



This presentation is part of an educational modular program designed to provide new and beginning farmers and ranchers with relevant information to initiate, improve and run their agricultural operations



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Sustainable Agriculture





Sustainable agriculture

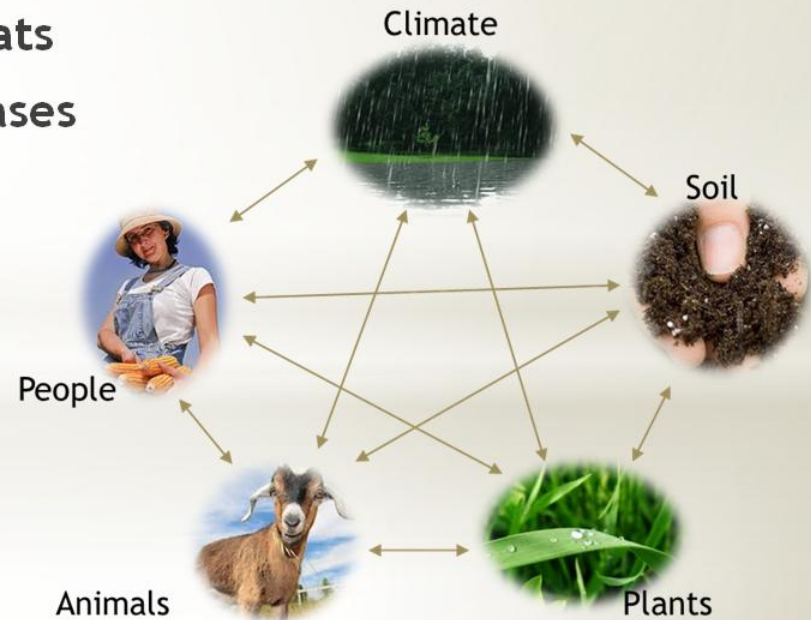
“Consumers are increasingly demanding on the ethical dimension of food quality. This relates to the process of production and trade and its broad impacts on society and the environment. It includes a wide range of social, environmental or cultural issues such as the treatment of workers, a fair return to producers, environmental impacts and animal welfare.”

[*Value-adding standards in the North American food market: Trade opportunities in certified products for developing countries* by Alice Byers and Pascal Liu. (Food and Agriculture Organization of the United Nations, Rome, 2008), <http://www.fao.org/docrep/010/a1585e/a1585e00.htm>, NAL Call no. TP372.6 .B94 2008]

Farm as an ecosystem: energy flow

Sustainable agriculture is the practice of farming using principles of ecology

- Some of the objectives of this type of farming are:
 - Protect the soils from erosion and degradation
 - Increase soil fertility
 - Conserve water and natural habitats
 - Reduce emission of greenhouse gases





Sustainable agriculture

This type of farming relies on and protects nature by taking advantage of natural goods and services, such as biodiversity, nutrient cycling, soil regeneration and integrated pest management



Sustainable agriculture

This type of agriculture is a clear contrast to traditional agricultural models characterized by:

Traditional agriculture

- Use of non-renewable and synthetic resources (fossil fuels, chemicals and genetically engineered crops)
- Intensive farming of monocultures (reduces diversity and damages soil structure and fertility)
- Breaks mineral and nutrient cycles
- Promotes erosion (intensive tillage and other agricultural practices)





Sustainable Agriculture

- Sustainable farmers limit the use of external inputs and work to maximize reliance on natural, renewable, and on-farm inputs
- They select alternatives that are the least toxic and least energy intensive. However, converting to sustainable practices does not mean simple input substitution. It requires planning ahead of time to employ preventive strategies to control potential problems before they develop:
 - For example, crop rotation protects the nutrient content in the soil without the need for fertilizers
 - Introducing different animal species into the grazing rotation reduces the need for weed killers (goats and sheep eat plants that cattle will not eat)
 - Rotational grazing helps to control parasites and pathogens in the animals by reducing the time that they are exposed to feces on the ground

