

Chapter 04: Introduction to Agrosystems:

1-Definition of agrosystem:

An agrosystem is an ecosystem supporting the food production systems in farms and gardens. It is defined as a set of plant and animal communities that interact with the physical and chemical environment and are used by humans to produce food, fibre, fuel, and other products for human consumption and processing. Agroecosystems are natural communities that occupy about 40% of a global land surface and which have been modified by humans for agricultural purposes and transformed to cultivable lands and grasslands.



Figure 01. Agricultural land

2-Components of Agroecosystems:

The components of an agroecosystem are variables depending on the specific type of agricultural system. However, some common components of agroecosystems include:

❖ Abiotic Components :

- Climate (Temperature, light intensity, day length, CO₂).
- Resources (Water availability, nutrient supply.....).
- Landscape (Topography and relief).
- Soil (Fertility, salinity and pH levels).

❖ Biopic Components :

- Pests (Parasites, herbivores.....).
- Competition relationships between plants.
- Symbiotic relationships (Subterranean organisms and pollinators).
- Farmers (Including their management of natural factors).

- Livestock (Raising of livestock, such as cows, chickens, or pigs, for the production of meat, milk, or other products).
- Crops (Cultivation of crops for human consumption or other purposes, such as animal feed or industrial use).

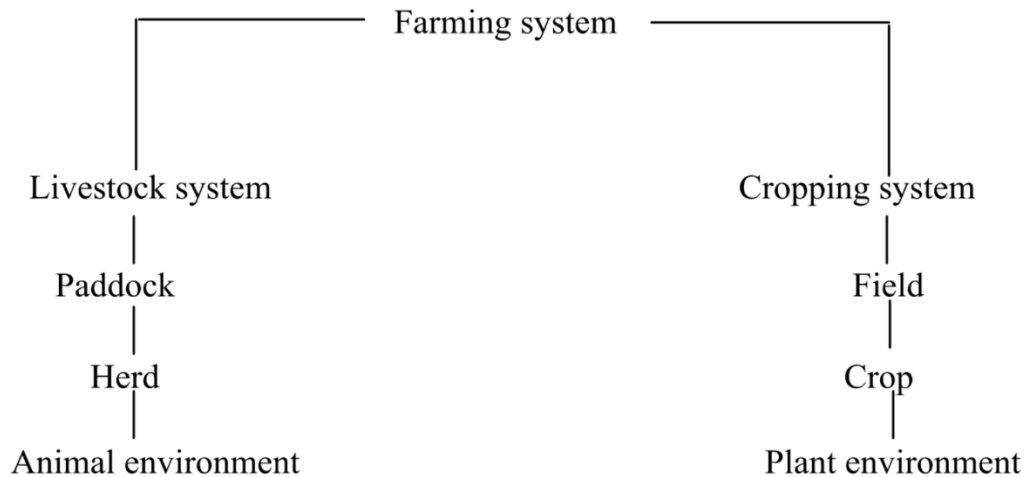


Figure 02. Farming land system

3-Agroecosystem food chain elements:

Components of agroecosystem food chain are:

3-1- Producers (Autotrophs):

Producers are also called autotrophs because they make use of abiotic factors, to produce their food using the energy from the sun along with water and carbon dioxide. In agriculture, producers are green plants and algae.

3-2-Consumers (heterotrophs):

Dependent components of an Agroecosystem, they do not make their food but rather depend on the autotrophs for food. In the food chain, they are referred as secondary or tertiary organisms. For Agroecosystems, consumers are human beings that eat crops, vegetables, fruits, or other animals' products. They can also be predators or parasites.

3-3-Decomposers (Saprotrophs):

Organisms that feed on death and decayed plants and animal materials. They break down organic matter into inorganic components (carbon and nitrogen). The inorganic matter broken down by these organisms will return to the soil as nutrients for plant use (bacteria, fungi, earthworms).



Figure 03. Agricultural production cycle.

