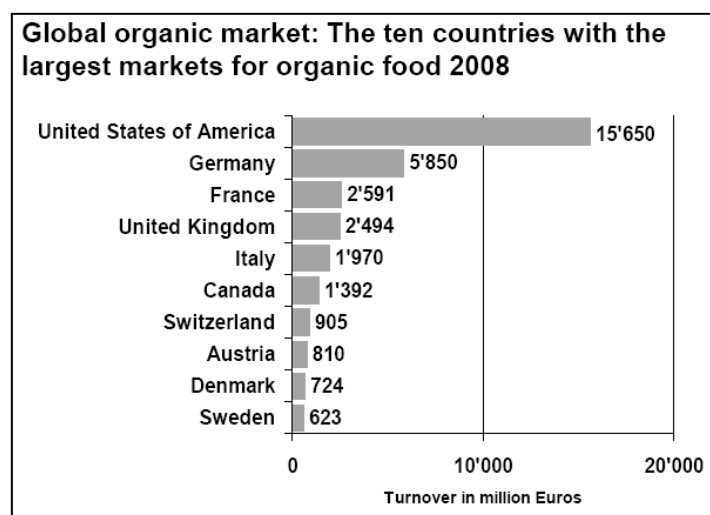


Figure 8: Global organic market 2008, (adapted from FiBL & IFOAM, 2010f: 5).

Standards and regulations

The standards and regulations for organic production are given by several institutions. The application of the rules depends on the nature of the producer and buyer countries.

In the case of European countries, in January 2009 has come into force the fully revised Regulation of Organic Production - EU Regulation (EC) 834/2007. Currently, 71 countries have implemented regulations on organic farming and 21 countries are in the process of drafting a regulation. In addition, there are more than 400 organizations that provide organic certification services worldwide. Most certification bodies are in the European

Union, United States, Japan, South Korea, China, Canada and Brazil (FiBL & IFOAM, 2009).






A working group called International Task Force on Harmonization and Equivalence in Organic Agriculture (ITF), which is formed by United Nations Conference on Trade and Development (UNCTAD), Food and Agriculture Organization (FAO) and International Federation of Organic Agriculture Movements (IFOAM), has been working from 2003 until 2008 in order to reduce technical barriers to trade in organic agricultural products that result from the lack of harmonization and interoperability of organic regulations, private standards and certification requirements (FiBL & IFOAM, 2009).

At a launch in Geneva in October 2008, two tools that were developed by the ITF were presented to the public:

- The Tool for Equivalence (EquiTool), an international guideline for Determining Equivalence of organic standards.
- The International Requirements for Organic Certification Bodies (IROCB).

Some of the principal standards for organic certification are presented in the Table 2.

Table 2: Standards for organic certification, (adapted from Biolatina, 2010).

Country/Region	Description	Symbol
European Union	Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.	
United States of America	The National Organic Program of the United States department of Agriculture (NOP-USDA).	
Canada	Canada's Organic Products Regulations (OPR) (June 30, 2009)	
Japan	Japanese Agricultural Standards (JAS)	
Switzerland	Bio Suisse Standards, Edition of 1.1.2009.	

3.2.5. Organic Agriculture in Latin America

Agriculture in Latin America is based on traditional farming, which comes from its ancient traditions that have prevailed over the years. The main ancient practices of this region is the rotation and crop selection, variety, fertility management, as well as sophisticated irrigation systems (IFOAM, SÖL & FiBL, 2008).

Generally, traditional agriculture is practiced by farmers of Indian origin, who are present in the mountain areas around the enclosed area from Mexico to Argentina. This activity involves hundreds of thousands of small farmers, who have begun to organize themselves into associations and cooperatives in order to promote their ancestral knowledge within the organic movement, using the internal control system to certify their crops (IFOAM, SÖL and FiBL, 2007, 2008).

According to data published by IFOAM, SÖL and FiBL (2007, 2008, 2009, 2010a), the main crops are handled from a home garden for food security. Many small farmers sell their fruits and vegetables in local markets, usually once a week. However, some associations are producing coffee, cocoa, bananas, sugar, among others, for export market. Organic agriculture has allowed many small producers to find a growing market for their products, thus they can improve their income.

In Latin America, more than 260 thousand of producers managed 8,1 million hectares of agricultural land organically in 2008. This constitutes 23 percent of the world's organic land. The leading countries are Argentina (4'007'027 hectares), Brazil (1'765'793 hectares) and Uruguay (930'965 hectares) (FiBL & IFOAM, 2009; Organic-world, 2010a).

Figure 9 presents the organic agriculture in Latin America. These data for 2008 show agricultural land under organic management in hectares.

Market:

Latin America has a variety of areas, products and markets. Markets have been varied from one country to another and they are directly related to the type, quality and quantity of products. The main market is export, however, local markets, such as fairs, supermarkets, specialty shops and service delivery have an important role, specially for small farmers in many countries.

The **local and regional fairs** are the most popular form of organic trade, where local markets operate on the basis of organization and creativity of farmers who sell their products in different spaces within their country. For example, in Brazil this kind of markets work through the weekly fairs called "Eco Vida", in Ecuador through the Maquita Cushunchic Foundation and in Costa Rica, the producers of vegetables using the slogan

“from my family to your family” (“*de mi familia a tu familia*”) (Organic-world, 2010c; IDMA, 2008; García, 2002).

Supermarkets in Latin America are beginning to sell organic products, implementing spaces specially designed for this type of products. This kind of marketing can be found in Uruguay, Costa Rica, Honduras, Peru, Brazil, Argentina and Nicaragua. Some supermarket chains have developed their own organic brands (IFOAM, SÖL and FiBL, 2008; GARCIA, 2002).

Another forms of marketing are the **specialized stores**, where products are sold from local organic farmers to an informed customer base about healthy food. Typically, these stores are a gathering spot of products and also serve as offices for information on local activism organic regulations.

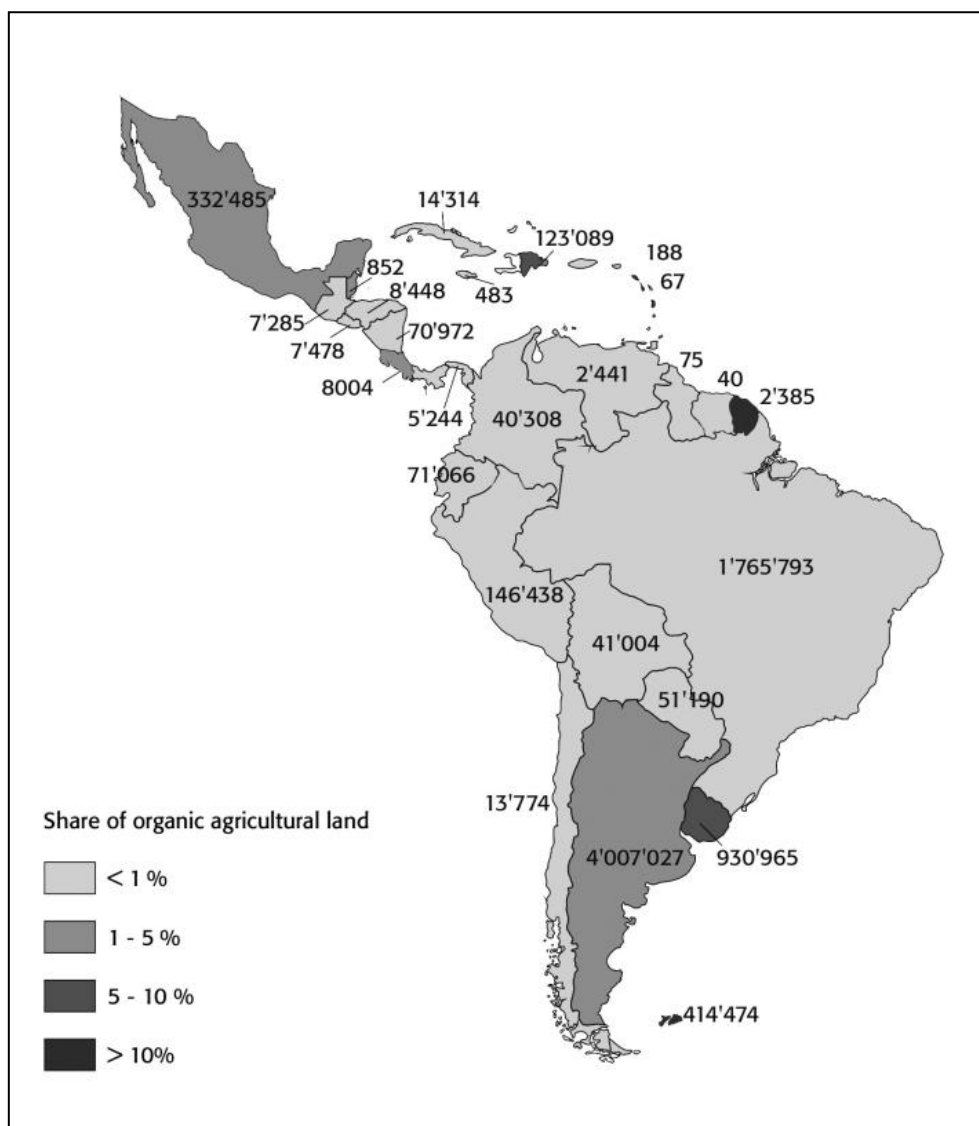


Figure 9: Organic agriculture in Latin America 2008, (adapted from Organic-world, 2010c)

In some countries, **box schemes and home delivery** service, also called “door to door” (“*de puerta en puerta*”) are important trade systems. This kind of marketing is concentrated in metropolitan areas and it usually consists of the delivery of a quantity of fruit and vegetables agreed between producer and buyer. For many associations, this kind of distribution has served to start their organization (Garcia, 2002).

Regarding to the **local selling price**, many producers in most countries sell their organic products in the same price as conventional products. Therefore, it means that consumers can choose the product that they want. Thus, it avoids speculation that an organic product is more expensive and addressed only for reach people (IFOAM, SÖL and FiBL, 2008; GARCIA, 2002).

As explained above, the majority of organic production in Latin America is destined for export markets. The main exports products are coffee, cocoa, fruit, sugar, cereals and meat. Unfortunately, the increasing trend of exports has not allowed the development of local markets. Likewise, an important point is that exporters are producers with medium and large agricultural land areas, thus they always have a great advantage over the thousands of small farmers (IFOAM, SÖL & FiBL, 2008).

Table 3 presents a list of organic products offered at higher volumes to external markets by different Latin American countries.

Table 3: *Products and countries of origin of Latin American organic products produced in larger quantities, 2000, (adapted from García, 2002: 24).*

Product	Country of origin
Sugar	Paraguay, Brazil, Ecuador and Argentina.
Cocoa	Mexico, Bolivia, Dominican Republic, Costa Rica and Panama.
Coffe	Peru, Mexico, Bolivia, Colombia, and Central American countries.
Meat: beef, lamb and chicken	Argentina: beef, lamb and chicken. Chile: beef and lamb. Uruguay: beef.
Cereals and grains	Argentina and Brazil: corn, wheat and soybeans. Paraguay: soybeans.
Fresh fruits	Argentina: apples, pears and citrus. Brazil: apples and grapes. Chile: kiwi, raspberries and strawberries. Colombia, Ecuador, Mexico, Central American countries and Dominican Republic: bananas, pineapples, mangoes and other tropical fruits. Mexico: mango, apples, avocados and bananas.
Processed products	Argentina: olive oil, pureed pears, grape juice concentrate and apple, raisins and wine.
Vegetables	Argentina, Brazil, Chile and Mexico. Central American countries: fresh and dry vegetables.

Standards and regulations

In Latin America there are over fifteen countries that have legislation on organic agriculture. Beside, Costa Rica and Argentina have both attained third country status according to the EU regulation on organic farming (FiBL & IFOAM, 2009).

Some countries, especially in highland areas, small farmers are developing participatory certification systems, which is based on establishing a direct relationship between consumer and producer, as well as support institutions, with active community participation (IDMA, 2009; IFOAM, 2007).

3.2.6. Organic Agriculture in Peru

Organic agriculture in Peru is based and enriched with traditional farming knowledge. Most organic farmers have less than three hectares of land, however, organized they have come to market their products in the internal market and on export (Alvarado, 2004).

In 2008, Peru has registered 146 438 hectares with organic certification, which places Peru as the sixth-largest producer in Latin America. However, with more than 50 000 farmers, most of them small and indigenous people, Peru is the country with the largest number of producers in Latin America, who are divided into 16 regions (Alvarado, 2004; IFOAM, SÖL and FiBL, 2008).

Since the past three decades there have been several activities of promoting, training, technical assistance and certification of organic production in Peru, which have led by organizations such as Network of Ecological Agriculture of Peru (RAE: Red de Agricultura Ecológica del Perú), Action Network for Alternative Agriculture (RAAA: Red de Acción en Agricultura Alternativa), National Association of Ecological Producers of Peru (ANPEP), Organic Coffee Committee of the National Coffee Board, and five organic certification companies that work regularly. In spite of the difficulties encountered, joint work of these institutions is an important positive aspect for organic farming development in Peru (Alvarado, 2004).

In addition to the certified land areas, there are a significant number of producers in transition (in-conversion) to organic farming, which can increase the offer and diversity of organic products in the short term (Perú Orgánico, 2007).

Market

The most important market for Peruvian organic products is the export. However, in many cities there are several marketing initiatives, whether through weekly fairs, regional fairs, supermarkets, home delivery, among others. The main products sold in the domestic market are vegetables, fruits, grains and legumes, tubers, among others (IFOAM, SÖL and FiBL, 2008).

Thanks to the efforts of organizations and institutions such as the Agro-Ecological Network (RAE), the Institute for Environment and Development (IDMA), the Association of Ecological Producers of Peru (ANPEP), it has been developed many local markets where more than 400 varieties of products are sold weekly in many cities of Peru, taking advantage of local traditional trade with indigenous communities (FiBL & IFOAM, 2009; IDMA, 2008).

The most important products organically certified are coffee, cocoa, sugarcane, cotton fiber and textile clothes, vegetables and fresh fruits such as mango, banana, grapes and papaya, native and exotic fruits, Andean tubers and grains such as *quinoa*, amaranth, *yacon* and *maca*, sesame seeds, olives and olive oil, palm, lemon, tomato and tomato paste, Brazil nuts, honey, essential oils, a wide range of natural dyes and herbs for different medicinal uses (IFOAM, et al.; 2007, 2008).

The Peruvian organic products of greatest export quantity (see Figure 10) are coffee (58,68%), banana (21,42%) and cocoa (9,56%), followed by cotton (3,9%) and mango (1,38%). The principal buyer countries/regions are United States of America and Europe (IFOAM, SÖL and FiBL, 2008; IDMA, 2008d).

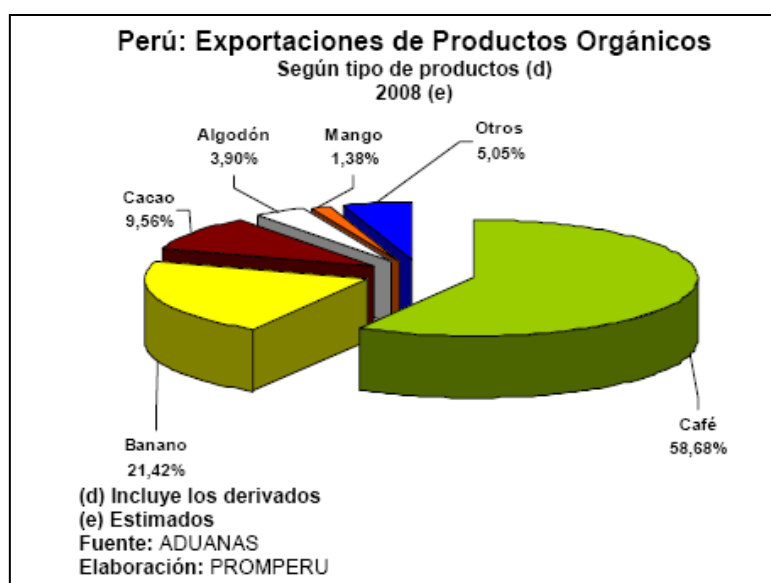


Figure 10: Export of Peruvian organic products, (adapted from IDMA, 2008d: 9)

On the other hand, it is important to note that the production and export of organic products has grown significantly during 2008 (see Figure 11), maintaining an ever-growing trend in the last ten years. According to the National Service of Agricultural Health (SENASA), there are 46 000 small and medium producers who export almost 88% of its production, but they do not appear in official figures. Similarly, thousands of small organic farmers producing for local markets (ecological fairs, Eco-fairs, Bio-fairs) could represent a larger number and it is believed that sales of these small producers exceed one million dollars annually (IDMA, 2008d).

