

Introduction to Ecological Farming

Farmer-to-Farmer Participatory Training Course



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Author: REAP Canada is an independent, research, education and development organization based in Ste-Anne-de-Bellevue, Quebec, Canada. REAP has 16 years experience working with farmers, scientists and the private sector to advance rural development both in Canada and abroad mainly through participatory on-farm research and farmer-to-farmer training. REAP-Canada has been working on agro-ecological village development with Philippine partners since 1997 in projects sponsored by CIDA and USAID. The organization has leading expertise in working with communities on sustainable farming and renewable energy systems development.

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Course Objectives

The objectives of this course are to:

- Provide a basic understanding of ecological farming systems and practices which enhance the long-term care of the land, and water, as well as some practical methods.
- Assist each participant to evaluate their farming practices and goals and to start designing a farm plan according to ecological principles.

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Introduction

Farmer-to-Farmer Participatory Training Course

Objectives

- Know fellow participants, their farm type and expectations
- Recognize that each farmer can make a positive impact on their lives, their community, and the environment through the implementation of ecological farming principles



Introduction

Name _____

ACTIVITY: Have the farmers draw a resource map, provide them with paper and colored pens.

Draw a map of your farm! Include the important resources that you and your family have including fields (and their area in mu) the natural areas on your farm, water sources, livestock, and other plants and animals.

Which are the most important resources on your farm? How do these resources affect your farming activities?

- Farm Details:** 1. Types of crop and Area of each crop: _____
2. Types of livestock: _____
3. Natural Areas (mu): _____
4. Total Area (mu): _____

What crops, livestock or other important changes do you plan to introduce to your farm in the next 5-10 years?

How could you make your farm more sustainable?

What do you hope to gain from participating in this course?

Ecological Principles

Before we can talk about creating an eco-village or even our own individual ecological farm we need to understand the basic processes of natural systems, our agricultural history and why present day society is not sustainable.

What is an ecosystem and biodiversity?

ACTIVITY: Have a buzz (where the farmers take a moment or two and talk to their neighbors about a particular question) followed by a group discussion about the following three questions.

What is an ecosystem? What is biodiversity? Identify some key concepts.

What is an ecosystem?

What is biodiversity?

Identify some key concepts.

An **ecosystem** is the complex system of interactions between living things such as plants, bugs, animals and bacteria as well as non-living things like soil, water, rocks, climate, and the sun. These living and non-living things greatly depend on each other, and it is the presence and abundance of their interactions which provides integrity to the entire ecosystem. Thus, all parts are important! If just one part of the system is removed or becomes damaged, other parts can be greatly affected. The integrity of the ecosystem can then weaken which often leads to various social, economic, and environmental disasters.

Within the ecosystem, there are many different living species existing together. These include insects, bacteria, soil organisms, birds, rodents, and large mammals like deer. The presence of various living things existing together in an ecosystem is called **biodiversity**. With greater biodiversity, the ecosystem is more stable. For example, on the natural grassland, there are much more kinds of grasses than artificial grassland, since the natural

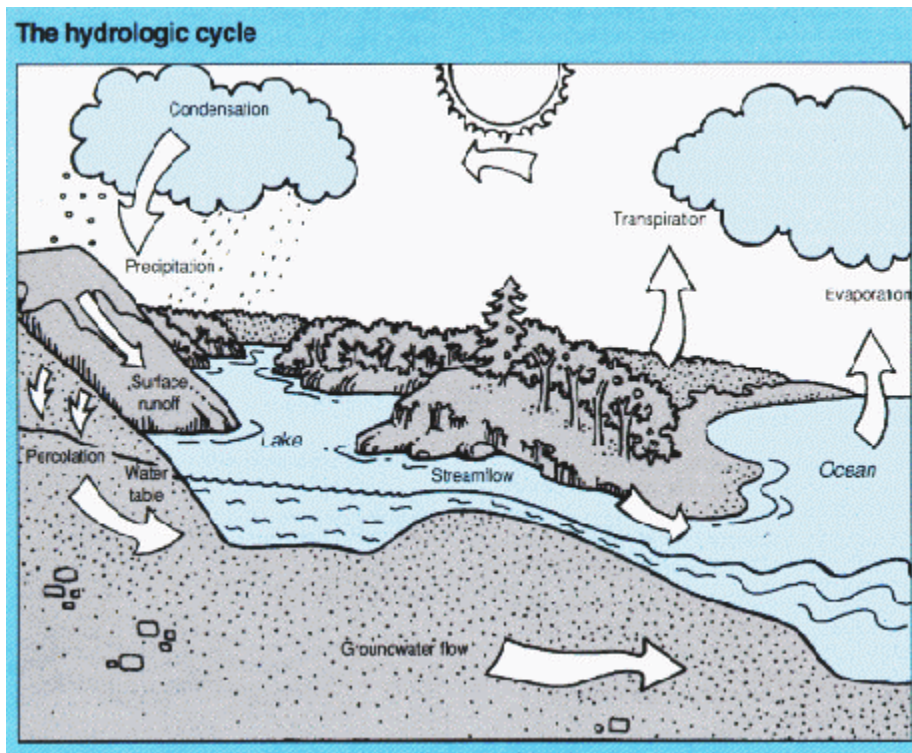
grasslands have greater resistance to natural disasters. On the farmland, if there are many kinds of crops within one area, the easier it is for them to resist to insects and diseases.

