SUMMER FIELD SCHOOL
MOUNTAIN ECOSYSTEMS AND RESOURCE MANAGEMENT

GRASSROOTS INSTITUTE

TOPIC OF PRESENTATION :

SOIL MICROBIAL DIVERSITY AND SOIL HEALTH IN NE INDIA

Presented by :

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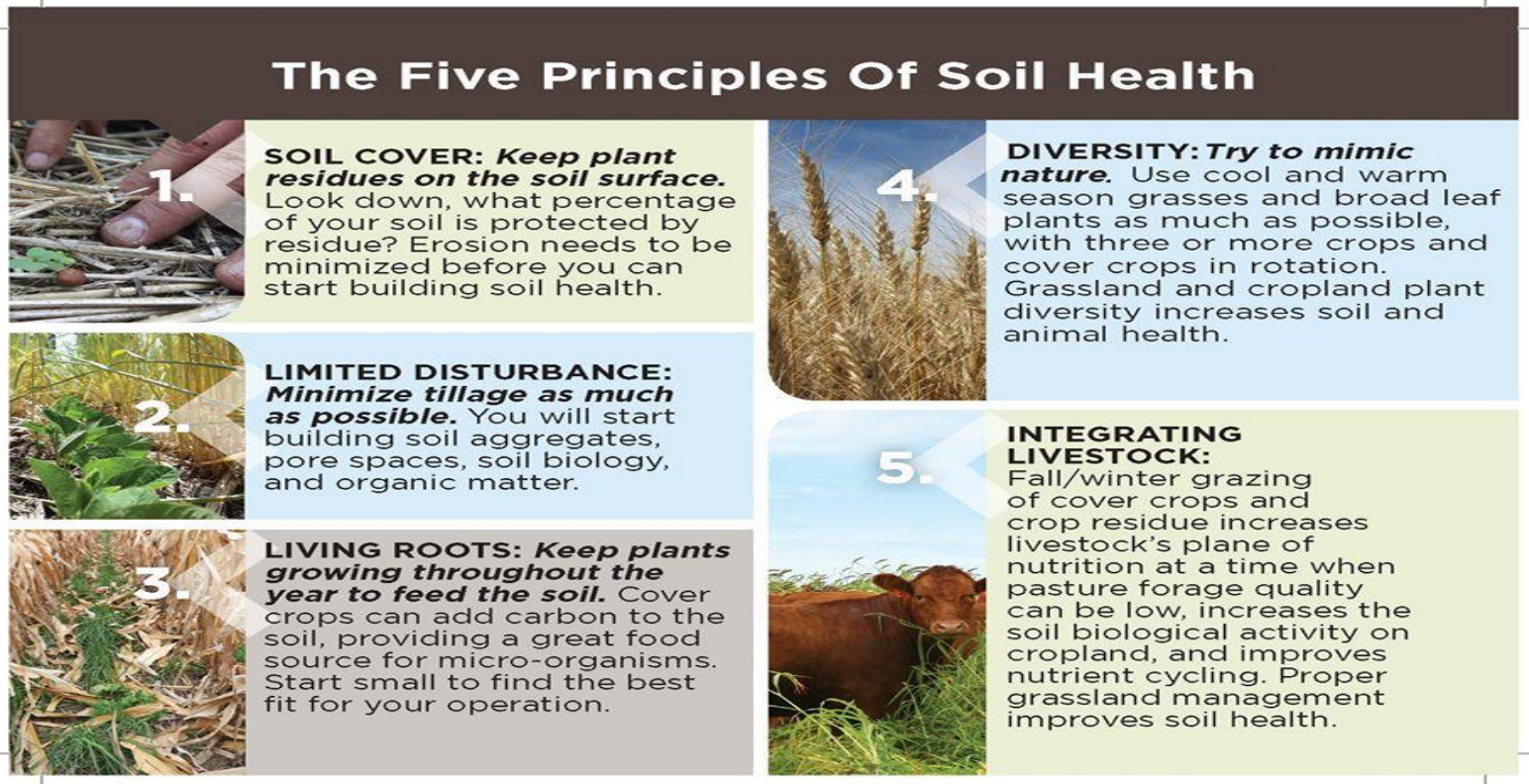
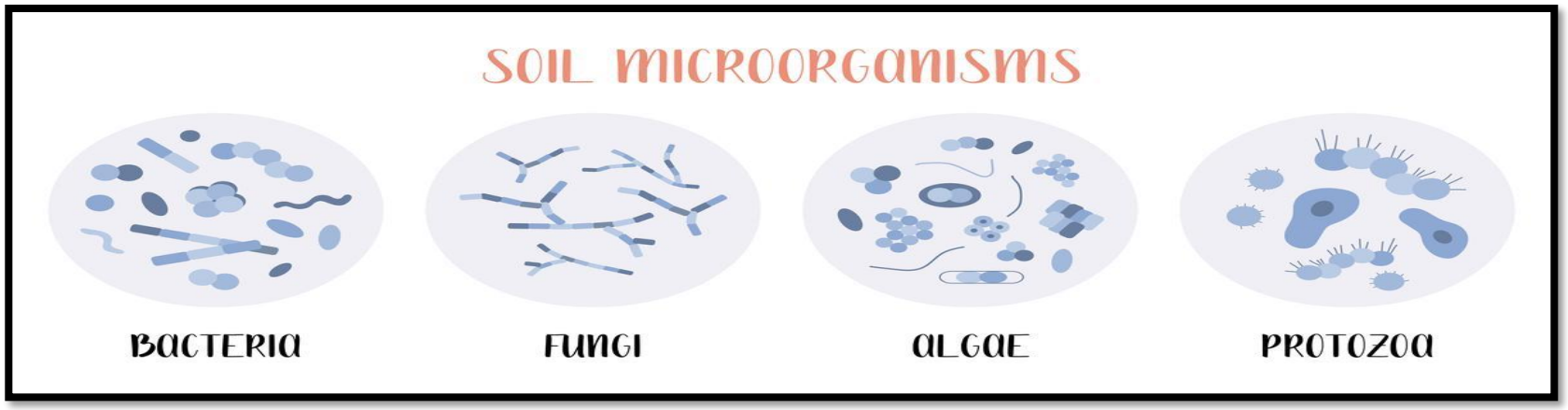
INTRODUCTION :

