

**act:onaid**

# AGROECOLOGY GUIDE

by **ACTIONAID NIGERIA**



**For Farmers, Gardeners, and  
Agricultural Extension Agents.**



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# INTRODUCTION

**A** GROECOLOGY is the science that draws on social, biological and agricultural sciences and integrates these with traditional knowledge and farmer's knowledge. This gives rise to basic principles that materialize in specific technological forms.

At the heart of the agroecology strategy is the idea that an agro ecosystem should mimic the functioning of local ecosystems, thus exhibiting tight nutrient cycling, complex structure and enhanced biodiversity. These can also be in forms of crop production, pest resistance and conservative nutrients. Agroecology further emphasizes interaction and synergisms among biological components which will enhance recycling and biological control, thus improving overall ecological efficiency and environmental protection. Agroecology is therefore increasingly recognized as the way forward for agriculture, capable of delivering productivity goals without depleting the environment and disempowering communities. Agroecology uses ecological concepts and principles for the design and management of sustainable agricultural systems.

To support the use of Agroecology by farmers, this Guide for Farmers and Agricultural Extension Agents has been designed to provide relevant directions for practices of Agroecology in Nigeria.

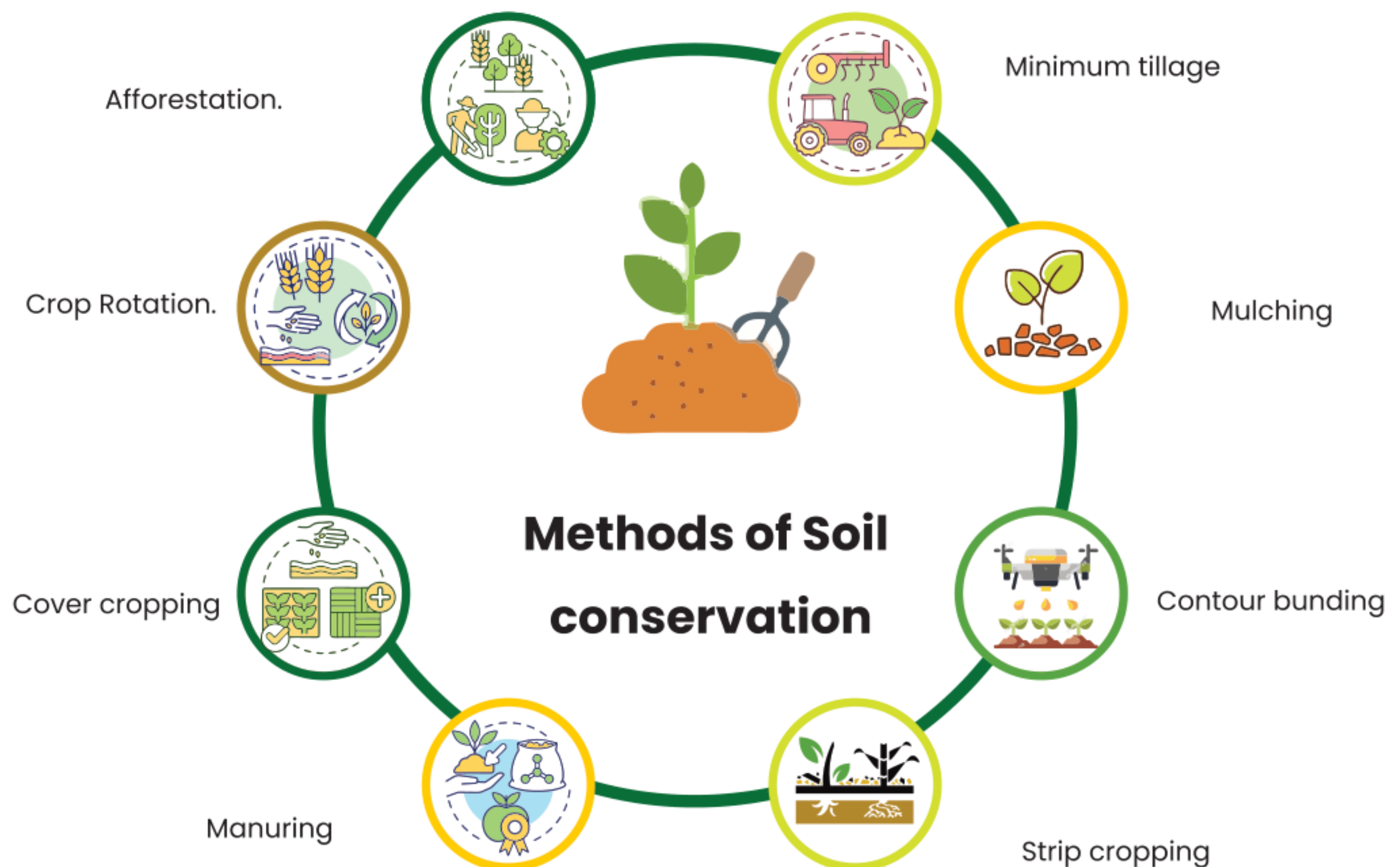


## Soil Conservation

Soil Conservation is a combination of practices used to protect the soil from degradation. Soil conservation involves treating the soil as a living ecosystem. This means returning organic matter to the soil on a continual basis. Soil conservation can be compared to preventive measures against soil degradation.