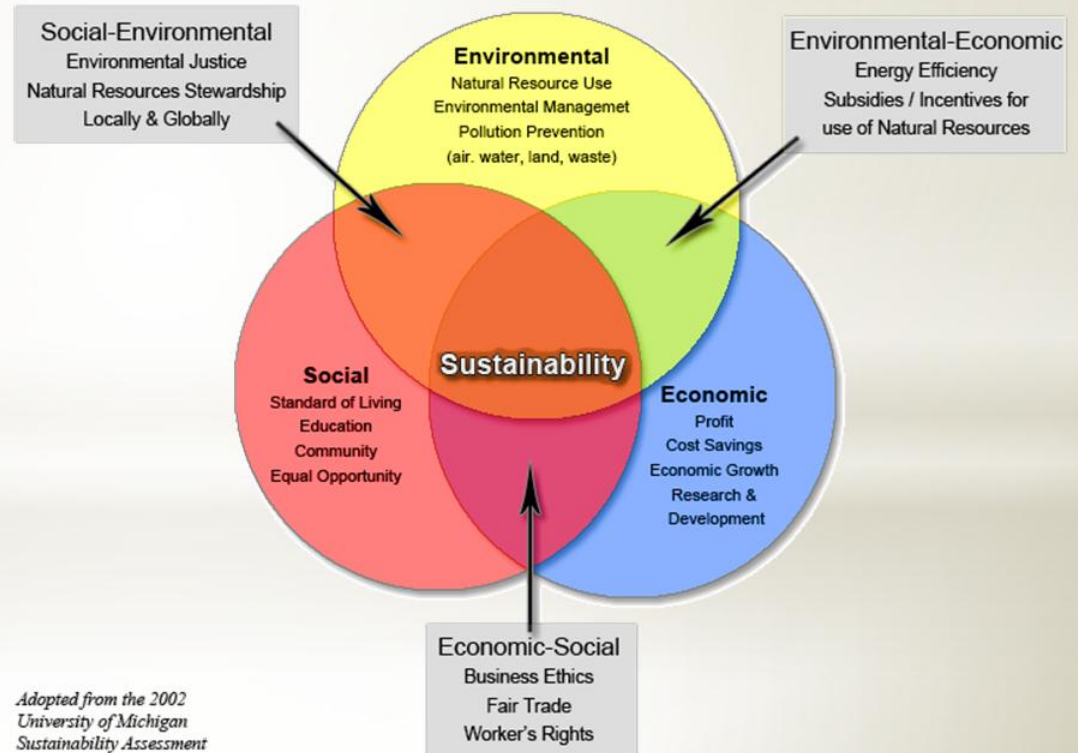


Sustainable agriculture

By stimulating the health of the farm ecosystem, this type of practices will ensure the long term persistence of the farm

- This will help to promote:
 - Social sustainability
 - Economic sustainability

The Three Spheres of Sustainability



*Adopted from the 2002
 University of Michigan
 Sustainability Assessment*



Sustainable agriculture

Some of the most common agricultural practices that are used in sustainable agriculture are:

- Soil and water protection
- Integrated pest management
- Rotational grazing
- Multi species grazing programs





Soil and water protection





Soil protection

See the module "Soil" in this program

- There are several practices that are used in sustainable agriculture to protect and enhance soil quality:
 - Cover crops (also called green manure)
 - Crops planted primarily to manage soil fertility, water, weeds, pests, disease and other problems. After a specific period, they are plowed under to improve soil fertility and quality
 - Conservation tillage (none or reduced tillage)
 - By reducing tillage of the soil it reduces soil compaction, protects soil from wind and water erosion and favors the establishment of a stable ecosystem in the soil (organisms, nutrients and pH)
 - Composts
 - Addition of organic matter and nutrients to the soil and improves soil structure. By composting the organic matter, pathogens and unwanted seeds and weeds are destroyed in the process.



Water protection

See the module "Water" in this program

- There are different strategies that can be used to conserve water in the farm:
 - Selecting plants adapted to the conditions on your area
 - Incorporating a resting period in crop rotation
- Smart irrigation systems
 - Lining above ground ditches
 - Underground and portable piping systems
 - Drip systems
- Preservation of waterways
 - Streambank stabilization
 - Protection of riparian buffers
 - Grass waterway
 - Grade stabilizations
 - Wetland restoration