4-Agroecosystem types:

There are many different types of agroecosystems:

4-1-Small-scale subsistence farming:

It involves the production of crops or livestock for the purpose of feeding a family or small community. These systems are often found in developing countries and are characterized by low levels of inputs and technology.

4-2-Large-scale commercial agriculture:

It involves the production of crops or livestock for sale on a larger scale (For export). These systems are typically characterized by high levels of technology and inputs and are found in many developed countries.

4-3-Intensive horticulture:

It deals with the production of high-value crops (Vegetables and fruits), using intensive growing techniques. These systems are found in urban areas and are characterized by a high level of inputs and technology.

4-4-Agroforestry:

It deals with the integration of trees and shrubs into agricultural systems in order to provide a range of benefits, including increased productivity, soil conservation, and carbon sequestration.

4-5-Regenerative agriculture:

It's about the use of techniques such as cover cropping, composting, and crop rotation in order to improve soil health and increase resilience to environmental stresses.

5-Agroecosystems importance:

Agroecosystems are important for a number of reasons:

5-1-Food production: Agroecosystems play a vital role in global food production, providing the crops and livestock that feed the world's population. According to the Food and Agricultural Organization of the United Nations (FAO), agriculture is responsible for the livelihoods of approximately 1.3 billion people globally.

5-2-Economic development: Agroecosystems represent an important source of economic development in many countries. In developing countries, agriculture is a key sector of the economy, and the success of agroecosystems can have a significant impact on the prosperity of all the nation.

5-3-Biodiversity: Agroecosystems can support a wide range of plant and animal species, and the management of these systems can play a role in conserving biodiversity.

5-4-Environmental benefits: Agroecosystems can provide a number of environmental benefits, such as carbon sequestration, soil conservation, and water management.

5-6-Cultural significance: Agriculture is an important part of the cultural heritage of a community and plays a central role in traditions and practices.