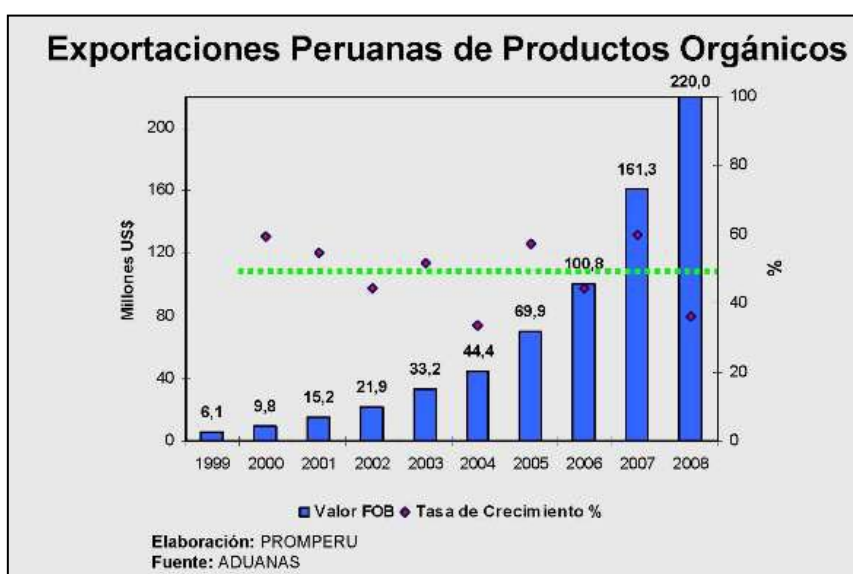


Figure 11: Peruvian export of organic products 1999-2008, (adapted from IDMA, 2008d: 9)

Standards and regulations

The institutional body responsible for regulating organic production in Peru is the National Commission of Organic Products (CONAPO). The CONAPO is an institution involving governmental entities, NGOs, universities and researchers who have been working since 1998. Finally, in September 2002, after a very long process of consensus, Technical Regulation for Organic Products was published (IFOAM, SÖL and FiBL, 2008). This regulation aims to (CONAPO, 2002: 3):

- *"Establish guidelines to guide and encourage the production, processing, labelling, certification and commercialization of products, food and non food, grown, raised and processed organically."*
- *"Ensure consumers that the products known as organic products, comply with the provision of this technical regulation Technical Regulation."*
- *"Ensure the adequacy and transparency of all actors in the process of organic certification."*
- *"To promote and ensure fair and transparent trade of organic products."*

Institutions working in the field of organic farming have organized in a consortium of NGOs, which include the Network of Organic Agriculture (RAE), Centro IDEAS and the Organic Producers Association of Peru (ANPEP). One of the important activities of the consortium is the Capacity Strengthening Program. The NGOs consortium has also begun the implementation of a participatory certification called “*Sistema de Garantía Participativo-SGP*”(Participatory Guarantee System), in order to build trust and credibility between producers and consumers in local marketing areas (IFOAM, SÖL and FiBL, 2008; IDMA, 2008; SGP-PERU, 2010).

In 1994, four NGOs (Diakonía; Centro de Investigación, Educación y Desarrollo-CIED; Coordinadora Rural and Centro IDEAS) formed the first national certification body called "Inka Cert". Subsequently, in 1998, Inkacert along with three other Latin American companies (Bio Muisca from Colombia, Bio Pacha from Bolivia, CENIPAE from Nicaragua) formed a coordination called *Bio Latina*. Through Bio Latina has been achieved massif certification, and the most important point has been the reduction in costs, being even five times lower than some international certification bodies (IFOAM, SÖL and FiBL, 2008; Alvarado, 2004; Cabrera, n.d.).

According to information published by IFOAM, SÖL and FiBL (2008), Bio Latina has been accepted by the European Union. In addition to Bio Latina, the certification bodies SKAL, IMO and SGS Peru have offices in Lima.

3.3. The role of the rural agribusiness in the environmental conservation

Most rural agro-industry activities have been developed under organic farming principles, which involve developing sustainable production systems that incorporate ecological, technical, socioeconomic and cultural dimensions along the productive chain (Chávez, 2003; Riveros, 2007).

The rural agro-industry optimizes the use of local resources, promotes the agroecology, thus helping environmental conservation. The main activities related to environmental conservation are: soil conservation, efficient water use, biological pest control and use of organic fertilizers. In fact, the agroecology also avoids the use of synthetic chemical products, which are considered environmentally hazardous (Chávez, 2003; Riveros, 2007; CAC, 1989).

Several studies (Giaccio, 2008; Torres, 2007; Naranjo & Dullo, 2007; IDMA, 2007; Benavides et al, 2005; Chavez et al, 2003; Boucher, 1989) argue that peasant economies perform their agricultural activities based on traditional knowledge in a context of respect to environment, according to agroecological principles. Rural agriculture is the foundation of rural agribusiness, and consequently, under the same agroecological principles contributes to the maintenance and conservation of the environment.

Therefore, rural agro-industry is closely linked to agroecological practices (Chávez, 2003), for this reason it contributes significantly to the conservation of the environment from a holistic context, which means that economic and social variables are also included (Smilevski, 2008).

3.3.1. Rural agribusiness and sustainability

Taking the concepts explained by Naranjo & Dullo (2007) about sustainability, rural agribusiness is sustainable because it has environmental, social and economical viability. The proceedings of products transformation take into account the environmental balance. Small producers are part of a process of collective social action and generate income from the sale of products.

The agribusiness is an important aspect of rural development. Processed products help food security, generate employment and income for rural families, increase production and productivity of the field, caring environment and propitiate a space for fellowship and social dynamics in a local scale (Altieri & Nicholls, 2000; IDMA, 2008; Naranjo & Dull, 2007).

Rural agribusiness is an activity that involves millions of people around the world. It is believed that about 2000 million farmers are small producers who use traditional methods to grow in heterogeneous environments, mainly subsistent (Naranjo & Dullo, 2007).

In Latin America there are more than five million business units that meet the characteristics of rural agribusiness and about 15 million people are linked to this activity, constituting an element of income generation for vulnerable families in the countryside. Rural agribusiness reflects the diversity of rural and peasant economies generating development (IICA, 2009).

In Peru, the mountain region has a population over 8 million people, which represents 31.8% of the national population. Currently, according to figures from the Ministry of Agriculture, NGOs and certification companies, there are more than 35 000 farmers agroecologically certificated. Those farmers work in more than 100 000 hectares, and another larger group is in a period of transition (INEI, 2007; Chavez et al, 2003).

Small farmers live in marginal and dangerous lands in arid and vulnerable mountain areas. They often have lack access to sufficient or adequate agricultural land, credit and other resources as well as agricultural and rural services. Most of the farmers have less than one hectare of sown area (Naranjo & Dull, 2007; IDMA, 2007).

A rural agribusiness production based in agroecological principles integrates the traditional with the current knowledge. The techniques and possibilities are adapted to local ecological and socioeconomic conditions. In this manner, from the traditional family units and with a participatory and critical perspective, it projects to sustainable rural development (Martinez, 2000).

3.3.2. Rural agribusiness and food security

According to FAO (2000), food agribusiness and food safety are systemic elements. Food security is achieved when all people at all times have physical and economic access to sufficient food, safe and nutritious, to meet their nutritional needs. Rural agribusiness, properly managed, can provide safe, adequate and good quality food for the rural population.

In many production units, rural agribusiness is a means of subsistent because of their delicate situation of food insecurity and poverty¹. The rural population are faced with low food availability and therefore their activities are directed to prioritize the obtaining of food for the family, using craft techniques or some appropriate technologies.

¹ Human Development Index of the Latin America and the Caribbean countries is below average. The annual income per household is very low and more than 15% of the population lives on less than the equivalent of one U.S. dollar per day (UNDP, 2002). In Peru, the average poverty rate is 34%, but in some departments this figure exceeds 70% (INEI, 2010).

In developing countries, food security is linked to agricultural production, where rural agribusiness plays a fundamental role in agri-food systems because it promotes the proper use of local resources to provide innocuous food, safe and good quality, contributing positively to food security and improving income of small farmers (UNDP, 2002; FAO, 2000).

The relationship between food security and rural agribusiness depends on the scale. This means there will be a greater effect on food security if the agribusiness units (or companies) are closely linked to primary production, processing and product processing.

The rural agro-industrial units operate within the family unit and in a specific community with active participation of men and women, and therefore, the benefits are extended to these marginal populations, providing important elements for the basic family basket helping to improve food and nutritional security of rural families (FAO, 2004).

3.3.3. Rural agribusiness and biodiversity

Rural agriculture, base of rural agribusiness, is developed to preserve biodiversity. In contrast to intensive agriculture, which produces several negative environmental impacts, agriculture in rural areas has been developed on a scale that preserves the genetic diversity of crops in agricultural systems (Castellanos, 2003; Naranjo & Dull, 2007).

Nicholls & Altieri (2000) argue that optimal production system depends on the level of interactions between its components. This means that throughout the production process, products of a component can be used in the production of another component.

However, biodiversity can also subsidize the operations of the agroecosystem through ecological services such as recycling, biological pest control and water and soil conservation. In the case of rural agribusiness, intermediate products or by-products can be used as food supplements for certain animals or as crop fertilizer (IDMA, 2007; Altieri & Nicholls, 2000).

The International Federation of Organic Agriculture Movements (IFOAM, 2002) argues that there is a positive relationship between organic production and biodiversity conservation, where organic farmers and organizations play an important role. In this context, rural organic agribusiness also contributes positively to biodiversity. However, these contributions are not sufficient for the protection of threatened or endangered species.

Agroecological practices such as crop rotation, integrated pest management and cultural practices, help the conservation and maintenance of vegetal and animal species, even though in adverse weather conditions and water shortage in many Andean areas.

Rural agribusiness integrates ecological phenomena that occur in a crop field or breeding area. RAI not only seeks to maximize production, but also optimize the agroecosystem in general, for people, animals and plants coexist properly (Altieri & Nicholls, 2000; IDMA, 2008).

The RAI criticizes conventional approaches and promotes biodiversity. RAI prohibits the use of chemicals throughout the production process, which could contaminate the environment, there is no large machinery or mechanized systems that attempt to flora and fauna, and it is opposed to monocultures (Altieri & Nicholls, 2000; Martinez, 2000).

3.3.4. Agribusiness and climate change

Rural agribusiness, as it has been mentioned before, is based on agricultural production of small producers, most of whom perform it under agroecological practices. In recent years traditional knowledge has been used to address emerging issues of climate change, such as efficient water use, soil conservation, among others (IDMA, 2007; FAO, 2009).

However, governmental and institutional actions in rural areas are inadequate. Unfortunately several ecosystems that serve as means of life for many varieties of native plants and animal are being increasingly threatened by the effects of a commercial culture, such as conventional agriculture, land use changes, population growth and climate change impacts (FAO, 2009).

Activities related to rural agro-industry, directly or indirectly, promote the sustainable management of agroecosystems and climate change mitigation. Many communities have been initiated innovative processes, for example, forest conservation and reforestation, which could increase the capture of CO², risk and disaster prevention, implementation of appropriate technologies, among others (FAO, 2009; MINAM, 2009).

According to Ministry of Environment, Peru is one of the ten most biodiverse countries in the world with life-generating sources of life that create water balance of the world and deserves to recognize the value of their ecosystems. This feature has been regarded as crucial by the World Bank as part of the analysis of climate change impacts in the region and the decisions to prevent its effects (MINAM, 2009).

Climate change is already impacting in Peru, especially in the highlands areas, where during the last 35 years it is believed that Peru's glaciers have been reduced by 22%, and in the next 20 years the glaciers of the Andean mountains could be disappearing if adequate measures for its prevention are not taken (MINAM, 2009).

A study done by International Federation of Agriculture Organic Movements (IFOAM, 2004) discusses the great potential of organic agriculture as an instrument to prevent and capture greenhouse gases emissions. IFOAM's study clearly describes the differences

between organic and conventional agriculture. Likewise, it suggests how organic farming can be considered within the implementation mechanisms of the Kyoto Protocol.

Organic agriculture has the capacity to contribute to mitigating climate change through sustainable use of land, which in turn can improve production and productivity of crops, provide food security, conserving biodiversity and maintaining social dynamics of belonging (IDMA, 2007; IFOAM, 2004).

Both organic agriculture and rural agribusiness use traditional knowledge and wide range of integrated technologies. It is important to recognize the potential of organic agriculture and rural agribusiness to reduce greenhouse gases. The decision makers and policy makers should design and develop programs suited to each particular area and not the general and often inapplicable to small-scale (IFOAM, 2004).

Agricultural activities in general are responsible for more than 30% of emissions of greenhouse gases emissions, but global and local policies not taken significant action to mitigate their effects yet, and by contrast it seems to be still increasing global warming (IFOAM, 2004).

3.4. The study area

3.4.1. General information about Lurin River Basin

The Lurin River Basin is located in central Peru in the department of Lima, extending from the western slopes and glaciers in the Andes to the Pacific Ocean on the coast. This basin across ten districts in the provinces of Lima and Huarochiri and has a land area of 1.720 km² between 0 and 5,000 meters above sea level (m.a.s.) (IDMA, 2006; Allende, 2003). Table 4 describes some data from the districts of Lurin River Basin.

Table 4: Districts of the Lurin River Basin (adapted from IDMA, 2006).

Zone	District	Area (Km ²)	Population (inhabitants)	Density (inhabitants per Km ²)	Basin percentage (%)
Low part: province of Lima	Lurín	180,26	34268	190,10	10,8
	Pachacámac	160,23	19851	123,88	9,6
	Cieneguilla	240,33	8993	37,42	14,4
	Antioquía	387,48	1469	3,79	23,2
Middle and high part: province of Huarochiri	Langa	80,99	1378	17,01	4,8
	Lahuaytambo	81,88	1095	13,37	4,9
	San Damián	343,22	1990	5,80	20,5
	San Andrés de Tupicocha	83,35	1543	18,51	5,0
	Santiago de Tuna	54,25	498	9,18	3,2
	San José de los Chorrillos	60,02	423	7,05	3,6
	Total	1672,01	71,508		100

A study done by Allende (2003) details that the Lurin River Basin is located on the western flank of the Andes mountain, exactly between the geographic coordinates 76°56' and 76°11' west longitude, and 11°15' and 12°18' south latitude. Figure 12 shows the location of the Lurin River Basin in Peru.

The geography of the Lurin River Basin has steep slopes in the middle and high part, with a steep and rugged physiography, cut by deep gorges. The lower part presents a drawdown in the hills, with sharp decrease of the slopes leading to a uniform and a little rugged valley (IDMA, 2006; Vega, 2008; Allende, 2003).

The climate of the Lurin River Basin is arid and semi-warm. The maximum and minimum temperatures recorded were in a range from 27,4°C – 28,8°C in the January-March period, and 13,0°C - 14,7°C in the July-September period respectively (IDMA, 2006; Allende, 2003).

The Institute for Environment and Development (2006) divides the Lurin River Basin into two zones: a valley area and a mountainous area. The valley area is located between 0 and 800 m.a.s., comprises three districts in the lower part and extends until the coastline. The mountainous area located between 800 and 5000 m.a.s. is an extensive area covering seven districts, which are located in the middle and high parts of the basin.



Figure 12: Lurin River Basin, (adapted from AAM, 2007).

The total population is over seventy thousand inhabitants, with an average density of 4,3 inhabitants per hectare. The farmers' age range is between 14 and 55 years. The average number of members per family is 5 and over 50% of the population are parents with 3 children on average (INEI, 2010; IDMA, 2007).

The economy of the population is dependent from agricultural activities. In the agriculture, the cultivation of fruits and vegetables, cereals and legumes are the principal products. In livestock, most farmers are engaged in raising small animals (IDMA, 2007; Vega, 2008).

A baseline study prepared by the Institute for Development and Environment-IDMA (2007a), describes the basic services of the population differ from one area to another,

where the lower districts have greater access to services such as portable water, sewerage and electricity; whereas, in the districts of the middle and high part, over 60% of the population does not have access to portable water or sewage.