## Importance of soil conservation

Soil conservation is key to environmental sustainability: It helps protect natural resources and watersheds, restores habitats for plants and wildlife, improves water quality, and makes soil healthier.



## CROPPING SYSTEMS

**a. Mixed cropping:** this involves growing two or more crops on the same piece of land at the same time, during the same growing season. This is practiced where farmland is in short fall. Examples are; cassava is intercropped with cowpea or inter-planting maize with yam.

### Advantages

The fertility of the soil is used to the maximum by the growing crops. Protection against soil erosion is guaranteed. The spread of pests and disease is minimal. The fertility of the soil can be improved with the inclusion of legumes in the system. Disadvantage is that it discourages farm mechanization.

**b. Multiple cropping:** it is similar to mixed cropping. It is the growing of different crops on the same piece of land more than once a year and harvested before planting another during the season. Advantages are it ensures maximum use of land. It guards against crop failure. Disadvantage is that the soil may be overused.



## TYPES OF MULTIPLE CROPPING



**ALLEY CROPPING:** This is the growing of food crops in spaces between hedge-rows of alley trees (leucaena, gliricidia) that are nitrogen fixing. After 4 years, the trees are pruned. Advantages are the pruned leaves helps in feeding ruminants. Nitrogen is fixed for the crops and mulching.

**Organic manure:** This refers to decayed plant and animal remains which have been carefully prepared to supply nutrients to crops. Types are:

**Green manure:** Is formed from leguminous crops and other fresh plants which are ploughed into the soil while they are still growing. Usually, they are ploughed before flowering stage. Example mucuna, centrocema and pueraria.

**COVER CROPPING:** This is the practice of planting certain plants mainly to cover soil surface. By doing so, the nutrients are conserved in the soil. Examples are leguminous crops such as mucuna, pueraria and pubescens.



# Module 2

## SUSTAINABLE WATER MANAGEMENT

**S**ustainable water management in agriculture aims to match water availability and water needs in quantity and quality, in space and time, at reasonable cost and with acceptable environmental impact. Under water demand management most attention has been given to irrigation scheduling (when to irrigate and how much water to apply); giving minor role to irrigation methods (how to apply the water in the field). Many parameters like crop growth stage and its sensitivity to water stress, climatic conditions and water availability in the soil determine when to irrigate or the so-called irrigation frequency. However, this frequency depends upon the irrigation method and prevailing weather condition therefore, both irrigation scheduling and the irrigation method are inter-related.

### METHODS OF IRRIGATION

Irrigation is widely recognized as one of the most efficient methods of watering crops. Localized irrigation systems (trickle or drip irrigation, micro-sprayers) apply the water to individual plants by means of plastic pipes, usually laid on the ground surface. With drip irrigation water is slowly applied through small emitter openings from plastic pipes with discharge rate.

### IMPORTANCE OF WATER MANAGEMENT

Irrigation management is essential for gardeners or farmers in order to promote plant growth. In turn, stock farmers can use them in order to make sure their animals have available food sources for healthier systems.

### WATER HARVESTING

Water harvesting is the capture, diversion and storage of water obtained from different freshwater sources for crop irrigation, domestic purposes, individual purposes, groundwater recharge and other uses. It also provides water for domestic and livestock use. Water conservation is a broad term that encompasses the regulations, control, use, conservation and harvesting of water in agriculture.