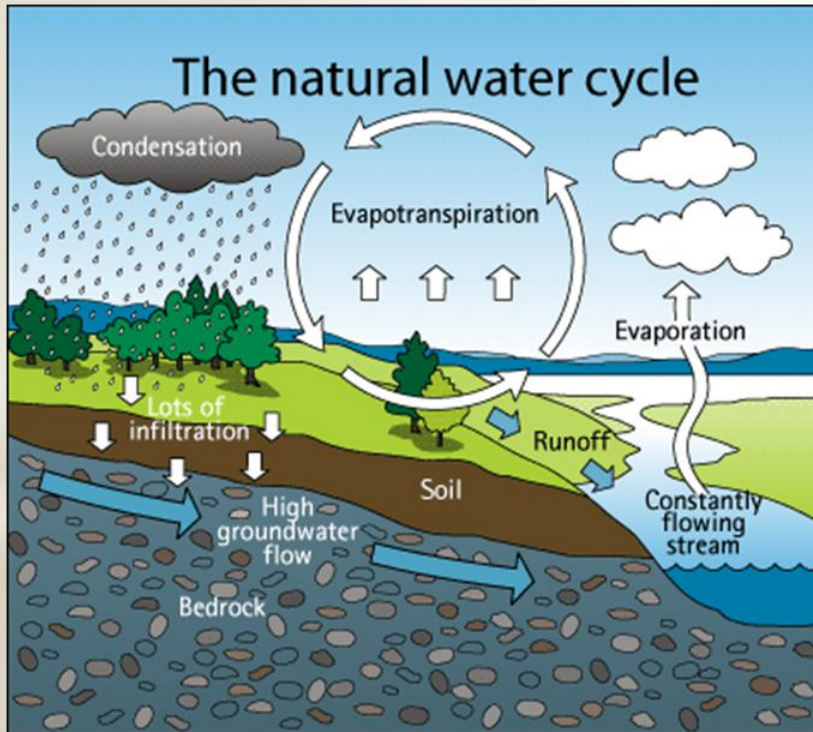


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Sustainable agriculture

EXAMPLE:

- Farm as an ecosystem: Water cycle



- Management decisions on the farm that add to ground cover and soil organic matter enhance the natural water cycle
- Effective water use on the farms results in low surface runoff, low soil surface evaporation, low drought incidence, high transpiration by plants and high seepage of water to underground reservoirs



Integrated pest management



Integrated pest management

See the module “Principles of Integrated Pest Management”
in this program

Integrated pest management is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices

- It uses methods that control pests while reducing exposure to people, property and the environment
- Some of the methods used are:
 - Biological controls
 - Organic chemicals controls
 - Physical controls





How to control weeds using Integrated pest management

- Do not allow weeds to form seed heads and/or perennial rooting structure in the cropping systems
- Thoroughly clean equipment before moving it from one farm or location to another to avoid transporting weed seeds from infested fields
- Thoroughly compost all imported manure to insure destruction of viable weed seed
- Improve soil structure, aeration, water infiltration and fertility to optimize crop growth and minimize weed pressure
- Work with neighbors to eliminate or minimize the potential for spread of noxious and problematic weeds from adjacent lands





How to control weeds using Integrated pest management

- Some of the most common practices used in sustainable agriculture will help to control weeds in the field, such as:
 - Crop rotations
 - Strategic planting and cultivation
 - Rotational grazing
 - Mowing
 - Irrigation
 - Use of mulches

For example, crop rotations reduce weeds by eliminating the constant niche established by mono-cropping systems

Control of pest diseases

To control diseases in plants you should select pathogen-free planting materials, resistant cultivars, and make a program of crop rotation

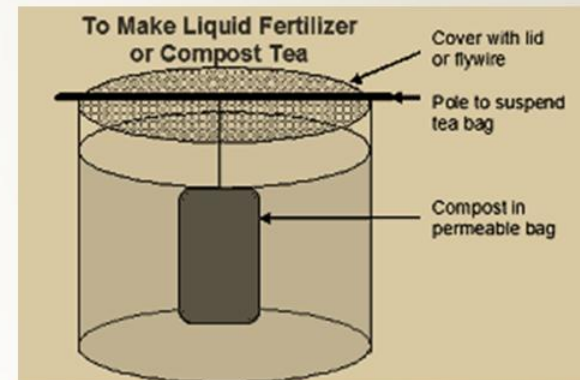
- Make sure not to follow plants from the same family as the ones before (like potatoes following tomatoes)
- By interrupting the cycle with a different crop (like corn or squash) you will prevent the persistence of the disease in the plot
- If you have a disease in the crop, you should try to clean all the crop residues to avoid contamination or spreading the disease to other parts of the farm