Soil health is the capacity of the soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health.



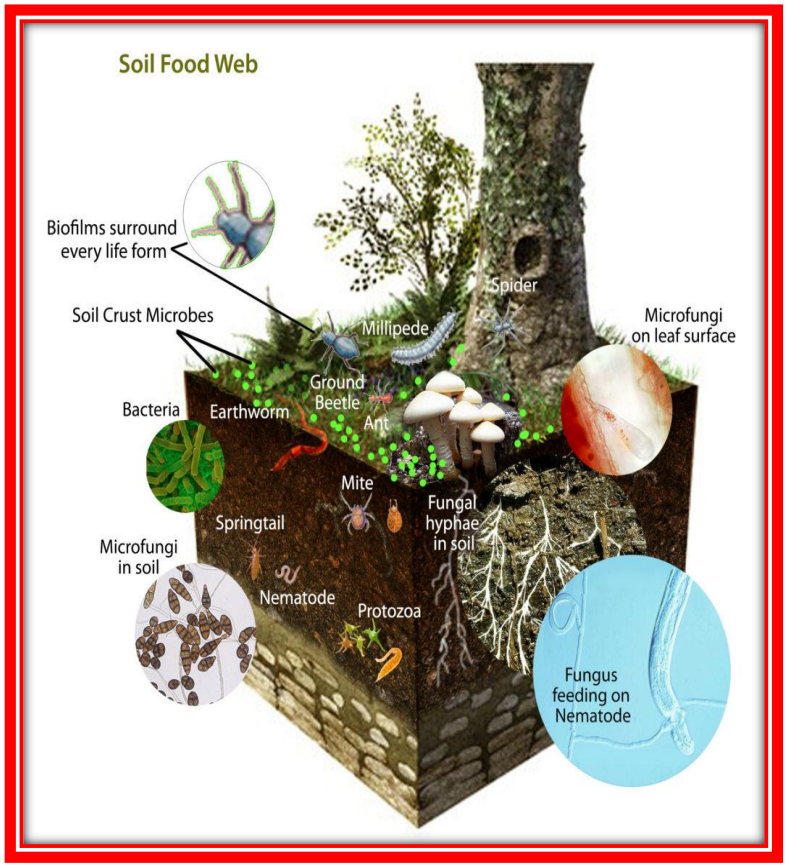
Courtesy : https://twitter.com/GrowResilience_/status/1219272233907998720

Soil microbial community act as primary driving agents of nutrient cycling, regulating the dynamics of soil organic matter, soil carbon sequestration and green house gas emissions; modifying soil structure and water regimes; enhancing the amount of nutrient acquisition by vegetation; conferring stress tolerance, resisting pathogens and improving plant and soil health.