#### IMPORTANCE OF WATER HARVESTING



01



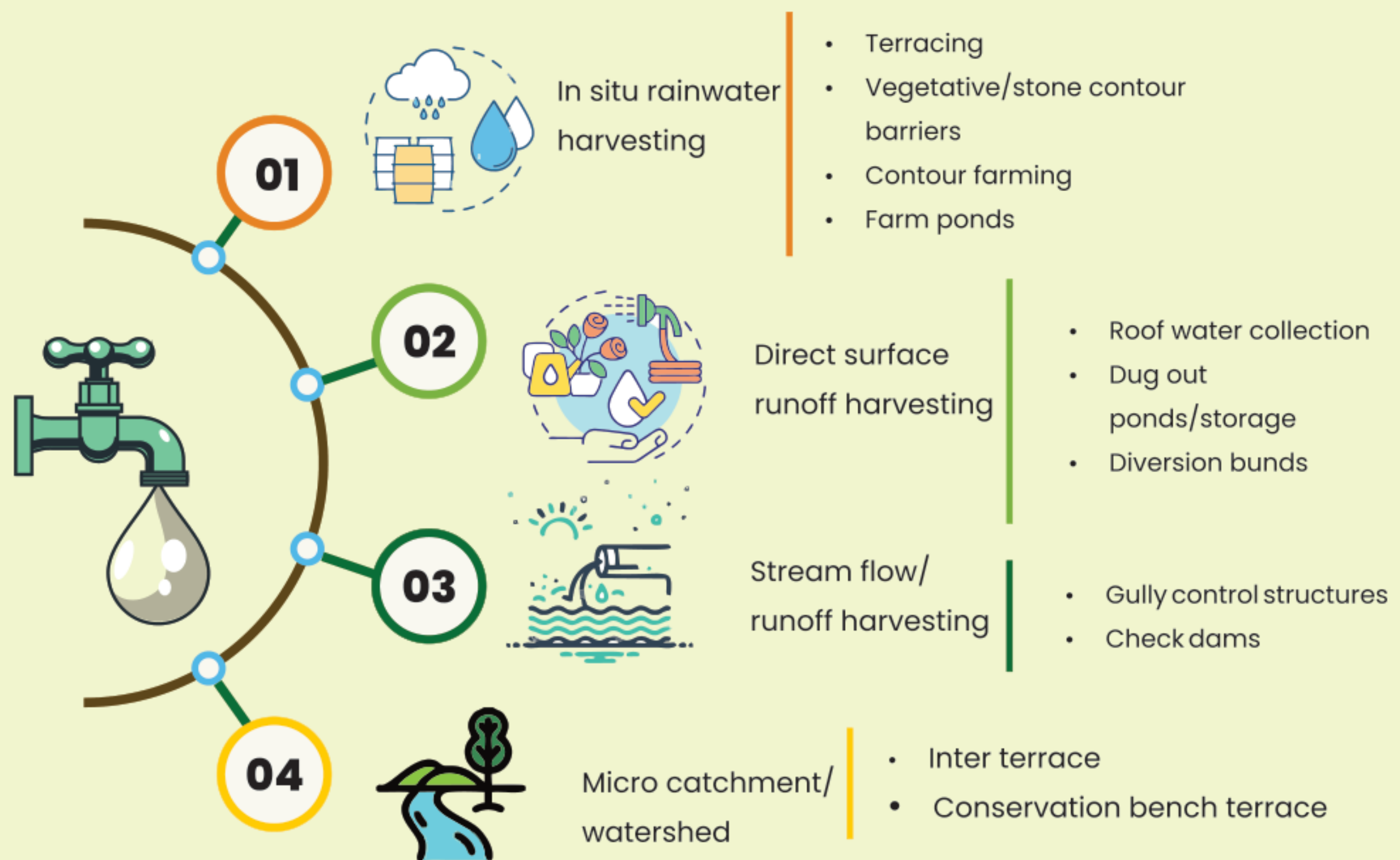
Reduce runoff water loss in agriculture

02



Meet the increasing demand of water in agriculture, Supplement ground water supplies during lean season.

