Ecosystem Services Provided by Soil Organisms

Introduction

Soil organisms underpin a wide range of ecosystem services that support agriculture, forestry, and natural landscapes. These services include nutrient cycling, soil structure formation, pest control, and carbon storage. Understanding how these services are provided is essential for sustainable land management and for assessing the impacts of soil degradation and climate change.

Nutrient Cycling

Soil organisms decompose organic matter and release nutrients in forms that plants can absorb. Bacteria and fungi break down complex compounds, while larger organisms such as earthworms and termites fragment litter and mix it into the soil. This process makes nitrogen, phosphorus, and other elements available for plant growth.

Soil Structure

Earthworms, ants, and termites create tunnels and chambers that improve soil aeration and water infiltration. Fungal hyphae bind soil particles together and contribute to aggregate stability. Healthy soil structure reduces erosion and supports root growth.

Pest Control

Predatory mites, nematodes, and ground beetles feed on pests that damage crops. Entomopathogenic fungi and bacteria infect insect larvae and reduce their populations. Farmers can encourage these organisms by avoiding broad-spectrum pesticides and maintaining diverse habitats.

Carbon Storage

Soil stores more carbon than the atmosphere and vegetation combined. Microbial decomposition releases carbon dioxide, but some carbon is stabilized in humus and mineral complexes. Practices that increase organic matter input can enhance carbon storage and mitigate climate change.

Conclusion

Protecting soil biodiversity is a prerequisite for maintaining these services. Monitoring soil organisms and their functions provides early warning of degradation and guides restoration efforts.