# Annex 1: List of principes of Agro-ecology:

1. Use Renewable Resources
    - Use renewable sources of energy instead of non-renewable sources.
      Use biological nitrogen fixation.
    - Use naturally-occurring materials instead of synthetic, manufactured inputs.
    - Use on-farm resources as much as possible.
    - Recycle on-farm nutrients.

2. Minimize Toxics

- Reduce or eliminate the use of materials that have the potential to harm the environment or the health of farmers, farm workers, or consumers.
- Use farming practices that reduce or eliminate environmental pollution with nitrates, toxic gases, or other materials generated by burning or overloading agroecosystems with nutrients.

3. Conserve Resources

- Conserve soil: Sustain soil nutrient and organic matter stocks and minimize erosion.
    - Use perennials
    - Use no-till or reduced tillage methods.
    - Mulch
    - Conserve water: Dry farm and use efficient irrigation systems
- Conserve Energy: use energy efficient technologies.
- Conserve genetic resources: save seed, maintain local landraces and use heirloom varieties if possible.

4. Manage Ecological Relationships

- Reestablish ecological relationships that can occur naturally on the farm instead of reducing and simplifying them.
- Manage pests, diseases, and weeds instead of "controlling" them.
- Use intercropping and cover cropping
- Integrate Livestock
- Enhance beneficial biota
    - In soils: my corrhizae, Rhizobia, free-living nitrogen fixers
    - Beneficial insects: Provide refugia for beneficials and enhance benefial populations by breed and release programs.
- Recycle Nutrients
    - Shift from throughflow nutrient management to recycling of nutrients.
    - Return crop residues and manures to soils.
    - When outside inputs are necessary, sustain their benefits by recycling them.
- Minimize Disturbance
    - Use reduced tillage or no-till methods.
    - Use mulches.
    - Use perennials

5. Adjust to Local Environments

- Match cropping patterns to the productive potential and physical limitations of the farm landscape.
- Adapt Biota: adapt plants and animals to the ecological conditions of the farm rather than modifying the farm to meet the needs of the crops and animals.

6. Diversify

- Landscapes
  - Maintain undisturbed areas as buffer zones
  - Use contour and strip tillage
  - Maintain riparian buffer zones
  - Use rotational grazing
- Biota
  - Intercrop
  - Rotate crops
  - Use polyculture
  - Integrate animals in system
  - Use multiple species of crops and animals on farm
  - Use multiple varieties and landraces of crops and animals on farm
- Economics
  - Avoid dependence on single crops/products.
  - Use multiple crops to diversify seasonal timing of production over the year.
  - Diversify markets
  - Try to value the multifunctional character of farming

7. Empower farmers

- Ensure that local farmers control their development process.
- Use local knowledge
- Promote multi-directional transfer of knowledge, as opposed to "top-down" knowledge transfer.
- Increase farmer participation.
- Strengthen communities: Encourage local partnerships between people and development groups. Ensure intergenerational fairness.
- Guarantee agricultural labor: Ensure equitable labor relations for farm workers.
- Teach principles of Agro-ecology & sustainability.

8. Manage Whole Systems

- Use planning processes that recognize the different scales and levels of agroecosystems.
  - Value and/or supply chains
  - Landscapes
  - Households
  - Farms
  - Communities
  - Bioregions
  - Nations
- Minimize impacts on neighboring ecosystems.

9. Maximize Long-Term Benefits

- Maximize intergenerational benefits, not just annual profits.
- Maximize livelihoods and quality of life in rural areas.

- Facilitate generational transfers.
- Use long-term strategies: develop plans that can be adjusted and reevaluated through time.
- Incorporate long-term sustainability into overall agroecosystem design and management.
- Build soil fertility over the long-term: build soil organic matter.