## Methods of on-farm water conservation



Farm bund



Contour farming



Conservation bench terrace



Gully control structure





## Benefits of water harvesting

To arrest ground water decline and argument ground water table



To reduce soil erosion



To conserve surface water runoff during rainy season



Storing water underground is economically friendly

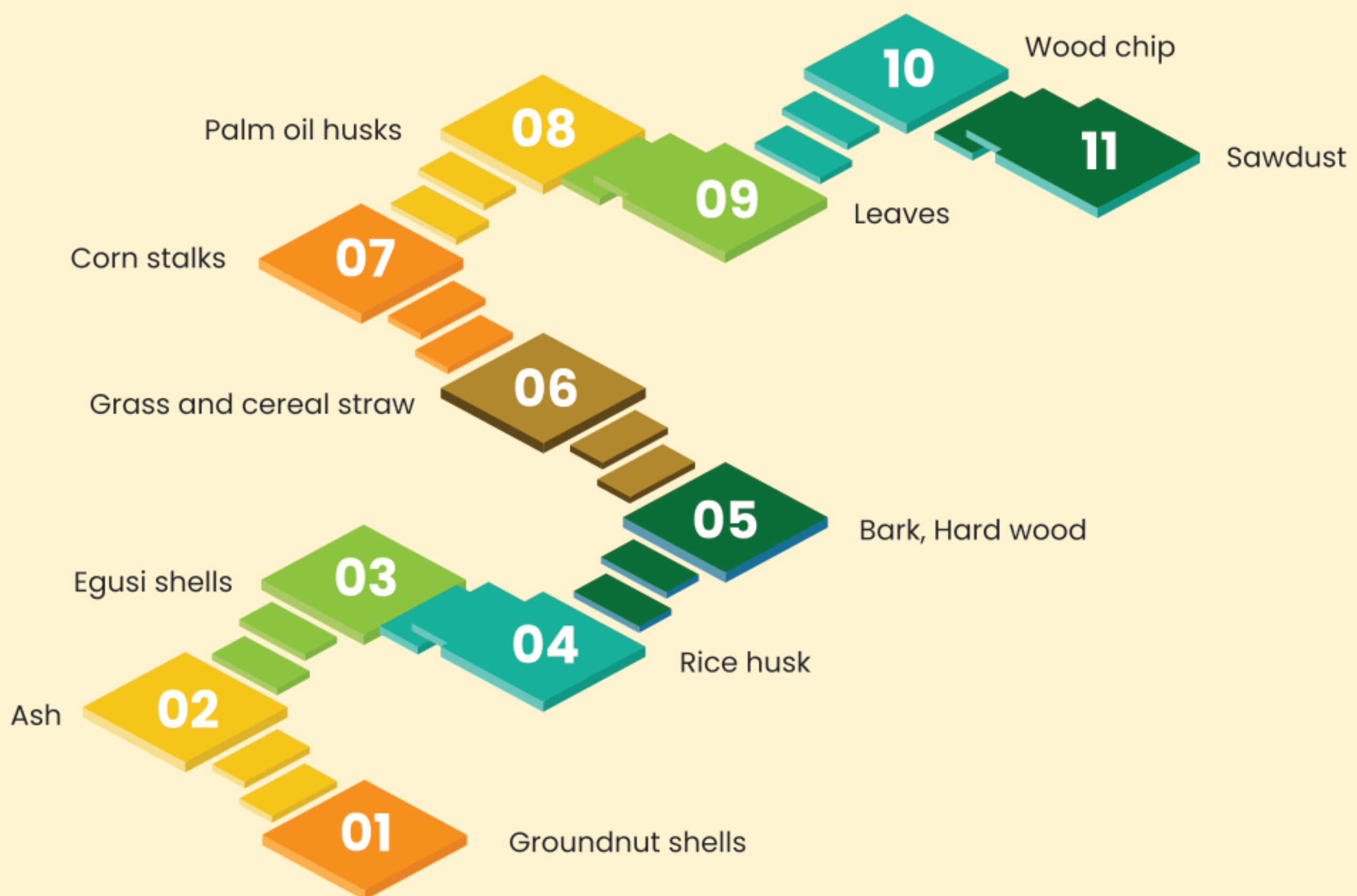


# Module 3

## COMPOST FERTILIZER (NATURAL FERTILIZER)

Composting is a process in which oxygen-consuming bacteria and fungi feed on the mixed organic wastes in a pile and convert the waste to compost. Properly managing a compost pile provides optimum conditions for the bacteria and fungi that do the real work of composting. These microorganisms require four things: carbon (C), nitrogen (N), water, and oxygen.

### Materials for compost making



### PRACTICAL METHOD OF MAKING COMPOST

#### Site selection

Select a suitable location near the water source, preferably a level, well-drained and shaded area.

#### Preparation of materials

Many types of organic materials can be used for compost making. Sod, grass clippings, leaves, hay, straw, weeds, manure, chopped corncobs, sawdust, wood ashes, kitchen waste and many kinds of plant residues from garden are some of the possibilities. Combine materials and the Carbon/Nitrogen ratio should be approximately 30 for accelerating the process. Large materials should be chopped into small pieces so that they decompose more quickly.

## Methods of composting

- Community composting
- Aerobic pit compost
- Surface layered composting
- Animal beddings composting
- Household box composting

## Piling

- Making a heap require a square wooden frame from 4 wooden sheets, each of which measures 30 cm by 1.5 m.
- Pile rice straw about 15 cm thick uniformly.
- Apply Poultry manure/ for adjusting Carbon/Nitrogen ratio.
- Pile the materials 15 cm thick again.
- Sprinkle water to each layer, till water drips among fingers when the materials are squeezed.
- Trample on the materials, slightly stronger trampling pressure along the frame borders.
- This process is repeated until the height of the heap reaches about 1.5 m.
- Put a cover over the pile to prevent leaching losses of nutrients through drying and rain.
- Turning (to bring the maturity of compost to the same level).
- The temperature in the pile may rise up to 60 – 70 degree, 3 – 4 days after piling.
- Turn over the pile 3 to 5 weeks after piling.
- Repeat the piling again and apply water, if the composting material is too dry.

The compost will be matured after 3~4 months, which become moist, soft, and deep brown or black in color.

## Benefit of compost



Maintains soil fertility level.



Increases the nutrient level of the soil or improves the soil's physical condition by improving soil structure and aeration



Increases the infiltration capacity of the soil, thus reducing surface runoff.



