GAVIN PUBLISHERS

OPEN ACCESS

Current Trends in Forest Research

Editorial

Bargali SS. Curr Trends Forest Res: CTFR-120.

DOI: 10.29011/ 2638-0013. 100020

Forest Ecosystem: Structure and Functioning

Surendra Singh Bargali*

Department of Botany, Kumaun University, Uttarakhand, India

***Corresponding author:** Surendra Singh Bargali, Department of Botany, DSB Campus, Kumaun University, Nainital-263002-(Uttarakhand), India. Tel: +919410579117; Email: surendrakiran@rediffmail.com

Citation: Bargali SS (2018) Forest Ecosystem: Structure and Functioning. Curr Trends Forest Res: CTFR-120. DOI: 10.29011/ 2638-0013.100020

Received Date: 14 August, 2018; **Accepted Date:** 15 August, 2018; **Published Date:** 23 August, 2018

Editorial

An organism does not exist in isolation in the nature. It is associated with organisms of its own and of different ecosystems/ communities within the habitat. Habitat consists of physico-chemical environment. If the organism is a plant, it depends for its growth on two types of environment i.e. first, the aerial environment for light, temperature and carbon di-oxide and second, the soil environment for inorganic nutrients and water. An animal depends on the plants for food and shelter whereas a micro-organism depends on the dead organic matter from plants and animals for its food and release the minerals tied in the organic matter for the reuse of plants. A forest is a highly organized system in which dominant elements are plants, in particular trees, forming a canopy cover and playing the role of its major constituent species and animals with their habitats. A great variety of life-forms in the forest are linked with its multi-layered structure, which is the result of varying amount of sunlight reaching the understory layer. There are continuous and causal interactions among the organisms and between the organisms and the habitat resulting into an integrated functional unit known as ecosystem. If all these interactions happen in a forest than it is called forest ecosystem. A forest ecosystem is the community formed by plants and animals of that particular area that interact with the chemical and physical features of the environment in which they live. The Amazon rain forest ecosystem is an example of a forest ecosystem. This ecosystem is a home to a wide variety of plant and animal species, which include producers, consumers and decomposers. These organisms are interdependent on each other for their survival.

The forest performs a great number of functions both as a natural formation and as a product of skilful human activity. The three main functions performed by a forest ecosystem are protective, productive and social. Forest structure is both a product and drivers of ecosystem processes and biological diversity. It has become apparent in recent years that changes in forest structure as a result of management or disturbances have undesirable consequences for other components of forest ecosystem. Forest ecosystem consists of organisms (plants, animals and micro-organisms) and their habitats (the soil and air). The functioning of forest ecosystems is characterized by energy and nutrient flow and cycling, biomass production and the decomposition of dead organic matter.

Forest ecosystems are characterized by long time frames, unique structure and function, multiple services, useful products and many stake holders. Human activities are part of the ecosystem dynamics and human perception of forests are changing. In recent years, human activities have changed the structure and functioning of forest ecosystems in most region of the world. While deforestation and conversion to agricultural land are the most visible threats to forests worldwide. These systems are also increasingly exposed to atmospheric nutrient decomposition and climate change.

Ecosystem is the basic unit of the ecology, several essential but invisible services flow through the functions of ecosystems that human use. In a strict sense the term ecosystem services include all services to humans that are generated as a consequence of interactions and interchanges between biotic and abiotic components of ecosystem. Some examples of this are mitigation of climate change by green plants, removal of toxic metals from soil, cycling of nutrients and soil formation. For example, in western Himalaya, water filtration and water retention within a catchment are ecosystem services of intra-regional level (or local level), soil formation by oak forest and its transportation to the Gangetic plains for maintaining cropland soil pool is of inter-regional nature, and carbon sequestration by trees is a global service. Services (provisional, regulatory, cultural and supporting services) may be referred to several things; carbon sequestration and moderation of climate, recreational existence, provision of decomposing litter and soil transfer to cropland to replenish fertility, water filtration, spring life, pumping of nutrients from deeper layers, nutrient retention and supply to other ecosystems [1].

Interaction among plant soil hydrology and microbes regulates nutrient cycling and other processes in ecosystems. These interactions vary in time and space, greatly complicating ecosystem scale assessment of nutrient loss from the soil following disturbance, effect atmospheric deposition and climate change, and responses to changes in species composition [2].