There are two ways to access to the Lurin River Basin, one for the Lurin district in the south of Lima and the other by Cieneguilla district in the southeast of Lima. Only the tracks located on the low part (coast), which represent less than 30% of the total, are asphalted and the remaining part is a rural in regular condition. Regarding to telephony services, the population does not have home phone installation, usually every district has one community center or public telephone (rural telephony).

3.4.2. Environmental characteristics

3.4.2.1. Climate

According to the *National Service of Meteorology and Hydrology* of Peru (SENAMHI, 2005), the climate of the Lurin River Basin is characterized by a climate that varies from warm to cold, high humidity and constant cloud cover during the winter. Depending on the season and the area of the basin, the tropical weather can be dry or desert.

The climate of the Lurin River Basin is variable because of the basin presents significant differences in its geography along the route of the main River. The heterogeneity in the relief and changes in rainfall amounts depending on the area generate different microclimates (SENAMHI, 2005; Allende, 2003).

In the bottom of the Lurin River Basin the climate is subtropical-desertic and warm-tempered with low rainfall throughout the year without extreme warm or cold. In the middle and high part of the basin climate is cold tropical, dry in winter, with abundant rains during the summer and low in winter and autumn periods (Allende, 2003).

The climate of the mountains is "opposite-season" with that of the coast. If it is summer on the coast in the mountains it is winter and vice versa. Furthermore, in the middle and high part of the basin the temperature ranges between day and night is more pronounced (SENAMHI, 2005).

According to the investigation done by Allende (2003), the climate of the Lurin River Basin is under stable conditions. The wind is damp, associated with sea temperature and cloudiness in the morning. The weather can change with considerable natural phenomena such as "El Niño". Table 4 describes the climatic characteristics of the Lurin River Basin.

Table 4: Climatic features in the Lurin River Basin, (adapted from SENAMHI, 2010; IDMA, 2008 and Allende, 2003).

Zone of the basin	Rainfall (mm/year)	Minimum temperature (°C)	Maximum temperature (°C)
Low part	20,0 - 28,43	13,0 - 14,7	27,4 – 30,0
High part	80 - 450	-2,2 – 10,5	15,0 - 25,0

Rainfall varies greatly between the periods of rain and dry periods. Figure 13, Figure 14 and Figure 15 show the spatial distribution of the annual accumulated rainfall for the period 2007-08. The darkest area corresponds to the greatest amount of precipitation.

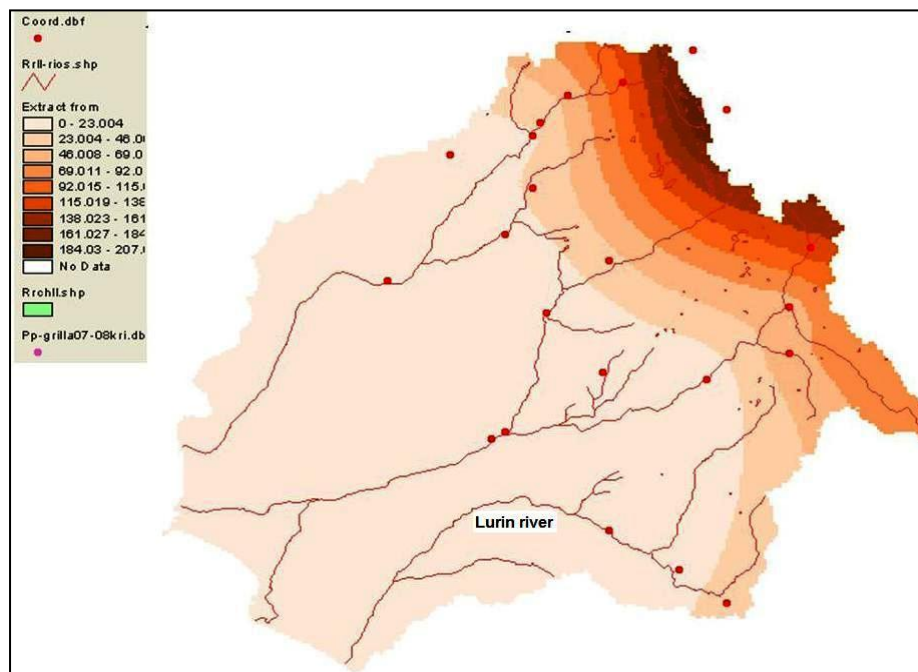


Figure 13: Spatial distribution of accumulated rainfall (mm) for September-November period, hydrologic year 2007-08, (adapted from Arboleda, 2008: 2).

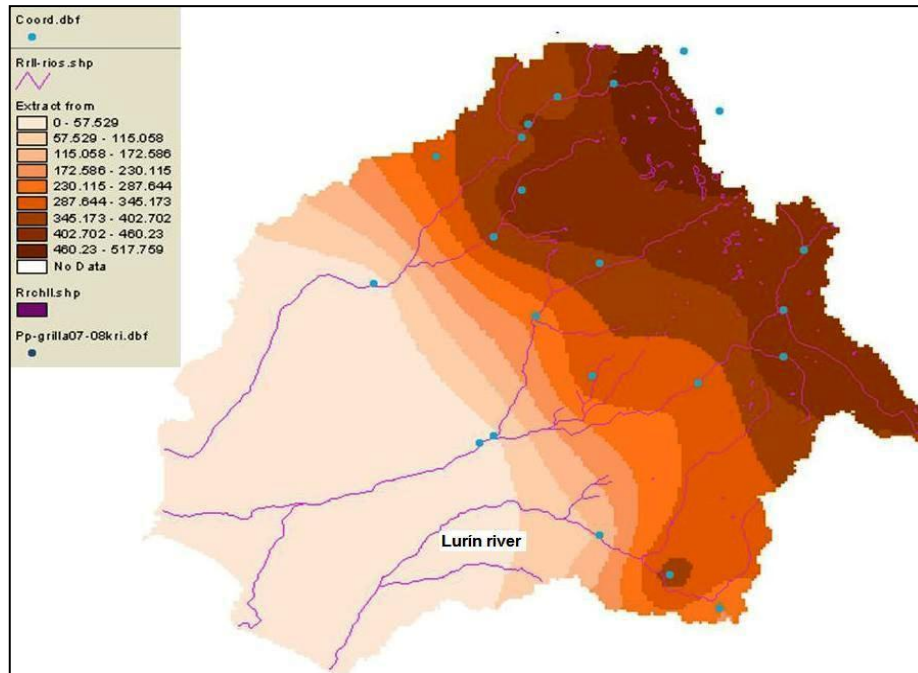


Figure 14: Spatial distribution of accumulated rainfall (mm) for December-March period, hydrologic year 2007-08, (adapted from Ibid: 3).

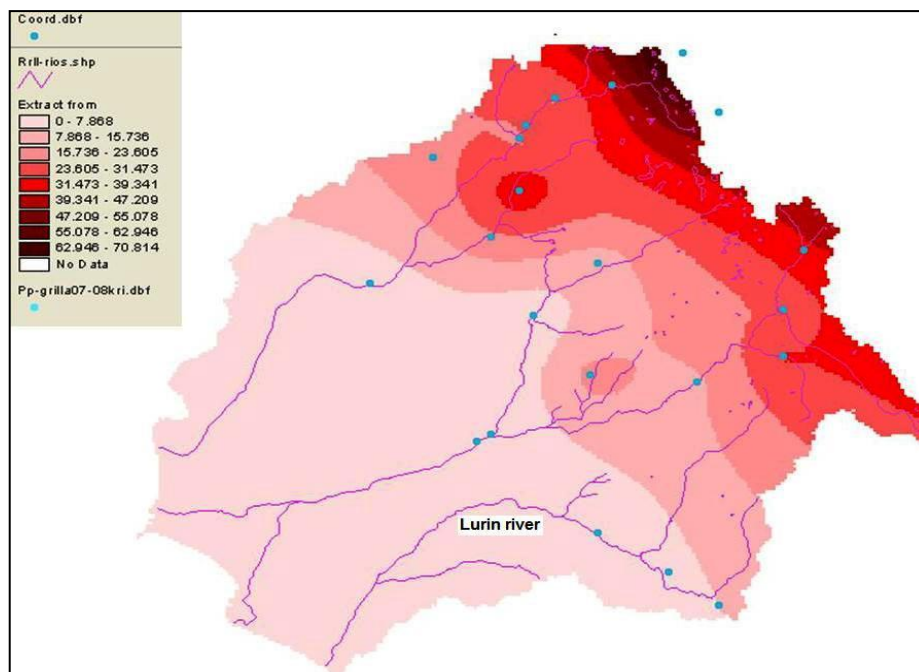


Figure 15: Spatial distribution of accumulated rainfall (mm) for April-August period, hydrologic year 2007-08, (adapted from Ibid).

3.4.2.2. Hydrography

The Lurin River Basin belongs to the Pacific Hydrographic System, extending from sea level until mountains over 5000 m.a.s. The natural lakes and snow capped mountains of the Occidental Andean Mountains give rise to the formation of the Lurin River, which is the main water collector in the basin (SENAMHI, 2005; Allende, 2003).

Lurin River has a length of 108.57 km, and in its course receives input from numerous small rivers and streams. The slope of the River decreases as it approaches its estuary by the sea. At the high part of the River the slope is 6.8%, in the middle 3.2% and the bottom 1.8% (Allende, 2003).

Data reported by SENAMHI (2008) indicate that the Lurin River flow for hydrologic year 2007-08, in the wettest period (March) had a maximum flow of 8.0 m³/s, in the driest period (August) the flow recorded was 0.4 m³/s.

Figure 16 shows the behaviour of the Lurin River compared to its historical average. In the wet season it discharges 70% of the total annual precipitation.

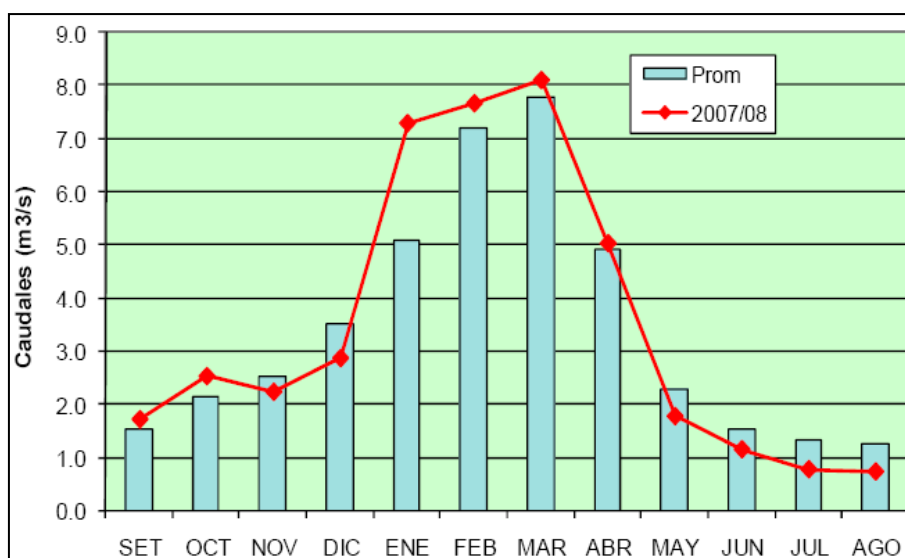


Figure 16: Flow hydrograph of the Lurin River for hydrologic year 2007-08, (adapted from Arboleda, 2008: 7).

3.4.2.3. Geology, relief, soils and erosion

The Lurin River Basin is located between two large morph structural areas called coastal pampas and Andean mountains. Its geomorphology is the result of tectonic, plutonic and geodynamic processes. Along the basin there are natural igneous rocks, sedimentary and unconsolidated deposits, which range in age from Cretaceous to Quaternary Holocene (Allende, 2003).

According to the geological map of the Lurin River Basin, the basin is composed of high volcanic rocks, which presents a greater susceptibility to erosion (Felipe-Morales. 2008).

Allende (2003) largely explains the geology of the Lurin Basin, where he mentions that the tectonic features of the rocks that appear in the bottom and middle part of the basin has been deformed forming folds and geological faults.

The main geological processes are landslides, mudslides and floods caused by heavy and continuous rainfall in the middle and high part of the basin. Landslides affect farmland, the roads and populations settled in the riverbanks and streams (Allende, 2003).

The physiography and topography of the Lurin Basin is varied. The topography of the middle and high part are characterized by the presence of hills and high mountains resulting in a rugged relief. The topography is uniform in the lower part and very rough at the top, where the land is more difficult to handle.

Throughout the Lurin River Basin the predominant soil are clay-loam and sandy-loam type. The middle and high part of the basin present obvious natural and artificial erosion processes. Natural erosion is due to the rains and landslides, and erosion is due to artificial agricultural and industrial activities.

3.4.2.4. Biodiversity

The mega diversity of Peru, propitiated by the characteristics of its three main geographical regions (coast, sierra/mountain and jungle) and its eight natural regions, is considered biodiversity center for the world (Ríos, 2010; Allende, 2003). Table 5 and Figure 17 present the features of the *Eight Natural Regions of Peru*.

Peru has 84 of the 104 known microclimates, which are distributed in the eight natural regions ranging from the coast, passing through the mountains and end in the Amazon jungle. The different altitudes and climates create exceptional conditions for the development of agriculture (Ríos 2010).

Since ancient times agriculture has been one of the most important activities, with a traditional basis for selection and care of plant and animal species, which has allowed meet the needs of the national and global population with important foods such as potatoes and corn, among others (Allende, 2003; AGRECOL, 2009).

Lurin River Basin has six of the eight natural regions distributed between the coast and the mountains. The coastal zone consists of a thin strip with numerous valleys with suitable conditions for growing fruits and vegetables. The mountain region includes numerous Andean valleys and mountain plateaus where cultivation of cereals and tubers are predominant, as a result of an ancient and splendid biodiversity (Allende, 2003).

Table 5: Features of the Eight Natural Regions of Peru, (adapted from Rojas, 2009).

Nº	Natural region	Altitude (meters above sea level)
1	<i>Coast or Chala</i>	0 - 500
2	<i>Yunga</i>	500 – 2300
3	<i>Quechua</i>	2300 -3500
4	<i>Suni or Jalca</i>	3500 – 4000
5	<i>Puna</i>	4000 – 4800
6	<i>Janca or Cordillera</i>	4800 – 6768
7	<i>High Jungle or Rupa Rupa</i>	400 – 1000
8	<i>Low jungle or Omagua</i>	83 - 400

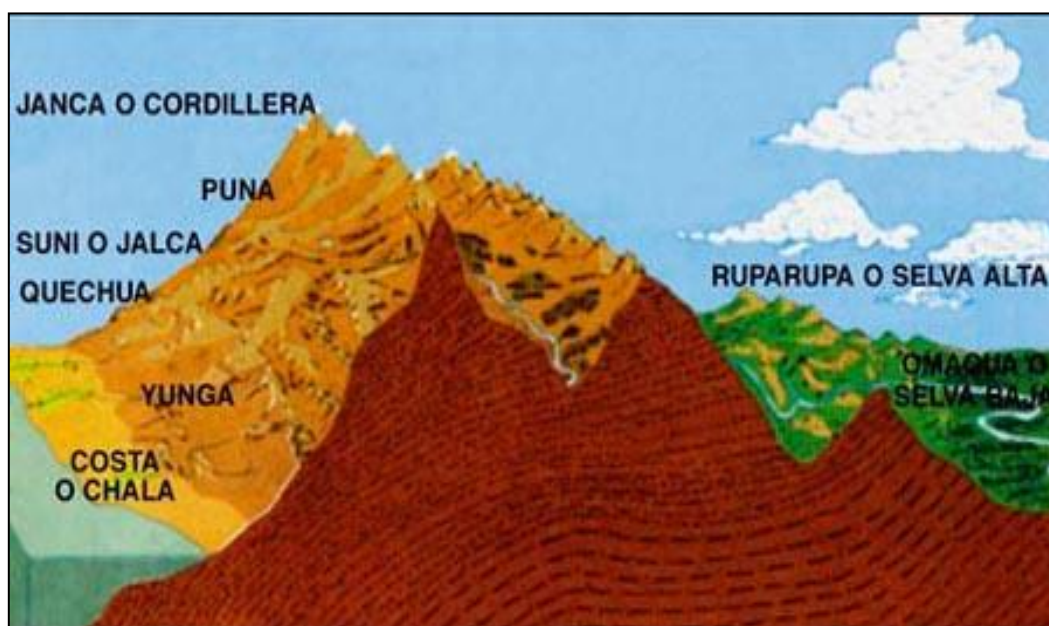


Figure 17: The Eight Natural Regions of Peru, (adapted from Rojas, 2009).