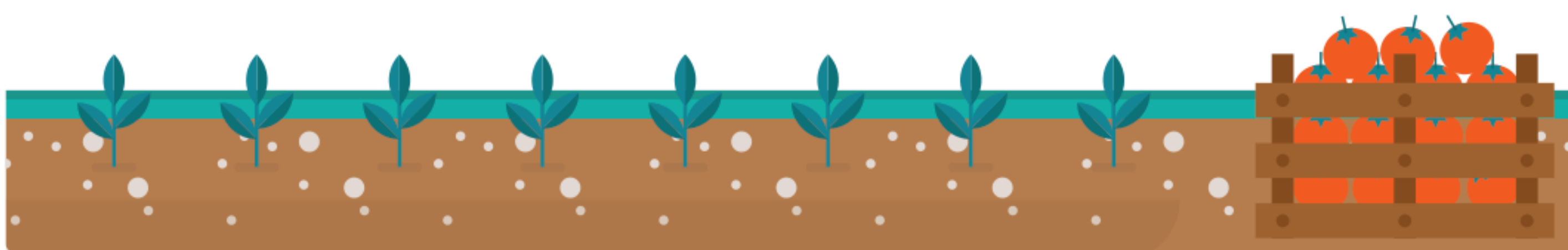
Helps to retain plant nutrients and moisture.



Well-decomposed compost buffers soil reaction and controls soil temperature.



It also increases soil microbial activity which helps mineralization of applied chemical fertilizers, making them more available to crops.