Within an ecosystem, various things get recycled and reused. These include:

1. **water**,
2. **energy**, and
3. **nutrients**.

How is water cycled?

Water is essential to life. It exists in three forms: solid, liquid, and gas. The water cycle process can be divided into five parts: Condensation, Infiltration, Runoff, Evaporation and Precipitation.



<http://www.und.nodak.edu/instruct/eng/fkarner/pages/cycle.htm>

Condensation is when water vapor in the atmosphere condenses to form clouds. When clouds can no longer hold the moisture, they release it in the form of **precipitation**, which can be in the form of snow, rain, hail, etc. **Infiltration** is when precipitation seeps into the ground. This process depends on the permeability of the soil and the amount of water already in the ground. If channels in the soil are not open to take water, the amount of water that infiltrates can decrease (i.e. due to tilling). Infiltrated water eventually flows into streams, rivers and larger bodies of water such as lakes or the ocean. If the rate of precipitation occurs faster than the rate of infiltration, the water flows on the surface of the ground and is called **runoff**. Runoff remains on the surface and also flows into streams, rivers, and eventually large bodies of water. The heat from the sun can cause the

water above the ground surface to change into vapor form, or **evaporate**. The vapor in the sky can then be condensed into clouds, and the water cycle repeats itself.

How are nutrients/energy cycled?

One of the major parts of an ecosystem is the cycling of energy. All living things in an ecosystem need energy to survive whether it be from the sun, or from consuming plants or other animals. The main source of energy for life on earth comes from the sun. The sun provides energy for plants through photosynthesis. Animals, including humans, get their energy from plants and other animals. The cycle of organisms eating and being eaten is one way that parts of the environment interact with each other. For example:

- Plants collect energy from the sun and then provide food to most living things.
- The plant dies and feeds the soil organisms that decompose the organic matter into humus, which builds the soil.
- Insect's feed on the plants and decomposing matter in the soil.
- Small animals and birds feed on the insects and plants.
- Larger animals (including humans) eat the smaller animals and birds.
- Small (microscopic) organisms break down the bodies of dead animals and plants and use them to build the soil, which can then grow new plants, closing the circle or cycle.

Today humans are having such an impact on natural ecosystems that some of our actions are affecting their ability to function and cycle properly.

