

Did you know?

Without organic matter soil becomes mere dirt. **Soil organic matter (SOM)** -

- is composed of soil microbes (including bacteria and fungi), decaying material from once-living organisms such as plant and animal tissues, faecal material, and products formed from their decomposition.
- is made of organic compounds that are highly enriched in carbon. Soil organic carbon (SOC) levels are directly related to the amount of organic matter contained in soil and SOC is often how organic matter is measured in soils.
- improves soil structure and reduces erosion, leading to improved water quality in groundwater and surface waters, and ultimately to increased food security.

Soil organic matter is essential for ecosystem health and food production and therefore important for climate change adaptation.

Increasing organic matter in soil will also a) help reduce emissions of CO₂ from soils to the atmosphere; and b) increase carbon sequestration (uptake of CO₂ to be stored in soils).

Conserving soils, increasing soil organic matter, contributing to climate change mitigation

Agroforestry systems

Agroforestry systems include both traditional and modern land-use systems where trees are planted together with crops and/or animal production systems on a piece of land.

Agroforestry systems with greater species diversity are better able to store carbon than mono-cropping systems.



Mulching (organic)

Mulching is the process of using organic matter such as leaves, grass, bark, placed around plants. Mulching keeps existing water trapped in the soil, suppresses weed growth, and breaks the fall of water during rainfall therefore, lessening the force of its impact on the ground. When mulch slowly decomposes on top of the soil, nutrients and carbon are released into the soil.



Fire management

Fire management is the process of planning, preventing and fighting fires to protect communities, property and ecosystems. In Fiji, setting fire to extensive areas of grassland and burning down forests



for cropping is a major concern. Continuous burning results in soil and land degradation and increase GHG emissions.

Restoring degraded and eroded land

Restoration of degraded areas with vegetation cover and tree planting will increase organic matter in soil and help in restoring soil fertility. The restoration of degraded land will increase the soil's capacity to sequester and store carbon. Fiji has large areas of talasiga grasslands that has potential for restoration.



Contour planting with vetiver hedgerows

The method of planting crops following the landscape with vetiver grass inter-planted with crops. This practice promotes soil retention on hilly and steep slopes and adds organic matter into the soil.



Conservation tillage

Conservation and zero tillage are methods of establishing crops with minimum soil disturbance. The benefits include improved soil quality, retention of water in soil, and the slower decomposition of organic matter and depletion of soil carbon that normally occurs from intensive tillage or ploughing.

Conservation tillage is seen as an important adaptation measure for food security in especially dry areas.



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Climate Change and Soils in Fiji



Soil – a major carbon sink and carbon source

Fact box

- More carbon resides in soil than in the atmosphere and all plant life combined.
- Soils — and the microbes that live within them — store three times as much carbon as is in the atmosphere, and four and a half times as much as in all plants and animals.
- There are 2,500 billion tons of carbon in soil, compared with 800 billion tons in the atmosphere and 560 billion tons in plant and animal life. Only the ocean has a larger carbon pool, at about 38,400 GT, mostly in inorganic forms.
- Since the industrial revolution, the conversion of natural ecosystems to agricultural use has resulted in the depletion of soil organic carbon levels, releasing 50 to 100 GT of carbon from soil into the atmosphere. This is the combined result of reductions in the amount of plant roots and residues returned to the soil (removal of plants and vegetation from soil), increased decomposition from soil tillage, and increased soil erosion

(Source: Ontl, T. A. & Schulte, L. A. (2012)
Soil Carbon Storage. Nature Education Knowledge 3(10):35)

Poor land use and agriculture practices will result in the release of huge amounts of carbon stored in soil. This will be released as carbon dioxide (CO₂) – increasing greenhouse gas (GHG) emissions. CO₂ is the most common greenhouse gas emitted into the atmosphere. The increase in GHGs in our atmosphere is causing global warming, bringing about climate change.



Climate change impacts on soil

Increased erosion

In agriculture, soil erosion refers to the wearing away of a field's topsoil by the natural physical forces of water and wind or through forces associated with farming activities such as tillage (ploughing).



For Fiji, there is high confidence that the frequency and intensity of extreme rainfall events will increase.

The greater the intensity and duration of a rainfall, the higher the erosion potential. The impact of raindrops on the soil surface can break down soil aggregates and disperse the aggregate material.

Land cover and land use practice affects the risk of erosion.

Desertification and land degradation

Desertification is the persistent degradation of dry land ecosystems resulting from both natural events and human activities.



Land degradation occurs everywhere, but is defined as desertification when it occurs in the dry lands. Overgrazing, over-cultivation, deforestation, poorly planned irrigation systems and frequent burning cause degradation and desertification. Extreme weather events such as prolonged droughts, heavy flooding and extreme high temperatures can accelerate the degradation process.

There is very high confidence that annual mean temperatures and extremely high daily temperatures will continue to rise. Further warming is expected over Fiji. Strong El Nino episodes also results in prolonged extreme dry conditions.

Salinisation

Salinisation is the process by which water-soluble salts accumulate in the soil.



Salinisation is a resource concern because excess salts hinder the growth of crops by limiting their ability to take up water. High levels of salt in the soil have a similar effect as droughtiness by making water less available for uptake by plant roots, thus increasing water stress and reducing growth.

Salinisation can arise as the result of natural or man made causes. Causes include - low annual rainfall; high evaporation rate; sea level change; high salt content of the parent material or ground water; insufficient drainage due to water scarcity; and water retention infrastructure (dams etc.).

Inundation

Salt water inundation occurs when soils are flooded with sea water or brackish water.



In low-lying coastal zones, this occurs largely as a result of storm and tidal surges and a retreating coastline. Sea level rise will increase the impact of storm surges on land. Contaminated soils with elevated salt levels (salinisation) make it more difficult for plants to take up water. Very high salt levels may also draw water out of germinating seedlings and the roots of plants, causing shriveling.

For Fiji, there is very high confidence that mean sea level will continue to rise over the course of the 21st century.

Flooding of soils with freshwater usually occurs after excessive rainfall. After 24 hours in a flooded state, the oxygen concentration in soil approaches zero. Without oxygen, the nutrient and water uptake of plants is impaired and root growth inhibited.