Courtesy :https://serc.carleton.edu/kskl_educator/soil_biology/chap_3_elaborate.html

SOIL MICROBES AND FUNCTIONING OF SOIL ECOSYSTEM



Courtesy : https://endofite.com/soil-health/

Fig : Microbes and the interaction with soil

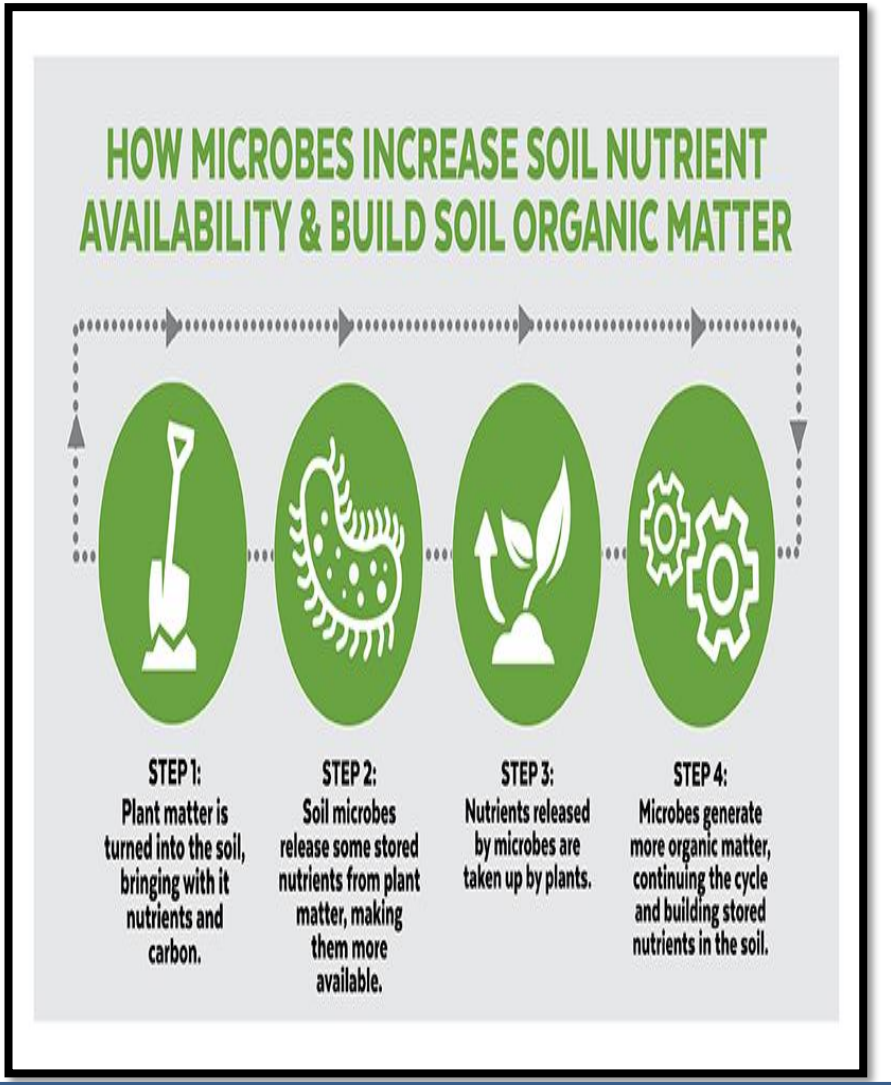
With hundreds and thousands of taxa per gram of soil, microbial diversity dominates the soil biodiversity.

While numerous studies have established whereby it has been stated that microbial communities respond rapidly to environmental changes, the relationship between microbial diversity and soil functioning remains controversial.

