World Agroforestry Centre

Soil and Water Conservation as Agroecological Practice for Cacao Cultivation

Sustainable Farming in Tropical Asian Landscapes (SFITAL)

The **malpractices** of farming systems by upland farmers affect the lives and the livelihoods of the **people living downstream.**

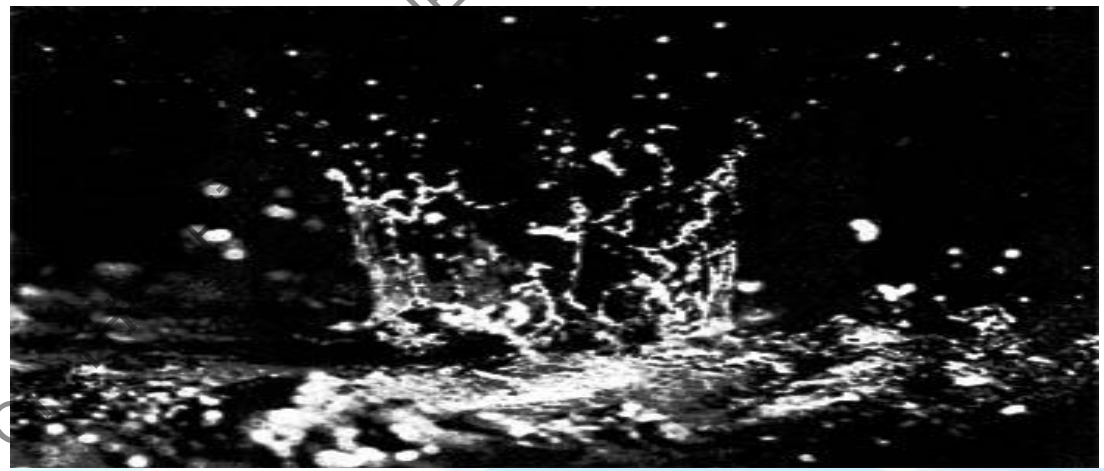
- **soil erosion**, which contributes to **soil degradation** and **siltation to water bodies** including the coastal affecting marine resources that has a **direct impact on livelihoods and food security.**

Soil erosion

- is the detachment of soil materials and subsequent transport by an agent (water, wind gravity) to an area of deposition.
- a consequence of unsustainable land use that results in soil degradation exacerbated by attempting to farm slopes that are too steep, cultivating up-and-down hills
- **Water** is the most important agent of erosion

Types of water erosion

1. Splash erosion – detachment of soil by raindrops.
2. Sheet erosion - splashed soil is removed more or less uniformly.
3. Rill erosion –small channels can be smoothed by tillage.
4. Gully erosion –large channels that can not be removed by tillage.



Factors affecting soil erosion

1. Rainfall
2. Soil erodibility
3. Texture – the fineness and coarseness of soil particles
4. Soil structure – the arrangement of primary particles into aggregates (crumbs) affects erosion by increasing infiltration or through the function of stable aggregate brought about by increased organic matter.
5. Vegetation –the extent of plant cover