The microclimates and ecological zones of the Lurin River Basin make it a privileged position in terms of bio-availability of species. The great variety of ecological zones facilitates the cultivation of a high range of agricultural products, many of them native or wild, which throughout the year allow staggered harvests (IDMA, 2008; Allende, 2003).

The biodiversity of the Lurin Basin is almost used exclusively based on the extraction and has not worked in the area of agribusiness yet. Allende (2003), points out that there is no research in this area, for example, regarding to ecological studies, taxonomy, physiology, pests and diseases, with which it could better exploit the comparative advantages of the basin.

In most areas of the Lurin River Basin, farm products are marketed fresh or simple packaging treatment (IDMA, 2008).

Regarding the flora and fauna, according to the classification used by the IDMA (2006), Lurin River Basin presents different ecological floors divided into six life areas² with various species of flora and fauna, and natural landscapes.

The flora and fauna varies depending on the area of the basin. At the lower part predominates agriculture and small livestock. In the middle part, the agriculture is based on the cultivation of fruit and vegetables and raising small animals. At the top, agriculture is oriented to the cultivation of cereals, root crops and raising animals like cattle, sheep and goats.

3.4.3. Rural agribusiness in the Lurin River Basin

Rural agribusiness in the Lurin River Basin is in an early stage of development. The first experiences have been emerged in the earlier nineties, due to decreased agricultural production, low selling prices and high losses to the products of low quality (Díaz, 2002; Benavides et al, 1996).

The protagonists of promoting rural agribusiness have been the same farmers, who were mainly supported by different NGOs, began to process its raw materials and give added value. The first products processed were jams and nectars, produced using fruits with some marketing difficulties. This initial stage of processing was performed using artisanal methods (Díaz, 2002).

² Life areas: 1) Sub-tropical desert 2) Sub-tropical desert scrub 3) Lower montane steppe thorny 4) Montane steppe 5) Sub alpine very humid paramo 6) Alpine rain tundra.

3.4.4. Importance of rural agribusiness in the Lurin River Basin

The RAI is presented as an important alternative for farmers' income generation in the Lurin River Basin. Each area of the basin has potential for agribusiness products, but there are difficulties from the management of crops, processing facilities, organization and marketing.

The work of NGOs has been approached to provide training, technical assistance, implementation of processing modules and the search for markets. Notably, most of rural agro-industry initiatives are under training, meaning it is a slow process and requires cooperation and participation of all stakeholders. Some districts have made significant progress; however, in others there is a stalemate.

According to the national panorama, rural agribusiness in the Lurin River Basin is important because it involves many people. Agriculture is the most important economic activity for all inhabitants of the Lurin River Basin and rural agribusiness has begun to improve income and better quality of life for some populations.

3.4.5. Agribusiness production in the Lurin River Basin

The agro-industrial production of the Lurin River Basin is wide because of the heterogeneity in agricultural production. The districts of the lower part are characterized by the cultivation of fruits and vegetables and some animals. The districts of the middle and high part have greater amounts of fruit crops, vegetables, cereals and legumes, as well as small livestock and cows. The products of both areas have conditions to be processed. Appendix 3 describes the agricultural production in the Lurin River Basin.

Currently there are few agro-processing plants, and some are being implemented in most districts where villagers make their products through artisanal practices. Also, the quantity, quality and variety of products vary between districts, depending on the type of agricultural production and use of technology. Table 6 describes the implementation of rural agro-industry projects in the Lurin River Basin.

Processed products, which initially were for subsistence, have begun to be marketed locally and regionally. To entry in some markets is necessary to comply with various requirements and certifications, in some districts farmers have already begun this process of implementation to expand and improve sales.

As shown in Table 6, all districts are conducting some type of processing, however in most of them the process is artisanal and do not have the complete equipment for obtaining a uniform good quality product.

In each districts of the basin, an important point has been the participation of farmers. Initially, all agribusiness projects have been implemented by NGOs and now some governmental programs are beginning to participate more actively, with part of either financial or by other inputs (technical assistance, land transport, etc.).

Table 6: Implementation of rural agro-industry projects in the districts of the Lurin River Basin, (adapted from IDMA, 2006; CIED; 2000; FONCODES, 2006).

District	Process line	Products	Notes
Lurín	Fruits and vegetables	Vegetables minimally processed, pickles, Jams.	Artisanal processing.
Pachacámac	Fruits and vegetables	Vegetables minimally processed, pickles, Jams.	Artisanal processing.
Cieneguilla	Fruits, vegetables and others	Jams, aromatic herbs, pastry.	Artisanal processing.
Antioquía	Fruits	Jam, vinegar, nectar.	Semi-industrial processing. There is a small plant with basic equipment.
Langa	Grains	Grains dehydrated and packaged flour.	There is only a solar drying module.
Lahuaytambo	Grains	Grains dehydrated and packaged flour.	There is only a grain mil (for cereals). For honey, the same producer is responsible of the process.
San Damián	Milk and dairy products	Dairy products: pasteurized cheese, yogurt, and butter.	Semi-industrial processing. There is a small plant with basic equipment.
San Andrés de Tupicocha	Herbs	Herbs dehydrated and milled.	Semi-industrial processing by implementation. There is a solar drying module and a small plant for milling.
Santiago de Tuna	Fruits	Nectar, jam.	Semi-industrial processing. There are some equipments, however there is no implemented yet.
San José de los Chorrillos	Fruits	Jam, nectar, wine and vinegar.	Semi-industrial processing. There is a small plant with basic equipment.

3.4.6. Institutional framework

Currently, the institutions that support rural agribusiness in the Lurin River are the NGOs, local governments and some ministerial programs. It is important to note the role of the NGOs, who until now have been developing training support activities, technical assistance and micro-credits for small farmers.

In recent years it has tried to form networks and inter-institutional cooperation plans in order to address the issue of rural agribusiness and other aspects of the Lurin River Basin. However, the different points of view and forms of action by local governments, NGOs, and producer groups cannot get obtain good results. In the Appendix 4 there is a brief description of NGOs working in Lurin River Basin.

The good results obtained in some districts are basically because the joint participation of farmers, NGOs, local governments and some state programs as the Global Fund for Development Cooperation Social (FONCODES).

3.4.7. Market

The agro-industrial production of the Lurin River Basin is destined to auto consumption or subsistent, local sale and in less quantity to regional sales. The handmade products, especially in the districts of the middle and high parts, are intended for self-consumption and local sale. The products elaborated using semi-industrial process, in the districts with small processing plants, are for sale locally and regionally. Regional sales have as main target the city of Lima. The marketing of products is made in ecological fairs called "*Ecoferias*" or "*Bioferias*".

Ecological fairs conduct the production and consumption of organic foods (De la Cruz, 2008) as well as the diffusion of the ecological and the special goods benefit of food without agrochemicals (ANPE, 2010). Ecological fairs are places of interaction between producers, consumers and promoters, where the sale takes place without intermediaries, offering the consumer healthy food and generating income for farmers (IDMA, 2008).

However, sales obtained at ecological fairs are relatively small and to achieve market positioning it is necessary to strengthen the farmers' organization, consumers and institutions to support and implement processes for research, technology and innovation management which all together will improve the supply, ensuring quality of products and enter to new markets (FAO, 2005; Ravello, 2008).

Ravello (2008) argues that, at the low bargaining power of producers, a marketing alternative is the implementation of a "point of sale" in the city of Lima, which could become a collection center, control and marketing of the products from the Lurin River Basin.

3.4.8. Potentials and limitations of the agribusiness in the Lurin River Basin

3.4.8.1. Potentials of the agribusiness in the Lurin River Basin

The rural agro-industry has several potentials. The key is the growing consumer's preference for this kind of products, the valorisation of small production, commissioning agenda of RAI as an axis of development and ecological diversity of the Lurin River Basin. Besides, it is developed locally; employs strength helps farmers and rural economy. For this reason, it is a good opportunity with great potential to improve the incomes and quality of life of rural families (Riveros, 2007).

Trends in consumption of rural agribusiness products have increased in large and intermediate cities. Consumers show their interest in the agroecology products, which are foods considered healthy, functional and a good lifestyle. Moreover, consumers have greater concern for environmental issues, and sensitivity to the issues associated with supporting small farmers and poverty alleviation.

The RAI is valued economically, socially and environmentally, because most of the production units are developed in an agroecological context. The existence of the modules for processing fruits and vegetables, dairy products, herbs, among others, provide concrete examples of valuation of the small agribusiness in the Lurin River Basin, allowing farmers' development and creating great potential for improving a better quality of life.

The RAI is considered an important area for development. Whereas the rural in general has not been considered in governmental plans, now it is important that the central government, local governments and other institutions such as NGOs and universities, are considering the rural agribusiness important for development. Putting the issue of RAI in the political and social agenda are important initial steps.

The ecological diversity of the Lurin River Basin is presented as an asset for the development of new agribusiness products. It comes to take the comparative and competitive advantages of the basin in each area to obtaining differentiated products with special characteristics associated with the origin, ancestral knowledge, health, and respect for the environment, among others.

3.4.8.2. Limitations of the agribusiness in the Lurin River Basin

The limitations of the agribusiness in the Lurin River Basin are the weakness in the productive units, shortage use of technologies, farmers' organisation, market articulation, and institutions (Riveros, 2007; FAO, 2006).

The weaknesses in the productive units are directly related to low production and productivity in crop production, post harvest losses and the non-utilization of agricultural surpluses in high-production seasons.

The use of technology is low and the adoption in the local reality is slow because there is reluctance to "leave the artisanal" and some farmer fear they cannot adapt to the use of equipment and instruments.

Regarding to the organization, many farmers do not assume leadership responsibilities, so they almost always have the same people who lead the group or association of producers, in addition, not being formally constituted cannot allow to access credit or other benefits.

The little bargaining power of producers do not allow to sell their products competitively. In addition, difficulties in the electricity, water and sewage as well as the high cost of transport increase production costs. Markets are few to put all the production, which requires moving and incursion into new spaces, with adequate logistical support to facilitate the sale products profitably.

The institutions supporting rural agribusiness neither have a joint plan of action nor promote research. Since the government did not prioritize the real needs of rural areas, many laws are designed for big industries and the legal requirements are difficult to achieve, or for some cases as there is no specific regulations, which generate administrative barriers to obtain certifications and for the formalization. There are no strong networks of institutions involved in the rural agribusiness, for example, some NGOs operate isolated.

Additionally, another problem is the absence of monitoring and projects systematization, especially those successful experiences that could be replicated in areas with similar characteristics.

4. Materials and Methods

4.1. Purpose

The purpose of this thesis is to study the current and future situation of Lurin River Basin, as well as an analysis of sustainability. The situation will be discussed in three scenarios: one business as usual and two predictive backcasting scenarios. To do this, one of the scenarios will be chosen and suggest strategies that can be used to reach it. Likewise, problems and uncertainties facing development of scenarios will be described.

4.2. Boundaries and limitations

- Geographical boundary: Lurin River Basin (Lima-Peru)
- Time boundary: 2010-2020
- Problems will be defined internally and externally.
- The development of the scenarios should include an analysis of all stakeholders.

Limitations

The main difficulty is the availability of data. Government data are very general and usually reflect wider geographic areas. There is no record of local data, which makes difficult to analyse data and results.

The data used are mostly of NGOs and farmers themselves.

4.3. Methodology

The information and research compiled to conduct this work is obtained from NGOs working in the Lurin River area, local governments, the portal of the Peruvian State and online/internet sources.

The factors to consider in the *current situation* are production, processing, selling and organization. The main factor to consider in the *future situation* is how to improve the environmental conservation of the Lurin River basin through rural agribusiness. The work also describes the importance of the technical, social and economic sustainability.

4.4. Scenarios

Considering the Lurin River Basin information it has been developed three scenarios: one forecasting (Business as usual) and two backcasting (Organic-point of sale and Organic-all Basin).

- Scenario 1: Forecasting scenario (Business as usual).
- Scenario 2: Organic-point of sale.
- Scenario 3: Organic-all Basin.

The *Organic-point of sale* scenario has been chosen for posterior evaluation.

4.5. Analysis of Sustainability

It will be held environmental, social and economical sustainability analysis.

5. Results and Discussion

5.1. Boundaries and limitations

The geographical region selected to perform the study is the Lurin River Basin, which is located in the department of Lima, Peru. Specifically, it will analyze the data of the Association of Ecological Producers of the Lurin River Basin “Monticielo” (usually called *Monticielo Association*) for the period 2010-2020. For more information about Asociación Monticielo, see Appendix 5.

The Association of Ecological Producers of the Lurin River Basin “Monticielo” brings together organic farmers in the Lurin River Basin, who are working with NGOs, central and local governmental institutions. However, the institution who has been working for over 20 years is the NGO Institute for Development and Environment (IDMA).

5.2. Current situation of the rural agribusiness in the Lurin River Basin

In this section the current situation of rural agribusiness in the Lurin River Basin is analyzed from the perspective of organic agriculture, because this kind of agriculture is the basis for rural agribusiness.

5.2.1. Production

5.2.1.1. Agricultural land and producers of the Lurin River Basin

According to the Institute for Development and Environment (IDMA, 2007b), there are over 300 organic farmers in the Lurin River Basin, who for several years are managing their fields, post-harvest and processing activities under agro-ecological practices. Each district has a local organic producers association, who together have formed the Association of Ecological Producers of the Lurin River Basin "Monticielo".

The Association of Ecological Producers of the Lurin River Basin "Monticielo" has 86 certified producers, who grow more than thirty hectares under organic farming standards (see Table 7).

In the Lurin River Basin, more than thirty percent of the organic agricultural land, including in-conversion areas, is located in the district of San Damian (32,9%), followed by Tupicocha (24,9%), San José de los Chorrillos (14,7%) and Lahuaytambo (12,5%). The zones of Manchay Alto and Redprausa present 4,9% and 1% respectively (see Figure 18).

Table 7: Agroecological production in Lurin River Basin 2009, (adapted from Asociación Monticielo, 2009).

Zone	Producers	Total area (ha)	Cultivated area (ha)	Total production (t)
Tupicocha	22	9,477	8,077	118,922
San Damián	14	11,970	10,680	77,275
Lahuaytambo	10	5,442	4,061	36,560
Langa	6	8,812	2,980	35,008
S.J. Chorrillos	14	5,685	4,767	63,015
Manchay Alto	5	2,500	1,577	32,863
REDPRAUSA ³	15	2,395	0,315	1,988
Total	86	46,281	32,457	365,631

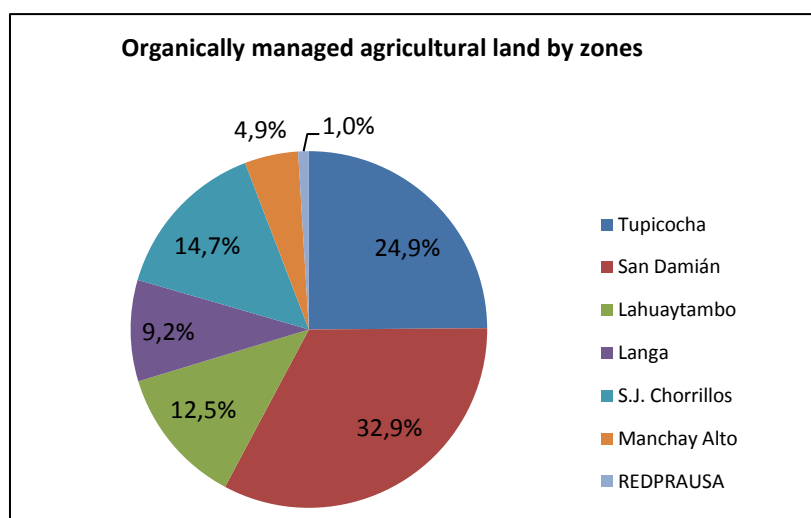


Figure 18: Organically managed agricultural land by zones 2009 (total 32,5 hectares), (adapted from Asociación Monticielo, 2009).

Figure 19 shows the organic producers by zone in the Lurin River Basin, where the greatest number of producers is in Tupicocha (26%), followed by Redprausa (17%), San Damián and S.J. Chorrillos (both 16%), Lahuaytambo (12%), Langa (7%) and Manchay Alto (6%).

³ Network for the Promotion of Urban Agriculture and Food Security (REDPRAUSA).

