CHAPTER 6
CONCLUSION AND FUTURE PROSPECTS

The current study investigates the role of soil properties on carbon mineralisation of an unexplored semi evergreen forest of Northeast India during 2020-22. The experimental site was located within the Kaziranga National Park (KNP) in Assam, India. The basal respiration was estimated in the laboratory by using alkali absorption method. Attempts were made to correlate the CO_2 efflux variations with the soil properties of the various ecosystems (grassland, forestland and wetland) of the forest in three different seasons (pre-monsoon, monsoon and post-monsoon).

Season as well as ecosystem had significant impact on the cumulative carbon mineralisation. It was found to be highest in wetland ecosystem while least carbon mineralisation was noted in forestland. Monsoon season recorded more cumulative carbon mineralisation as compared to the other two seasons.

Soil physicochemical properties have a significant seasonal variation in the three studied ecosystems of Kaziranga National Park, with a decrease in the aforementioned properties with increasing depth. Maximum values of the soil physico-chemical properties were observed during monsoon season while minimum of the same was observed during pre-monsoon season. Wetland ecosystem recorded the highest values while the lowest was recorded in forestland ecosystem.

Significant seasonal variation in MBC and enzymatic activities, with the highest values in the monsoon season and the lowest in the pre-monsoon season was noted. Differences in MBC and enzymatic activities were observed among the studied ecosystems due to difference in quality and quantity of substrate as well as soil nutrients. The higher values of MBC and enzymatic activities in wetland ecosystem was confirmed by their positive correlation with SOC.

Soil metagenomic analysis detected a total of 47, 46, and 45 phyla across the ecosystems during the pre-monsoon, monsoon, and post-monsoon seasons, respectively. The dominant phyla across all ecosystems and seasons were *Proteobacteria, Acidobacteria, Actinobacteria, and Chloroflexi*.

The mineralogical analysis of the soil inferred the presence of phyllosilicate minerals with quartz, montmorillonite, vermiculite, augite, and dolomite as the major phases.

Regardless of the season, a stronger correlation of carbon mineralisation with soil chemical and biological properties was found compared to physical and mineralogical properties.

Soil moisture, SOC, total N, MBC and enzyme activities are the key regulators of soil respiration in KNP. Moreover, the relative abundance and diversity of bacteria were found to play an important role in regulating soil respiration in all the three ecosystems. Soil mineralogy, on the other hand, was the least important factor in regulating C mineralization.

Thus, from the present study, we can conclude that seasons have a strong influence on the soil CO_2 flux with the highest in monsoon and lowest in pre-monsoon season. Soil moisture, SOC total N, MBC, soil enzymatic activities, and relative abundance of bacteria are the pre-dominant soil variables controlling CO_2 efflux in all three ecosystems. Among the ecosystems, the highest soil CO_2 flux was found in the wetland ecosystem followed by the grassland and forestland ecosystems. This difference in soil CO_2 flux between the three ecosystems could be attributed to differences in soil properties, which could play a significant role in regulating CO_2 efflux.

FUTURE PROSPECTS

1. The study on soil respiration was on destructive samples in the laboratory using the alkali absorption method. However, non-destructive sampling of the same with GC analysis may be performed to obtain a more precise measurement of soil CO_2 efflux.
2. SOC is one of the key factors regulating soil respiration in our study. Analysis of SOC fractionations may provide a better understanding of the contribution of organic carbon fractions to CO_2 efflux.
3. The relative abundance and diversity of bacteria were investigated in the present study. However, further research into the community composition of fungi and microbial functional genes controlling soil respiration is important for a better insight into the role of microbes in regulating soil CO_2 efflux and carbon sequestration.
4. The strength and duration of soil organic matter (SOM) binding by soil minerals can be assessed as long-term binding of SOM is required for carbon sequestration in soils.
5. Variation in soil respiration is primarily influenced by climate, soil properties, and vegetation characteristics. So, study of the vegetation characteristics of KNP can help in better prediction on dynamics of soil CO_2 efflux.