smart skills
smart sustainable agriculture

Course 5: Climate-Smart Agriculture (CSA) Techniques

M3: Soil Conservation & Carbon Sequestration

Co-funded by the European Union

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contents

In this module, learners will discover techniques to prevent soil erosion, promote carbon capture, and understand how to monitor soil health with technological tools. We will discuss:

- Enhancing soil health with organic matter.
- The benefits of cover cropping
- Monitoring and adjusting practices to suit the soils needs

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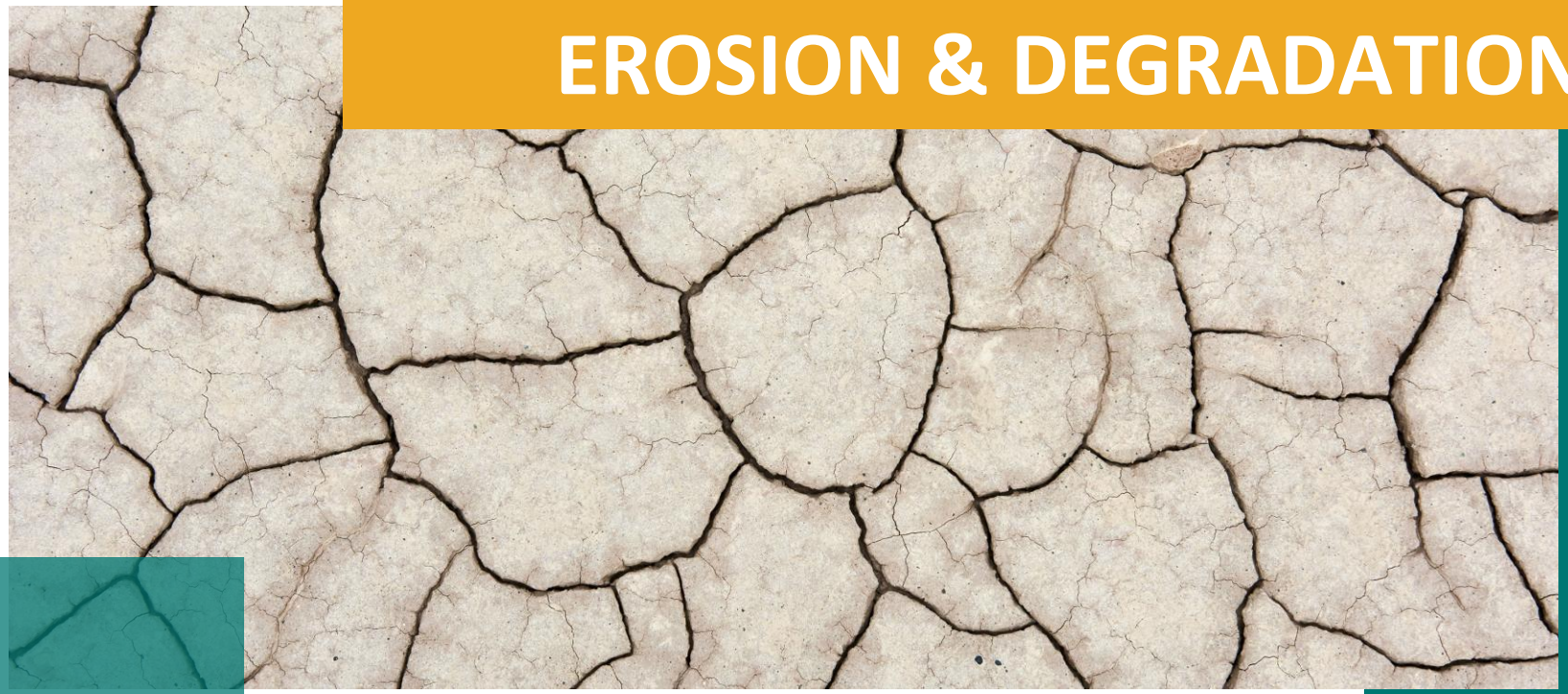
01

TECHNIQUES FOR PREVENTING SOIL EROSION & DEGRADATION

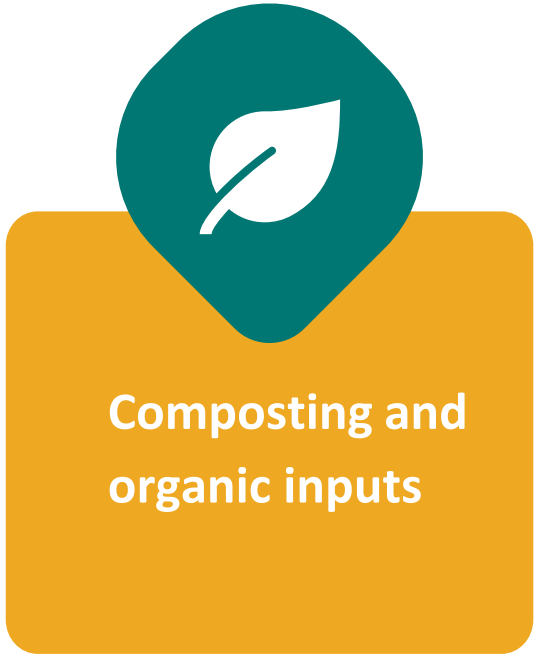


Enhancing Soil Health with Organic Matter

10 WAYS TO PREVENT SOIL EROSION

Maintaining **healthy soil** is essential to prevent erosion and preserve agricultural productivity. Practices that increase organic matter help improve soil structure, promote water retention and reduce the risk of degradation.