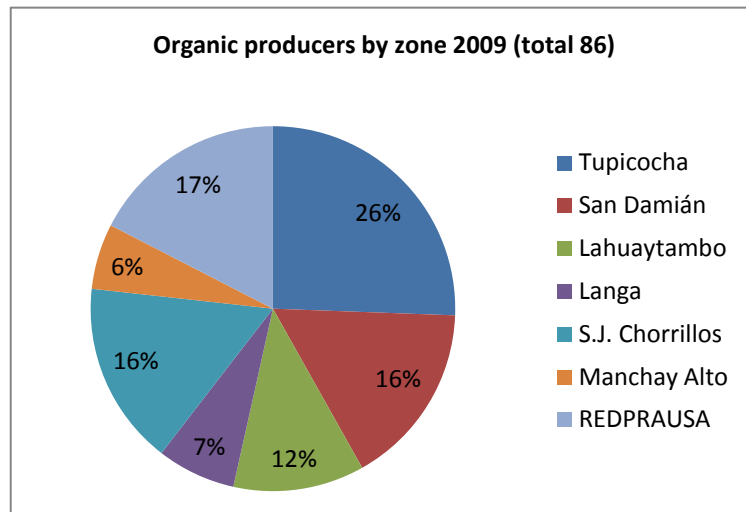


Figure 19: Organic producers by zone 2009, (adapted from Asociación Monticielo, 2009).

5.2.1.2. Agricultural production in the Lurin River Basin

In the Lurin River Basin, as in many watersheds of Peru, several agricultural management structures coexist. Most people have small farms, in some districts there are groups called peasant communities, and other areas have recently been initiated cooperative processes of organization of small and medium farmers.

Many forms of organization, individually and collectively, to agricultural management as the main livelihood of rural families, has distinct characteristics that vary from one area to another and according to the nature of the production type and level of organization. Therefore, there is a wide dispersion of production.

Another important factor for agricultural production is the weather. Lurin River Basin has six of the eight natural regions of Peru, which allows a high biodiversity and it is also considered as a natural source of comparative advantage.

The districts of the Lurin River Basin range from zero to 5000 meters above sea level. The geographical, agricultural and productive features are different in each area (low, middle and high part).

Table 8 presents the main agricultural products of the Lurin River Basin.

Table 8: Agricultural products of the Lurin River Basin by zone, (adapted from IDMA, 2006, 2007 and Claverías, et al., 2000).

Zone ⁴	Agricultural production
Lower part	<ul style="list-style-type: none"> - Fruits: strawberry, banana, apple, peach, avocado. - Vegetables: tomatoes, peppers, chilli, cabbage, cauliflower, broccoli, carrot, radish, beets, lettuce, onion, potato, Chinese onion, squash, celery, pomegranate, pear. - Cereals and legumes: hard yellow corn, corn, beans. - Forage: Alfalfa. - Roots and tubers: cassava, sweet potato, beetroot, leek, radish, yacon. - Herbs: lemon verbena, rue.
Medium and high part	<ul style="list-style-type: none"> - Fruits: apple, quince, pear, plum, peach, tumbling, cherimoya, passion fruit. - Vegetables: carrot, radish, beets, lettuce, onions, squash, cabbage, cauliflower, chard, spinach, green beans. - Cereals and legumes: maize, barley, wheat, peas, beans, beans. - Forage: alfalfa, oats, clover, rye grass, <i>dactyl</i>. - Tubers and roots: potatoes, <i>oca</i>, <i>olluco</i>, <i>mashua</i>, <i>yacon</i>, <i>arracacha</i>. - Herbs: rosemary, lemon verbena, rue, chamomile, wormwood, <i>muña</i>, <i>huaman pinta</i>, etc.

5.2.1.3. Livestock production in the Lurin River Basin

In the Lurin River Basin, raising animals is a very important component, because it is a complementary activity to agriculture. The animals are feed on natural pastures, cultivated pastures and farm products such as cereals and some by-products of the crop.

In general, the dominant livestock production throughout the basin is the breeding of small animals. There are few areas where there is the greatest animal husbandry, due to difficulties with the rugged terrain of the basin. Some species of animals such as fish, bees and some birds need special care and conditions, thus producers have animals that have adapted to each zone.

Animals contribute to the sustainable management of the basin, because they are an important source of nutritious food for residents, fibers and skins are used to make clothing and accessories and the remains of animals used as fertilizer on crop fields. Some families of the high part of the basin use animal manure as fuel. Additionally, animals are a source of income from the sale of meat, fiber or fur. The marketing depends on the characteristics of the producing areas, the demand from consumers and transport facilities.

Table 9 describes the livestock production of the Lurin River Basin.

⁴ Districts of the lower part: Lurín, Pachacámac, Cieneguilla. Districts of the medium and high part: Antioquía, Langa, Lahuaytambo, San Damián, San Andrés de Tupicocha, Santiago de Tuna, San José de los Chorrillos.

Table 9: Livestock production of the Lurin River Basin, (adapted from IDMA, 2006, 2007 and Claverías, et al., 2000).

Zone ⁵	Livestock production
Lower part	- Small animals: creole chicken, guinea pigs, ducks, creole turkey, pork.
Medium and high part	- Small animals: Creole chicken, guinea pig, rabbit, duck, sheep, goats, pigs. - Major animals: cows (creole, brown Swiss, Holstein), donkey and horse. - Other: bees (honey, pollen, royal jelly).

5.2.1.4. Agro-industrial production in the Lurin River Basin

The agro-industrial production in the Lurin River Basin is at an early stage of its development and responds to the characteristics of rural agribusiness. Many small farmers elaborate (transform) their products using traditional methods, mainly for household consumption and a lesser amount for local sales.

Agro-processing requires some special characteristics such as availability of raw materials, equipped processing plant, transportation, markets, among others, which means trained personnel and to have a financial investment to cover the production costs.

The Lurin River Basin has good conditions for rural agribusiness development. In recent years it has developed several projects funded by NGOs and governmental agencies, generally designed to add value to primary production in all districts of the basin. However, it has not achieved the expected results due to production, economic and administrative difficulties.

As mentioned above, this paper will analyze the current situation of rural agribusiness of the Association of Ecological Producers of the Lurin River Basin "Monticielo": dairy products in San Damián, apple and quince processing in San Jose de los Chorrillos and aromatic and medicinal herb processing in Tupicocha.

The districts of San Damian, San Jose de los Chorrillos and Tupicocha are located in the middle and high part of the Lurin River Basin, in the province of Huarochiri, region of Lima. According to the Poverty Map of Peru (FONCODES, 2006), these districts are classified as poor and very poor, because of low levels of income. However, they have a productive potential for agribusiness. The agro-industrial production of these three districts is described below.

⁵ Districts of the lower part: Lurín, Pachacámac, Cieneguilla. Districts of the medium and high part: Antioquía, Langa, Lahuaytambo, San Damián, San Andrés de Tupicocha, Santiago de Tuna, San José de los Chorrillos.

5.2.1.4.1. Dairy products in San Damián:

The district of San Damian is located on the high part of the Lurin River Basin, province of Huarochirí, region of Lima, to 3235 m.a.s. The population is engaged in farming and raising cattle. Small producers have an average of five head of cattle, of which about two cows are in production period.

Raising livestock is usually extensive type, because the main source of animal feed is by grazing natural and cultivated pastures. The main grasses grown are alfalfa and grass association as Rye grass with some legumes such as clover. Some farmers have begun to manage their cattle in a semi-extensive grazing supplemented with concentrate feeds based on input from industry as cottonseed, molasses, among others.

Cow breeds that farmers work with are Creole race (85%) and "enhanced" race (15%). The improved breed is the product of the intersection of Brown Swiss Creole race. Average milk production per day is 6,9 liters for Creole race cows and 12 liters for of the "enhanced" race cows.

Farmers are organized locally in the Association of Ecological Producers of San Damian have a small processing plant (known as "*La Planta*"), where is processing various products such as cheese, yogurt, caramel or sweet milk, butter and cottage cheese. The processing plant is implemented with basic equipment to process up to 1200 liters of milk per week. However, its current use is less than 20% of its installed capacity.

According to information collected by IDMA (2007), milk production in San Damian is intended for the manufacture of some dairy products (see Table 10 and Figure 20), which predominates fresh cheese, the remaining balance is sold as fresh milk and a small percentage is for auto consumption. The district of San Damian concentrates about 50% of the cheese production of the Lurin River Basin, thus this sector is considered strategic for its development.

Table 10: Destination of milk production in San Damián, (adapted from IDMA, 2007).

Product	%
Fresh milk	10
Pasteurized cheese	23
Artisanal cheese	43
Yogurt	11
Blancmange (sweet of milk)	8
Auto consumption	5
Total	100

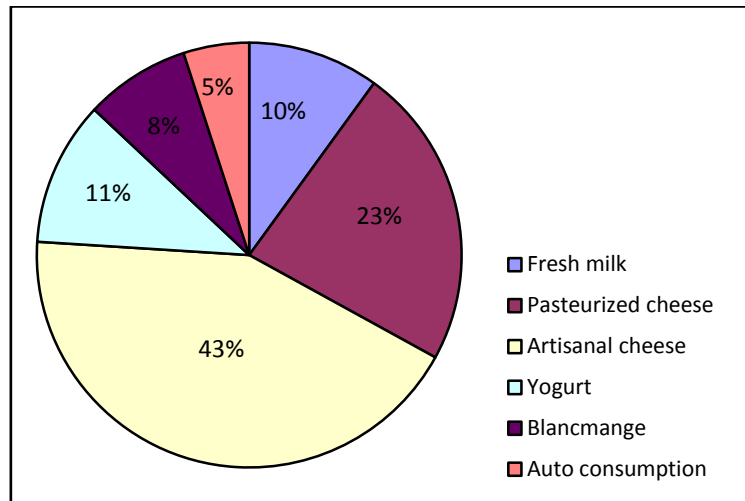


Figure 20: Destination of milk production in San Damián, (adapted from IDMA, 2007).

Table 10 shows that most quantity of milk is intended for the artisanal pasteurized cheese processing (66%), followed by yogurt (11%) and blancmange (8%). In addition, about 10% of milk is sold as fresh milk and 5% is intended for auto consumption, which can vary by market, that is, if producers are able to sell this small margin, they can sell it.

During the processing of cheese a considerable amount of serum is obtained, which can be used as a raw material for produce butter and cottage cheese.

Table 11 presents annual production of dairy products in San Damián.

Table 11: Production of dairy products in San Damián 2007, (adapted from IDMA, 2007).

Product	Milk used (L)	Performance	Product (Kg.)
Fresh milk packaged	480	100%	480
Pasteurized cheese	5904	15%	885,6
Yogurt	720	100%	720
Blancmange o caramel	480	35%	168
Yogurt ice cream	96	95%	91
Total	7680		2344,8

In the processing plant of the Association, the fate of the milk (see Figure 21) is mainly for the production of pasteurized cheese (77%), and a lesser amount for the manufacture of yogurt (9%), caramel and fresh milk packed (both with 6%).

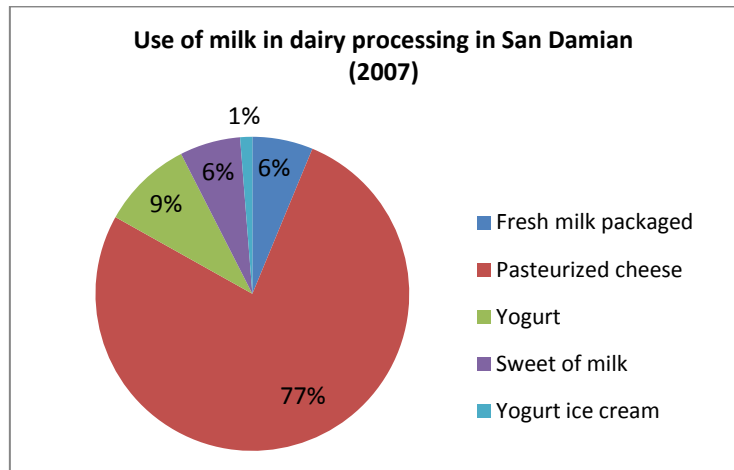


Figure 21: Use of milk (percentage) in dairy processing in San Damian, (adapted from IDMA, 2007)

The main products obtained (see Figure 22), are pasteurized cheese (38%), yogurt (31%) and fresh milk (20%). To a lesser amount caramel (7%) and frozen yogurt (4%).

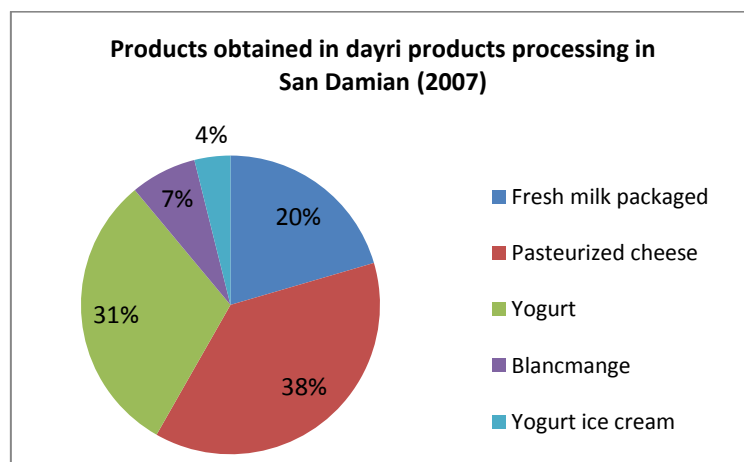


Figure 22: Products obtained (percentage) in dairy processing in San Damian, (adapted from IDMA, 2007)

5.2.1.4.2. Apple and quince products in San José de los Chorrillos

The district of San Jose de los Chorrillos is located in the middle-high part of the Lurin River Basin, province of Huarochiri, region of Lima, between 1900 and 3200 m.a.s. The main activity of the inhabitants is the cultivation of apple (variety San Antonio and Winter) and quince. The plantations are permanent, with at least 25 years. In lesser quantities farmers have pears, avocado and plum trees and some vegetables in the rainy season, because at other times there is no availability of water.

Farmers are organized into the Association of Ecological Producers of San Jose de los Chorrillos. On average, each farmer has a cultivated area of 4000m², with a total of approximately 20 hectares in the whole association. The amount of cultivated areas depends on water availability and household economy.

There is no water infrastructure supplying to all productive areas, thus crops are dependent on the rainy season. Consequently, farmers can only get one crop a year. In addition, crops have been seriously affected since 2001, from which are recorded long periods of drought.

According to data from the 2007-2008 period, an estimated total production of apple and quince is about 75 tons per year (70 tons of apple and 5 tons of quince).

The producers association has a fruit tree nursery and a small plant for processing fruits. The nursery of fruit trees is used for the propagation of fruit tree seedlings and reforestation. The processing plant is implemented with basic equipment for fruits processing.

The derivatives of the apple and quince that are made in the processing plant (see Table 12) are wines, jams, vinegar and nectars.

Table 12: Products made from apple and quince in San José de los Chorrillos 2007-2008, (adapted from IDMA, 2008c).

Product	Unit	Quantity	Percentage
Wine	Litres	2660	31%
Jam	Kilos	665	8%
Vinegar	Litres	3180	37%
Nectar	Litres	2160	25%
Total		8665	100%

The main quantity of processed product (see Figure 23) is vinegar, which represents 37% of total production, followed by wine (31%), nectar (25%) and jam (8%).

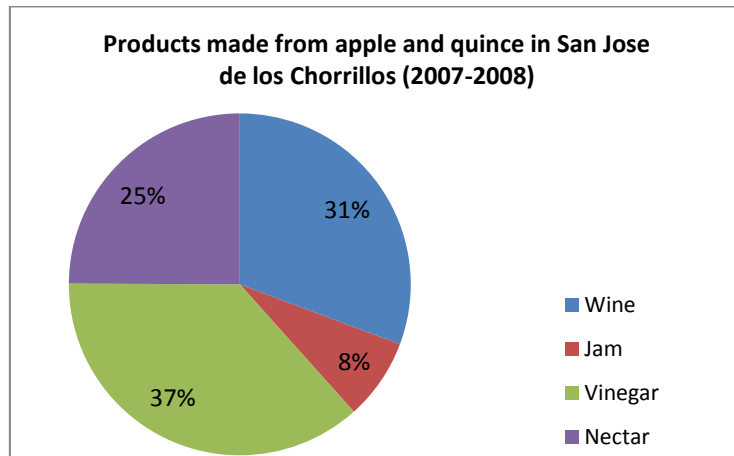


Figure 23: Products made from apple and quince (in percentage) in San Jose de los Chorrillos (2007-2008), adapted from IDMA (2008c).