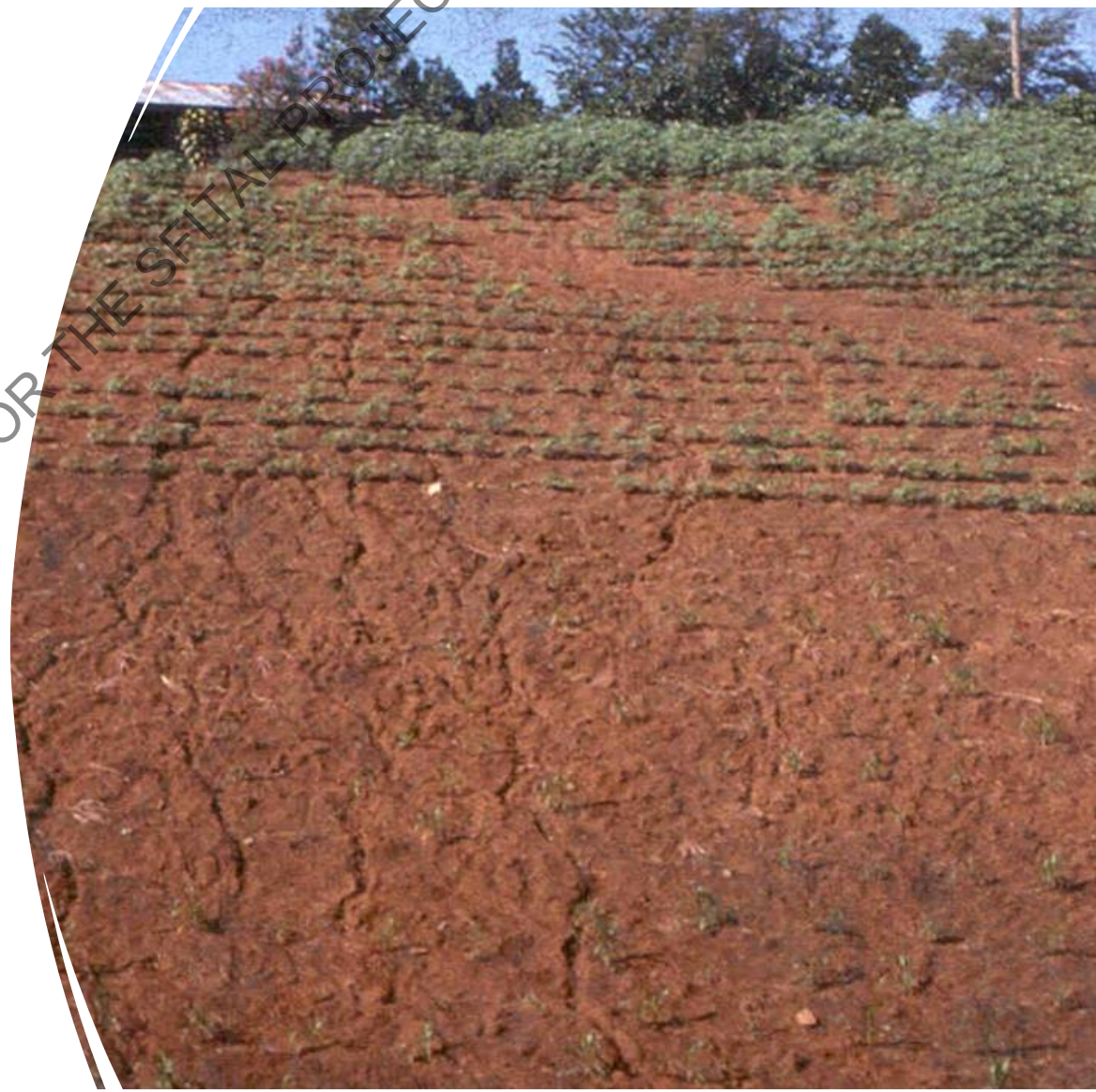
Factors affecting soil erosion

6. Relief or slope – the steepness of the land; the higher the slope, the soil becomes conducive to erosion
7. Human activities – types of human activities affect the potential for soil erosion; for example, intensive cultivation of steeper slopes promotes soil erosion.

Result of soil erosion

a) Onsite effect

- This is a **loss of agricultural production** (crops and animals) which is the result of reduced water infiltration, low moisture holding capacity of the soil, reduced depth of the soil, and loss of soil nutrients.



Result of soil erosion

b) Offset effect

- this is the **increased sedimentation through downstream siltation** of irrigation canals, farmlands, water bodies, and reservoirs thus affecting water quality, fisheries and the life of the infrastructure such as hydroelectric dams, irrigation dams and canals.
- Flooding in the downstream areas is the one of worst off-site effects. The decrease in water flow during the dry season is hurting agricultural uses of water, which is the result of soil erosion in upstream areas of the watershed.

Soil conservation

- A combination of all management and land use methods that safeguard the soil against depletion or deterioration caused by nature and/or human

Principles of soil conservation

1. Protecting soil against erosion

- Protecting the soil surface with ground cover (30% is sufficient)
- Reducing the rate of runoff
- Reducing the length and steepness of the slope
- Increasing the surface roughness

2. Reducing soil susceptibility to water or wind erosion

- Improved soil management such as incorporation of crop residues, manure and a practice crop rotation

3. Combination of 1 and 2

Approaches in soil conservation

1. **Barrier approach -** this is to check run-off and soil removal by means of contour-aligned barriers. Examples are terraces, ditch and bund earth structures, grass trips, hedgerows, diversion channels, and grassed waterways – to promote water infiltration.
2. **Cover approach -** this is to check raindrop impact and run-off through maintenance of good soil cover formed by living or dead plant materials including herbaceous plants, crop residues, tree litters and prunings.

