SOIL BIODIVERSITY FOR SUSTAINABLE AGRO-ECOSYSTEM FUNCTIONING

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INTRODUCTION

Soil biodiversity is the variety of life that exists within the soil, including bacteria, fungi, earthworms and termites. A teaspoon of topsoil typically contains a vast range of different species and up to 6 billion microorganisms. The maintenance of soil biodiversity is essential to both the environment and to agricultural industries. Soil is by far the most biologically diverse material on Earth. Soil contains a large variety of organisms which interact and contribute to many global cycles, including the carbon and nitrogen cycles. Soil provides vital habitats for micro-organisms such as bacteria, fungi, as well as insects and other organisms.

IMPORTANCE

The diversity of organisms living within soils is critical to all earth ecosystems because soil organisms:

- are essential for the cycling of ecosystem nutrients
- are necessary for plant growth and plant nutrition
- improve the entry of water into soil and its storage in the soil
- provide resistance to erosion
- suppress pests, parasites and disease
- aid the capture of carbon
- are vital to the world's gas exchange cycles
- break down organic matter.

Soil biodiversity is recognised as a critical influence on agriculture as it can enhance sustainability through improved:

- soil structure
- soil water movement
- nutrient availability
- suppression of pests and diseases.

The Food and Agriculture Organization of the United States (FAO) estimates the socio-economic value of soil biodiversity exceeds US$1542 billion.

SOILS AND ECOSYSTEM BIODIVERSITY

Soils are a vital component of ecosystems because:

- the majority of plants grow in soil
- soils determine the nutrients such as nitrogen, phosphorus, sulfur, potassium, calcium, magnesium and micronutrients that are available for plants
- soils, with climate and topography, can determine the available water for plants
- soils can prevent some plant species from growing because of waterlogging, poor aeration, acidity, aluminium, heavy metals and high soil strength
- soils influence the distribution of animals as the occurrence of plant species provides food and shelter for them.

Examples of ecosystems and plant communities formed by a unique combination of soil and climate include:

- Bimble Box woodland on red earths on the CobarPeneplane in north western NSW
- Coolabah woodland on grey cracking clay on the Darling Riverine Plain in north western NSW
- Iron bark forest on shallow clayey soils in the Sydney Basin
- Applebark (Angophora) forest on sandy soils in the Sydney Basin
- Myall (Acacia) woodland on grey cracking clay on the Darling Riverine Plain in western NSW
- Black Box woodland on poorly drained grey cracking clays on the Darling Riverine Plain in western NSW.

MAINTAINING SOIL BIODIVERSITY

Soils that support natural, non-agricultural ecosystems usually have the greatest soil biodiversity.

In agriculture, soils that receive less manufactured inputs (e.g. chemical fertilisers and pesticides) generally have higher soil biodiversity.

Grazing systems which encourage plant diversity usually have higher soil biodiversity, due to the greater availability of food resources from roots and litter, which support a greater variety of organisms in the soil.

Cropping systems generally have low soil biodiversity, unless they increase inputs of carbon and nitrogen to the soil, which will increase soil microbial populations. Crop management techniques that increase soil organic matter will also increase soil stability and soil biodiversity.

The application of organic matter to the soil, such as crop stubble, supports greater populations of surface feeding creatures including earthworms.

Management techniques such as crop rotation and reduced tillage increase the quantity and quality of organic matter available to soil organisms and develop a more stable environment that encourages more soil biodiversity

SUMMARY

Soil biodiversity represents the variety of life belowground whose interaction with plants and small animals forms a web of biological activity. It improves the entry and storage of water, resistance to soil erosion, and plant nutrition, while also controlling soil pests and disease, and facilitating recycling of organic matter in the soil. Soil biodiversity is therefore the driver of healthy soil for sustainable crop production. However, intensive agricultural activities are reported to lead to loss of soil biodiversity. This has been attributed to environmental degradation, and consequently to climate change. This paper highlights the importance of soil biodiversity and some factors associated with its loss, and presents a case study on selected soil organisms in Kenya. Results from this study indicated that land use changes affect soil biodiversity, and soil biodiversity determines the distribution of the aboveground biodiversity.