Soil is the largest pool of terrestrial organic carbon in the biosphere, storing more C than is contained in plants and the atmosphere combined [3], and plays a significant role in C sequestration. The abundance of organic C in the soil affects and is affected by plant production and its role as a key control of soil fertility and agriculture production has been recognized for more than a century [4]. The forest floor development is the energy source for heterotrophic organisms, a reservoir for mineral nutrients and influences forest hydrology and ground vegetation [5,6]. The pattern and control of Soil Organic Carbon (SOC) storage are critical for our understanding of the biosphere, given the importance of SOC for ecosystem processes one aspect of the organic carbon pool that remains poorly understood is its vertical distribution in the soil and accompanying relationships with climate and vegetation.

The dominant tree species have fundamental effects on biological and chemical soil properties. Some tree species may slow down the cycling the nutrients [7] where as others may improve soil fertility [8]. The soil pH base saturation microbial C and N mineralization may also vary with dominant tree species.

Plants allocate a considerable portion, often more than 50% of their photosynthetic to the blow-ground portion [9]. It has been estimated that about 60% of this energy is allocated to root production, while the rest is liberated into the soil as rhizodiposition, a collective term describing the total carbon entering the soils via root [10]. Since microbial growth in soil is C- limited it is widely believed that rhizodeposition is a key process influencing the growth and structure of soil biota, decomposition rate and nutrient availability of soils [11]. Approximately one-fourth of the carbon assimilated by the foliage of coniferous trees is utilized by their symbiotic association, mycorrhizal fungi [12].

Micro-organisms play important roles in regulating ecosystem processes ranging from nutrient cycling to soil carbon (C) storage, fluxes, transformation of aqueous solutes and processing of water pollutants [13].

Given the recognized importance of microorganisms in regulating transfer of C: N and other elements there is surprisingly little information on vegetation in microbial biomass and activity in relation to vegetation type, soil factor, climate and other controllers of ecosystem structure and function. There is even less information available on relationships between microbial biomass and specific microbial activities (e.g. N mineralization and soil respiration) especially in forests. In the montane forests elevation and topography have an important influence on soil characteristics, plant communities and nutrient cycling. The determination of influence of nutrient availability on the mechanism used by plant to acquire nitrogen and phosphorus, either individually or in combination, limit primary productivity in most terrestrial ecosystems and investment by plants in acquisition of these soil nutrients can have important implications for plant growth and nutrient dynamics.

Mycorrhizal fungi are one of the major soil organisms. Their widespread occurrence in nature and importance in mineral nutrients of almost all plants has been documented in hundreds of experimental and review papers, as well as numerous books [14]. Despite this very little understanding of the contribution of mycorrhizae to nutrient cycling has emerged from the increasing research on the function and productivity of forest ecosystems.

The enhancement of ion uptake and translocation by decomposers, particularly phosphorus, is well known [15,16]. These may conserve nutrients against leaching by immobilizing elements in tissue [17]. Direct nutrient recycling through mycobionts capable of decomposing leaf and other litter material has also been postulated [18,19].

The addition of ion uptake rates, data is needed but unavailable on nutrient content and transfer in the production, senescence and decomposition of mycorrhizae. Reviews of the shedding of plant parts and litter decomposition (15) only briefly mention mycorrhizae; no measurements of mycorrhiza production or decomposition are cited. An understanding of the role of mycorrhiza in these processes is important in understanding withdrawal (immobilization) or release (mobilization) of plant nutrients to the ecosystems.

Current trend in Forest Research is a journal devoted to a broader view in forest science research and potentially making significant contribution to scholarly research publication on various aspects of forest science. It is a place for addressing common concerns on forest studies and involves contribution with divergent professional backgrounds to encourage methodologically diverse studies, employing both quantitative and qualitative approaches.

Special issues are a supplement to main stream of regular papers and offer readers a focused set of related topic. Present issue of Current trend in Forest Research is a special issue devoted to ‘Structure and Functioning of Forest Ecosystems’. This issue includes scholarly contribution related to structure and function of forest ecosystems from a wide range of geographical settings. This issue specially tried to seek out studies which explore various aspects of forest ecosystems. The article published in this issue tried to stimulate more and wide discussion about the manifold interactions in forests and their ecosystems that influence the products and services on which people rely.