Using well-controlled laboratory approach and empirical evidence microbial diversity and its role in soil health maintenance is being tried to be studied and understood in details

❖Soil microorganisms are important for maintaining soil quality because of their role in decomposition of organic matter and nutrient cycling and storage, and they represent a potentially very sensitive biological marker.

❖Soil organic matter (SOM) can be seen as a mixture of biogenic components that include, in variable proportions and evolutionary stages, microorganisms and non-decomposed plant materials (1–10%). SOM has a new significance for it correlates well with physical, chemical, and microbiological properties of soil and the status of healthy soil . High significance for organic matter decomposition depend on soil microbial diversity of the soil .



Courtesy : https://www.midwesternbioag.com/leveraging-soil-microbes-build-som-crop-yields/

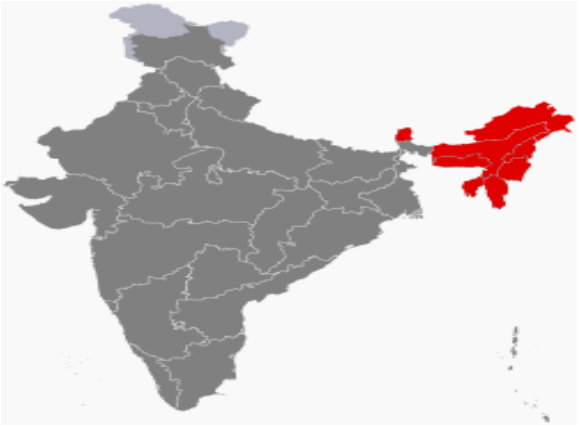
- **There are a number of key indicators related to microbial activity and the diversity in soil , and some can be used to estimate both biomass and activity (e.g. soil respiration and the microbial quotient).**
- **Biological indicators used for determining soil ecosystem wellbeing includes :**

Microbial biomass ,Microbial activity , Bacterial DNA synthesis , Bacterial protein synthesis , CO_2 production , Carbon cycling , soil respiration ,Decomposition of organic matter ,N-mineralization, Nitrification , Denitrification , N-fixation ,etc .

❖**North-Eastern India (21° 34′N latitude and 97°52′E longitude) is a genetic treasure house of plant, animal and microbial resources. This region falls in a distinctive part of the Indo-Burma mega biodiversity hotspot and is being considered as prime one amongst the two identified in Indian sub-continent.**

❖**From North East India a wide variability of soil microbes have been reported and can be safely be called the niche area for microbial growth and diversity**

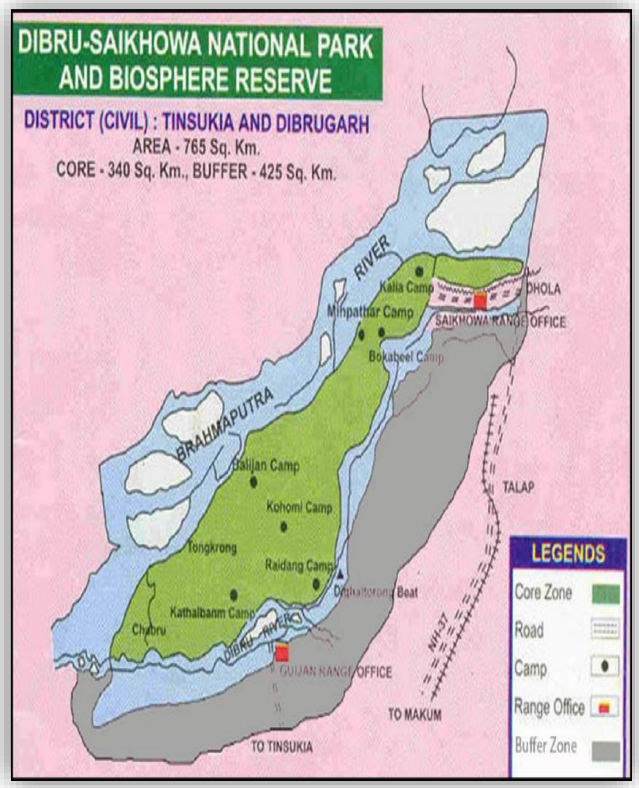
❖**Extensive studies have been carried out here in North East India and from the studies , the microbial population diversity has been correlated to different physico-chemical parameters and studies have been made regarding soil health and its sustainability .**



Courtesy :https://en.wikipedia.org/wiki/Northeast_India

APPRAISING STUDIES CONDUCTED IN NORTH EAST INDIA :

The Northeastern region of India is one of the most important biodiversity hot spots of the world. The microbial resources of this area have tremendous potentiality for sustainable human development and livelihood management .