5.2.1.4.3. Aromatic and medicinal herb processing in San Andrés de Tupicocha

The district of San Andrés de Tupicocha is located at the high part of the Lurin River Basin in the province of Huarochiri, region of Lima, to 3306 m.a.s. The main economic activities of the area are agriculture and livestock. In agriculture predominates the crop of herbs (cultivated and wild).

The producers are organized into the Association of Ecological Producers of San Andrés de Tupicocha. Farmers have approximately 12 hectares of land for crops, of which 3,97 hectares are for growing medicinal and aromatic herbs.

The main species of cultivated herbs (see Table 13) are the lemon verbena and rosemary, followed by Melissa, rue, oregano and other (rue, mint, thyme). The district also has a high yield of weeds as *muña*, *huaman pinta*, among others.

In general, most of the production is marketed fresh and only a small part goes to manufacturing processes. The producers' association has a mini rural processing plant, which has basic equipment for dehydration and milling of aromatic and medicinal herbs.

According to data from the NGO IDMA (2007b), the three types of products made for producers (see Table 14) are fresh herbs, dried herbs and ground herbs.

Table 13: Average annual production of herbs in Tupicocha 2007, (adapted from IDMA, 2007b).

Herb	Area (ha)	Fresh herbs		Dried herbs	
		Performance (kg/ha)	Production (kg)	Performance (kg/ha)	Production (kg)
Lemon verbena (<i>Aloysia triphylla</i>)	2,38	4750	11305	1567,5	3730,65
Rosemary (<i>Rosmarinus officinalis</i>)	0,99	3360	3326,4	574,2	568,458
Melissa (<i>Melissa officinalis</i>)	0,32	2250	720	742,5	237,6
Rue (<i>Ruta graveolens</i> L.)	0,12	8515	1021,8	1587,3	190,476
Oregano (<i>Origanum vulgare</i> L.)	0,08	4125	330	1296	103,68
Others	0,08				
Total	3,97		16703,2		4830,864

Table 14: Approximate production of aromatic and medicinal herbs in San Andres de Tupicocha 2007-2008, (adapted from IDMA, 2007b, 2008d).

Product	Amount of fresh herb used (Kg.)	Performance	Amount of product (Kg.)
Fresh herbs	2880	100%	2880
Dried herbs	480	30%	144
Ground herbs	96	25%	24
Total	3456		3048

More than 90% of the production corresponds to fresh herbs. Only a low quantity is processed into dried herbs (4,7%) and ground herbs (0,8%) (see Figure 24).

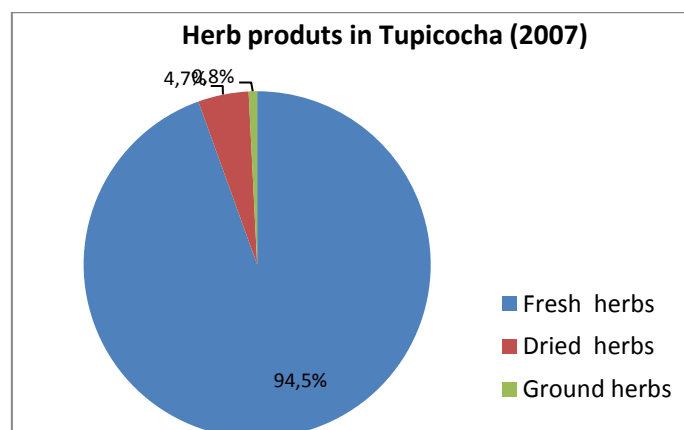


Figure 24: Production of aromatic and medicinal herbs in San Andres de Tupicocha (2007-2008), adapted from IDMA (2007b, 2008d).

5.2.2. Market

The main market for the products of the Monticelo Association is the city of Lima and a small amount is sold in the same places of production. Lurin River Basin is in advantage over other areas of Peru, because of its proximity almost every production (fresh and processed) are destined to the city of Lima.

Marketing in Lima is done through weekly ecological fairs, regional fairs, institutional sales, home delivery, among others. Table 15 (see also Appendix 6) describes the number of products marketed under the market rate (IDMA, 2008d). Some products, like fruits and herbs are sold on the Fruit Market and the Market *La Parada* (both in Lima).

Table 15: Marketing of products by type of market, (adapted from IDMA, 2007, 2008d).

Product	Amount of sales (Kg.)							
	In the district	Ecological fairs	Mini markets	Wholesale market	Institutions	Delivery	Others	Total
Dairy products	343,08	1416,72	130	0	150	170	135	2209,8
Apple products	620	6930	430	0	305	135	245	8420
Herb products	0	368	0	2500	0	0	200	2868
Total Kg.	963,08	8714,72	560	2500	455	305	580	13497,8

Figure 25 presents the marketing of products by type of market in kilos (2008).

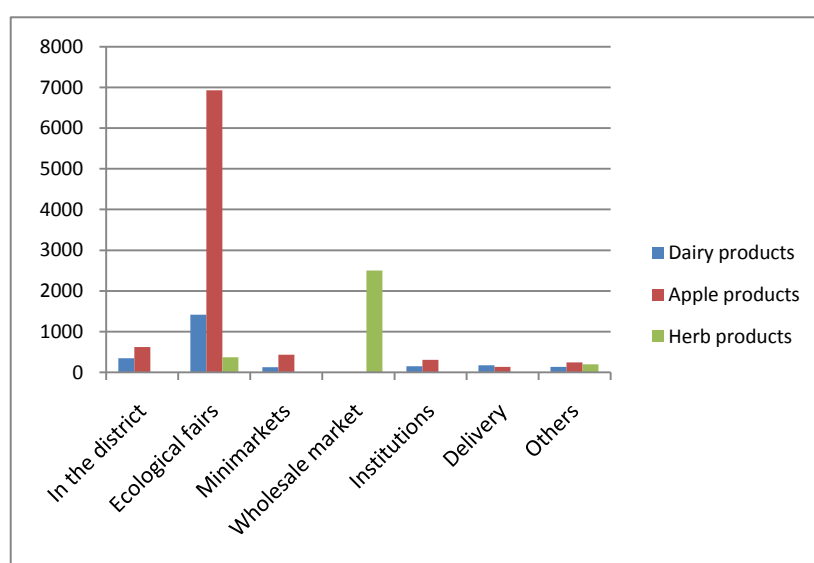


Figure 25: Marketing of products by type of market in kilos 2008, (adapted from IDMA, 2007, 2008d).

According to Table 15, products made from apple (including quince) present the most sales volume (8420 kg) (see Figure 55), followed by herb products (2868 kg) and dairy products (2209 kg).

The commercialization of the more processed products (see Figure 26) takes place in the ecological fairs (65%), followed by the wholesale markets (19%) and local sales (7%). A lesser number of products are marketed in minimarkets and local stores (4%), institutional sales (3%) and home delivery (2%). The category of others (4%) includes occasional sales to customers, visitors, etc.

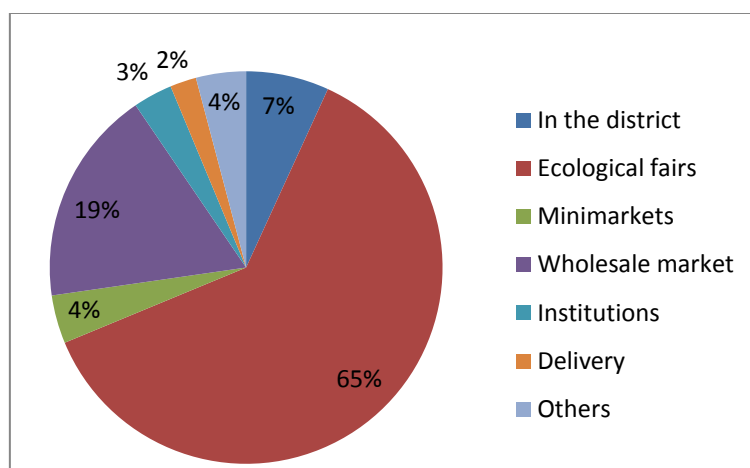


Figure 26: Marketing of products by type of market in percentage 2008, (adapted from IDMA, 2007, 2008d).

5.2.3. Standards and certification

According to current legislation, the agency responsible for regulating organic production in Peru is the National Commission of Organic Products (CONAPO). In 2002, CONAPO published the Technical Regulations for Organic Products, which defines and regulates the production, processing, labelling, certification and marketing of products described as organic, ecological or biological. Technical Regulation of CONAPO is required for all products marketed as organic (CONAPO, 2002:3).

Members of the Association of Ecological Producers of the Lurin River Basin “Monticelo” are certified by the certifier Bio Latina and the Participatory Guarantee System-SGP.

5.2.4. Organization

Producers are organized in the Association of Ecological Producers of Lurin River Basin "Monticielo", which is registered in the National Superintendence of Public Records of Peru (SUNARP) (Asociación Monticielo, 2007).

5.2.5. Environmental conservation

The main activities for environmental conservation in the three districts studied are described below.

Environmental conservation in San Damián

- Crop rotation.
- Maintenance of biodiversity through the breeding of small and major animals.
- Soil conservation.
- Preparation of organic fertilizers.

Environmental conservation in San Andrés de Tupicocha

- Management and efficient use of water.
- Crop rotation.
- Preparation of organic fertilizers.
- No use of agrochemicals.

Environmental conservation in San José de los Chorrillos

- Ecological pest control.
- Soil conservation.
- Efficient use of water.
- No use of agrochemicals.

5.2.6. Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of the rural agribusiness in the Lurin River Basin

SWOT analysis is an assessment tool of Strengths, Weaknesses, Opportunities and Threats, which helps build a picture of the current state of a project, company or organization, in order to obtain an accurate diagnosis that allows making decisions consistent with objectives and policies formulated.

SWOT analysis has two internal and two external variables. Strengths and weaknesses are internal to the organization, making it possible to act directly on them. Opportunities and threats, on the other hand, are external, which in general is difficult to modify (URP, 2010).

Strengths

Strengths are the special abilities available to the organization and which has a strong position against competitors or other organizations.

The Lurin River Basin has a rich biodiversity and microclimates that favor organic production. The soils have good physical, chemical and biological properties. There is no use or abuse of agrochemicals in agriculture, thus the ecosystem is unchanged and slightly damaged. In addition, there are no major polluting industries or mining activities.

Farmers preserve the ancient knowledge and conduct collaborative work using the technique "from farmer to farmer" (*"de campesino a campesino"*). Producers have been trained and the technology employed is low cost and easy to handle. Farmers have small processing plants with intermediate technology, as well as demonstration areas of modern irrigation systems and nursery gardens.

More than 300 farmers and their families use ecological farming practices in the cultivation and processing of their products. At least 70% of land cultivated by 86 farmers in the Monticielo Association is organically certified, with over 50 products. There is enough raw material availability for processing.

Another of the strengths of the Lurin River Basin is its strategic location close to the city of Lima, which is considered the largest market in Peru. Currently, there are already green markets where its products are marketed, especially in ecological fairs.

There are predisposition and confidence to continue working with institutions and organizations committed to and involved as the Institute for Environment and Development (IDMA). In addition, the certifier Biolatina coordinates and works regularly with producers.

Weaknesses

Weaknesses are those factors that cause a disadvantage against competitors, show the resources that are lacking, not to possess skills, activities that do not develop positively, etc.

The main weakness of the producers of the Lurin River Basin is the low production, productivity and quality of its products such as fruits, due to phytosanitary problems, seasonality and rugged lands of the middle and high part of the basin. Many areas have insufficient water supply to all farm units, thus most products are grown without irrigation, the crop is only once a year and offer is poor and discontinuous.

The lack of technical knowledge to crop management, preparation of fertilizers, pest control, among others, does not allow farmers efficiently manage their production units. Many producers cannot transform their products and diversify its offer.

Low technological level in production and processing. There is no technical irrigation infrastructure, and harvesting, transport and processing of some products is done by hand (artisanal). There are not processing plants with the appropriate equipment for the process and quality control.

The inexperience, poor negotiating capacity of farmers and lack of market studies by product type does not allow adequate marketing. There is a "disorder" in the market, intermediaries pay low prices, the logistics of the product from the process zone to customers has high cost. In addition, farmers are affected by lack of knowledge about the forms of access to credit, low income families and the lack of capital.

The local producer organization is not formalized. In some areas there is little leadership, mistrust and fear of taking responsibility. Generally, in all districts are almost always the same people who assume the farmers' representation.

Few researches about organic production. There are few support institutions (mainly NGOs) for extension and training to farmers in organic farming issues.

Opportunities

Opportunities are those factors that are positive, favorable, to be discovered in the environment where the organization operates, and it can permit to obtain competitive advantages.

The main opportunity for producers in the Lurin River Basin is the increasing demand of organic products consumption. There is a growing consumer market for organic products in Lima and the interior of the country where consumers prefer this kind of products because they are aware of the importance to the environment, health and poverty alleviation.

Agro-ecological products are differentiated products with many comparative advantages.

For example, apple vinegar is considered irreplaceable because of their functional properties.

Peru's economic stability and growth of agro-ecological sector can be exploited. There are some financial institutions such as Agrobanco and Municipal Funds, as well as equipment manufacturing industries that offer credit and machinery that could be exploited by farmers.

A Ministry of the Environment has been established and there is an ongoing decentralization process. The revival of agriculture is seen with a good chance of support from governmental and private institutions, which have begun to implement policies and programs to support rural agribusiness.

In the Lurin River Basin there are no threats of pollution and promoting environmental awareness is increasing. Society perceives rural and ecological products as part of a cultural legacy. Farmers can use this panorama to establishing strategic alliances with technology development institutions such as NGOs, research institutes and universities.

Threats

Threats are situations that come from the society and can reach even attempt against the permanence of the organization.

The main threat is the dispersion of production and competition with larger companies, who offer the same products at lower prices. For many sectors of the population, final product price is more important than origin or type of production (organic or conventional).

Access to technology is limited and costs are high for the rural economy. Other regions of Peru have more advantages in having modern technology, improved road infrastructure and offer the same products with better quality and at lower prices.

Low institutional presence of the State. For example, neither the Ministry of Agriculture nor the Ministry of Environment have a coordination office in the area. There are no specific measures of recognition to organic production; however, some policies encourage the production and import of agrochemicals.

Since some years climatic factors have affected the Lurin River Basin area, especially drought and frost, and the occurrence of pests and unknown diseases.

Uncertainties to external economic crisis, the government and ethics. Companies do not opt for investing in rural areas. Because of the next general election, population fears how will be the continuity of rural policies. There is a possibility that some agents involved in the process could be marketed as organic something that is not.

5.3. Drivers of change

In order to define the scenarios and strategies to promote their development it is necessary to identify the drivers of change affecting rural agribusiness in the Lurin River Basin. Considering the characteristics of the rural agro-industry in Peru and the current situation of the rural agribusiness in the Lurin River Basin, it has been identified the main drivers of change that can influence this sector.

The main drivers of change selected for this study are described below.

5.3.1. Production and productivity

The low production and productivity of agricultural products due to various factors, such as land ownership structure and the improper handling of the crop (or animal husbandry), limited water supply, post-harvest activities and low prices of the primary production, which hinder the development of both economies of scale in purchasing inputs in the production and marketing. For the next ten years, the trend of low production, productivity and profitability will be almost the same.

The Lurin River Basin has a high fragmentation of farm units. Most farmers have smaller plots of land under one hectare and the geography is broken. Agricultural activities are supplemented by animal husbandry. Small productive units are directly related to the availability of financial resources for agricultural management (IDMA, 2006a; LEISA, 2010).

Many farmers are unaware of crop management techniques such as planning for planting, preparation of fertilizers and pest control, use of quality seeds, planting of specific crops profitable, among others. In the case of San José de los Chorrillos, permanent apple trees are over 20 years of age and they have not made the necessary care such as pruning and plant replacement. In San Andrés de Tupicocha, aromatic and medicinal herbs are grown without knowing the market demands, and in San Damián, the majority of the cows are fed only by natural grass, thus milk production is low (IDMA, 2007b; 2008c).

There are few areas of land that have enough water all year, most are dependent on rainfall, which has seriously affected for the long periods of drought since 2001. The type of gravity irrigation is used and there is no adequate infrastructure for the efficient use of water. The cost of implementation of irrigation technology is almost impossible to be borne by farmers (Ibid).