Find an energy diagram, insert here

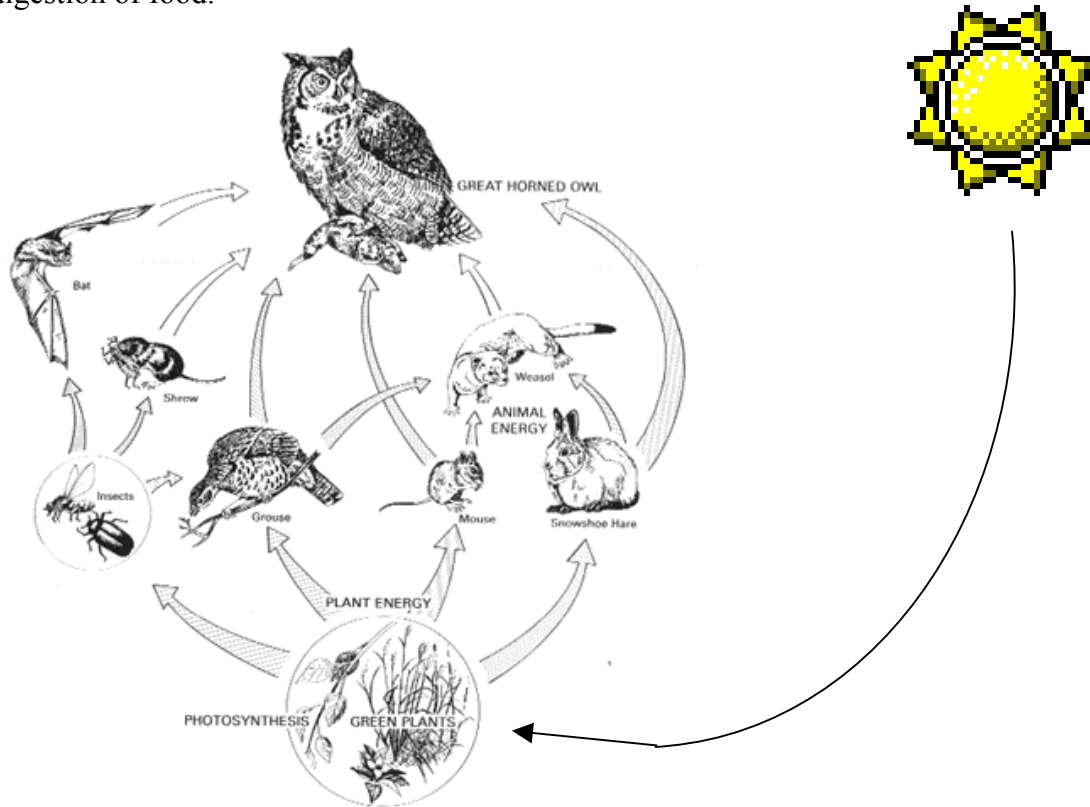
ACTIVITY: Ask the farmers to bring out the resource maps they drew at the beginning of the training session.

- 1) Draw the water cycle on your resource map. Label these processes.**
- 2) Draw the energy cycle on your resource map. Use arrows to indicate the transfer of energy.**

Once the farmers have completed their maps, display them on the walls.

Energy - The Food Web **Find a better diagram or make your own**

A model of a food web shows a series of interconnected food chains and the flow of energy within these chains. Energy moves from one organism to another through the digestion of food.



www.eagle.ca/~matink/themes/Biomes/foodweb.html

ACTIVITY:

- 1) As a group, list some of the native plants and animals within your ecosystem.**
- 2) Select one person from the group to draw. Have the farmer generate a food web using the list of plants and animals.**

Can you describe the native plants and animals in the ecosystem where you live?

ACTIVITY:

Have a buzz, followed by a group discussion, about what native plants and animals live in your area.

What native plants and animals live in your area?

Native vegetation on the central China loess plateau consists of mixed deciduous broadleaf forests. Original vegetation in the northern part of the loess plateau consisted of mixed, deciduous broadleaf forests dominated by oak, birch, maple, and linden with some aspen, willow, spruce, and mountain ash at the higher elevations. Elm and ash are the dominant tree species at the lower elevations. Disturbed areas from logging, cultivation, and grazing support shrub vegetation such as hazel, *Vitex negundo*, *Ostryopsis davidiana*, and *Spiraea pubescens*. Where grazing is intense, thorny shrubs predominate. These include *Zizyphus sativa* and *Caragana* spp. They are well adapted to the seasonally dry conditions that occur here. In spite of the regions almost complete transformation, small population of local wildlife still exist including rhesus macaque, musk deer, giant salamander, brown-eared pheasant, China larch and Koklass pheasant still persist. Three other protected bird species have been seen: black stork, Mandarin duck and golden eagle.

Agriculture in China

What is the relationship between humans and the environment?

To examine this we can look at how the original agricultural communities in China, “The first Eco-villages”, were fully dependent on natural systems.