References

1. Costanza R, Darge R, de Groot R, Farber S, Grasso M, et al. (1997) The value of the world's ecosystem services and natural capital. Nature 387: 253-260.
2. Vitousek PM, Field B (1999) Ecosystem constrains to symbiotic nitrogen fixers: a simple model and its implications. Biogeochem 46: 179-202.
3. Schlesinger ME and Mitchell JFB (1985) Model projections of the equilibrium climatic response to increased carbon dioxide. In MC MacCracken and RM Luther, eds. Projecting the Effects of Increasing Carbon Dioxide. DOE/ER-0238. US Department of Energy. Available from NTIS, US Department of Commerce, Springfield.
4. Tiessen HE, Cuevas, Chacon P (1994) The role of soil organic matter in sustaining soil fertility. Nature 371: 783 -785.
5. Bargali SS (1994) Forest floor development in *Eucalyptus tereticornis* Sm. plantations in a part of Central Himalayan tarai belt. Range Manag Agrofor 15: 61-68.
6. Bargali SS (1996) Weight loss and nitrogen release in decomposing wood litter in an age series of eucalypt plantation. Soil Biol Biochem 28: 699-702.
7. Ranger J, Nys C (1994) The effect of spruce (*Picea abies*) Karst.1 on soil development: an analytical and experimental approach. Eur J of Soil Sci 45: 193-204.
8. Bradley RL, Fyles JW (1995) Growth of paper birch (*Betula papyrifera*) seedlings increases soil available C and microbial acquisition of soil-nutrients. Soil Biol Biochem 27: 1565-1995.
9. Fogel R and Hunt G (1983) Contribution of mycorrhizae and soil fungi to nutrient cycling in a Douglas-fir ecosystem. Can J Forest Res 13: 219-232.
10. Van Vuuren AM, Tamminga S, Ketelaar RS (1991) In sacco degradation of organic matter and crude protein of fresh grass (*Lolium perenne*) in the rumen of grazing dairy cows. J Agri Sci 116: 429-436.
11. Bargali K, Manral V, Padalia K, Bargali SS, Upadhyay VP (2018) Effect of vegetation type and season on microbial biomass carbon in Central Himalayan forest soils, India. Catena 171: 125-135.
12. Finlay RD, Söderström B (1992) Mycorrhiza and carbon flow to the soil. In Mycorrhizal Functioning. An Integrative Plant-Fungal Process. Ed. M.J. Allen. Chapman and Hall, New York. Pg No: 134-160.
13. Groffman PM, Bohlem PJ (1998) Influence of exotic earthworm invasion on soil organic matter, microbial biomass and denitrification potential in forest soils of the northeast United States. Appl Soil Ecol 9: 197-202.
14. Sanders JG, Powell S, Kronaure DJC, Vasconcelos HL, Frederikson ME, et al. (2014) Stability and phylogenetic correlation in gut microbiota: lessons from ants and apes. Mol Ecol 23: 1268-1283.
15. Bargali SS, SP Singh, RP Singh (1993) Pattern of weight loss and nutrient release in decomposing leaf litter in an age series of eucalypt plantations. Soil Biol Biochem 25: 1731-1738.
16. Manral V (2018) A comparative account of the Microbial Biomass Carbon, Nitrogen and Phosphorus in soils of Natural forests in Kumaun Himalaya. Ph.D. thesis, Kumaun University, Nainital, India. Pg No: 220.
17. Trappe JM and Fogel R (1977) Ecosystematic functions of mycorrgizae. In: The belowground ecosystem: a synthesis of plant-associated processes (Ed. by J.K. Marshall), range Science Department Science Series No. 26 Colorado State University, Fort Collins. Pg No: 205-214.
18. Singh JS, Singh SP (1987) Forest vegetation of the Himalaya. Bot Rev 53: 81-192.
19. Usman S, Singh SP, Rawat YS, Bargali SS (2000) Fine root decomposition and nitrogen mineralization pattern: In: *Quercus leucotrichophora* and *Pinus roxburghii* forests in Central Himalaya. Forest Ecol Manag 131: 191-199.