POSTGRADUATE INSTITUTE OF SCIENCE

UNIVERSITY OF PERADENIYA

SRI LANKA

PGIS RESEARCH CONGRESS 2020

PROCEEDINGS

26th - 28th November 2020

Abstract No: 181 ***Earth and Environmental Sciences***

SOIL ORGANIC CARBON IN BLUE CARBON ECOSYSTEMS OF NORTH WEST OF SRI LANKA

D.D.M.O. Dissanayake[1], J.A.V.R. Jayasinghe[1], G.A.D. Perera[2], H.K. Kadupitiya[3], S. Seneweera[1] and R.R. Ratnayake[1*]

[1]National Institute of Fundamental Studies, Kandy, Sri Lanka
[2]Department of Botany, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka
[3]Natural Resources Management Centre, Department of Agriculture, Peradeniya, Sri Lanka
[*]renukaratnayake12@gmail.com

Blue carbon ecosystems with intense carbon accumulation are a dynasty in atmospheric carbon mitigation. These ecosystems are highly encroached and polluted and has become defective in functioning. With the intention of identifying the current status of the soil carbon pools, available nutrient contents and other associated edaphic conditions in blue carbon ecosystems, sampling was conducted from the top layer of soil (0-15 cm from surface) in mangrove and saltmarsh ecosystems at Vidataltivu, Achchankulam, Naravillikulam and Umangri, in the Mannar District. Subsequently, these were analysed for available nitrate, phosphate, ammonium anions, Microbial Biomass Carbon, Permanganate oxidizable carbon and soil organic carbon (SOC). Principal Component (PC) analysis was performed to reveal the spatial heterogeneity of examined parameters in above mentioned ecosystems using Minitab 17. Results showed two significant PCs, in which the first PC represented an inverse gradient of SOC and pH (PC loadings for SOC = 0.54, Moisture content = 0.53 and pH = -0.38). A gradient of significantly low phosphate and nitrate availability with high EC level was featured by the second PC (PC loadings for nitrate = -0.65, phosphate = -0.51 and EC = 0.244; mean values for phosphate = 53.75 ± 10.60 mg kg^{-1}, nitrate = 1.95 ± 1.53 mg kg^{-1}, and EC = 7.70 ± 3.97 mS cm^{-1}, respectively). Well grown mangrove sites have adopted for lower availability of soil nutrients. Soil organic carbon ranged at the lowest level of less than 10% and the highest range of pH (7.8 - 8.5) was cited descriptively via clustering at the sites of mangrove invaded saltmarshes, mixed dry forests, grazing lands, and mid mangrove sites encroached by fishing industry and human dwellings. Highest SOC of more than 25% was found in areas where dense growth of mature *Avicennia* or *Rhizophora* spp. were present under persistent water logging conditions. Thus, we confirm that anthropogenic activities affect adversely on SOC stocking in considering blue carbon ecosystems.

Financial assistance from the National Institute of Fundamental Studies is acknowledged.

Keywords: Labile carbon, Mangroves and saltmarsh ecosystems, Microbial biomass carbon, Principal component analysis, Soil organic carbon

Abstract No: 199 ***Earth and Environmental Sciences***

EVALUATION OF MICROBIAL BIOMASS CARBON IN PADDY SOILS OF ANURADHAPURA DISTRICT, SRI LANKA

T.M. Paranavithana[1], U.L.R.W. Prematilaka[1], S.K. Gunathilake[2], S.B. Karunaratne[3] and R.R. Ratnayake[1*]

[1]*National Institute of Fundamental Studies, Kandy, Sri Lanka*
[2]*Department of Natural Resources, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*
[3]*CSIRO Agriculture and Food, Butler Laboratory, Canberra, Australia*
[*]*renukaratnayake@yahoo.com*