10. Value Health
    - Human Health
    - Cultural Health
    - Environmental Health
        - Value most highly the overall health of agroecosystems rather than the outcome of a particular crop system or season.
        - Eliminate environmental pollution by toxics and surplus nutrients.
    - Animal Health
    - Plant Health

## Annex 2: Cases:

**Shade Coffee in Southeastern Brazil**
**Overview:** Intercropping trees into coffee plantings increases biodiversity, lowers costs and provides natural nutrients for the coffee plant.
Scale: Community, farm
Location: Viçosa, Brazil (20.5°S, 42.5°W)
Elevation: 0 to 150 meters
Climate: Moderate continental forest climate, mild winter (Cfa- G. T. Trewartha)
Agricultural Region: Plantation Agriculture - G
Population: Density 25 - 50 persons / square kilometer
Principal Crops: Coffee (Coffea arabica), fruit trees (many species), maize (Zea mays), beans (Phaseolus sp.), sugarcane (Saccharum officinarum)
Domestic Animals: none
Soils: latosols
Natural Vegetation: Semideciduous broadleaf evergreen (S)
Ecoregion: Rainforest altitudinal zone
Basic Principles addressed Use Renewable Resources, Conserve Resources, Manage Ecological Relationships, Diversify, Maximize Long-Term Benefits
Page Author : Rodrigo Matta-Machado with help from Chris Bley
**Description:**
Native tree species are deliberately planted between rows of coffee shrubs. Management of these trees includes pruning before the coffee flowering period, in order to avoid competition for light, water and nutrients. Trees sprout back, forming a slight canopy which protects the coffee environment, increases biodiversity and increases nutrient cycling to coffee plants.
**Lessons learned:**
Careful landscape design and management benefits coffee in shade coffee agroecosystems. Tree intercropping choices include species that fix atmospheric nitrogen, trees capable of taking up nutrients, like phosphorus, that are in otherwise unavailable forms, and deep-rooted "pumping" trees that bring up nutrients out of reach of coffee plant roots that would otherwise be leached out and unavailable. Seasonal pruning of deep-rooted "pumping trees" puts leaves and branches on the soil surface, forming a thick mulch, protecting soil from water and wind erosion. After mulch decomposition, essential nutrients are recycled and returned to the coffee plants. Shade coffee agroforestry systems increase biodiversity, helping to ameliorate associated pest and disease problems and can serve as corridors connecting natural forest fragments in the tropics.
**Principles illustrated:**
Use Renewable Resources
Shade trees increase biological nitrogen fixation, serve as a permanent green-manure crop helping to make on-farm soil nutrients more available to coffee.
Conserve Resources
Planting of perennials helps to minimize soil erosion, both by tree roots in soil and the formation of a mulch cover over soil.
Manage Ecological Relationships
The presence of diverse tree species helps in pest, disease and weed control, increases nutrient recycling, enhances beneficial soil biota, and provides habitats for beneficial insects.
Diversify
Introduction of shade trees increases biodiversity in agroecosystems in a form of agroforestry.
Maximize Long-Term Benefits
Trees can be harvested for firewood and timber, adding long-term value to the land output.
More information:

Institutions supporting shade coffee systems: CTA-ZM (Centro de Tecnologia Alternativa da Zona da Mata, Minas Gerais, Brazil)
Publications: Perfecto, R. 1996. Shade Coffee: A Disappearing Refuge for Biiodiversity. BioScience 46: 598-608.

**Cases 2**

**Role of Green Manure Crops in Lowland Rice Based Farming System of Northern Thailand**

Overview: Use of green manure to improve overall system productivity of rice-soybean production system

Scale: Field, farm, community

Location: San Sai district, Chiang Mai province (17-20°N-98-99°W)

Elevation: 312 meters

Climate: Tropical Savanna; cooler upland stippled

Agricultural Region: Intensive Subsistence Tillage, Rice unimportant

Population Density: 493 / square kilometer

Principal Crops: Rice (Oryza sativa L.), Soybean (Glycine max L.), Potato (Solanum tuberosum L.), Yard long bean (Phaseolus vulgaris), Tomato (Lycopersicon esculentum)

Domestic Animals: Pigs, Cows, Chickens, Fish, Buffalos

Soils: Mountain soils; Soil with various moisture and temperature regimes; mainly high altitude soils forming on steep slopes; soil vary greatly within a short distance

Natural Vegetation: Broadleaf evergreen trees

Ecoregion: Savanna Altitudinal Zone ; open woodland -steppe

Basic Principles addressed: Use Renewable Resources, Conserve Resources, Manage Ecological Relationships, Adjust to Local Environments, Empower People, Manage Whole Systems, Maximize Long-Term Benefits, Value Health

Page Author and Date: Budsara Limnirankul, Multiple Cropping Center, Chiang Mai University, Thailand, budsara@chiangmai.ac.th, 2001

**Description:**

Rice soybean production system is the main sequential cropping system in the irrigated lowland of Chiang Mai Valley. Traditionally, the lowland farmers plant rainy season rice with minimum inputs for subsistence. The soybean introduced in the early 20th century, is planted following rice for cash in the dry season. The biological nitrogen fixing soybean provides average yield of 1.25 t/ha and is able to maintain rice yield at 2.8- 3 t/ha without chemical fertilizer. Thus soybean is considered by farmers as fertility conserving and regenerating crop in this low external input production system. In recent years, the lowland farmers use chemical fertilizer to increase rice productivity to over 3 t/ha. However, since the economic crisis in 1997, the price of chemical fertilizer has increased causing farmers to work for alternatives for improving soil fertility and increasing rice yield.

