Long-term ecological research sites

The call for the establishment of a network of long-term ecological research (LTER) sites in India[1] is an excellent idea that would be highly valuable in tackling the country's environmental challenges in the 21st century. I agree with the author's vision that now more than ever, there is a great need for understanding ecological patterns and processes at relatively large spatial and temporal scales. Such information is important not just to advance the science of ecology. It is also essential to the development of sound sustainable environmental policy and management that would apply across a whole region, and over decades or longer. LTER networks in the USA and in Europe have provided successful foundations for a significant portion of the ecological research in those regions. In brief, there are at least three major benefits that India would derive by establishing a network of sites.

(i) Networks facilitate inter-site comparisons by studying ecological patterns, processes and responses to experimental treatments at regional scales (e.g. the nutrient enhancement, species removal and experimental atmospheric CO_2 enrichment (FACE) studies across the US).

(ii) Networks provide a foundation for new science initiatives and a valuable starting point for budding scientists. Not only is an infrastructure of potential sites available, but the research that has already taken place at the sites provides a powerful background on which new scientists can develop truly 'cutting edge' initiatives. Furthermore, there is often great potential for building interdisciplinary and complementary research teams (e.g. the initial establishment of the experimental species richness plots at Cedar Creek, Minnesota, and the warming/fertilization plots at Toolik Lake Alaska have fuelled high-quality science for at least the past 20 years).

(iii) Networks can provide a strong basis for ecological monitoring and modelling at the regional scale. As the author correctly points out, the value of long-term monitoring has now become extraordinarily valuable in understanding large scale ecological processes and responses to perturbations (e.g. the ~50 year record of atmospheric CO_2 concentrations from Mauna Loa that is the basis of our understanding of anthropogenic impacts on climate, the recent regional scale studies of terrestrial carbon exchange across Europe (CARBOEUROPE), and the international tundra experimental studies (ITEX)).

In short, establishing a network of LTER sites in India would be an excellent initiative towards promoting high-quality ecological research that would also be of great societal value in addressing urgent issues at spatial and temporal scales appropriate to the development of sensible environmental policies.

1. Tripathi, S. K., *Curr. Sci.*, 2010, **98**, 21–22.

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Micropropagation methods for frozen seed vault crops

The Defence Research and Development Organization's (DRDO) recent initiative to conserve in perpetuity India's crucial agri-biodiversity at sub-zero temperatures is commendable[1]. In addition to the Svalbard Global Seed Bank, a joint initiative by the Norwegian Government and Global Crop Biodiversity Trust (GCBT)[2], Defence Institute of High Altitude Research (DIHAR) is second in the world to have permafrost seed storage facility.

In this context, I wish to report here problems faced during germplasm recovery. A large number of seeds of crop species are recalcitrant in nature, posing serious problems of germination, establishment and survival soon after recovery from seed banks. It is imperative to address recovery of seed material and their establishment after prolonged exposure to subzero temperatures. In this context, plant tissue culture techniques can be successfully applied to overcome these problems and to generate true-to-type plants *in vitro*. Main issues that can be addressed include, but not limited to, micropropagation methods using mature embryos, endosperm, cotyledons and use of direct seed as an explant source. Because seed is a basic input of regeneration, identifying optimum conditions to break dormancy and regeneration after long-term storage at low temperatures are vital. For majority of crop species, this data is available in peer-reviewed publications. But there is need to compile universal crop-wise database that can be linked to the DIHAR seed vault.

And for crop species on which no such information is available, integrated and concerted effort by government institutions, public funding agencies and private sector corporations to develop reproducible micropropagation protocols and create a database is the need of the hour. Such synergistic efforts could go a long way towards recovering plants from seeds that are proven hard to propagate. GCBT (http://www.croptrust.org/documents/Press%20Releases/Trust%20grants%20-release%20FinalSept08.pdf) had initiated efforts to search for traits such as drought and salinity[3] that are needed to breed climate-proof crops. The efforts of DIHAR coupled with the discussed crop regeneration methods will supplement our search for food security.

1. Mishra, G. P. and Singh, S. B., *Curr. Sci.*, 2010, **98**, 466.
2. Hopkin, M., *Nature*, 2008, **452**, 404.
3. Eswaran, N., Parameswaran, S., Sathram, B., Anantharaman, B., Raja, K. K. and Tangirala, S. J., *BMC Biotechnol.*, 2010, **10**, 23.

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