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SOILS OF SRI LANKA AND BIODIVERSITY

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INTRODUCTION

Formation of soils depends on factors such as parent material, environmental conditions, topography (slope), organisms, time and management practices. Biological activity is a primary factor in the physical and chemical processes of soil formation. Biological activities in a soil mainly depend on environmental conditions and drainage conditions which ultimately decide the types of flora and fauna living in the soil and types of soil formed. Hence, soils and Biodiversity are strongly linked as the soil is the medium for a large variety of flora and fauna living in soils and biosphere, and they interacts closely with the wider biosphere. Soil provides a vital habitat for large plants to microbes including bacteria and fungi; for microfauna such as aprotozoa and nematodes; mesofauna such as microarthropods and enchtraeids; and macrofauna such as earthworms, termites and millipedes (Bardgett, 2005). Regarding the preferred living environment, above ground and below ground specialists can be distinguished.

Soil is one of the most diverse habitats on earth and contains the most diverse assemblages of living organisms. Generally, biological activity in soils is largely concentrated in the topsoil. The biological components occupy a tiny fraction (<0.5%) of the total soil volume and make less than 10% of the total soil organic matter. This living component consists of plant roots and soil organisms. Soil microorganisms are responsible for a large part of biological activity (60-80%) which is associated with processes regulating nutrient cycles and decomposition of organic residues. Earthworms often form a major part of the soil fauna biomass and can represent up to 50% of the soil fauna biomass in some temperate grasslands, and up to 60% in some temperate forests. High levels of biodiversity, particularly at the microbial scale accompany the huge numbers of soil organisms and about a hundred different bacterial species in g^{-1} soil is not an extreme number. Other than bacteria, hundreds of other species are present in soil.

The primary role of soil biota is to recycle organic matter that is primarily derived from the above ground plant biomass. Soil is in close cooperation with the wider biosphere and maintenance of soil fertility is one of the most vital ecological services the living world performs. The mineral and organic contents of soil must be replenished constantly as plants consume soil elements and pass them up the food chain (Baskin, 1997). The correlation of soil and biodiversity can be observed spatially, for example, both natural and agricultural vegetation boundaries correspond closely to soil boundaries, even at continental and global scales (Young & Young, 2001). A study, published in *Vadose Zone Journal*, found that the number of soil types in an area (called the "pedodiversity") and the biodiversity of that area *ie.* the number of species of vascular plants, amphibians, reptiles, birds, and mammals are strongly correlated on a global scale. Additionally, the findings show that pedodiversity could be used as an indicator of biodiversity, which can often be difficult to measure.

ROLE AND FUNCTIONS OF SOIL ORGANISMS

Soil organisms interact in a soil food web, where each trophic layer is food for the next trophic layer. In general a soil food web is based on the degradation of roots and dead organic material. The stability of the performance of an ecological function is dependent on the stability of the soil food web. The soil food web stability increases with an increasing number of interactions between the organisms. When predators have an increasing choice in their food, the chance that they will predate on a specific species until its extinction, decreases. This is an important interest of biodiversity of soil organisms. Earthworms can improve the incorporation of organic matter below the soil surface, increase the numbers of water stable soil aggregates, improve water infiltration, aeration and root penetration and increase microbial activity. Soil microorganisms also degrade toxic residues, form symbiotic associations with plant roots, act as antagonists to pathogens, influence the weathering and solubilisation of minerals and contribute to soil structure and aggregation. Majority of vascular plants is associated with arbuscular mycchorizal or ectomycchorizal fungi and benefits from an increased capacity to extract phosphorus and other nutrients from the soil. Mycchorizal fungi thus have an important role in plant community development, nutrient cycling and the maintenance of soil structure.