Sesbania rostrata has been introduced as green manure crop before rainy season rice in the rice soybean system. The legume is broadcasted in mid May and incorporated into soil after 55-60 days. Rice is then transplanted 7-10 days after Sesbania incorporation. The on-station studies and on-farm participatory experimentation show convincing results of increasing rice yield over 20%, which is equivalent to yield obtained by applying 54 kgN/ha. After two years of farmer participation, the area planted to Sesbania rostrata in the test site as green manure crop has been increased three folds. The farmers, realizing the importance of Sesbania as a resource conserving and regenerating crop, have begun to organize a seed production unit within the community. In the 2001 season, the farmer group in the test site has been able to produce 120 kg of Sesbania seeds, which can be used to cover 40 rai (6.4

ha) (seeding rate 18.75 kg/ha). Seeing the real benefit of Sesbania, the farmers have organized themselves to produce Sesbania seed for community use.

**Lessons learned:**

The reduction of production costs is an important production strategy for small rice farmers in Chiang Mai Valley. Therefore the use of low external inputs while maintaining stable rice yield is a practical solution. The benefit of green manure crops is observed in the long term, but the Sesbania rostrata in rice soybean system shows immediate positive result in increasing rice yield, resulting in farmer adoption. The contribution is due to its nitrogen fixing ability and its fast growing habits, producing dry biomass of over 3 t/ha at 55-60 days and with 3.5% nitrogen content.

The relatively lower C:N ratio (16-24) as compared to soybean residue (30) also makes it decompose easily. The growth of Sesbania rostrata fits the cropping calendar of rice-soybean system. It suppresses weed growth, thus reducing the use of herbicides in rice cultivation. It fits in the lowland ecological niche, particularly on the clay-loam soil. The heavy clay soil will cause poor seedling establishment.

As farmers see the benefit of Sesbania in improving system productivity, they adopt the technology and organize the community seed production, so that seed is available within the community. It is expected that with the increasing price of chemical fertilizer, use of Sesbania rostrata as green manure will continue, and it could have long term benefit to soil organic matter.

**Principles illustrated:**

Use Renewable Resources:

Sesbania rostrata is a biological nitrogen fixing plant, used as an on-farm resource.

Conserve Resources:

Incorporating S. rostrata increases soil nutrients and soil fertility without using chemical fertilizer.

Manage Ecological Relationships:

Use of S. rostrata returns crop residues and manure to soils, controls weed.

Adjust to Local Environments: S. rostrata fits with lowland rice -soybean cropping patterns.

Empower People:

This system enhances farmer participation in on-farm trial and encourages farmers to produce S. rostrata seed.

Manage Whole Systems:

S. rostrata increases farm productivity and reduces the use of chemical fertilizer in the community.

Maximize Long-Term Benefits:

Use of S. rostrata increases long term soil organic matter, reduces production cost and generates additional income.

Value Health:

Sesbania and soybean in the whole production system maintain environmental health and provide a nutritive diet.

Source: http://www.Agro-ecology.org/Case%20Studies/greenmanure.html

Images : http://www.Agro-ecology.org/Case%20Studies/greenmanure2.htm

**Case 3**

**Food and Health Education in Northeastern Brazil**

**Overview**: Educating people on nutritional and health issues promotes interest in growing home gardens and improves the quality of life in the community.

Scale: Homegarden, household, region.

Location: Barra de Santa Rosa, Paraiba State, Brazil (6.7°S, 36.3°W)

Elevation: 350 meters

Climate: Tropical Steppe (BSh), rainy season from March to June.