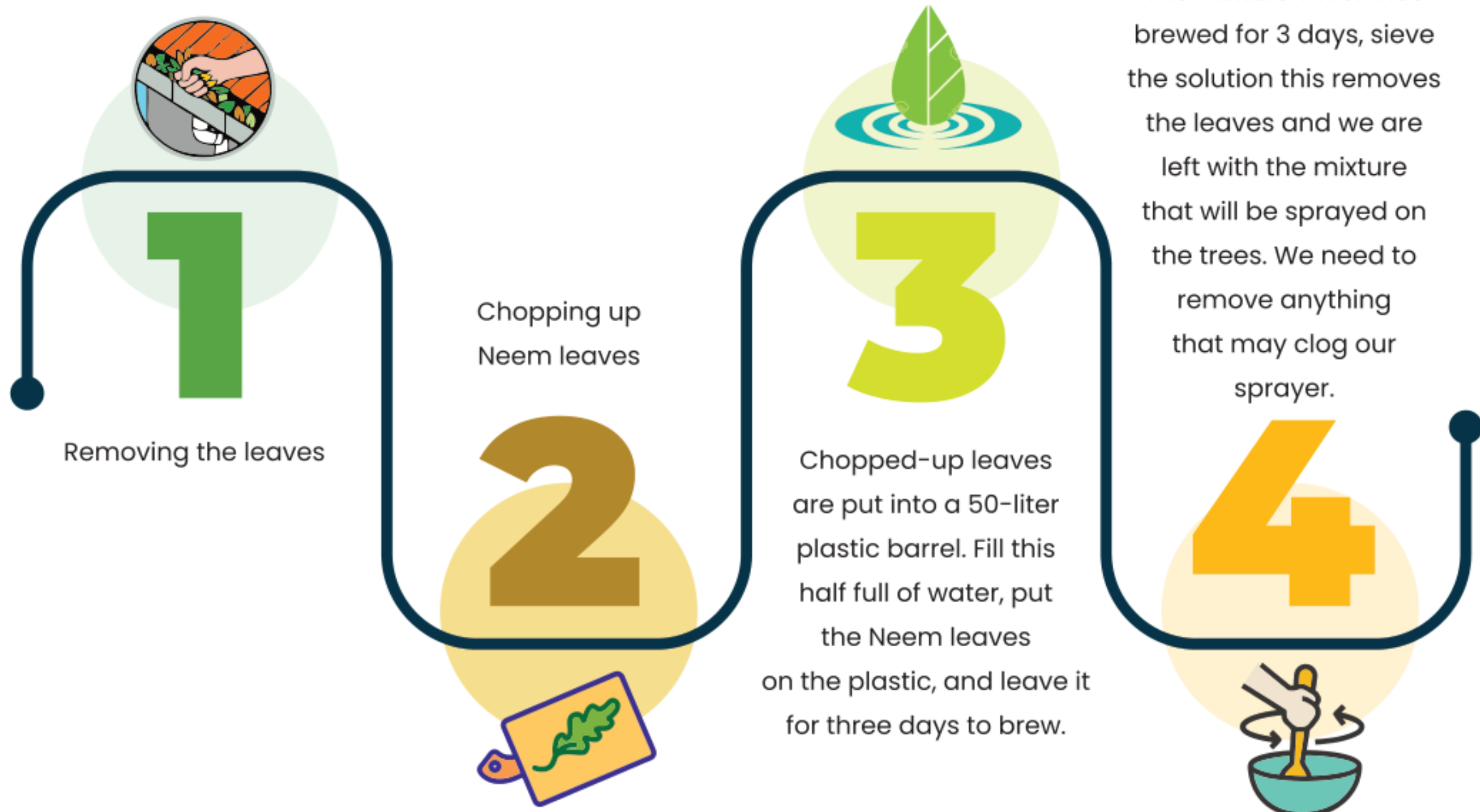


# Module 4

## SUSTAINABLE INSECT TRAPPING AND PESTICIDES/ HERBICIDE PRODUCTION


The way we farm today is damaging our climate, our wildlife, our soils and our health. We can solve these interconnected crises by changing the way that we grow food and what we put on our plates. The over use of pesticides underpin this current damaging system of farming they are a major part of what needs to change.

### How to make an Organic pesticide using Neem leaves



*"Mixture is ready for use when the mixture will smell like a cross between urine and onions. Not a pleasant smell but effective against insects. Because of the smell, you may want to make the mixture away from the house".*

### Adding Oil and Detergent

- 01**  
  
To make sure the pesticide sticks to the plants and doesn't just run off, add oil and dish soap.
- 02**  
  
3 spoon of cooking oil and the same amount of dish soap.
- 03**  
  
The role of the dish soap is to break down the oil, and the role of the oil is to make it stick to the leaves.

## Making pesticide using Neem seed

**01**

Find the Neem tree with green and yellow fruits

**02**

Select the ripe fruit which are yellow in colour

**03**

Let the fruit dry in the sun for about 3 or 4 days until they turn brown.

**04**

Using a mortar and pestle, the fruits are slightly pounded to remove the shelves from the fruits without breaking the seed inside.

**05**

The content of the mortar is winnowed to separate the shelf from the seed

**06**

The seed are classified and separated base on the colour, the good ones are dark in colour while the lightly one are eliminated.

**07**

Place a number of the seeds on the mortar and pound it until they are converted to a fine powder.

**08**

Pour the fine powder into a container containing water and then mix the solution well.

**09**

The proportion to be used is 350g of fine powder per 10 liters of water which is approximately six handful of fine powder into 10 liters of clean water.

**10**

Let the mixture rest for 24hour before it is used

**11**

Filter the mixture.



### **INSECT TRAP**

Insect trap is also used to trap insect through the following step. Yellow colour is attractive to white fly while blue colour is attractive to aphids.

- Get a yellow or blue colour plastic.
- Cut the plastic into a require size.
- Rub a gum on the plastic.
- And hang on the farm.

### **ORGANIC HERBICIDE**

Organic herbicides are made from chemicals that naturally occur in nature. Both types of herbicides have their advantages and disadvantages. Organic herbicides break down quickly and are low in toxins. They're also very popular due to their environmental and health benefits to both the plant and the soil.

- Pour 1 gallon of white vinegar into a bucket. White vinegar is fine.
- Add 1 cup of table salt.
- Stir in 1 tablespoon of liquid dishwashing soap.
- Blend all thoroughly and then funnel the weed killer into a plastic spray bottle.

### **SALT/WATER MIXTURES**

Salt is an organic way to treat weeds, too. When applied to weeds, salt seeps into the soil and dehydrates the roots, killing the weeds.

### **MAKING SALT WEED KILLER MIXTURE**

- Dissolve rock or table salt to water at a fairly weak mixture of 3:1 ratio of water to salt.
- Increase the amount of salt daily until the salt begins to kills the target plant.
- Mix 5 tablespoons of liquid soap (such as dishwashing liquid) in one quart (4 cups) of water in a spray bottle.

# Module 5

## AGROFORESTRY

**A**groforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence having both ecological and economical interactions between the different components.

Agroforestry can also be a dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels.

In particular, agroforestry is crucial to smallholder farmers and other rural people because it can enhance their food supply, income and health. Agroforestry systems are multifunctional systems that can provide a wide range of economic, sociocultural, and environmental benefits.

There are three main types of agroforestry systems:

- Agrisilvicultural systems are a combination of crops and trees, such as alley cropping or home gardens.
- Silvopastoral systems combine forestry and grazing of domesticated animals on pastures, rangelands or on-farm.
- The three elements, namely trees, animals and crops, can be integrated in what are called agrosilvopastoral systems and are illustrated by homegardens involving animals as well as scattered trees on croplands used for grazing after harvests.

Agroforestry systems grouped into three categories: Commercial, Intermediate and Subsistence systems.



# 1. SILVO-ARABLE AGROFORESTRY

At a most basic level, this is when crops are grown beneath and in between trees. Trees are often placed in rows that are wide enough for a tractor to fit down without damaging them.

Usually about 10 to 15 meters. This wide tree spacing with companion crops grown between is referred to as alley cropping. Silvo-arable agroforestry is possible with most crops.

