70% of the lake. This has led to a decline in the number of rooted floating plants species such as *Nelumbo nucifera*, *Trapa natans*, *Euryale ferox*, *Nymphaea* sp., and *Nymphoides indica* (to name a few), which were abundant in the area. This habitat, which served as home to important birds such as *Hydrophasianus chirurgus* and *Metopidius indicus* is now devoid of them. Over 16 indigenous species of fish and 20 economically important species of aquatic plants are reported to have been disappeared so far.

The water-holding and possible phyto-sequestering or remediation capacities of the floating mass are reported to have been lost to a large extent. The root cause of these issues has been the construction of the Ithai barrage that has led to the damming of the lake and degradation of catchment areas[1,2]. Most of the reports are restricted to enumeration of biota and description of the species richness of the lake. Wetzel[9] has rightly commented on the concentration of research towards higher organisms and described the importance of biotic components, especially microbes as the fastest means as a metabolizing system.

Figure 1. An aerial view of the Loktak showing spreading *phumdis*.

Lovely[10] and Banning *et al.*[11] have highlighted the importance of analysis of microbial genes involved in bioremediation as their presence has been positively correlated with degradation of contaminants. Therefore, identification of microbial biota, using modern molecular biology tools, stands crucial for the Loktak remediation programme.

Analysis of 16S rRNA gene, a highly conserved sequence found in all microorganisms, has been the most intensely used approach for quick identification of the micro flora of the lake. The information thus obtained could be meaningfully utilized for restoration and remediation biology. Besides, the study of 16S rRNA gene could help characterize microorganisms associated with other biotic communities[12]. In some instances, subsurface microbes (aerobes) which can oxidize organic contaminants to carbon dioxide have been utilized for remediation of the environment[13].

Microorganisms, because of their diverse enzymatic activities, are capable of mediating bioremediation through sequestration in associating with the roots of plants. Hence, there is an urgent need to study the microbial diversity of this unique and fragile ecosystem. Bioremediation mediated by microorganisms is simpler, cheaper and more environment-friendly than other approaches[10].

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Biowaste utilization for improving health and productivity of acid soils in North East India

Nutrient requirement in agriculture has been rising and is likely to increase further to boost the agricultural productivity in order to keep pace with growing food demand in the country, especially in the context of climate change[1]. Chemical fertilizers have been indiscriminately used to meet the growing nutrient demand over the past half a century which, of course, boosted the agricultural productivity, but not without its deleterious impact on soil health and sustainability of crop production. Further, economic and environmental concerns associated with the excessive use of chemical fertilizers make it imperative to search for an alternative which can reduce the over-dependence on chemical fertilizers and increase soil health and crop productivity as well. This is particularly important for North East region (NER) of India where inadequate availability of nutrients and soil health-related constraints induced by extreme forms of soil acidity are the major impediments to crop production and food security[2]. As NER has abundant availability of biowaste, such as crop residues, weed biomass, forest litter, animal dung, etc. and use of chemical fertilizers is traditionally minimal, efficient utilization of biowaste could be an important strategy to meet the growing nutrient requirement and improve soil health and productivity in this agriculturally important region.

The agro-climatic conditions of NER favour production of enormous amounts of biowaste under different land uses and farming systems. These are potential sources of organic carbon and plant nutrients. The biomass production in weeds roughly ranges from 5 to 20 tonnes/ha depending upon the weed species, season and growing conditions[3]. Around 9 million tonnes (mt) of crop residues (rice, maize, pulses and oilseeds) are produced annually in NER[4]. Even considering half of these residues to be available and 40% loss of the nutrients contained therein, these crop residues can add up to ~10,000 tonnes of N, ~2000 tonnes of P_2O_5 and ~35,000 tonnes of K_2O to the soil. Around 15 mt of animal dung produced annually can also supply substantial amount of nutrients to the soil. Besides nutrient supply capacity, biowaste can improve the soil organic carbon, moisture retention capacity, buffering capacity and many other desirable attributes of soil quality. In fact, these benefits of crop residues (through mulching or *in situ* incorporation) have been witnessed in many studies undertaken in different rice and maize-based cropping systems of NE India. The biowaste can alternatively be utilized for production of quality organic manure within a short period of 50–80 days using earthworms and cellulose-decomposing microorganisms, either alone or in consortia[5]. Such methods need to be standardized and popularized among the farming community. Further, development of appropriate techniques for *in situ* utilization of such biowaste is also necessary for improving soil health under hilly conditions of NER. Improvement of compost through mineral amendment or microbial culture is another viable option. One of the possible ways of improving nutrient content in the compost is by inoculating nitrogen-fixing microorganisms and phosphate-solubilizing microorganisms. The culture of efficient strains of nitrogen-fixing bacteria such as *Azotobacter*, *Azospirillum*, *Pseudomonas*, etc. can be inoculated in the compost either during composting or in the final compost to increase their nitrogen content. Similarly, phosphate-solubilizing microorganisms such as *Aspergillus awamori* are inoculated to enhance P content in the compost.

To conclude, as utilization of biowaste has great potential to improve the health and productivity of acid soils in NER, there is urgent need to develop appropriate technology for efficient utilization of the abundantly available biomass for production of quality organic manure. Techniques for *in situ* utilization of biomass also need to be evolved and popularized among the farming community for improving soil health and crop productivity of NE India in perpetuity.

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Occurrence of endangered orchid *Cymbidium whiteae* King and Pantl. in North Sikkim

Sikkim Himalaya is recognized as a paradise of orchids in India. The Sikkim orchids are well explored and documented[1–4]. During the residency of the first British political agent John Claude White, Lady White collected a beautiful orchid from the capital town of Sikkim, Gangtok. This plant was later named after her as *Cymbidium whiteae* in a monumental work[2]. Because of its beauty and horticultural potential, this magnificent species was cultivated throughout Europe and the West. Extensive collection from the wild for cultivation and export dwindled its natural population. Keeping this in view its collection and export was banned on 8 July 1910 by The Chogyal, King of Sikkim[3], many decades before the existence and implementation of modern CITES rules. This endemic, rare, cherished and prized species with extremely restricted distribution in Gangtok town only is listed in almost all the flora works, taxonomic works related to orchids, garden-cultivated plant books, Red Data books, IUCN books and Appendix II of CITES checklist[3–8].

This species was spotted in its type locality Gangtok up to early sixties[9,10] and was growing at Deorali near present forest secretariat (U. C. Pradhan, pers. commun.), but later disappeared. The causes for its disappearance are thought to be clearing of natural forest for the development of township as well as the increased vehicular emission and human concentration[10]. After its disappearance from type locality Gangtok, it was thought to be extinct from wild and efforts were made for its conservation in its homeland, Gangtok by a local nurseryman and orchid enthusiast, who reintroduced it in cultivation from Europe with the joint efforts of Writhlington School in Great Britain[11]. After more than a century of its discovery, very few plants were found growing in another locality, Rumtek[10]. This is a rural area near Gangtok, where dense and humid natural forests still exist. There are chances of seed dispersal from Gangtok to Rumtek and vice versa because both fall in the same altitude and latitude with hardly a couple of kilometres aerial distance.

In December 2011, I also found one more population of *C. whiteae* when it was in full bloom near Hee-Gyathang, lower Dzongu, North Sikkim, between 900 and 1200 m (Figure 1). This locality lies at the fringe of Khangchendzonga