Practical solution against soil erosion for cacao in sloping land

- Soil fertility declines are a leading factor in decreasing cacao yields.
- The application of chemical fertilizer is often not an option for cacao smallholders, either because of a lack of access or its high cost.
- Soil management starts at the establishment of a cacao farm.
- By maintaining and improving the soil characteristics for cacao production across its life cycle, production costs are reduced.

Practical solution against soil erosion for cacao in sloping land

- It is highly recommended the adoption of soil and water conservation techniques by lay-outing of contours using an A-frame and making use of natural vegetative grass strips, fodder grasses or other materials available to filter eroded soil, slowing down the rate of water flow and enhance water infiltration before the establishment of the cacao farm.

Practical solution against soil erosion for cacao in sloping land

Practical solution against soil erosion for cacao in sloping land

- Contour establishment is recommended before laying out the planting holes for cacao.
- Contour planting with vegetative grass strips (e.g., fodder grass) filters the eroded soils, slows down the rate of water flow, and enhances water infiltration, making them very effective for soil and water conservation.

Practical solution against soil erosion for cacao in sloping land

Water conservation

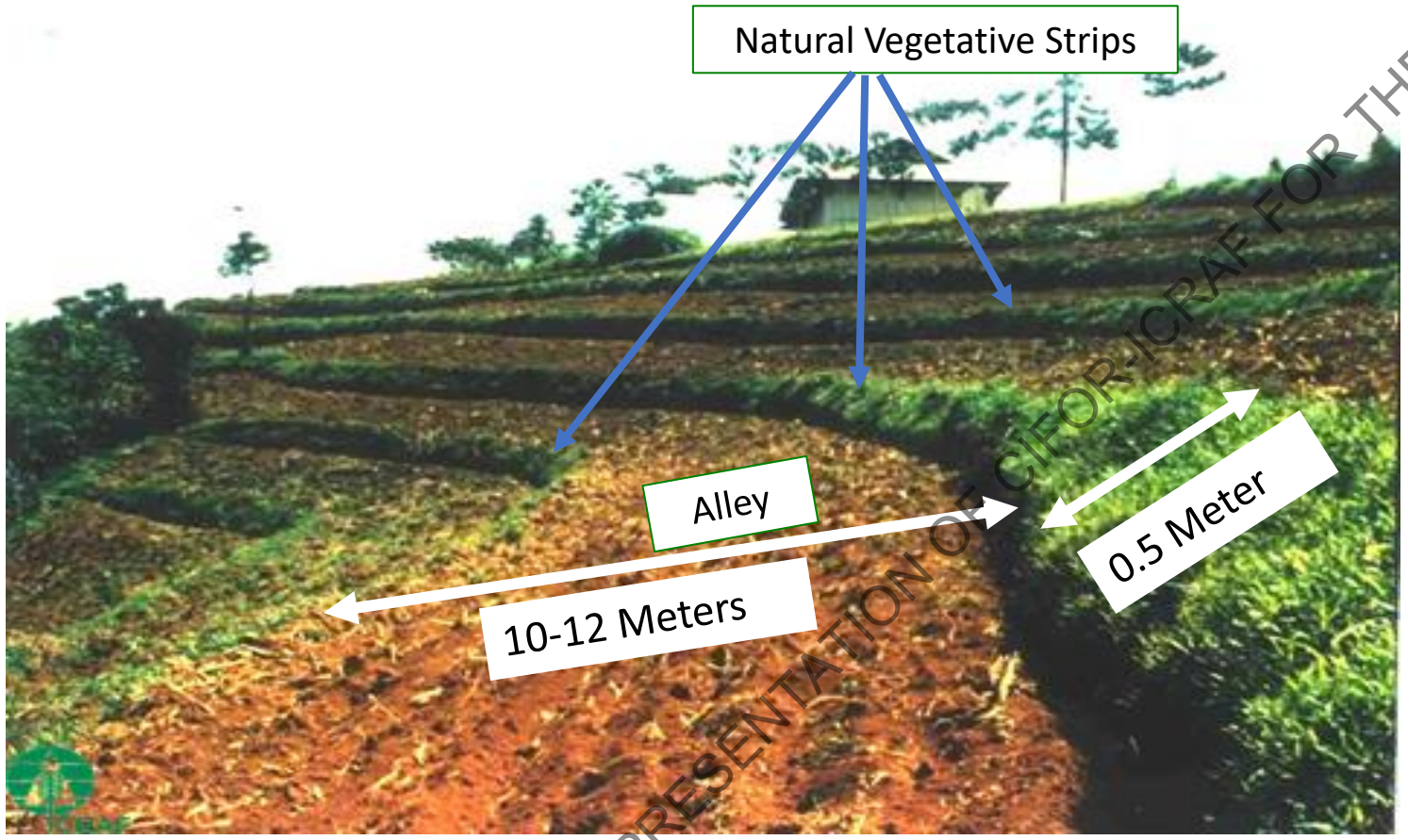
- **Rainwater harvesting** can also be an important component of cacao-based agroecological practice. In this system, water runoff is harvested in a pond that stores water during rainy days which prevents downstream flooding. Harvested water can be used during the long dry spell.