6000 years ago, communities were completely dependent on their ecosystems for their survival. The ecosystems provided them with their basic needs:

- fresh air
- clean water
- trees to frame houses and build tools
- energy for heating houses, cooking and to make pottery
- plants as the main food source (also for clothing, fishing nets and housing and medicine)
- many types of food including fish, shellfish, birds and animals (also for clothing and bones for tools)

- healthy soil to grow crops and make houses, clay utensils and pottery

and other important services including:

- mitigation of floods and droughts
- detoxification and decomposition of wastes
- renewal of soil and soil fertility
- pollination of crops and natural vegetation
- control of the vast majority of agricultural pests
- dispersal of seeds and translocation of nutrients
- maintenance of biodiversity
- stabilization of climate and moderation of temperature extremes and strong winds
- aesthetic beauty and intellectual stimulation

Why did life deteriorate for some ancient civilizations?

As populations increased, people were forced to occupy more arable land to meet the rising demands of their communities. This led to deforestation and intensified agricultural production, which negatively impacted their local ecosystems. People began to experience a decrease in energy supply, watersheds, and soil quality. Additionally, people no longer had the land base to grow the necessary food or the energy systems to transport their food from distant lands. Thus, the environment was stretched beyond its carrying capacity. **Carrying capacity** is the maximum number of people that can be supported by the natural resources in a given environment. Dwindling resource quality and supply can eventually lead to social, economic, and ecological breakdown.

In China, what have been the detrimental impacts of conventional agriculture on the environment?

Conventional agriculture has had many unfavorable effects on the environment including:

- As early as 1000 AD, population densities pushed Chinese farm families from the prime valley bottoms toward marginal lands in marshy, hilly and mountainous areas. Due to the poor conditions in these areas, economic returns on these lands were poor. Thus, farmers were unable to invest on the maintenance or enhancement of their farmland, resulting in serious farmland degradation.
- Inappropriate cultivation techniques and overgrazing have led to the soil degradation and siltation of rivers in China.
- Conventional farming practices such as the burning of crop residues have resulted in the loss of nutrients from the land.
- The conversion of forested and grassland areas into farmland led to a loss of biodiversity, the weakening of local ecosystems and changes in local climatic conditions -- the effects of which can be observed today. The biodiversity of China's plants, animals and birds have been devastated through the expansion of lands in marginal areas and intensification of production systems. Flooding events and dust storms are currently more intense due to the loss of trees and other vegetation which

had previously held back the rains. Water flow in rivers is now much more seasonal as the release of water from the landscape is no longer gradual.

How can I have an effect?

The need now is to change the way we do things so that we do not exceed our current carrying capacity. In order to do this, we need to model our activities after nature to create a sustainable economy. **Sustainability** is the ability to meet the needs of the present without interfering with the capacity of future generations meet their needs. Just imagine if you could manage the natural processes on your farm so that you can support your soils, your crops, your livestock, your family, *as well as* descendants of your family in future generations.

Ecological Farming

ACTIVITY: Have a buzz followed by a group discussion.

What is ecological farming? Identify some key concepts.

What is ecological farming?

The term "**ecological farming**" is a holistic production management system which promotes and enhances the ecosystem. It is based on mimicking nature and minimizing the use of external inputs, such as synthetic fertilizers and pesticides.

Since we depend directly on the landscape for our existence (i.e. food, clothing, water etc.), we benefit greatly from gaining a complete understanding of how the landscape functions. Nature functions only as a whole, not in parts, and we will understand nature better when we manage it as a whole rather than as separate parts. Ecological farming is a holistic approach for managing your farm that will optimize the health and productivity of the interdependent soil life, plants, animals and people. It emphasizes designing productive systems guided by ecological principles instead of trying only to increase production and deal with the effects of the problems instead of the causes.

Deepen Your Understanding



To better understand how nature functions, we must consider the basic ecological processes. Four basic processes can be found in all natural systems:

The first natural process is the cycling of water. First, water falls to earth as rain, filters through the soil and is either taken up by plants or continues downward and becomes groundwater. When water is cycling effectively, floods are infrequent and of lower impact; water is released slowly through underground flow into streams and springs; and erosion is virtually non-existent. If, on the other hand, the soil is bare, there may be soil erosion, much less water infiltrating into the soil and severe and more frequent flooding. So, the need for an effective water cycle is apparent in nature and essential to ecological farming.