Enhancing Soil Health with Organic Matter



Composting and organic inputs

Adding compost, stimulating microbial activity and improving soil fertility.

Cover Cropping and green manuring

Cover crops (legumes, cereals) between harvests protect the soil surface from erosion

Reduced tillage (No-Till/Min-Till)

Tilling the soil less limits surface erosion. Increases the accumulation of organic carbon.

Enhancing Soil Health with Organic Matter

These techniques, central to **Climate-Smart Agriculture**, reduce dependence on chemical fertilisers and ensure **long-lasting productivity**, even in variable climatic conditions.

Find out more

02

ROLE OF AGROFORESTRY & COVER CROPPING IN CARBON SEQUESTRATION.

Agroforestry: trees in synergy with agriculture

Carbon sequestration: Trees absorb CO_2, contributing to the mitigation of climate change.

Crop protection: They act as windbreaks and provide shade, reducing erosion and heat stress.

Agroforestry: trees in synergy with agriculture

- **Biodiversity and microclimate:** They offer a habitat for pollinators and natural predators of parasites, improving the health of the ecosystem and regulating temperatures.
- **Income diversification:** Additional products (wood, fruit, nuts, medicinal plants) reduce the economic risk associated with climate variations.

Cover Cropping: to enrich the soil

- **Increase of organic matter:** legumes and other species fix nitrogen and, once incorporated, enrich the soil with carbon.
- **Soil protection:** they reduce erosion between one crop cycle and another, keeping the soil covered.
- Natural **pest management:** A wide crop diversity helps control pests, reducing the use of pesticides.

Together, **agroforestry** and **cover cropping** promote **resilience** to climate change, improve agricultural **productivity** and make a significant contribution to **mitigation** (by sequestering carbon and protecting biodiversity). These practices embody the **three objectives** of Climate-Smart Agriculture: **mitigation, adaptation** and **improvement of livelihoods**.

03

MONITORING & ENHANCING SOIL HEALTH WITH TECHNOLOGY

Climate-smart agriculture offers a comprehensive framework for tackling the intertwined challenges of food security, climate change, and environmental degradation.

(Alliance Biodiversity & CIAT)

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More efficient irrigation technologies

Precision agriculture uses the latest technology to optimise farming practices by collecting and analysing data on **soil conditions, weather patterns, and crop health**, providing farmers with the best information to make informed decisions.

- **Remote sensing:** Drones, satellites, and sensors can monitor crop health and detect issues like water stress or pest infestations early, allowing farmers to address problems before they become serious.
- **GPS-guided machinery:** Tractors and other farm machinery equipped with GPS can precisely plant seeds and apply inputs, reducing waste and improving efficiency.

More efficient irrigation technologies

- **Smart irrigation systems:** These systems use data from weather forecasts and soil moisture sensors to automatically adjust water levels, ensuring that crops receive just the right amount of water.

- **Geospatial technology and GIS:** Geographic Information Systems (GIS) allow farmers to map their fields and track the performance of different areas. This helps optimize planting strategies and ensures that inputs are applied where they are most needed.

We need to develop and strengthen integrated information systems to address pressing multisectoral challenges, which should be available to all – especially to farmers who are the custodians of our natural resources, as well as their final controllers.

FAO Director-General

04

LETS PRACTICE

Choices for a Resilient Soil

Scenario: You manage a small hillside farm. In recent years, you've observed increasing soil erosion, declining fertility, and loss of biodiversity.

Goal: Choose the combination of practices mentioned on the next slide that best restores soil health and enhances carbon sequestration.

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Which option do you choose?

Option A

- Deep ploughing
- Intensive monoculture
- No ground cover between crop cycles

Option B

- No-till or reduced tillage
- Introduction of cover crops (e.g., clover or vetch)
- Composting and organic fertilization

Option C

- Frequent drainage and irrigation
- High doses of chemical fertilizers
- Removing hedgerows to expand cultivated land

Feedback

✔ **Option B** is the best choice!
It combines soil conservation and organic matter enhancement practices, improving fertility, structure, and the soil's ability to store carbon.

❌ Options A and C can **worsen soil degradation** and reduce biodiversity, moving away from Climate-Smart Agriculture principles.

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