Green infrastructure on sloping lands

It is just leaving 50 cm wide of natural vegetation usually unplowed strips along the contour to act as soil filters. The strips are spaced 6-10 meters apart on the sloping field.

Natural vegetative filter strips (NVS)

Desirable qualities of NVS



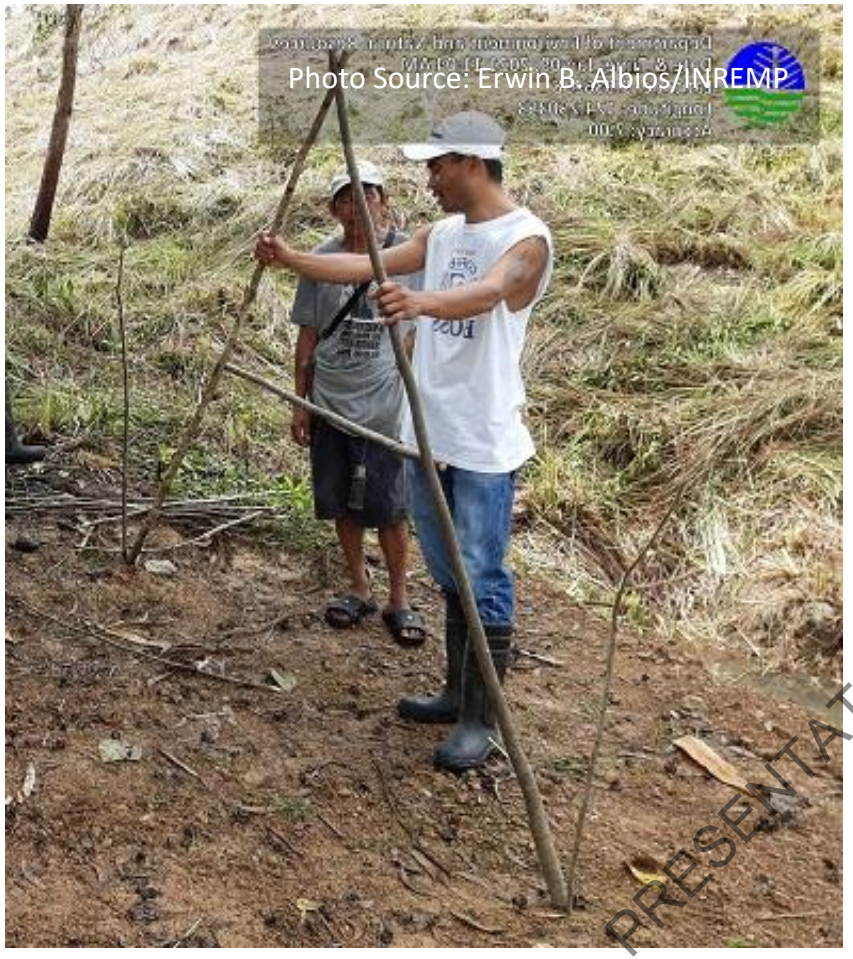
- Low labor requirement for establishment and maintenance. NVS is simply laid out by leaving 50 cm of strips along the contour unplowed.
- Effective in reducing soil loss. Research results showed NVS can reduce soil loss by more than 90%.
- Competition effects on adjacent field crops are minimal.
- Enhance infiltration of water.

Example of other practical Soil and Water Conservation Measures

Trash bunding

Example of other practical Soil and Water Conservation Measures

Method of establishing NVS – use of A-frame



SUSTAINABLE FARMING IN TROPICAL ASIAN LANDSCAPES (SFITAL)

Thank you!