A second natural process we can observe in nature is the mineral cycle. Minerals needed for biological growth are constantly recycled from the soil to plant to animal and back to the soil again. There is very little waste in the natural mineral cycle. **There is no need for fertilizer in nature**, as all the fertility is recycled again and again with very little loss. Ultimately, to be sustainable, we need to find ways to best utilize the natural mineral cycle while reducing our off-farm purchase of minerals. Farming practices that inhibit the natural mineral cycle, only reduce the long-term sustainability of farms.

A third natural process shows us that plant and animal communities strive toward high biodiversity. When biodiversity is increased, the need for pest control and fertilizer is decreased. **Crop rotation** is an effective way to achieve biodiversity on the farm. It helps break weed and pest life cycles and provides complementary fertilization to crops in sequence with each other. Advancing from rotation to multiple cropping systems where trees and different crops can coexist in a mutually supportive way in the same field represents an even higher level of biodiversity. Increasing habitat for more beneficial organisms with more borders, windbreaks and special plantings for natural enemies of pests represent even higher levels of biodiversity and stability.

The fourth natural process involves the flow of energy from the sun through the biological system. Sunlight is absorbed by the green plant. Energy is transferred below ground through plant roots. The dead roots become food for decomposer organisms. Finally the residue is broken down into nutrients and soil. Growing mixtures of two or more plant types increases the leaf area available to capture sunlight. The volume of plants also enhances energy flow. By growing two or more crops per year we can prolong the time that plants are in the field collecting energy from the sun. When the soil is bare, the decomposer organisms living in the soil are on a starvation state.

When we modify any one of these natural processes (water cycle, mineral cycle, biodiversity, and energy flow), we affect the others as well -- after all, they function as a whole. When we build or farm enterprises around these natural processes, we have a plan that will sustain our family today and future generations tomorrow. <http://www.attra.org/attra-pub/PDF/holistic.pdf>

Principles of Ecological Farming

- Use natural ecosystems as models for understanding sustainable agriculture.
- Maintain biodiversity within the farming system and its surrounding environment.
- Conserve and develop seeds and plants which can adapt to the local environment.
- Create wildlife habitat to encourage biological pest control and pollination of crops.
- Maintain and enhance long-term soil fertility by keeping the soil protected as much as possible while continually providing inputs of organic materials to encourage soil organic matter accumulation and soil biological activity.
- Recycle materials and resources to the greatest extent possible within the farm and its surrounding community as a strategy to create sustainable local nutrient and carbon cycles.
- Increase productivity by strengthening the various components of the agro-ecological farming system (i.e. water conservation, nitrogen fixation, mineral cycling, soil organic matter formation, testing of more adapted plant materials).
- Provide attentive care to the health and behavioural requirements of livestock.
- Develop and adopt new technologies with consideration for the long range social and ecological impact.

Making the Transition to Ecological Farming

- **Emulate nature:** use ecological principles as the basis of farm planning. Observe and learn from nature.
- **Diversify your crops:** diversify to ensure your farm system is resistant to poor weather conditions, insects, or disease outbreaks. It will also help you use your farm labour and equipment more efficiently.
- **Improve your soil:** use compost to adjust nutrient levels in order to create a more balanced soil; design a crop rotation that enables the soil to regenerate itself.
- **Select suitable species and number of livestock:** choose appropriate species and numbers of livestock to suit your own farms' special conditions and its carrying capacity (i.e. don't keep too many sheep if you don't have the hay and pasture)
- **Learn:** try your best to become a good observer on your farm. Talk with other farmers and visit their farms, join farmers' organization, or attend training courses, workshops and conferences.
- **Start from small scale:** begin from a scale that you can manage well and then make appropriate adjustments before you expand the system.
- **Monitor your results!** Make a plan and keep records.

- **Create a sustainable production:** no matter where you are, you can still find ways to create a sustainable production. For example, in drought and semi-drought areas, one may use compost to improve soil quality, which improves crop and/or grass production and quality, which improves livestock production.

ACTIVITY:

- 1) Break up farmers into groups of three or four.
- 2) Ask each group to make a list of their current farming practices. Label each practice as sustainable, unsustainable, unsure, or both.

For example:

Sustainable

- Crop rotation
- Composting
- Conservation Tillage

Unsustainable

- Monocropping
- Application of Chemical Fertilizers
- Application of Pesticides and Herbicides
- Tillage

- 3) Invite farmers to summarize the training.

List your farming practices under the following five categories:

Farming Practice	Sustainable	Unsustainable	Unsure	Both
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
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