Agricultural Region: Rudimental Sedentary Cultivation (D) and Livestock Ranching (B)

Population Density: 12 persons / square kilometer

Principal Crops: Cash Crops: Sisal (Agave sisalana L.) and Cotton (Gossypium spp.), Subsistence Crops: Corn (Zea mays L.), Beans (Phaseolus spp.and Vigna spp.), Squash (Cucurbita spp.), "Palma" cactus (Opuntia ficusindica). Encouraged to Grow: Vegetables, like Lettuce (Lactuca sativa), Cabbage (Brassica oleracea), Tomato (Lycopersicon esculentum), Okra (Abelmoschus esculentus), Peppers (Capsicum annuum); Fruit Trees, like Papaya (Carica papaya), Passion Fruit (Passiflora edulis), Guava (Psidium guajava); Medicinal Plants, like Common Plantago (Plantago major), Comfrey (Symphitum officinalis), Coleus barbatus, Plectranthus amboinicus, Bowles' mint (Menthaxvillosa), Mugwort (Artemisia vulgaris), among others.

Domestic Animals: Goats, Sheep, Cattle, Chickens.

Soils: Ustalfs, Warm subhumid to semi-arid; dry for >90 days (incl. some Reddish Chestnut and Red & Yellow Podzolic soils) - (A3)

Natural Vegetation: Broadleaf deciduous trees (Di)

Ecoregion: Tropical/Subtropical Steppe Province, Plants sufficiently far apart that they frequently do not touch (D1)

Basic Principles addressed: Conserve Resources, Diversify, Empower People, Maximize Long-Term Benefits, Value Health

Page Author and Date: Elena Giachetti, 1999.

**Description:**

For cultural and ecological reasons, the diet of inhabitants in this semi-arid region is chronically low in vegetables and fruits. Consequently, there are high levels of avitaminosis and malnutrition in the region, especially among women and children. Another problem is an increase of the indiscriminate use of pharmaceutical medicines and the loss of traditional knowledge about the medicinal use of native plants. The goal of the Food and Health Education Program (FHEP) is to train people, in particular women, giving them the intellectual tools to improve their diet and the health of their families and introduce them to an Agro-ecological vision of the environment in which they live. This goal is pursued by promoting courses and meetings about the following themes: basic nutrition, health linked with eating habits, food preservation, home gardening practices adapted to the semi-arid environment, medicinal plants and their use for safe, homemade production of medicines, where interpersonal and intergenerational transfer of knowledge is promoted. Importance is given to the rescue of traditional uses of medicinal plants and their preservation, and to an Agro-ecological home gardening approach.

**Lessons learned:**

In recent years, agricultural productivity declines caused by severe and prolonged regional droughts have combined with ecologically maladapted farming practices to reduce the nutritional value of the region's already poor diet. The FHEP has helped improve this situation in many ways. Training people about the nutritional value of food and helping them to start home gardens using household waste water has proved an effective way for improving the quality of life in the communities. Growing vegetables, fruit and medicinal plants near houses using only small amounts of water is one approach that may help slow emigration from the region. The rescue and validation of traditional knowledge on medicinal plants empowers people and promotes self-esteem. By learning to use medicinal plants to produce effective homemade medicines for the most common diseases, family health is improved while promoting intergenerational knowledge transfer. Home gardening activities are good tools for introducing Agro-ecological concepts like resource conservation, nutrient recycling, ecologically-sound management of soil, pests, and diseases and the interrelationships between plants, soil and climate. Functioning like an open laboratory, farmers learn and experiment with Agro-ecological practices in home gardens with a low level of risk. Once familiar with these practices, farmers gain confidence in applying them in their fields.

**Principles illustrated:**

Conserve Resources

The use of waste water for home gardens combined with efficient irrigation systems represent a conservative use of this very scarce resource. The rescue and validation of of traditional use of endangered medicinal plants combined with household cultivation systems conserves genetic resources.

Diversify

Growing vegetables, fruit trees and medicinal plants helps farmers improve the crop diversity while enriching their diets.

Empower People

By valuing, improving and transferring their local knowledge, women gain self-esteem and are able to improve the nutrition and health situation of their families. Moreover, the FHEP works to mobilize entire peasant communities.

Maximize Long-Term Benefits

Using home gardens to produce food and medicinal plants represents a long term benefit to households that can contribute to slowing down the rural exodus from the region.

Value Health

Nutritional education combined with home production and use of vegetables, fruits and medicinal plants improves the health of rural populations.

**Case 4**

**Tropical agroforestry homegardens in Nicaragua**

**Overview:** Tropical agroforestry homegardens "huertos caseros" are traditional agricultural systems characterized by the complexity of their structure and their multiple functions. In this study, socioeconomic importance and some key ecological characteristics related to sustainability were studied in 20 Nicaraguan homegardens.