Paddy (*Oryza sativa*) is the principle food as well as the main income source for many farm families in Sri Lanka. Both biotic and abiotic environments in paddy fields have been disturbed by excessive chemical inputs, which in turn disrupt the nutrient availability in agricultural fields. This leads to diminution of quantity and quality of the harvest. Paddy ecosystem serves as one of the favored habitats for a large number of soil microorganisms, which play a vital role in maintaining the nutrient cycles and soil fertility. Microbial biomass carbon (MBC) is the amount of carbon present within microbial organisms present in soil. This case study is aimed at assessing the status and functions of MBC of paddy-growing soils within a season in Anuradhapura, the largest paddy-growing district in Sri Lanka. Conditional Latin Hyper Cube Sampling design was employed in the study. Pooled soil samples (143) were collected from the Anuradhapura district at 0 - 15 cm soil depth. The soil MBC at each sample location was determined using chloroform fumigation and extraction method. Other soil parameters [pH, Electrical conductivity (EC), active carbon (AC) fraction, available potassium (K)] were also measured. Total soil carbon (TSC) content was estimated using CHN elemental analyzer. The results revealed that, the soil MBC varied in the range from 0.001 to 0.17 % and most of the soil pH values were scattered within the range of 5.76 - 8.62. The EC (r = 0.533), TSC percentage (r = 0.401), AC percentage (r = 0.326) and K percentage (r = 0.511) are positively correlated with the MBC percentage. The study revealed that the MBC, which may contribute to long term agricultural sustainability, can be maintained by managing the soil organic carbon and its fractions. Furthermore, it enhances the nutrient retention capacity and the availability of paddy soil.

Financial assistance from the National Research Council (*Grant No. 17-011*) *is acknowledged.*

Keywords: Microbial biomass carbon**,** Nutrient retention, Paddy, Total soil carbon

Abstract No: 185 ***Life Sciences***

MORPHOLOGICAL CHARACTERIZATION OF CYANOBACTERIA IN EXTREME ECOSYSTEMS OF SRI LANKA

R.W.T.M.R.T.K. Bowange[1], M.M.P.M. Jayasinghe[1], D.M.D. Yakandawala[2], K.L.W. Kumara[3], S. Abeynayake[4] and R.R. Ratnayake[1*]

[1]National Institute of Fundamental Studies, Kandy, Sri Lanka
[2]Department of Botany, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka
[3]Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Matara, Sri Lanka
[4]Department of Animal, Plant and Soil Sciences, La Trobe University, Melbourne, Australia
[*]renuka.ra@nifs.ac.lk

Sri Lanka, along with Western Ghats of India, is a biodiversity hotspot enriched with floral, faunal and microbial diversity. A diverse collection of ecosystems representing a range of environmental conditions contributes to this diversity. Ubiquitous, photosynthetic cyanobacteria with diverse morphological and biochemical modifications are a significant contributor of higher microbial diversity in these ecosystems. Being photosynthetic and capable of producing diverse, economically valuable bio-compounds make them ecologically and economically important. Most of them are fast growing and require less space and nutrients for growth, thus are economical over plant material in industry. They promote promising safe and low cost natural alternatives for current global demands: food shortage and Ultra Violet protection. However, most of their existence and diversity in these ecosystems is unnoticed thus not considerably discovered. Therefore, this study was carried out to investigate cyanobacteria diversity in extreme ecosystems of Sri Lanka based on morphological characterization. Two water samples were collected from surface and subsurface water in each site representing extreme ecosystems; 13 sites in salt marshes, 18 in mangroves, four in hot-water springs and four in lagoons. Culturing was carried out in BG 11 medium under 1,000 – 2,000 lux fluorescent light intensity with constant illumination at 25 - 30 °C. Purified monocultures were isolated by subsequent plate, liquid culturing and microscopic observations. Microscopic images were photographed with IMAGE FOCUS 4.0 software and morphologically characterized based on comparisons with available literature. One hundred and forty monocultures were isolated and 15 different cyanobacterial genera and orders including *Leptolyngbya*, *Oscillatoria*, *Nodosilinea*, *Anabaena*, *Geitlerinema*, *Gloeocapsa*, *Microcystis*, *Nostoc*, *Synechococcus*, *Lyngbya*, *Spirulina*, *Limnothrix*, *Pseudanabaena*, *Chroococcales* and *Oscillatoriales* were identified. *Leptolyngbya* is a dominant species in 12 salt marshes and 13 mangrove ecosystems while *Chroococcales* and *Pseudanabaena* were frequently recorded in all four studied hot-water springs. Morphological characterization revealed evidence for rich cyanobacteria diversity in extreme ecosystems in Sri Lanka. It further highlights the necessity of conserving this natural resource while utilizing them sustainably. Thus, extensive molecular characterization is necessary to provide a precise, informative and static picture of cyanobacterial diversity in Sri Lanka for conservation, future research and sustainable utilization of this valuable natural resource.

Financial assistance from the National Institute of Fundamental Studies is acknowledged.

Keywords: Cyanobacteria, Diversity, Extreme ecosystems, Morphology