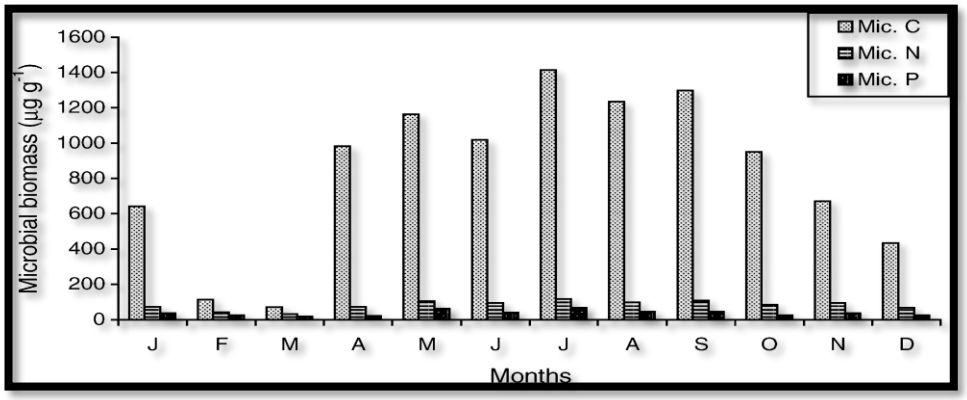
❖**In the plain topographical state of Assam , the highest microbial counts were recorded in the top soil (0-10 cm) layer except during the summer season when the population was greater in the subsurface (10-20 cm) layer.**

❖***Aspergillus* and *Penicillium* were the abundant genera in all sites studied. Parameters like water holding capacity, soil moisture content, pH, organic C, total N and available P had correlated with the microbial colony forming units (cfu).**

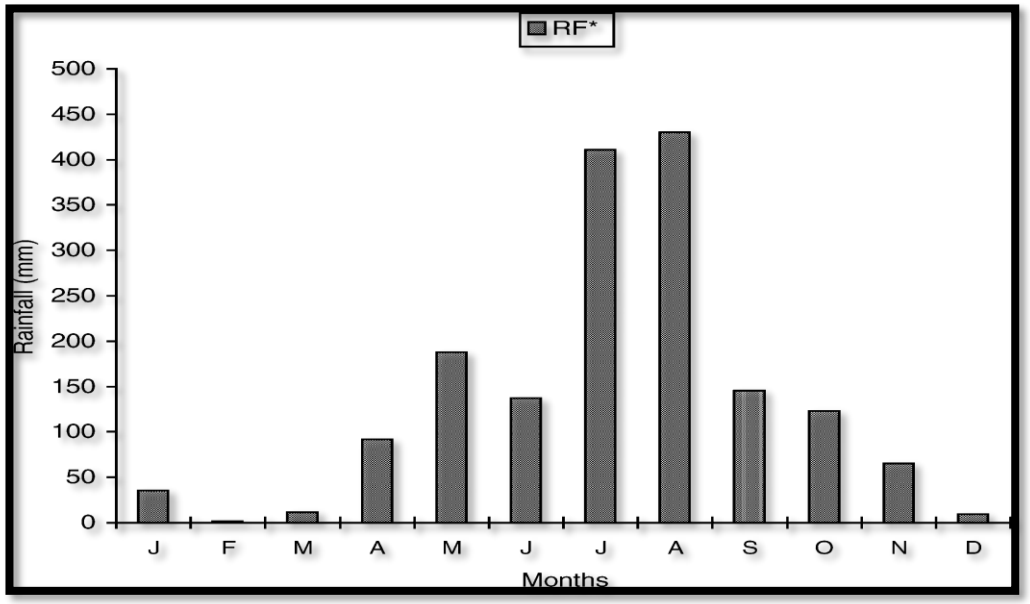
❖**Available P revealed a significant positive correlations with bacterial and fungal cfu as well as inverse correlations with water holding capacity, organic C and organic matter.**