Scale: Household, subsistence farm, village, local region

Location: San Juan de Oriente village, Province of Masaya, Nicaragua (11°59' N, 86°06' W)

Elevation: 0 to 150 meters

Climate: Dry tropical rainforest (with a marked, 6 month, dry season) (Af - G.T. Trewartha)

Agricultural Region: plantation agriculture

Population: Density 358 persons / square kilometer

Principal Crops: Coffee (Coffea arabica), Bananas & plantains (Musa spp), Local corn varieties (Zea mays), Local bean varieties (Phaseolus vulgaris), Different species of Passion Fruit (Passiflora spp), Fruit trees (many species), Multi-purpose trees (many species), Ornamental plants (many species) Herbaceous crops (many species).

Domestic Animals: Chickens, Pigs, Ducks.

Soils: Clay loams of volcanic origin; Mountain soils-Udic great groups of Alfisols, Entisols and Ultisols; Inceptisols (X3 - G.T. Trewartha)

Natural Vegetation: Broadleaf evergreen trees (E - A.W. Küchler)

Ecoregion: Humid tropical zone (Savanna altitudinal zones-Tr2- G.T. Trewartha); Premontane tropical rainforest (Holdridge Life Zone Classification)

Basic Principles addressed: Use Renewable Resources, Conserve resources, Manage Ecological Relationships, Adjust to Local Environments, Manage Whole Systems, Maximize Long-Term Benefits

Page Author and Date Ernesto Méndez

**Description:**

Information on 20 families and their homegardens was compiled between January & August 1996. Agro-ecological information of plant composition and structure was collected through inventories and participatory maps depicting management zones (area allocations to specific uses and management), general topography and plant location and use. Plants were further categorized by use and growth habit. Emphasis was put on having zones and plant uses defined by farmers. Socioeconomic importance was determined by homegarden income and product generation, occupations and labor investments by gender. Socioeconomic data was collected through surveys, semi-structured interviews and three in-depth case studies. The twenty homegardens were then classified into 6 "types", using a field-based typology and through a cluster analysis, using Ward's minimum variance method.

**Lessons learned:**

Homegardens at the site showed both characteristics of ecological sustainability and socioeconomic importance, although they differed in terms of structure and function. Local management strategies, exemplified through zonification, seem to be dynamic processes which are affected by both external forces (work opportunities) and internal choices (occupational preferences). Homegardens were specifically designed in order to meet each family's needs and preferences with available resources.

Although dependence on homegardens may vary according to specific conditions at a given time (i.e. labor availability; outside labor opportunities), they remain a consistent, flexible resource families use to provide for various needs. The methodological approach used in this investigation seems appropriate to study homegardens and similar agroecosystems. Clear advantages are the inclusion of both biophysical and socioeconomic data, essential for understanding complex agroecosystems, and its simplicity and flexibility.

**principles illustrated:**

Use Renewable Resources

Use of naturally-occurring, renewable, on-homegarden inputs.

Conserve Resources

Homegardens showed no signs of soil erosion, and provided refuge for plant and faunal biodiversity.

Manage Ecological Relationships

Nutrient cycling is increased through the multi-strata agroforestry structure of the homegardens. Trees and shrubs absorb nutrients at deeper soil levels and make them available to other plants through litter. Pests are regulated by maintaining high levels of plant diversity.

Adjust to Local Environments

Families have adapted homegarden management to their specific needs and environment.

Manage Whole Systems

Homegardens provide both Agro-ecological products an socioeconomic benefits, while conserving resources.

Maximize Long-Term Benefits

Families value the year-round, diverse production of homegardens, even if yields are lower than in monocultures. Use of perennial crops sustains these benefits over the long term.

Diversify

Homegardens are one of the most diverse agroecosystems in the world. By including a wide array of plant species and using space for work and recreation homegardeners ensure a wide range of their needs are met through the maintenance of these systems.

Empower people

Homegardening systems use local knowledge and management strategies to improve local environments and communities.

More information:

Mendez, V.E., R. Lok & E. Somarriba (in review) Interdisciplinary analysis of homegardens in Nicaragua: zonification, plant use & socioeconomic importance. submitted to Agroforestry Systems [The Netherlands].

