Chowdhury (JNU) discussed the effects of the edge energy on the lifetime of soap films. The lamellar phase of the amphiphilic molecules consists of a stack of approximately parallel membranes. Therefore the steric repulsion is expected to play an important role in the behaviour of this phase at finite temperatures. Sriram Ramaswamy (IISc) summarized recent results on the dynamic behaviour of this phase.

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OPINION

Increased microbial immobilization of nutrients will adversely affect afforestation in dry tropics during future climatic change

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Afforestation in leached and impoverished soils of dry tropics, if delayed, may be unyielding, as increased global warming and lowered soil water potential may increase microbial immobilization of nutrients in soil, reducing their availability to plants.

Management of global change in CO_2 concentration in air by carbon sequestering through rapid afforestation[1,2], especially in the nutrient-poor dry tropics[3], if delayed, may be jeopardized with changed microbial behaviour in soil. Various types of microbial encystments occur as an adaptation to heat and moisture stress in soil to avoid desiccation[4]. Encystment triggers accumulation of extracellular cyst-forming nutrients[5]. Also, lowered soil water potential triggers the accumulation of solutes within microbial cells from outside[6]. Increased global temperature due to infrared radiation trapping resulting from increased atmospheric loading of CO_2 and other greenhouse gases[7,8] will thus potentially lead to increased nutrient immobilization in microbial biomass through encystment and intracellular accumulation. Though the future patterns of precipitation and soil moisture are still not well-understood[9], as the surface and the atmosphere warm the saturation vapour pressure will increase exponentially with temperature, leading to more evaporation (including transpiration) from the earth[10]. The increased atmospheric loading of H_2O vapour will drive the temperature further higher through feedback effect, as the H_2O vapour is a strong greenhouse gas[10]. Thus exacerbated moisture stress due to lower water potential of soil and increased surface temperatures will increase immobilization both in encysting and noncysting microbial populations and reduce the release of nutrients in the growing season[11]. Increased water potential in soil is needed to induce plasmoptysis in microbial cells[11] and microbial predation to release nutrients[12,13]. Afforestation in the degraded, nutrient-limited dry tropical forests and savanna will be the abject victim where mineralization of microbial biomass in presence of higher water potential, in soil, is the chief source of nutrients during growth season[12,13]. The nutrients released from microbial biomass during first four weeks of rainy season contribute up to 32 kg per ha N and 13.2 kg per ha P in forest soils, and 25 kg per ha N and 10 kg per ha P in savanna soils[13]. These amounts are contributed by noncysting as well as encysting forms of microflora and are greater than the contributions from other sources of nutrients in dry tropical forests and savanna. The nutrient release from decomposing litters during the whole rainy season (12 14 weeks) which is supposed to be the next important source of natural plant nutrients in dry tropics is only 22 kg per ha N and 1.4 kg per ha P in forest soils, and 19 kg per ha N and 1.8 kg per ha P in savanna soils[14]. This is much lower than the amount of nutrients released through mineralization of microbial biomass only during first four weeks of the rainy season[13]. Moreover, prevailing time of litter decomposition, which is more than a year in dry tropics[15,16], is likely to prolong due to decreased microbial activity in suboptimum soil moisture level. There exists a possibility of litter accumulation in subsequent years after afforestation and consequent mulching effect, reducing the evaporation of water from soil, but in dry tropical forests strong wind current in winter and summer sweeps dry litters in different types of depressions, exposing larger portions of the forest floor[17]. Further, the increased litter accumulation will increase the fuel load on the floor and consequently will increase frequency of forest fires[18]. Thus any mulching effect due to litter accumulation in afforested land will be negated.

Nutrient deficiency in soil has been found to be detrimental to forest plantations in North Luzon in the Philippines, resulting in die-back, chlorosis and poor growth[19]. Among the

consequences of climatic change the possible emergence of soil moisture as a limiting factor will be ominous to the processes of dry tropical ecosystems. Higher transpiration rate of fast-growing species, if planted, will further add to the misery. Once a significant warming is imposed in the atmosphere, carbon sequestering through rapid afforestation in nutrient-limited dry tropics, will be too arduous a task to carry out in face of the accentuated nutrient immobilization. Limitation of soil moisture should be perilous to various ecophysiological processes, especially physiology of nutrient uptake by plants, and therefore, even addition of plant-available nutrients from outside to meet the ravenous demand of rapidly establishing biomass of fast-growing species may be a futile effort.

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