Courtesy : https://kaziranganationalparkassam.in/dibru-saikhowa-national-park

- **In Manipur , the study by Devi *et al in* 2005 from mixed oak ecosystem , highlighted that microbial biomass C and P showed a positive significant correlation with abiotic variables, i.e. soil moisture, soil temperature, rainfall, mean air temperature and relative humidity .**
- **From the study it is safe to conclude that , in forest stand , microbial C contributes about1.7–2.7% of the total soil organic C, the maximum being contributed during rainy season and the minimum during winter season.**



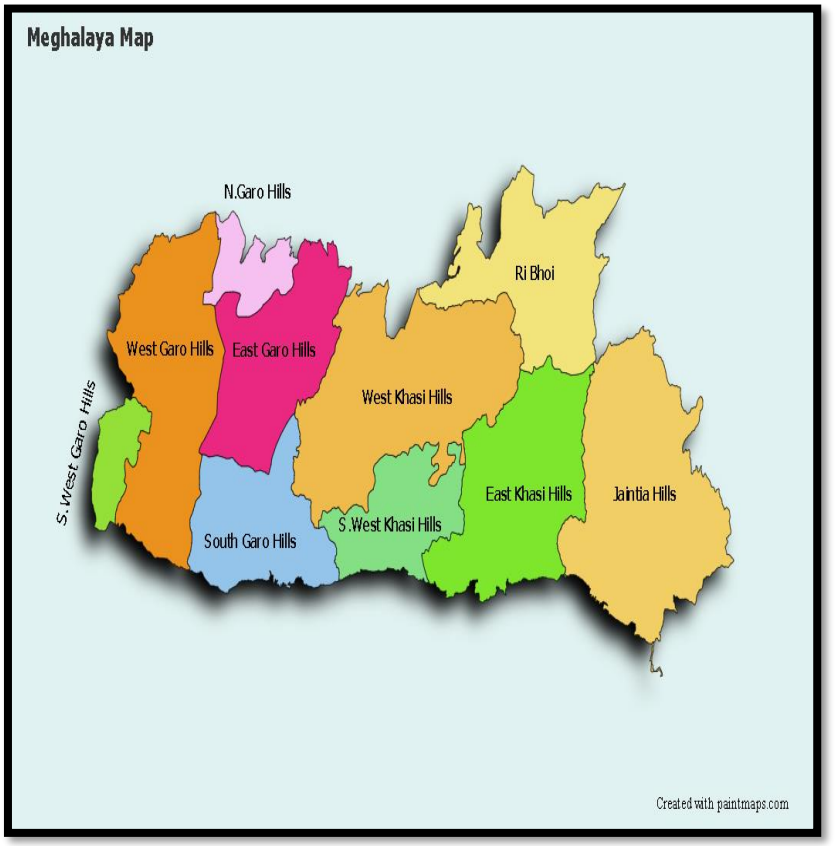
Monthly variation of microbial biomass C, N and P in the soils of forest stand