Mendez, V.E., R. Lok & E. Somarriba (1999) Interdisciplinary analysis of tropical homegardens: a case study from Nicaragua. Pp. 260-263. In Jimenez, F. & J. Beer (compilors) Proceedings of the International Symposium on Multi-strata Agroforestry Systems with Perennial Crops, 22-27 Feb. CATIE: Turrialba, Costa Rica.

Mendez, V.E. & R. Lok (1997) Analisis agroecologico de huertos caseros tradicionales en Nicaragua. pp 240-244. In Proceedings of the Third Scientific Week at CATIE, 3-6 Feb. CATIE: Turrialba, Costa Rica.

Mendez, V.E., R. Lok & E. Somarriba (1996) Analisis agroecologico de huertos caseros tradicionales en Nicaragua. Agroforesteria en las Americas 10:36-40 [Costa Rica].

**Case 5:**
**Zapopano Maize Agrecosystem**
**Overview:** In this agroecosystem, we will transition to sustainable agriculture.
Scale The zapopan valley has mainly subsistence farm. Production is for the local market, the EJIDO, and rural owners.
Location: It is located in Jalisco state near to Guadalara city. The latitude is 20 42` N and altitude of 100 23).
Elevation: It is 1750 m above sea level.
Climate: Tropical Savanna (Aw) Cooler uplands stippled.
Agricultural Region: G (Plantation agriculture).
Population Density: unknown
Principal Crops: Corn (Zea mayz), Sorghum (Sorgum vulgare), Beans (Phaseolus vulgaris), Star grass (Cynodon plectostachyus).
Domestic Animals: cows, horses, chickens, some pigs.
Soils: Arididols (Pedogonic horizons lower in organic matter and dry > 6 mo. of the year (Desert and Reddish Desert *) Salts may accumulated on or near surface. Argids D2 with horizons of clay accumulation.
Natural Vegetation: Broadleaf evergreen, shrubform minimum height 3 feet, growth singly or in groups or patches.
Ecoregion: D2 Tropical Subtropical Steppe Altitudinal Zone (Upland steppe and desert shrub).
Basic Principles addressed: Use Renewable Resources, Minimize Toxics, Conserve Resources, Manage Ecological Relationships, Value Health
Page Author and Date: MC Santiago Sanchez Preciado, 2001
**Description:**
The zapopano corn system originated in the 1960s with a government program called Plan Jalisco which had the intention of raising the yield of corn. For this, before the harvest the corn plant was cut, then it was doubled over so that later the harvest could be done by hand. When the weeds present at this time began to flower, they were incorporated with machinery, permitting the decomposition of the weeds in the soil and incorporating the organic matter. It is very common in this region that some rains occur in the months of December and January, called "cabañuelas", which allowed the soil to conserve this moisture due to its content of organic matter. In addition this moisture was trapped with a light cultivation. With the use of new technologies that the producers have adopteded (principally the use of herbicides, fertilizers, and mechanical harvesting) the traditional practices were discarded. This contibuted to raising the cost of production, contamination of the environment, and reduction in the amount of organic material and the fertility of the soil. Due to the loss of price supports that had been given by the government, which had kept them above international prices, corn production no longer was profitable. The latter bound the farmer to recover traditional practices in order to reduce the cost of inputs. The government has implemented programs to recover the fertililty of the soil through the use of compost developed from waste and vermicompost, organic fertilizer, and in some cases biofertilizers. Also, the use of biological control of insects such as Trichrograma and Crisoperla.
**Lessons learned:**
The most important aspects of this agroecosystem are: first, that the farmer did not believe that his production was sustainable by using expensive inputs to raise yields. The average yield when this agroecosystem study began was was 1200 kl/ha. With traditional management systems the yield was raised to 2200kl/ha. With the use of conventional technologies an average yield was between 1300 y 1500 kl/ha. With this type of production it was not possible to make earnings due to the fact that the costs of inputs fluctuate (there is no set price). There were farmers who obtained yields above 6000 kl/ha in the conventional system but they are not represenative of the majority. It is it the farmers who convinced themselves that they needed to reduce the costs of production and to make sustainable their main acitivity which is farming. The high levels of pesticides and fertilizers of which they apply upwards of 240 kl of nitrogen,120 kl of phosphorus, and in same cases 60 kl of

potassium, caused problems with acidity and soil contamination. To recover Agro-ecological practices in the production of corn in this region would help us to reach a sustainable agriculture.