In addition to crops grown between the rows, the trees themselves can produce a number of valuable resources. Since the trees are grown in such close proximity to the crops, it is important that the alleys are deeply cultivated on an annual basis.

No-dig or no-till techniques are likely to result in the area filling with tree roots, even if raised beds are used. Ideally, tree rows should be aligned North to South to make the best use of sunlight. To increase wind protection, additional shrubs and taller plants can be planted beside the trees.

Particularly while the trees are young. Coniferous trees are also sometimes placed between rows of trees to help train crop trees to grow straight, and are later thinned out.

## Advantages and Disadvantages of Silvo-arable Agroforestry

Silvo-arable agroforestry has some great benefits compared to conventional agriculture, but it also has some drawbacks you should be aware of as well.

### Advantages

- Increased production. In addition to normal crops, you're also growing wood or tree products with little to no reduction in crop yields, particularly while the trees are still young and growing. Once trees do mature, enhanced microclimate conditions often produce higher crop quality and yields, which offsets any space lost to tree rows.
- Better for wildlife. Silvo-arable agroforestry creates more wildlife habitat for birds, bats, and other beneficial tree-dwelling animals, which in turn will keep pests under control.
- More diverse landscape. Instead of having a single monocropped field, the rows of trees break up the scenery and create a different aesthetic.
- Better soil. Leaves from trees add organic matter to the soil. Specific trees such as honey locust may be selected for their nitrogen-boosting abilities.

### Disadvantages

- Perceived inconvenience. Some farmers are hesitant to place trees in their fields, for fear that they will get in the way. Although if rows and alleys are designed with machinery in mind, this isn't usually a problem.
- Trees may not grow straight. Trees grown for timber in alley cropping conditions tend to grow crooked because of the uneven lighting. This can be corrected and overcome, but requires additional pruning or the use of nurse trees.



## 2. SILVO-PASTORAL AGROFORESTRY

In silvo-pastoral agroforestry, grazing livestock are used instead of the crops featured in silvo-arable agroforestry. These animals eat the plant matter under the shelter of the trees, while dropping manure that enriches the soil, in turn improving production of tree crops.

Trees are deliberately introduced to open fields or other areas where animals were already foraging in most cases. They may or may not be evenly spaced in rows as done with silvo-arable agroforestry. The alternatives to row planting are cluster planting or even wide spacing.

Cluster planting has many advantages of row spacing and provides more localized shade. Even wide spacing means trees are spaced equally far apart. This comes with some additional challenges such as damage from foraging animals and increased problems with weeds.

### Advantages and Disadvantages of Silvo-pastoral Agroforestry

#### Advantages

- Sustainable. Farmers get the same economic returns from their livestock, but with a more sustainable and environmentally-friendly system.
- More profitable. Added benefit of tree crops often greatly exceeds the income from pastures alone. Likewise, the addition of animals is more lucrative than orchards or forests alone.
- Diversity. Using fencing, the area can be designed to still allow for growing other crops on the same land while still maintaining forage for livestock as well.
- Wind protection. Trees offer wind protection and shade for livestock. Less intervention is required by farmers in cold or hot weather since wind chill and heat stress are reduced. Livestock mortality is reduced as a result.

#### Disadvantage

Animals can damage trees. Protecting trees from livestock can be difficult. Using fencing or special materials to keep animals away often costs more than the trees themselves. Techniques like pollarding can be used, but requires more time and effort.





### 3. FOREST FARMING

Forest farming is the cultivation of high-value crops under the protection of a forest canopy, which provides a microclimate and many other benefits. Often silvo-pastoral or silvo-arable agroforestry involves only one or two types of trees or plants.



### 4. MUSHROOM PRODUCTION

Mushrooms are crops that could potentially be grown in an agroforestry system. Producing edible mushrooms has the potential to generate a decent amount of income. fallen logs and even the ground itself can be inoculated with mushroom spores or spawn, depending on the variety of mushroom you're planning to grow.

Oyster mushrooms or shiitake are the most popular and probably the easiest. Mushrooms aren't just food, but they can help the overall health of your food forest as well. Fungi rapidly break down organic matter like rotting logs and leaves, and helps to turn them in to rich soil.

The mycelium or root systems of fungi also have beneficial relationships with trees and crops and can make them grow larger and more quickly.