Poor post-harvest activities are therefore considerably reducing the amount of product, especially during transport, as well as packaging used (boxes of various uses and jute or plastic bags for fruits and herbs, or plastic containers reused for fresh milk) are not equipped to adequately protect the product (Ibid).

Because much of the production is sold fresh, and many of the products are of low quality, the prices paid by intermediaries are below the market average (Ibid).

5.3.2. Use of technology

The use and access of the technology in the three districts surveyed is still low, both in primary production and in processing plants. The trend for the next ten years is that this aspect will improve to the extent that producers achieve trained, organized and properly market their products, which could buy some equipment, materials and tools for improving their farming systems and processing (IDMA, 2007).

In crop management, some demonstration units have been deployed fruit nurseries, preparation of organic fertilizers and irrigation technology in each district. For agro-processing, it has been implemented three small plants with basic equipment for milk processing, fruit and aromatic and medicinal herbs. However, both for crops and products a good quality has not yet been obtained. The lack of some equipment and tools cannot permit to develop new products, making an adequate quality control and obtaining a standardized product with the requirements of the current law (Ibid).

Farmers have been trained by institutions such as the Institute for Environment and Development (IDMA) and Cooperation Fund and Social Development (FONCODES) on issues of production technology, agronomic management, modern irrigation systems, post harvest management, agro-processing, quality control, among others (Ibid).

The main difficulty for access and use of technology is the availability and costs. Many manufacturers usually have equipment for big industries, for that reason it is difficult to implement them in rural areas.

5.3.3. Research and technological development

One of the main limitations of rural agribusiness is the small amount of research. There are no records of statistics and indicators on district information, since the Ministry of Agriculture figures are based on modern agriculture and agribusiness (Benavides et al, 1996). Unfortunately, institutions dealing with this issue (Ministry of Agriculture, Ministry of Environment, Ministry of Production, universities, professional associations, among others) have not researches in agro-ecological production and rural agribusiness.

The main institutions doing research in the field of rural agro-industry are the NGOs and some university programs. There is a positive trend to increase. Therefore, for the coming

years it is expected to obtain a considerable growth in research, although not in sufficient quantity.

Rural agribusiness often operates in a context of limited information. Due to socioeconomic and geographic features no adequate information systems are analyzed. Therefore, production systems are conducted with many limitations (IDMA, 2007b; Benavides et al, 1996).

The lack of data and publications, market studies by type of product and successful experiences systematization, do not allow farmers to take steps before starting the cultivation or processing. Investigation research is an important tool in the decision making process, for example, to know what kind of products are more profitable, which markets can turn a product, how to develop and standardize a product that meets consumer demands , and so on.

5.3.4. Farmers' organization

In recent years there have been entrepreneurs organized groups of producers in many regions of Peru. As mentioned previously, the main farmer`s organizations are supported by NGOs. In the Lurin River Basin, there are groups of NGOs working on different themes with rural producers.

In this context, with the support of the NGO Institute for Development and Environment, the Association of Ecological Producers of Lurin River Basin "Monticelo" has been formed, in order to improve the competitiveness in the market with comparative advantages of the Basin (IDMA, 2008c).

However, forms of organization are a relatively in slow process. It is expected that within ten years the Association Monticelo could be consolidated, especially in local units in each district.

5.3.5. Marketing

Marketing is one of the key steps in the production chain, because it allows economic returns for producers. An appropriate marketing depends on many factors such as type of product, the market you target, the price, among others.

For producers of the Lurin River Basin, the main marketing advantages are its location near the city of Lima and the supply of differentiated products (organic products) and price (the same or slightly higher than conventional products). However, because of the lack of experience and negotiating capacity of farmers, as well as the dispersion of production and supply of similar products from other areas of Peru, marketing is not adequate (Ibid).

Agricultural production is mostly being sold fresh. Furthermore, there is continuity in the quantity supplied and the volumes are few in substantial. Prices are set according to supply and demand where often the agent has control (Ibid).

Currently there are no identified potential markets, there is no marketing plan or a marketing strategy. Farmers only sell in some ecological fairs and intermediaries. Prices of products are low paid and often do not cover production costs (Ibid).

The trend for the next ten years is that agricultural production will remain about the same. The production is expected to increase and generate agro value to primary production.

5.3.6. Elections and political changes

Elections and policy changes affect the rural agribusiness. There is no strong national policy support to rural agro-industry, so that the political approach that will provide varies according to personal characteristics, in the case of local government and party, in the central government.

Some local governments have implemented programs and projects to support rural agro-industry, although when it starts a new management, programs are modified or cancelled. Each electoral process involves changes in the structures of the decentralized offices of the Ministry of Agriculture and opportunistic attitudes are reflected, which create uncertainty and mistrust by the population.

For the next ten years, in Peru at least four general elections are scheduled, which entail changes to current agricultural policy and rural agribusiness development.

5.3.7. Policies and support institutions

The central government has begun implementing a series of policies to support rural agribusiness. The programs of different ministries and the ongoing decentralization process could become a set of tools that foster rural agribusiness development.

The development of rural agro-industry requires the implementation of strategic alliances between producers and support institutions. This would enable producers to improve their production systems, formalize producer organizations, generate added value to primary production through processing, promote organic certification, identify potential markets, and promote agro-ecological products (Ibid).

Producers and support institutions often argue that there is no time to build relationships between them. Each organization or institution has been operating in their own terms, and

often there is duplication of effort, when the best intervention would be to have coordination systems and bring together.

The benefit of a strategic partnership is not only for producers. It is also for participating institutions. Many of the benefits of a strategic alliance are intangible and are related to learning, cooperation and interaction with each other. This requires a good management system that allows achieving a concerted and joint cooperation between farmers, local governments and public and private institutions working in the Basin (IDMA, 2008c; Claverías, 2000).

As a result of a joint effort between the public and private institutions *Procuencia Lurín*⁶ formed a program in 2005, in order to "*articulate and manage a concerted government action: National and Local Government, the Civil Society Sector Private in the context of the National Plan for Poverty Eradication and Sustainable Development Plan of the municipalities of the watershed*" (MIMDES, 2005).

The trend for the next few years is that the policies in the rural agribusiness sector will not have major changes.

5.3.8. Urbanization and population growth

The increase in levels of urbanization is one of the factors that may encourage the consumption of organic products. The population of large cities have limited amount of time for the acquisition, preparation and consumption of food. Hence there is a growing trend of food consumption outside the home and a permanent increase in the use of processed foods (Riveros, 2007).

Demographic change and rural urban migration generate a potential consumer group for an ethnic or nostalgia market, where demand for local products are growing (Ibid).

Additionally, the population growth is accompanied by an increase in organic food interest, considered functional, healthy, and free of preservatives (Riveros, 2007; IDMA, 2007).

To capitalize these opportunities it is necessary that the production units in rural agribusiness adapt their production processes, quality control and marketing. This involves implementing quality systems in accordance with the law and the principles of agro-ecological production, certification and implementation of appropriate strategies for logistics to enable them to streamline the costs associated with tasks such as storage, transport and distribution of products (Riveros, 2009).

⁶ Procuencia Lurín is a cross-cutting proposal made by the central government (directed by Ministry of Women and Social Development), the Association of Municipal Authorities of the Lurin River Basin (AAM) and the platform of NGOs (Development and Environment Institute Environment - IDMA, Center for Research, Education and Development - CIED and the GEA Group) (Gevara, 2005).

The average growth of the population of Peru has an annual rate of 1.13 and the same trend is expected for the coming years (INEI, 2010b).

5.3.9. Increase of environmental awareness

People perceive that the problems of climate change are affecting the entire society. In the energy field it is a tendency to use renewable energy, for food there is a growing tendency to buy organic products, which are considered environmentally friendly. Organic products are considered healthy and free of chemicals that may cause harm to health (Riveros, 2009).

Currently, the sensitivity to environmental issues is increasingly growing. Many sectors of the population, especially those with higher levels of education and income, express their interest in products that have been developed considering its environmental impact. These characteristics have led to the development of organic markets, also known as green markets (Riveros, 2007).

In Peru, the trend of environmental awareness for coming years could grow considerably because it is an issue that is increasingly on the social agenda.

5.3.10. Climate change

Climate change is an important issue for agroecological production, because it directly affects farmland, water and final production. Some effects attributed to climate change are the severe droughts that Lurin River Basin has experienced in recent years. If this trend continues for the next ten years the agricultural and livestock production would be affected, especially in districts that rely solely on rain water (IDMA, 2008c; IFOAM, 2004).

Many studies indicate that climate change can have catastrophic effects on nature and humans. The glaciers, for example may melt and increase the sea level. Agricultural productivity and nutritional quality may be affected precluding the ability of survival of many populations. The main impacts will affect biodiversity, affecting the existence of species and plants, genetic diversity, and stability of habitats and ecosystems (IFOAM, 2004; DESCO/RAP, 2009).

Driving forces evaluation

In order to measure the predictability and the impact of drivers of change it has been made a score for each. Assigned score is between 1 and 10, where 1 corresponds to the lowest level of impact or predictability and 10 is the highest, By multiplying the two indices a total score of each drivers has been achieved.

Table 16 presents the results of driving forces evaluation.

Table 16: Driving forces evaluation.

Drivers of change	Predictability	Impact	Total
Biodiversity and productivity	7	9	63
Use of technology	6	6	36
Research and technological development	4	5	20
Farmers' organization	6	7	42
Marketing	7	7	49
Elections and political changes	3	4	12
Policies and support institutions	4	7	28
Urbanization and population growth	8	3	24
Increase of environmental awareness	5	3	15
Climate change	7	4	28

5.4. Scenarios

5.4.1. Scenario1: Forecasting (Business as usual)

This scenario is called business as usual because it projects what will happen in rural agribusiness situation in Lurin River Basin if there were no changes. It has been assumed the current data of the production, processing and sales as well as the organization of producers.

If the current conditions remain the same until 2020, it would achieve a small increase in the processing of raw materials and sales. The strongest growth was experienced in products derived from apple. However, in dairy products, growth is almost negligible due to the perishable nature of milk products. The most influential drivers of change are production, farmers' organization and sales, where the main problem is the market, thus producers continue to market their products as fresh herbs.

5.4.2. Scenario 2: "Organic-point of sale"

This scenario aims to implement a point of collection and sale called "Organic-point of sale", in order to articulate the processed products to different markets.

The "Organic-point of sale" is not just a selling point, is a key point in the whole productive chain. Due to technical and logistical difficulties with the producers to market their products, "Organic-point of sale" was established as an important focal point between producers and consumers.

Through the "Organic-point of sale" may establish an efficient marketing chain of eco-business, which will increase sales and can contribute to improving the quality of life for producers and respect for the environment. In addition, farmers will have more resources, they can improve their skills and be able to manage efficiently the productive fields, processing plants will be implemented with appropriate technology and social organization will be consolidated.

Expected results by 2020:

- Farmers organically certified: 80% by Participatory Guarantee System-SGP, 60% by third certifier.
- Five new products are developed, standardized and certified.
- On average sales are increased 15% per year.
- Farmers will have more resources and skills for managing their fields, processing plants and social organization.
- A strategic alliance of territorial development is established.

5.4.3. Scenario 3: Organic-all Basin

This scenario implies that all stakeholders in the Lurin River Basin take an empowerment of the agroecological proposal. By 2020, 80% of the agricultural fields will be organically certified. All districts will have agro-processing plants where they develop new products and markets will be identified for each kind of product.

Expected results by 2020:

- 80% of the agricultural fields will be organically certified.
- All districts will have solid organizations and agro-processing plants are implemented.
- 20 new products are developed, standardized and certified.
- The main markets are identified and products are marketed successfully (sales are increased 30% per year).
- Strategic alliances are established.

5.4.4. Finding strategies towards “Organic-point of sale” scenario

In order to achieve the desired “Organic-point of sale” scenario by 2020, the current situation and driving forces were taken into account and the strategies and pathways towards the scenario were developed.

The strategies were divided into five main categories:

- Biodiversity, production and productivity.
- Use of technology.
- Farmers’ organization.
- Marketing.
- Institutions (territorial rural development and strategic alliances).

5.4.4.1. Biodiversity, Production and Productivity

One of the strengths of the Lurin River Basin is its biodiversity, but due to various problems, production and productivity is low. Therefore, intervention activities should be focused on the maintenance and conservation of biodiversity and the design of plans and programs to strengthen the technical and productive capacity of farmers.

Proper management of crop fields, using agroecological practices (soil conservation, crop rotation, preparation of organic fertilizers, water efficiency, ecological pest control, etc.), will provide higher crop yields, better quality products, adequate supplies of raw materials

for processing plants, all in balance with nature. In addition agricultural management should pay particular attention to post-harvest activities, as this will avoid losses and damage to production from the field (IDMA, 2008c).

A good soil structure promotes rooting of fruit trees suffer less by excessive rain and better resist drought, the topography must be appropriate. Crop rotation can maintain biodiversity, makes better use of soil nutrients, and obtain a variety of products both for their own consumption and for agro-processing and marketing (Ibid).

Animal waste can be used in the preparation of organic fertilizers to improve soil quality and provide nutrients to plants. The ecological pest control can be performed using local materials such as herbs macerated or through biological control, which is handling a number of natural enemies, also known predators, with the aim of reducing or completely combat parasites affecting a particular plantation (Infoagro, 2010). With regard to water efficiency, schedule production according to water requirements of each crop. You can deploy modernized systems drip irrigation or spray (LEISA, 2010; FAO, n.d.).

Harvesting should be done carefully, since most fruits and vegetables are susceptible to bruising and injuries that result in premature wear. The careful handling and transport are of vital importance to maintain quality.

5.4.4.2. Use of technology

The primary production and agro-processing require the development and adaptation of technology aligned with rural areas. The equipment, materials and tools must be easy to use and management, so that they can be operated directly by the producers. Generally, manufacturers do not have computers and machines that fit easily into the rural agribusiness, either by size or cost. Fortunately, due to the boom in the development of organic agriculture and agribusiness, there are several small innovative companies that manufacture equipment and materials tailored to the needs of rural areas, which can be used to implement it in the fields (technical irrigation) and processing plants (processing equipment and quality control) (IDMA, 2008c; FAO, 2004).

The use of technology significantly increases production rates and productivity. With a minimum investment, farmers can access and purchase equipment and use it in the fields and in their processing plants. In this sense, it also improves the conditions for market access requirements.

Access to and use of appropriate technologies can be improved through the promotion by the central government and local governments.

5.4.4.3. Farmers' organization

The organization of producers is important because it can adequately address the problems in the value chain (production, transport, processing and marketing of agricultural products), connecting producers with consumers in an organized or associative way, since otherwise (individually) would be very hard, especially considering the characteristics of small rural farmers (IDMA, 2006a; Benavides, et al., 1995).

The organization allows farmers to be empowered by the proposal, so they can improve coordination between the productive and commercial activities. A good producer organization can optimize the increase in value added along the supply chain, and to mobilize support from other stakeholders and can help the farmers to negotiate a fair share of the total profits (IDMA, 2006a).

As mentioned earlier, rural agro-industry develops in a family environment and the production is small scale. This feature hinders access to markets, but an organization of producers as an alternative to deal cooperatively with the demands of the market could be helpful.

The intervention strategies of development projects should be implemented in a rural agribusiness organizational perspective, under a proposed dynamic in which the activities are evaluated, reformulated and are in constant feedback, according to a logical and planned, subject to the local cultural characteristics, idiosyncratic, knowledge level and needs.

A tool that has had good results and can continue to apply to cooperative learning organizations is called "farmer to farmer", which is conducive to active involvement of members of the association.

5.4.4.4. Marketing

The main challenge facing the producers of the Lurin River Basin is the marketing. Several factors influencing the market, such as educational level and bargaining power, lack of market research to meet product demand and market potential by product type, transport logistics and distribution to others.

For an adequate market access strategies are needed to develop a business management program designed to improve their business management skills and organizational development and implementation of a business plan. This proposal will allow the "Organic-point of sale" to become the first point of sale of organic products in the city of Lima.

The Organic-point of sale will increase the competitiveness of agribusiness and its chain in the Lurin River Basin through a collaborative effort and a proper marketing strategy, taking advantage of marketing opportunities. The organic-point of sale allows joint production between farmers and consumers, competitive products, cost and guaranteed by the certification. It expects to achieve an efficient marketing process which benefits the first link in the agricultural production chain: farmers (IDMA, 2008c; Chapilliquen, 2006; Boucher, 1989).