SOILS OF SRI LANKA AND BIODIVERSITY

Sri Lanka has a total land extent of 6.5 million hectares distributed in diverse ecological conditions such as highland, mangroves, marshlands, *villus*, semi desert. The mountain mass in Sri Lankan land known as central highlands which is located towards south central part of the country and the area surrounded by the central highlands is a plain mass. The country has a great diversity in topography, climate, soils and vegetation which is represented by seven climatic regions and 46 agro ecological regions. The topographic classes include flat to undulating (0 – 8 %), rolling to hilly (8 – 30 %), hilly to mountainous (30 – 60 %) and extremely steep (over 60 %) and therefore varying soils *via* short distance can be found. There are 12 soil orders in the world, of which 7 soil orders have been identified in Sri Lanka, and this is mainly due to the variation of the agro ecological conditions of the country. At the local level, these soils are further classified into 14 Great Soil Groups (Panabokke and Alwis, 1963). The natural vegetation exists covering these soils as ecosystems, namely forest, grasslands, coastal and marine vegetations, and inland wetlands. All these ecological factors collectively create a greater soil biodiversity in Sri Lanka.

Ten out of the 14 Great Soil Groups are located in the dry and semi dry areas in the country. They are the Reddish Brown Earths, Low Humic Gley Soils, Non- Calcic Brown soils, Red-Yellow Latosols , Alluvial Soils, Solodized Solonetz, Regosols, Soils on Old Alluvium, Grumusols, Immature Brown Loams. In the wet and semi wet areas in the country, 5 Great Soil Groups have been identified. These soils are Red-Yellow Podzolic Soils, Reddish Brown Latosolic Soils, Immature Brown Loams, Bog and Half Bog Soils and Latosols and Regosols on Old Red and Yellow sands. In addition, some other Great Soil Groups and miscellaneous land units occur scattered in the country which are considered as minor with respect to extent. The Great Soil Groups of minor extent are Rendzinas, Meadow Podzolic Soils, Wet Mountain Regosols and Lithosol. The miscellaneous land units include rock knob plains and eroded lands, erosional remnants, and Steep Rockland and Lithosols.

Low Humic Gley Soils, Alluvial Soils, Grumusols, Bog and Half Bog Soils occur in the flat and lower aspect of undulating landscape. Solodized Solonetz Soils on Old Alluviumare are located in the coastal plain of the country and have unique ecosystems for those conditions. In this group of soils, rice is cultivated in human influenced lands and the biodiversity of these lands is narrow due to mono crop cultivation and control of other species of plants. Soil flora and fauna are also greatly affected by intensive cultivation and application of various kinds of agro chemicals. Aquatic plants spp. dominate on virgin lands in *villus*, mangroves, salt marshes, mudflats, sea grass beds, flood plains, and swamp forests and the flora and fauna found in these ecosystems are unique to those systems. Soils in the flood plains in major rivers consist of *villus*. Basically Bog and Half bog soils are inundated with either fresh water or brackish water and the ecosystem change accordingly.

The soils occur on higher aspect of undulating landscape in dry and semi dry areas include Reddish Brown Earths, Non-Calcic Brown soils, Red-Yellow Latosols and Immature Brown Loams. The soils have a fairly a good drainage condition and aeration. Therefore, soil micro organisms are completely different to those of poorly drained soils. In this group of soils, other field crops, vegetables, seasonal fruits, sugarcane, tobacco, planted forest *etc.* are grown. Soils on virgin lands provide support for tropical dry mixed evergreen forests, tropical thorn forests, savannas and dry *patanas.*

The soils occur on rolling, hilly and mountainous topographic land classes in wet and semi wet areas are Red -Yellow Podzolic Soils, Reddish Brown Latosolic Soils, Immature Brown Loams. In this group of soils, plantation crops such as tea, rubber, coconut, spices, tree fruits, tobacco and exotic vegetables are grown on human influenced lands. Soils on virgin lands provide support for tropical wet evergreen forests, tropical moist semi evergreen forests, tropical lower montane forests, tropical upper montane forests and wet *patanas*. High soil organic matter content in top soils of these virgin soils is a common factor and therefore, greater soil biodiversity can be found in these soils than in the soils in the dry zone.

The soils and miscellaneous land units occurring in other topographic positions scattered in the country are Regosols, Latosols, Regosols on Old Red and Yellow sands, Rendzinas, Meadow Podzolic Soils, Wet Mountain Regosols, Lithosols, rock knob plains, eroded lands, erosional remnants, and steep rockland. Regosols in human encroached lands are used to grow seasonal vegetables, fruits, coconut *etc.* Lands having other soils in this group are not fully utilized for human uses and are occupied by grasses, shrubs and trees in different species under virgin situation.