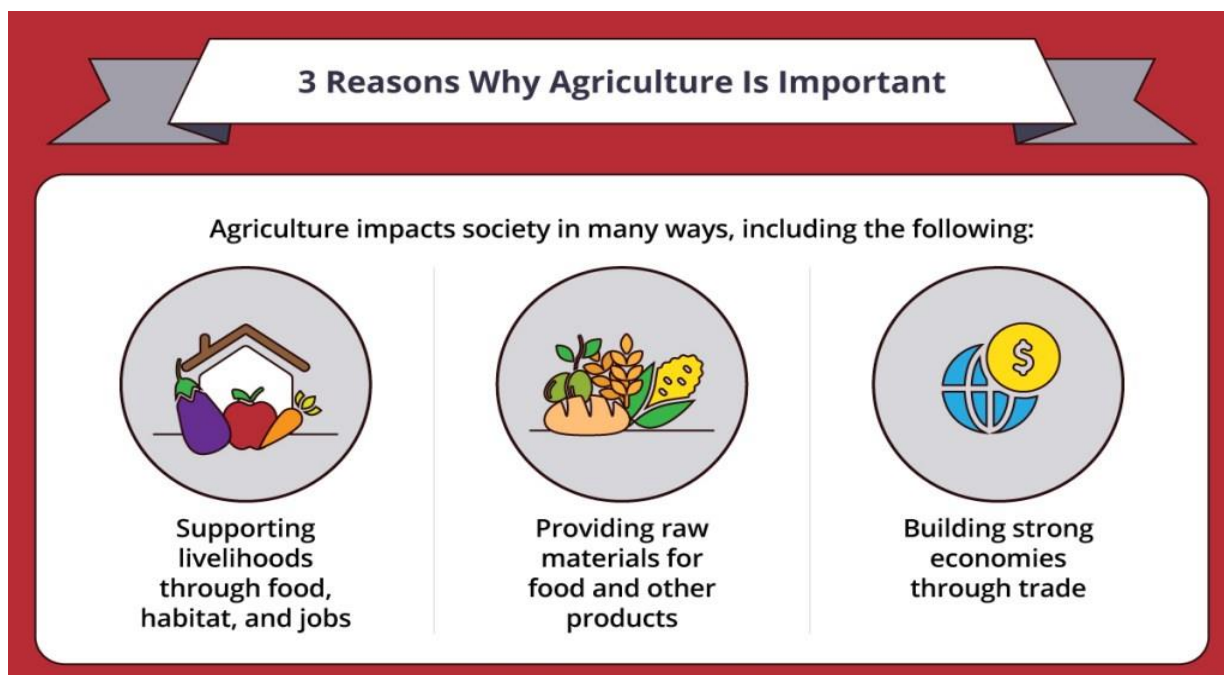


Figure 04. Agroecosystem importance

6-Practices in agroecosystems:

6-1- Agricultural positive practices for environment:

6-1-1- Composting process:

It is a natural process of recycling organic matter (Leaves, food scraps, yard tree trimmings) to a valuable fertilizer for soils, by providing an ideal environment for bacteria, fungi, and other decomposing organisms (Worms, sowbugs, and nematodes). Composting methods are used to improve soil's physical, chemical, and biological properties in gardening, horticulture, and agriculture. This technique is based on the following indications for farmers:

1. Collect and store your brown and green wastes.
2. Choose a space in your yard for your compost build or buy a bin.
3. Prepare your ingredients for composting by breaking the green wastes up into smaller pieces and placing them into the bin.
4. Repeat the process as you generate wastes until the bin is filled and add water to keep it moist.
5. Mix the layers constantly to circulate the air and help decomposition and use a garden fork to turn the outside of the pile inward.
6. Allow your pile to cure, or finish, for at least four weeks and always cover the last layer with soil or brown residues. Protect the container with a mesh to avoid animals.



Figure 05. Compost cycle principal steps

6-1-2-Crop rotation process:

Crop rotation is the practice of planting different crops sequentially on the same plot of land to improve soil health, optimize nutrients in the soil, and combat pest and weed pressure through a considerable period of years (3 to 7 years). It's a sequence of crops grown in a specific field, including cash crops, cover crops and green manures. A simple rotation might involve two or three crops, and complex rotations might incorporate a dozen or more. An example of crop rotation is maize, followed by a legume.

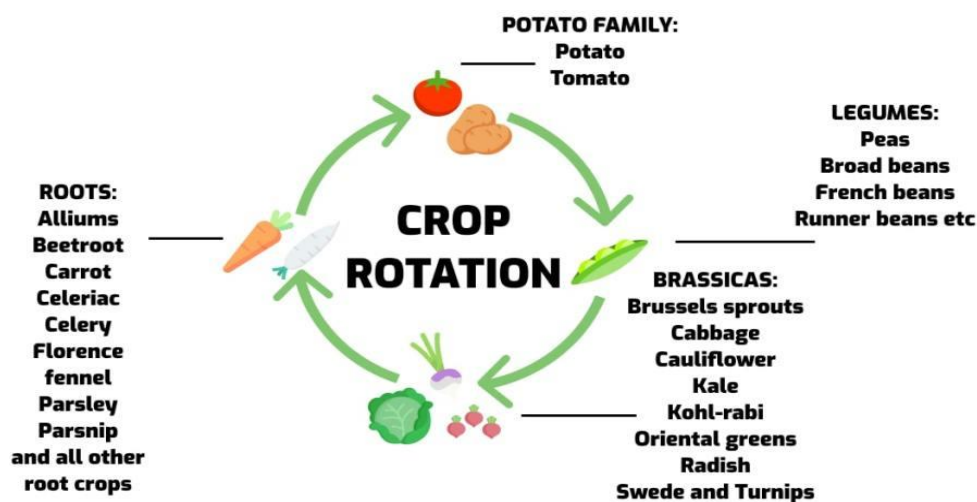


Figure 06. Crop rotation process

6-1-3-Sustainable agriculture:

Sustainable agriculture is farming in sustainable ways meeting society's present needs, without compromising the ability for current or future generations to meet their needs and to conserve the planet's health. Sustainable agriculture consists of environment friendly methods of farming that allow the production of crops or livestock without causing damages to human or natural systems. Sustainable farming goals are:

- Satisfy human food and fiber needs.
- Enhance environmental quality and natural resource bases.
- Make the most efficient use of renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls.
- Sustain the economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

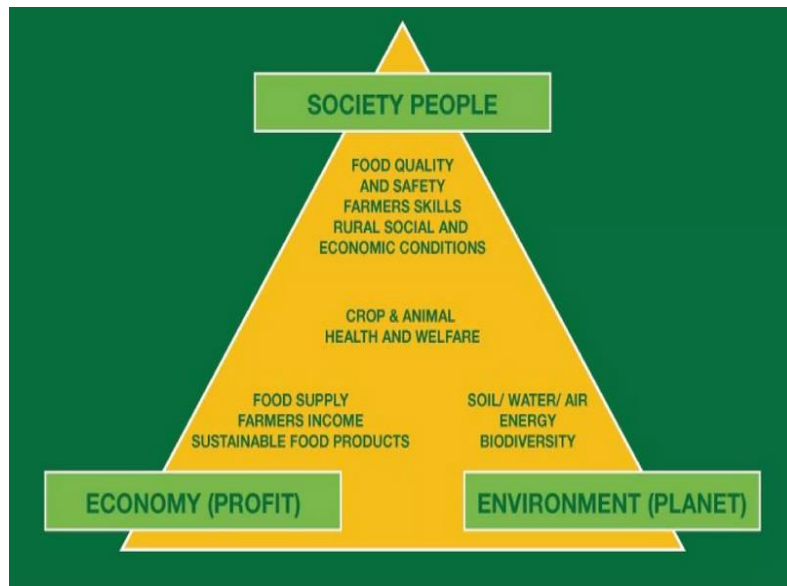


Figure 07. Sustainable agroecosystem principal axes

6-2- Agricultural negative practices for environment:

6-2-1-Genetically Modified Organism (GMO) Seeds:

The negative impacts of genetically modified organism seeds are observed on many environmental aspects. The contamination from the GOM plants has serious ecological, economic and social impacts. Gene flow from these crops poses a threat to wild and weedy crop relatives. The use of these crops can have negative impacts on non-target organisms, soil and water ecosystems. Environmental concerns can deal with:

- The risk of outcrossing, where genes from GMO seeds pass into wild plants and other crops.
- A negative impact on insects and other species.
- Reduction in other plant types, leading to a loss of biodiversity.

6-2-2-Intensive farming:

The purpose of intensive farming is to earn more revenue from agricultural production. It is usually accompanied with the use of chemicals and fertilizers to meet the targets of production. Which then results in higher risks of contaminated products. It's also known by intensive livestock wish means holdings large groups of livestock together indoors, or on small plots, in high densities for the whole or vast majority of the year to maximize profits and productivity through economies of scale.

❖ **Impact of pesticides and Fertilizers:**

- Fertilizers (Nitrogen and phosphorus and Ammonia) from agriculture, predominantly due to runoff, contaminate water sources, harming aquatic and Aerial ecosystems.
- Application of chemical pesticides participates in increasing the range of exposure, and affecting nearby fields, homes, and schools which contaminates ground and surface water, resulting in many human diseases.

❖ **Impact of intensive livestock:**

- Intensive farming contributes to global warming by releasing large amounts of carbon dioxide into the atmosphere during the production of animal feeds, from the machinery.
- Animal waste and discards are often not treated appropriately when farmers dispose their waste in rivers where they pollute the water and threaten all the ecosystem's biodiversity.

7-Concept of agroecology:

Agroecology is an integrated approach that applies ecological and social concepts and principles to the design and management of food and agricultural systems. The Main Agroecological Structure of agroecosystems is an environmental index that includes ecosystem and cultural criteria, which allows visualizing some of the main relationships established between human groups (farmers) and their biophysical environment. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system.