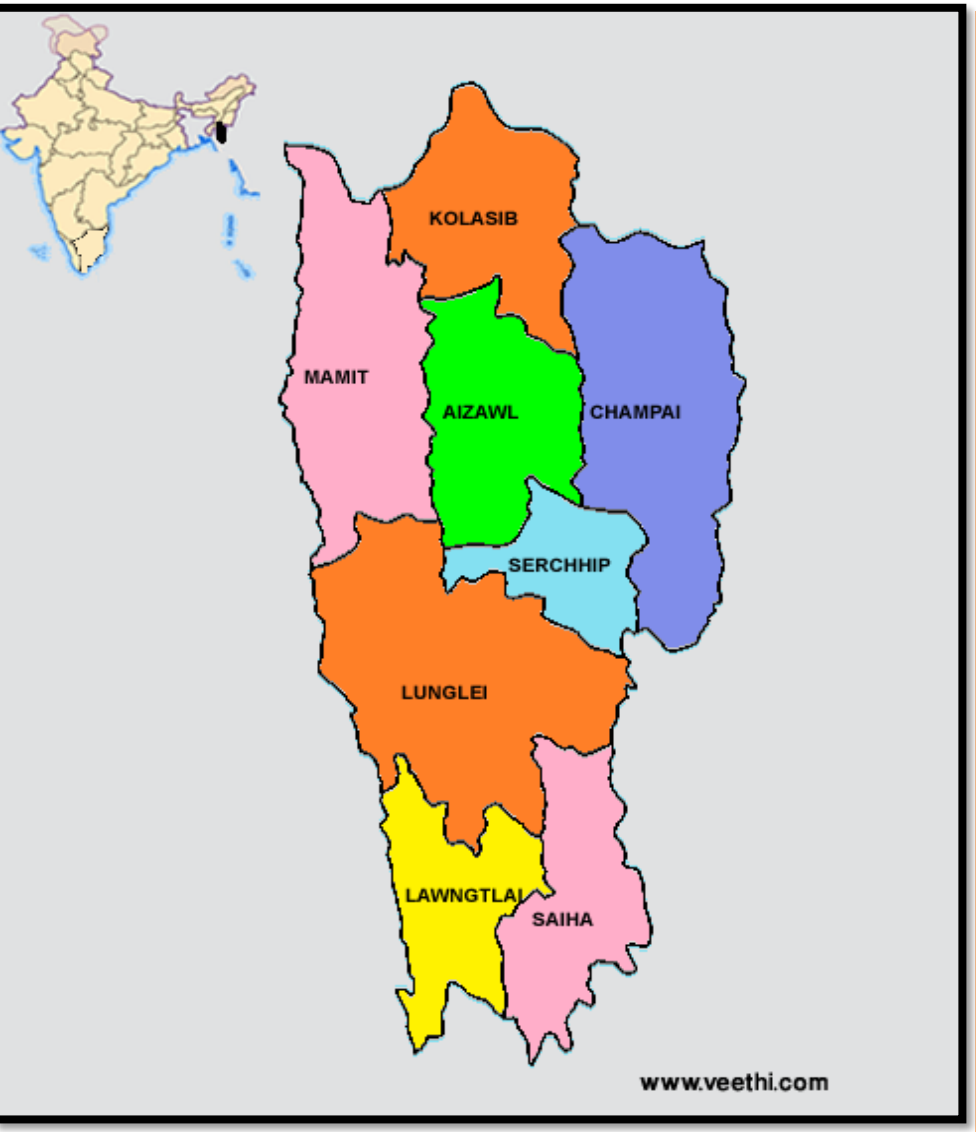
Monthly variation of rainfall during the study period (2002).

Courtesy : :N. Bijayalaxmi Devi, P.S. Yadava, Applied Soil Ecology 31 (2006) 220–227

- **Laxminarayana(2010), working with integrated farming system in the hilly terrains of state of Meghalaya indicated that Microbial biomass carbon (C) had a significant relationship with organic C, microbial biomass N, and biomass P, indicating that the living part of soil organic matter is involved in the transformation of nutrients into the labile pool and governs their availability to the plants .**
- **Soil organic C too showed a significant relationship with biomass C and biomass N, indicating that increased C substrate helped in increased microbial activity and in fact soil health .**



Courtesy :https://paintmaps.com/map-charts/256c/Meghalaya-map-chart



Courtesy : https://in.pinterest.com/pin/259379259759430328/

- In the state of Mizoram, from a study in the tropical and sub tropical forest, the population of fungi and actinomycetes was related to rainfall .Marked seasonal variations were observed in the groups of microbial population counts . The study shows that seasonal changes in microbial populations (fungi and actinomycetes) are more strongly influenced by fluctuations in the rainfall, temperature and their associated variables. However, the abiotic variables were able to only regulate the variability in the population of actinomycetes
- It can be suggested that more frequent data on seasonal abiotic variables (at least monthly) would be required to understand the role of abiotic variables on soil microbial population .

CONCLUSION

- **By considering a plant nutrition point of view, soil microbial biomass C, N, and P are the most important parameters in assessing the biological activity of soils.**

  These parameters were significantly influenced by application of manures and other organic sources, and their role may have helped in nutrient transformations thereby influencing soil health .

- **Microbial biomass has positive relations with available nutrients, and it had a direct impact on nutrient transformations as well as nutrient availability.**

  Improvement in microbial biomass will not only enhance the soil quality but also increase sustainable crop production .

Thank you!