Plant disease management

Use crop rotations, biodiversity, resistant cultivars, clean seed and soil fertility measures to prevent plant diseases

- **Compost tea** is usually considered as one of the best methods to control fungal diseases in plants
- It is made by steeping compost in water for 3-7 days. It is also used as a fertilizer
- Because it is very concentrated it is usually diluted before using
 - It is usually sprayed on the leaves when it is used to control fungal diseases
 - Or, it is applied to the roots when it is used as a fertilizer



Visit the ATTRA website for publications on the use of Compost tea



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Rotational grazing

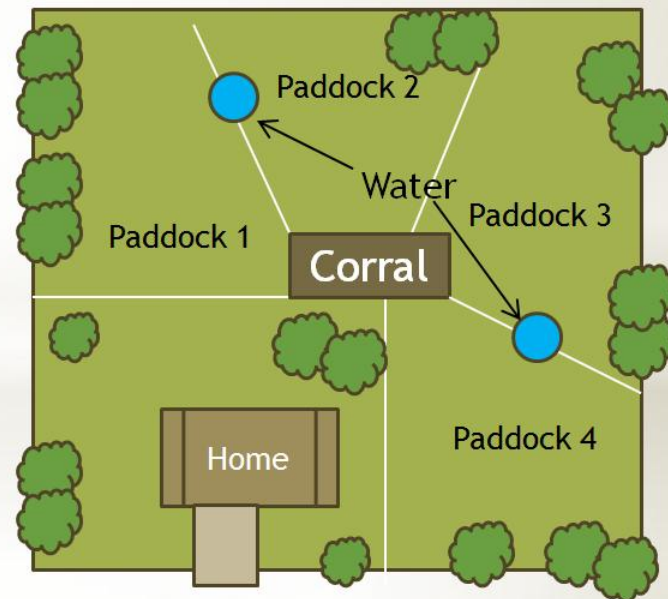




Rotational grazing

In rotational grazing, animals graze on one portion of a pasture, called a paddock, while allowing the other portions of the pasture to recover

- The length of the time in the paddock depends on the type of animals, the size of the herd and the paddock, and the condition of the pasture





Rotational grazing

There are many advantages of this systems:

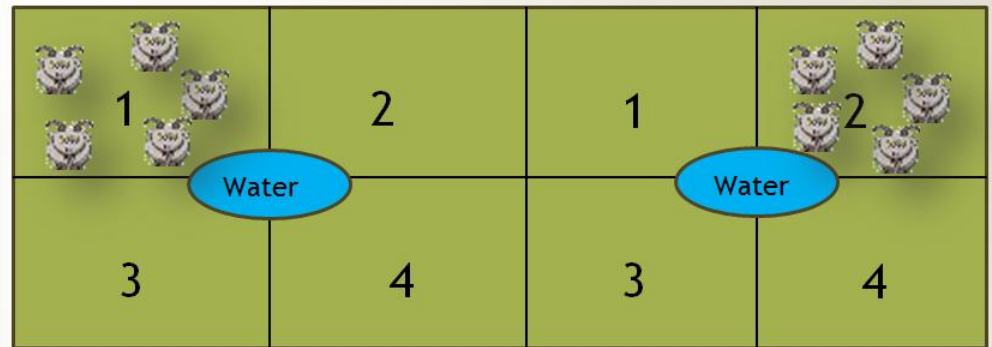
- The resting periods allow the pasture to recover and develop better root systems (which in turn improve soil structure and water retention) and helps to control weeds in the paddock
- As the animals graze the paddock they spread manure and return nutrients to the system. By moving the animals often, you ensure an even distribution of the manure around the farm
- The animals always get access to high quality forage and the resting period helps to reduce parasite and bacterial infections in the animal by reducing exposure of the animals to feces
- By promoting the establishment of a diverse and dense pasture, farmers are able to extend the grazing season.
- These paddocks are usually more stable and resilient than intensively grazed paddocks. They are also more capable of responding to adverse environmental conditions, such as drought



