SUSTAINABLE LAND USE

SLU13

SOIL MULCHING

ADDRESSED HAZARDS

PROTECTED CRITICAL INFRASTRUCTURE

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Organic mulch. [Freepik], [n.d.], Free to use.

What is it?

Soil Mulching is a land management practice that involves applying a protective layer of organic or inorganic material to the soil surface. This method conserves moisture, reduces erosion, regulates temperature, suppresses weeds, and enhances soil health. Mulching materials can include straw, wood chips, leaves, compost, gravel, or biodegradable fabrics, each offering specific benefits to different soil conditions and climates. It is widely used in agriculture, horticulture, and land restoration efforts to improve soil structure and resilience against climate-related hazards such as drought, heatwaves, and extreme rainfall events that cause soil erosion and nutrient loss. (Abd El-Mageed et al., 2018; Rossi et al., 2024; Yaseen and Abdulqadir, 2024).

Challenges this NbS addresses

Soil mulching helps mitigate multiple hazards by preventing, reducing, or recovering from their impacts:

- **Drought –** prevention and reduction (enhances soil moisture retention by reducing evaporation losses)
- **Erosion –** control (stabilises soil, preventing wind and water erosion)
- **Heatwaves –** reduction (insulates the soil, reducing temperature fluctuations and preventing heat stress on crops)

Primary functions and key services

- **Moisture retention:** reduces water evaporation from the soil, maintaining consistent soil moisture levels.
- **Soil temperature regulation:** mulching insulates the soil from extreme temperature fluctuations, keeping it cooler and supporting plant root health.
- **Weed suppression:** mulching blocks sunlight to inhibit weed growth, reducing the need for chemical herbicides.
- **Erosion control:** protects the soil from runoff and wind erosion, reducing sedimentation in water bodies and drainage systems.

Infrastructure protection: prevents soil displacement that could clog irrigation systems, drainage channels, and rural roads.

Climatological hazards:

- Moderate mitigation of drought by maintaining soil moisture and reducing water loss.

Meteorological hazards:

- Moderate mitigation of heat stress by insulating soil and preventing rapid temperature fluctuations.

Hydrological hazards:

- Limited mitigation of surface runoff by improving infiltration and reducing direct soil exposure to heavy rainfall.
- Moderate mitigation of soil erosion by covering and stabilising vulnerable soil surfaces.

Site suitability, scale and coverage

Soil mulching is applicable in:

- Agricultural and horticultural landscapes seeking to improve soil moisture and fertility
- Peri-urban and rural areas with high soil erosion risks
- Regions affected by prolonged drought, heat stress, or degraded soil conditions

Ecosystem services

- **Soil fertility improvement:** organic mulch decomposes over time, adding nutrients to the soil and improving soil structure.
- Increases organic matter in soils, **supporting long-term carbon storage.**
- **Weed suppression:** reduces competition for water and nutrients by limiting reed growth.
- **Enhanced biodiversity:** supports beneficial soil organisms, pollinators, and microbial life.
- **Water conservation:** improves soil water retention and minimises irrigation demands.

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Cost-benefit profile

Studies indicated that compost mulching contributes to lower the detrimental effects of water stress and saves irrigation water by 15% (Abd El-Mageed et al., 2018).

Some of the most relevant cost savings from implementing this technique are below summarised (Abd El-Mageed et al., 2018):

- Soil mulching reduces irrigation costs by improving moisture retention and reducing water loss.
- It minimises erosion-related maintenance expenses for irrigation infrastructure, drainage networks, and farmland roads.
- Organic mulching enhances long-term soil fertility, reducing the need for synthetic fertilisers and improving agricultural productivity.

Environmental impacts
(EU taxonomy)

- ☐ **Climate change mitigation**
- ☑ **Climate change adaptation**
- ☐ **Sustainable use and protection of water and marine resources**
- ☑ **Transition to a circular economy**
- ☐ **Pollution prevention and control**
- ☑ **Protection and restoration of biodiversity and ecosystems.**

Example of installation

1. Organic Mulching: A Sustainable Technique to Improve Soil Quality (Rossi et al., 2024)

Authors: Gabriella Rossi, Claudio Beni, Ulderico Neri

Description and results: This research evaluated the effects of organic mulches such as wheat straw, wood chips, spray cellulose pulp, compost, and a cover crop mixture on soil quality. The study found that organic mulching significantly improved soil organic carbon levels, reduced bulk density, increased infiltration rates, and enhanced soil physical-mechanical properties.

2. Mulching Strategies and the Significance of Mulching in Improving Soil Fertility and Soil Physical Properties: A Review. (Yaseen and Abdulqadir, 2024)

Authors: Arshad Yaseen, Mardin Khdr Abdulqadir

Description and results: This review examined the effects of various mulching materials and procedures on soil and the surrounding environment, focusing on crop productivity. The study suggested that mulching techniques can reduce cultivation costs, improve soil properties, regulate soil temperature, moisture, and biological activities.

Main components

- **Organic mulching:** made of materials like straw, wood chips, compost, or grass clippings that slowly decompose, enriching the soil with organic matter. Organic mulching is a promising technique for sustainable weed control and soil management, as it enhances crop growth, soil quality, water retention, and erosion control (Rossi et al., 2024).
- **Inorganic mulching:** materials such as stones, gravel, or biodegradable fabrics used in landscaping or agricultural settings to retain moisture and suppress weeds. Mulching application methods: Surface spreading, sheet mulching, and incorporation into soil beds.

Types of mulch: (Yaseen & Abdulqadir, 2024)

- **Straw mulch –** benefits: water productivity rises while water usage falls; improvement in rice yield, grain quality, and recovery; Less runoff or erosion, better soil water management and temperature control.
- **Compost mulching –** helps to reduce water stress and to secure more water that otherwise would be needed for irrigation (Abd El-Mageed et al., 2018).
- **Newspaper –** lower soil temperature and keep moisture in soil.
- **Sawdust –** preserved moisture and generated comparatively less "Savoy" baby cabbage (Yaseen & Abdulqadir, 2024).

References

Abd El-Mageed, T. A., El-Samnoudi, I. M., Ibrahim, A. E.-A. M., and Abd El Tawwab, A. R. (2018). Compost and mulching modulates morphological, physiological responses and water use efficiency in Sorghum bicolor (L.) Moench) under low moisture regime. Agricultural Water Management, 208, 431-439.

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Kader, M. A., Senge, M., Mojid, M. A., & Ito, K. (2017). Recent advances in mulching materials and methods for modifying soil environment. Soil and Tillage Research, 155-166.

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