## 5. BEEKEEPING

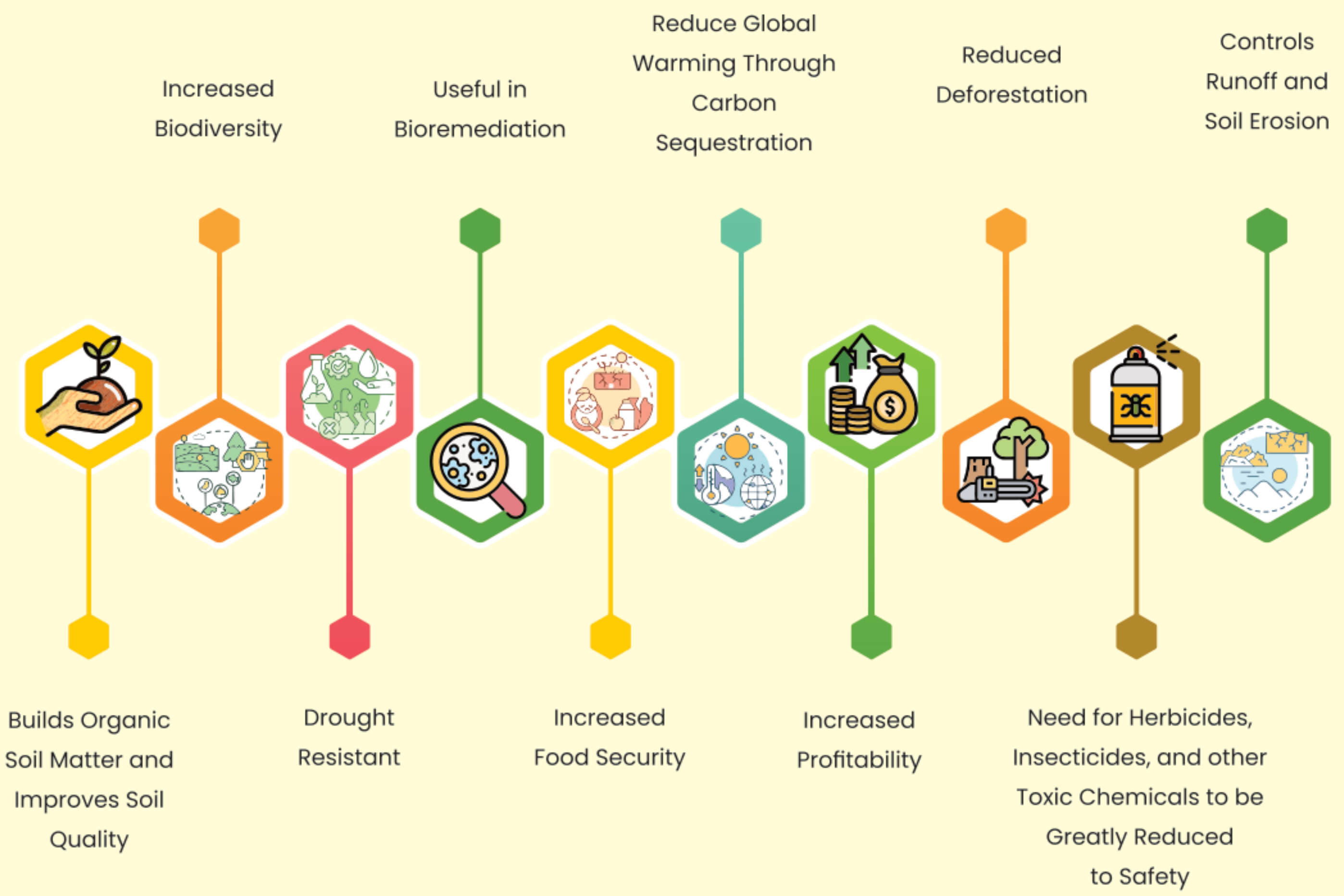
Bees make a fantastic addition to any agroforestry system. When a farmer provides bees a place to live, they in turn pollinate crops, which increases plant yields. Setting up a bee colony and caring for them takes less time and effort.



## 6. SNAIL FARMING

Snail farming is one of the sustainable, money making Agribusinesses that goes well in an agroforestry system. Also known as heliciculture, snail farming is a process of raising edible snails for human consumption or cosmetic purposes.

# Benefits of Agroforestry





Agroecological Farm Practices Checklist


S/NO	Agroecological Practices	Practicing (Yes/No)		Number of farmers practicing	Why are you practicing?	Why are you not practicing?
1.	Soil fauna and flora (improvement and management)					
2.	Production of organic manure (compost manure)					
3.	Production of organic pesticide or use					
4.	Production of organic herbicides or use					
5.	Soil conservation techniques (mulching, minimum tillage, bunding, contouring)					
6.	Water harvesting or drainage and irrigation systems (soil water management)					
7.	Mixed farming (production of crops and animals)					
8.	Mixed cropping (crop rotation, relay cropping, intercropping)					



# act:onaid

 **Abuja**  
ActionAid Nigeria  
Plot 477, 41 Crescent,  
off Sa'adu Zungur Avenue  
Gwarimpa, Abuja.

 **Lagos**  
1A, Adeboye Solanke Street  
Off Allen Avenue (behind  
Zenith Bank)  
Ikeja, Lagos.  
Tel: +2348126644268

 **Borno**  
Old G.R.A. Beside  
Lodge 7, Maiduguri.

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