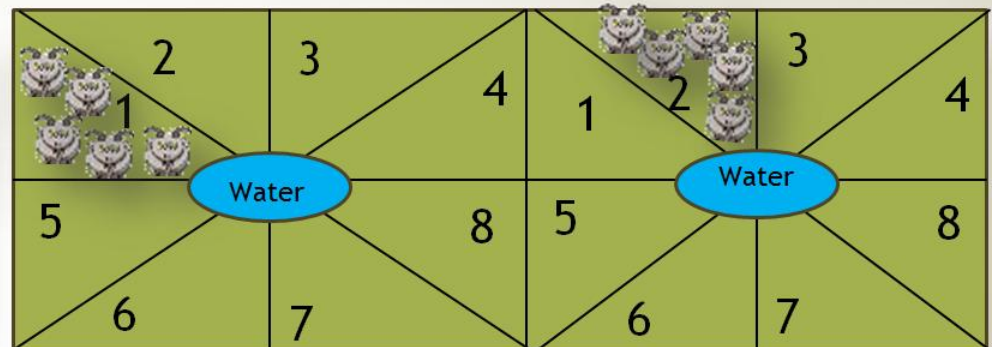
Continuous grazing



Rotational grazing



Intensive grazing



Multi species grazing

- In addition to the rotational management, many sustainable farmers have discovered the advantages of having multiple species grazing on the same paddocks
 - This management practice is based on the fact that cows and horses prefer grass, sheep prefer forbs and goats prefer trees and shrubs
 - So there is no competition for resources and there is a better use of the paddock
 - Studies have shown that by increasing the number of animal species in the paddock, you can increase meat production by 24% versus just cattle grazing
 - Also, because cows, sheep and goat have different internal parasites, there is no risk of disease transmission





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Multi species grazing

- Multi species grazing is flexible and can be done either simultaneously by putting all the animals in a pasture together at one time (called “mob grazing”) or in a “leader-follower” method, which places one flock or herd through a pasture for a grazing period, then immediately follows with another flock or herd
- One other method is to use the principles of rotational grazing and keep the animals in different paddocks and then rotate the species as part of the rotation



Multi species grazing

- Some people include pigs and chickens in the rotation.
 - In the case of chickens it can be done by letting them loose in the paddock along with the other animals
 - Or, moving the chicken portable pens as part of the grazing rotation
 - Chickens will benefit from short pasture and will be able to eat the insects that are attracted by the feces of the larger animals
 - Also, by breaking up the feces, any parasite or bacteria present in them will die faster and reduce disease problems in the herds





Multi species grazing

- However there are some things that must be considered when grazing different animals in the same paddock:
 - Copper toxicity in sheep
 - Sheep can die of copper toxicity which is one of the important minerals in cattle feed. Keep the cattle feed higher so that cattle can reach it, but sheep cannot
 - Bullying problems
 - Even though cattle can look impressive, it is usually the rams that end up causing problems. If an animal doesn't like sharing, remove it from the group
 - Fencing
 - Goats in particular are hard to keep fenced in. Electric fencing is generally the best alternative when keeping a multi species group



Sustainable Agriculture

- There are many specific practices that can be incorporated into a sustainable farm, but the common thread is that these farmers embrace farming practices that mimic natural ecological processes
- Beyond growing food, the philosophy of sustainability also encompasses broader principles that support the just treatment of farm workers and food pricing that provides the farmer with a livable income
- Critics of sustainable agriculture claim that these methods result in lower crop yields, however studies have shown that over time, sustainably farmed lands can be as productive as conventional farms





Need more information?

- ATTRA. What is Sustainable Agriculture? Resources. <https://attra.ncat.org/fundamental.html>
- SARE. Sustainable Agriculture Research & Education. What is Sustainable Agriculture? <http://www.sare.org/Learning-Center/SARE-Program-Materials/National-Program-Materials/What-is-Sustainable-Agriculture>
- SARE. Sustainable Agriculture Research & Education. Online Curriculum on Sustainable Agriculture <http://www.sare.org/Learning-Center/Courses-and-Curricula/National-Continuing-Education-Program/Course-1-Sustainable-Agriculture>
- National Sustainable Agriculture Coalition. <http://sustainableagriculture.net/publications/>



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