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Microbes: Key Ecological Drivers in Controlling the Issues Related to Environmental Changes

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Editorial

The major environmental issues such as green house gases emissions or rise of average Global temperatures, climate change, sea level rise, ozone layer depletion, land degradation, biodiversity loss, among many others, are impacting directly or indirectly the human health and ecosystems stability. Anthropogenic interventions are also altering the potential of ecosystems services to provide healthy food products, air, water and soil. The ecosystems destruction such as land use changes (conversion of natural forests to farming lands) can impact on human health in a variety of ways. Therefore, protecting ecosystems and human health from these Global environmental changes requires critical management at many levels. It is also important to find out the key ecological drivers which are more deleterious to environmental changes and sustainability of human life on Earth. At the same time it is equally necessary to find the eco-friendly viable options to attenuate the deleterious catastrophic impact of environmental hazardous. The WHO indicates to investigate the devises that can be linked to environmental disturbances and human health agendas, and by advising the human health sector on the necessary responses to address the various risks posed by broad level climatic changes.

While responses to alterations in environmental changes to higher organisms such as plant and animal communities can be seen relatively slow, in most cases, but the responses in structure and function of microbial communities may be noticed instantly. The microbial communities are undoubtedly the key responders to any environmental disturbances, however, exact and detail mechanisms how the microbial community compositions or their functional activity responses against alterations in environmental parameters, in most of the cases are still unresolved. The wonderful quick responses of microbial communities in response to environmental disturbances up to some extents, may be explained with the facts that microbial communities having complex massive genomic pool with millions of species, including a lot of unknown beneficial potentials.

Land degradation is caused by multiple biotic and abiotic forces, has accelerated during the 20th century due to increasing and combined pressures of agricultural and livestock production (over-cultivation, overgrazing, land use changes, etc.), urbanization, deforestation, and climate change events such as extreme weathers (droughts, floods, higher temperatures, etc.) and soil salinisation. Because of the current public concerns about the harmful impacts of ecosystem degradation, there is an increasing interest in improving the understanding of microbial communities, and the way, it contributes to restoration and functioning of degraded lands [1]. The soil microbial communities, an important driver of soil functioning, may be considered as the sensitive key biological indicator of perturbations owing to soil degradation. A comparative study of soil microbial biomass between degraded and restored lands has been discussed, but the knowledge about key ecological drivers influencing the patterns of soil microbial community structure beneficial to degraded soil restoration is still warranted. Therefore, the study of soil microbial communities and their relationship to climate and soil drivers can enhance our understanding in restoration of land uses like spoiled coalmine areas, fly ash dumping sites, saline soils, etc.

The investigations suggest that attenuating emissions of most potent green house gas such as methane (CH_4) would not only slow global warming, but could avoid millions of deaths and loss of agriculture productivity per year, globally. It is well known that a unique group of soil microorganisms known as methanotrophs, acts as a strong sink of atmospheric methane (CH_4) [2]. The CH_4 consumption in aerobic soil, by methanotrophs is typically assessed by the detection of the *pmoA* gene, which encodes the β-subunit of pMMO enzyme [3]. It is assumed that land use changes can alter the soil physico-chemical properties which in turn may impact the methanotrophs abundance/diversity/*pmoA* gene copies and ultimately the CH_4 sink potential in soils. However,

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no studies have been conducted to assess the impact of land uses on abundance of soil methanotrophs/*pmoA* gene copies of in uplands soils, which acts as strong sink of CH_4. If measured into economic terms, the human health gains and crop yield enhancement associated with mitigation could offset much of the early cost of green house gas mitigation. This supports the conclusion that both climate-sensitive human health risks, and the benefits of cutting green house gas emissions and environmental pollutants, should be central to any discussion on climate change.

Microbes, tiny architects, play a crucial role the production of next-generation biofuels such as bio-ethanol, biodiesel and bio-methane [4]. The yeasts, efficient microbes can be used to produce ethanol from biomass due to fermentation process. Some microbes like cyanobacteria or Blue-Green-Algae (BGA) can accumulate large amount of lipids and can be exploited for the production of bio-diesel. Furthermore, though microbes may also release gases as by-products such as hydrogen, which could be very useful to use as gaseous biofuels and may be alternate to natural gas.

Microbes in general, are found all over the Globe and in every ecological niche conceivable therefore, with these unique properties they can survive even in adverse conditions of various extreme ecosystems. Because of these attributes, changes in their macro- and micro-molecular constituents in the microbial, under the stressed situations, are considered as bioactive compounds in addition to the macro-molecules. Hence, there is a huge unexplored microbial resource available to be exploited by the bio-fuel and pharmacy industry. Therefore, further investigations in the development of novel microbial technologies in the generation of commercial bio-fuels should be focused.

In conclusion, although, soil physico-chemical parameters are important factors to maintain soil health, soil microbial communities may be the key ecological driver in ecosystem services. Loss of beneficial microbial diversity associated with the land degradation and climatic disturbances are the major consequences contributing significantly to soil fertility and ecosystem functioning. Therefore, investigations related to responses of soil microbial communities associated with climate changes to combat problems of soil degradation and ecosystem disturbances need to be performed in greater depth. Today, it is urgently required to maintain the degraded soil and environmental health with emphasis on restoration and remediation of vast degraded land area using efficient novel microbial communities. Finally, the microbes are concluded to be key ecological drivers in controlling the soil health and environmental sustainability.

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