The organic-point of sale is very important in the flow distribution and marketing of organic products from Lurin River Basin, because it would have greater bargaining power to the different market types identified.

Additionally, through the organic-point of sale gaps are created to promote organic agriculture, which recognizes the work of farmers in the production of healthy products in balance with Nature. Product differentiation (organic) is presented as an advantage for the positioning of such products in the market for organic products.

5.4.4.5. Institutions: Territorial Rural Development

The institutional support is an important factor for the development of rural agro-industry. Institutions can provide training, technical assistance, financing, among others, to enable farmers to address the problems of production, processing, organization and marketing of competitiveness.

The development of the Lurin River Basin cannot be dispersed or focused solely on one activity or in one district. It is necessary that the institutions and all stakeholders have an overview of the entire Basin. Thus, the proposed interventions should be approached from a territorial development basis, by integrating and linking farmers, local governments, supporting institutions and consumers.

From a territorial development vision, it can establish strategic alliances with other producer organizations, with central government programs, local governments and NGOs working in this geographical area.

Territorial development is required to establish plans and procedures for intervention and articulated in the various social actors to achieve sustainable development of the Lurin River Basin. It is important to consider factors such as biodiversity, production, organization, pricing, marketing, advocacy, incentives for organic production, among others (IDMA, 2007b; Chapilliquen, 2006).

5.5. Analysis of Sustainability

The sustainability of rural agribusiness in the Lurin River Basin is based on different activities taking place in production, organization and business, including environmental, social and economic aspects.

The eco-agro rural, therefore, is a set of simple processes that can be adapted easily to the conditions of the area.

5.5.1. Environmental sustainability

In the Lurin River Basin, specifically for the Monticielo Association, all activities are conducted in the areas of cultivation and processing plants responding to organic agriculture criteria. The main agro-ecological practices developed are soil conservation, use of organic fertilizers, organic pest control, water use efficiency, crop rotation and biodiversity and processing techniques free of preservatives or chemical additives.

Agricultural management processes and processing are simple and allow farmers to develop them effectively.

Some areas of cultivation, fruit tree nurseries and processing plants are deployed with teams that employ a technology adapted to the work area, so its use and management is simple and the producers can manage properly.

5.5.2. Social sustainability

Rural agribusiness in the Lurin River Basin is seen as an innovative local development, where the main actors are involved and committed to this proposal. The producers show their interest in organized and formalized support institutions providing advice, training and technical assistance, and some local authorities are incorporating this type of initiative within their development plans.

Productive activities, organizational and business can become a reference replicable for other communities with similar characteristics.

In each district there is a local organization of producers, which together belong to the Association Monticielo. Monticielo Association works closely with the Organic Agriculture Network (RAE) and the National Association of Ecological Producers of Peru (ANPEP), which give institutional strength.

From this position, the implementation of actions in concert with the social partners allows fluid communication and empowerment of the proposal of human sustainable development.

5.5.3. Economic sustainability

In the Lurin River Basin, rural agro-industry is allowing for increased production and sales, income is reinvested in the same area of production, the producers association is formalized and the current context of legal and institutional framework is presented as a good opportunity.

Rural agribusiness, basically consists of adding value to primary production through processes of transformation, thus obtained more profitable products that can generate higher incomes for rural families.

In all processing plants, by mutual agreement of the members of the association, the income from product sales are reinvested in the purchase of supplies, materials and equipment to improve production systems.

The Monticielo Association is formalized, which not only gives institutional support but also allows to enter the market competitively with branded products, certification and comply with current legislation.

Over the past years a number of legal and institutional support for organic agriculture and rural agribusiness have been established, which is presented as an opportunity for growth and consolidation of this sector.

Currently, rural agro-industry presents many advantages to development, one of the most important point is the growth in consumption of these products. But, the main obstacle is the lack of technologies, production techniques and marketing knowledge (Riveros, 2007; FAO, 2006; Chávez, 2003).

Farmers in the highland areas know that their influence on the environment is positive, but they also know their limitations. They know the advantages of agroecology, but they are aware of their lack of knowledge on the technology available, processing and marketing topics (Nilsson, 2008).

One of the problems of Peru's rural areas is poverty. Therefore, rural agro-industry is considered a crucial issue (Chávez, 2003, CAC, 1989). Thus, a joint action by all stakeholders with an integral policies and strategies plan for its promotion can have a real impact, not only on employment creation and income generation, but also on the conservation of the environment.

The farmers feel they have a responsibility to their environment, and in that sense they are integrating ecological, economic and social variables. Even without the knowledge of theoretical concepts, their actions – based in agroecological principles - have been conducted with sustainable dimensions (Nilsson, 2008).

Consequently, rural agro-industry is an important tool in environmental conservation.

6. Conclusions

Rural agribusiness allows increase and retain the added value of farm production through transformation. In highland areas of Peru there are many small farmers who develop rural agribusiness, in general, by traditional methods, small-scale and in a family atmosphere.

The rural agribusiness is a very important sector because it contributes to food security and generates income and employment for rural families. In addition, ancestral knowledge and agroecological practices by farmers help preserving the environment.

The main strengths of rural agribusiness are the great biodiversity and microclimates that favor organic production, and growth in consumption of these kind of products by consumers. Moreover, the main constraints are lack of knowledge, the low use of technology and marketing problems.

In the case study of the Lurin River Basin it has been identified that most farmers use ecological farming practices in the cultivation and processing of their products. 70% of cultivated lands by members of the *Monticielo Association* are organically certified. There are three small plants for processing dairy products, apple and quince, and aromatic and medicinal herbs. However, the main obstacles are the low institutional support, weak organization and lack of marketing ability of farmers.

In the scenario analysis it has been identified that *organic-point of sale* scenario, which consist of a sales center implementation in the city of Lima, can become a key point for eco-businesses. *Organic-point of sale* would be an important link between producers and consumers, which could increase income for farming families, improve the level of organization and thus provide an efficient way to preserve the environment.

The strengthening of rural agribusiness involves a partnership between producers, consumers and institutions to support, throughout the entire production chain, to provide sustainability.

7. Recommendations

For agribusiness development in the Lurin River Basin it is necessary to continue with the training and technical assistance in production technology, business management and marketing.

The good results achieved in the development of certain programs and projects should be complemented by supervision and monitoring activities post-project ", in order to verify compliance with the techniques taught.

Additionally, should be implementing a policy of documentation or publications to prepare systematization documents of successful, innovative and replicable experiences.

Finally, the Lurin River Basin development requires an active participation of all stakeholders, in order to develop and strengthen initiatives of Territorial Development.

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Appendices

Appendix 1: Institutions to support the agribusiness

Institutions in support of organic farming and rural agribusiness, provide information, training and technical assistance, credit, among other services. However there is little inter-institutional coordination that allows to develop more effective actions in a planned and organized manner.

The following is a list of the main support institutions (MINAG-IICA, 2006; IDMA 2008):

1. Governmental institutions:

- ***Ministry of Agriculture:***
 - National Institute of Agricultural Research (INIA).
 - National Agricultural Health Service (SENASA).
 - National Project on Basin Management and Soil Conservation (PRONAMACHCS).
 - Projects of Agricultural Research and Extension (IEEP - INCAGRO).
 - ***Ministry of Women and Social Development:***
 - Cooperation Fund and Social Development (FONCODES).
 - National Food Aid Programme (PRONAA).
 - Ministry of Industry, Tourism, Integration and International Trade Negotiations (MITINCI).
 - Institute for the Defense of Free Competition and Protection of Intellectual Property (INDECOPI).
 - ***Ministry of Health:***
 - General Directorate of Environmental Health (DIGESA).
 - Health Centers
 - ***Universities:***
 - Universidad Nacional Agraria La Molina (UNALM).
 - Universidad Nacional del Centro del Peru (UNCP).
 - ***Municipalities:***
 - District Municipalities of the Lurin River Basin (Provinces of Lima and Huarochiri).
 - Metropolitan Municipality of Lima.
 - District Municipality of Miraflores (Lima).
 - District Municipality of Santiago de Surco (Lima).
 - District Municipality of San Borja (Lima).
- ### 2. Non Governmental Organizations (NGO):
- Institute for Environment and Development (IDMA).
 - Center for Research, Education and Development (CIED).

3. Training institutions:

- Engineering College of Peru (CIP).
- Rural Agribusiness Network (REDAR-Peru).
- Commission for the Promotion of Peru (PROMPERU).
- Commission for the Promotion of Exports (PROMPEX).
- International Technical Cooperation Agencies.
- Swiss Agency for Development and Cooperation (COSUDE).
- Food and Agriculture Organization (FAO).

Appendix 2: The main legal provisions relating to the rural agribusiness in Peru

- 1967-1970: For the first time, agribusiness is included in development plans, as a strategic sector. In 1968, because of military coup, the implementation was interrupted.
- 1970-1980: Implementing the model of "import substitution". Search for self-sustainability through the transformation of local raw materials.
- 1975: The agribusiness sector is not considered strategic. Priority is given to the industrial sector. 75% of inputs were imported food industries.
- 1983-84: not included on agro-industry development plans. Increases imports.
- 1985: "Industrial Restructuring." Programme to support exports.
- 1986-90: The National Development Plan, including the industrial sector as the main axis of development, use of domestic inputs and consumer oriented.
- 1990: Opening the market for imported products (cheap subsidized). Many domestic enterprises break through unfair competition.
- 1999: Law No. 27 060, authorizes the PRONAA purchase goods directly to small local producers. On this basis, many MSEs are developed in different areas (bakery, dairy, fish, cereals, etc.).
- 2000: Law No. 27 360, promotes the agricultural sector, favoring the small agribusiness in the country (except for Lima and Callao). The benefits of this law are valid until December 31, 2010.
- 2001: R.S. 435-2001-PCM, the National Commission of Organic Products (CONAPO), considered "birth certificate of organic farming".
- 2003: R. M. N ° 076-2003-AG approves the Technical Regulation of Organic Products.
- 2008: Publication of the Law No. 29 196, "Law for the Promotion of Organic or Ecological Agriculture".

Appendix 3: Agricultural production in the Lurin River Basin (data corresponds to Monticielo Association members)

Total agroecological production by zone and producers, (adapted from Asociación Monticielo, 2009).

Zone	Producers			Total area (ha)		
	Organic	In-transition	Total	Organic	In-transition	Total
Tupicocha	16	6	22	5,155	4,322	9,477
San Damián	11	3	14	9,720	2,250	11,970
Lahuaytambo	9	1	10	4,442	1,000	5,442
Langa	6	0	6	8,812		8,812
S.J. Chorrillos	12	2	14	5,455	0,230	5,685
Manchay Alto	4	1	5	2,450	0,050	2,500
REDPRAUSA	8	7	15	0,278	2,116	2,395
Total	66	20	86	36,312	9,968	46,281

Total agroecological production by cultivated areas, (adapted from Asociación Monticielo, 2009).

Zone	Cultivated area (ha)			Total production (kg)		
	Organic	In-transition	Total	Organic	In-transition	Total
Tupicocha	3,755	4,322	8,077	51 576	67 345	118 921,55
San Damián	9,720	0,960	10,680	64 125	13 150	77275
Lahuaytambo	3,061	1,000	4,061	26 560	10 000	36560
Langa	2,980		2,980	35 008		35008
S.J. Chorrillos	4,758	0,009	4,767	62 960	55	63015
Manchay Alto	1,522	0,055	1,577	32 493	370	32863
REDPRAUSA	0,191	0,124	0,315	1 200	788	1988,25
Total	25,987	6,470	32,457	273,922	91,708	365 630,8

Appendix 4: Brief description of NGO working in the Lurin River Basin.

There are several NGOs who have worked or currently are working in the Lurin River Basin. The two most important NGOs are the Institute for Development and Environment (IDMA) and the Centre for Research, Education and Development (CIED).

Concerning the case study of this thesis, the NGO working with the Monticielo Association is IDMA.

Institute for Development and Environment (IDMA), (adapted from Vega, 2008)

The Institute for Environment and Development (IDMA) is a non-governmental development organization (NGO), non-profit, founded on March 13, 1984. It is registered in the Public Records of Lima and Callao with registration card No. 8189 and renewed its registration in APCI as the recipient of International Technical Cooperation by Resolution N ° 529-2004/APCI-DE of October 27, 2004.

Mission: To achieve sustainable human development

Aim and Objectives:

Aim:

The IDMA is constituted in order to contribute from the local and regional to national development towards a sustainable development model to improve and raise the standard and quality of life, the democratization of society, social equity and gender.

Objectives:

- Peasants and farmers (men and women) develop sustainable agriculture, working out of conviction, in a responsible and organized way and contribute to the country's food security.
- The national educational system is training new generations adopt lifestyles in harmony with the environment.
- Social, regional and local governments work democratically and lead to sustainable human development processes.

Programs and accomplishments

IDMA works nationally in three programs of sustainable rural development:

- Sustainable Rural Development Programme Abancay (PDRS Abancay).
- Sustainable Rural Development Programme Huánuco (PDRS Huánuco).
- Sustainable Rural Development Programme Lima-Lurin (PDRS Lima-Lurin).
- Special Cochao Project in Huari-Ancash.

In all three programs and the special project, the multidisciplinary teams working in three lines, according to Institutional Strategic Plan 2002-2015:

1. Sustainable Agriculture and food security,
2. Environmental education, and
3. Citizenship and Governance.

As part of the process of devolution of responsibility programs, have the financial and operational autonomy.

Main achievements:

- Local and regional authorities sensitized on the conservation of natural resources and environment.
- Producers have been empowered to organic farming (sustainable) to increase use of local resources.
- Traditional technologies have been revalued and adapt appropriate technologies.
- Have been promoted and implemented joint agroecological production to the market through ecological fairs.
- Implemented and validated the proposed environmental education in educational institutions in rural areas and urban areas.
- Promoted and strengthened the organization of producers.
- Promote farmers and local leaders and defend their social, economic and political.
- Has the recognition of international cooperation agencies.

Appendix 5: Association of Ecological Producers of Lurin River Basin “Monticielo”, (adapted from Asociación Monticielo, 2009).

On March 24, 2001, 14 organic farmers of the districts of San Damian, Langa, Lahuaytambo and Pachacámac met in order to formalize the decision to start a civil partnership to be responsible for producing and marketing goods and ecological services. For this reason, it was agreed unanimously found the civil association called *Association of Ecological Producers of Lurin River Basin “Monticielo”*.

Monticielo Association was formed as an initiative of organic farmers. Since its beginnings , Monticielo Association has been working with the concept of territorial development (basin), promoting the chain of agribusiness. During the last seven years of institutional life farmers have been incorporated more organic producers, from 14 to 260, steadily, in the districts of San Damian, Langa, Lahuaytambo, Pachacámac, Tupicocha and San Jose de Los Chorrillos.

The main objective of Monticielo association is to encourage, promote and disseminate organic production diversified to insert the green markets, allowing greater competitiveness of these thanks to the partnership and in a cross pattern in regard to production, food security, water management, watershed management and environmental care.

For 2009, the association has the challenge of assuming the role of concerted efforts within the Association of Municipal Authorities of the Lurin River Basin (AAM).

Appendix 6: Marketing of products by type of market, (adapted from Asociación Monticielo, 2009).

Product	Amount of sales (kg)							
	In the district	Ecological fairs	Mini markets	Wholesale market	Institutions	Delivery	Others	Total
Dairy products in San Damián								
Fresh milk packaged	0	480	0	0	0	0		480
Pasteurized cheese	96	479,6	80	0	70	100	60	885,6
Yogurt	140	330	50	0	80	70	50	720
Blancmange	25	123	0	0	0	0	20	168
Yogurt ice cream	82,08	4,12	0	0	0	0	5	91,2
Total dairy products	343,08	1416,72	130	0	150	170	135	2209,8
Apple and quince products in S.J. Chorrillos								
Wine	400	1660	250	0	150	50	150	2660
Jam	30	580	30	0	15	5	5	665
Vinegar	40	2930	50	0	60	50	50	3180
Nectar	150	1760	100	0	80	30	40	2160
Total apple and quince products	620	6930	430	0	305	135	245	8420
Herb products in Tupicocha								
Fresh herbs	0	200	0	2500	0	0	200	2900
Dried herbs	0	144	0	0	0	0	0	144
Ground herbs	0	24	0	0	0	0	0	24
Total herb products	0	368	0	2500	0	0	200	2868
Total Kilos	963,08	8714,72	560	2500	455	305	580	13497,8
Total percentage	7%	65%	4%	19%	3%	2%	4%	100%

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