**Principles illustrated:**

Use Renewable Resources

The use of organic fertilizer and compost are sources of renewable energy that promote the fixation of nitrogen in a natural form, in place of synthetic inputs. Besides that on many occasions they are recycled on the farm.

Minimize Toxics

The use of fewer chemical products minimizes the toxicity in the soil, the environment, and in plants.

Conserve Resources

Adequately manage soil and water resources by the use of organic material, a readily available input.

Manage Ecological Relationships

A key aspect that has helped in the implementation of Agro-ecological practices is the reduction in costs of production, which helps the farmers get a greater profit from the agroecosystem. This is done by the release of beneficical insects such as trichograma to control cogollero y crisoperla to control rizofagas.

Value Health

For the future it is necessary and must be a permanenet obligation of the famers to care for and reduce risks in the health of people, animals, and the environment, and to achieve sustainable development in the region.

**Case 6**

**Community Supported Agriculture in Santa Cruz, California, USA**

**Overview:** Community Supported Agriculture (CSA) provides locally grown organic farm products to the community of Santa Cruz, California.

Scale: field, collective, local region

Location: Santa Cruz, California, USA (36.6N, 122.0W)

Elevation: 0 to 150 meters

Climate: Mediterranean or Dry Summer Subtropical (Cs)

Agricultural Region :Mediterranean Agriculture - H

Population Density >100 persons / square kilometer

Principal Crops: apples (Malus pumila), plums (Prunus domestica), broccoli (Brassica oleracea var. botrytis), cabbage (Brassica oleracea var. capitata), leeks (Allium ampeloprasum), onions (Allium cepa), garlic (Allium sativum), carrots (Daucus carota), beans (Phaseolus vulgaris), chard (Cynara scolymus), kiwis (Actinidia chinensis), maize (Zea mays), lettuce (Lactuca sativa), pears (Pyrus communis), eggplant (Solanum melongena), peppers (Piper nigrum), potatoes (Solanum tuberosum), tomatoes (Lycopersicon esculentum), spinach (Spinacia oleracea), strawberries (Fragaria ananassa), summer & winter squash (Cucurbita sp.), mixed green leafy vegetables (various species)

Domestic Animals none

Soils Specific: Sandy loam General: Mountain Soils - Xeric great group of Alfisols, Entisols, Inceptisols, Mollisols and Ultisols (X5)

Natural Vegetation: Needleleaf evergreen trees (E), Douglas fir- Redwood (29)

Ecoregion: Mediterranean Province (H11)

Basic Principles addressed: Minimize Toxics, Conserve Resources, Diversify, Empower People, Manage Whole Systems

Page Author and Date Chris Bley

**Description:**

Community Supported Agriculture (CSA) is a nationwide movement unifying local consumers and farmers into communities. The CSA in Santa Cruz, California is part of the UCSC Farm and Garden and provides 80 shareholders with organic fruits and vegtables grown on a 25-acre farm on the campus of the University of California, Santa Cruz (UCSC). Shareholders pay $500 ($23 per week) in exchange for a weekly selection of in-season crops produced on the farm. Shareholders collect their weekly shares at the farm and are welcome to harvest their own herbs and flowers while there.

**Lessons learned:**

The popularity of the CSA program in Santa Cruz has increased dramatically since its start in 1995 with 16 shareholders. Current interest in CSA's in Santa Cruz and around the nation demonstrate widespread consumer concern over food quality and an interest in interacting with producers directly. Interactions between consumers, farmers and farms is an important connection that consumers are missing in supermarkets and other food outlets. CSA closes this gap. Moreover, the organic farm at UCSC also functions as an education center, accepting 40 students for a six-month Apprenticeship in Ecological Horticulture program, supporting the extension of CSA methods to other areas.

**Principles illustrated:**

Minimize Toxics

The organic growing practices desirable to CSA consumers eliminate the use of materials that harm the environment, health of farmers, farm workers, or consumers.

Conserve Resources

Bank debt is kept to a minimum as shareholders invest in the future success of the farm and its products.

Diversify

The need to provide a "market basket" to consumers encourages farmers to diversify their production to include multiple species and varieties- there is a direct connection between diverse production and market success. Morever, CSA's are themselves an alternative market for farm products.

Empower People

CSA encourages people-centric development by unifying the consumer and the farmer where their food is produced.

Manage Whole Systems

Connections between the farm and the community strengthen with CSA programs