Climate change will pose new challenges to disaster management

Natural hazards are purely natural but climate change may exacerbate it. Anthropogenic interventions convert hazards into disasters. Climate change and natural disasters should be dealt with mutually and not in isolation. Disaster mitigation and preparedness are necessary for a sustainable growth of any society. It has also been observed that the numbers of people killed due to disaster are more in the places where human development is low. Hydrometeorological disasters cause more damage than those which are of geophysical in nature. Climate change is one of the most important global environmental challenges faced by humanity. The Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report (AR4) released during February 2007, has mentioned that eleven of the last twelve years (1995–2006) rank among the 12 warmest years in the instrumental record of global surface temperature. Global average sea level rose at an average rate of 1.8 mm/yr over 1961–2003. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected. In case of temperature rise, the best estimate for a low scenario is 1.8°C and the best estimate for a high scenario is 4°C. It is expected that the earth will be confronted with frequent warm spells, heat waves and heavy rainfall. This unprecedented increase is expected to have severe impact on the global hydrological system (receding glaciers, erratic monsoon), ecosystems, sea level, crop production and related processes. The impact would be particularly severe in tropical areas mainly consisting of developing countries, including India. With rapid development of coastal areas, industrialization and urbanization, more populations are becoming vulnerable to climate-associated calamities and many have no choice but to move to safer places. It is estimated that approximately 142 million people may inhabit coastal India in 2050 and India's total number of flood zone refugees alone could be anywhere between 20 and 60 million, with 30 million taken here as a conservative working figure[1].

Climate change is a global problem and India will also feel the heat. Nearly 700 million rural people in India directly depend on climate-sensitive sectors (agriculture, forests and fisheries) and natural resources (water, biodiversity, mangroves, coastal zones and grasslands) for their subsistence and livelihood. Under changing climate, food security of the country might come under threat. In addition, the adaptive capacity of dry-land farmers, forest and coastal communities is low. Climate change is likely to impact all the natural ecosystems as well as health (e.g. malaria) and socio-economic systems, as shown by the India's initial national communication to the UNFCCC (United Nations Framework Convention on Climate Change). To manage these climate change-induced disasters, the country needs to have improved scientific understanding, capacity building, networking and broad consultation processes across every section of the society.

Further, human activities that contribute to deforestation, land degradation and climate change not only result in huge losses to the environment, but also increase the vulnerability of the environment to disasters and alter the resilience of the natural environment by reducing its ability to recover effectively from damage.

Disaster and climate change are increasingly being considered as a development constraint; hence, mainstreaming them into the development policy is all the more pertinent in the current context. Researchers and policy makers across the world understood the importance of this. The Hyogo Framework of Action: Building the Resilience of Nations and Communities to Disasters 2005–15 is the result of that realization which recommends (para 32(e)) 'to integrate disaster risk reduction (DRR) considerations into development assistance frameworks,…'. DRR should become a normal practice and become a basic development agenda for our country. A systematic approach towards disaster mitigation is the need of the day. Since disasters are a human phenomenon, we can change our ways to reduce our risks. Shifting of focus from hazards to risk management could make our life safer. There is a need to have a paradigm shift in disaster management especially under changing climate. Initiatives such as adaptation to changes, disaster auditing, cross-sectoral risk analysis, regulatory authority (legal framework), knowledge management (community awareness), training and capacity building, training of media personnel, coastal zone management, private–public partnership (PPP), research and development, and last but not the least, establishing rewards or incentives for good management could be undertaken.

1. Myers, N., *Bioscience*, 1993, **43**, December.

SUDIP MITRA

M.S. Swaminathan Research Foundation, Chennai 600 113, India
e-mail: sudipmitra@yahoo.com

Need for a comprehensive eco-friendly approach for development

In India, vast stretches of land are lying barren. These could be brought into use by an eco-friendly approach. The land-use ratio of forest, agriculture, industry, commerce, housing, etc. should be such that it is in perfect harmony with nature. In this connection, the following points may be noted. (i) Some of the land may be earmarked for forests. In fact, every human settlement (i.e. village or township) should be accompanied by the 'Deorai' (i.e. forest comprising of trees of different species). Planting trees of different species would help in combating the so-called global warming by releasing oxygen from the enhanced carbon dioxide. They provide raw material for the manufacture of medicines. They also help counter degradation and/or desertification of the land and keep biodiversity intact. (ii) Some portion of the land may be brought under cultivation since it is the need of the hour for feeding the growing population, to raise buffer stock and also for export. Under no circumstance shall the existing fertile land be used for industry. The concept of Special Economic Zone (SEZ), which is currently under much attention, gives emphasis to industry alone. This approach is disastrous. In fact, we should not undermine the role of agriculture, as it alone provides the 'bread', whereas industry which gives us only 'money' does not. (iii) In some portion, ponds may be created to conserve the precious rainwater, which could be used for a variety of purposes including farming, and to build up the fast depleting groundwater table.

BHARAT K. OSWAL

902, Somwar Peth,
Talegaon Dabhade,
Pune 410 506, India

Taxonomy, the legacy of Linnaeus, transformed to phylogenomics

This is the tercentenary year of Carl Linnaeus, father of taxonomy, who was born in Sweden and lived from 1707 to 1778. The year 2007 therefore provides an occasion to remember the important contributions of Linnaeus to taxonomic biology, made in the mid-seventieth century and to review their relationship to the biology of the early twenty-first century.

Linnaeus' contributions were both visionary and prolific. He initiated work to make a universal catalogue that describes and classifies all living organisms. For this, he studied thousands of specimens of plants and animals, collected by himself or obtained from botanists, explorers and correspondents in Europe, America, Pacific, Asia and Africa. His extensive comparative observations on physical forms of a large variety of plants and animals led him to devise a system of taxonomic code for treatment of each distinct organism/species. The code comprises of a name, type specimen, description and list of distinguishing features. He invented the binomial system of nomenclature in which the first name referred to genus and the second to species. He also started the convention of placing the name of the author of the species after the species name. This ensured that priority of authorship of species validated by reference to a publication was established once for all. Thanks to him, four codes of nomenclature exist now, one each for animals, plants, fungi and cultivated plants. These methodologies are best exemplified in his book entitled *Species Plantarum* published in 1753, wherein names and definite descriptions of more than 5000 species of plants are included. Since Linnaeus, each studied organisms has a name and identity, studies on living organisms have become repeatable.

Linnaeus believed that the number of species was constant, there were as many species at the beginning of life as are present now. Although he dealt with enormous variability of form demonstrated by a plethora of organisms examined by him, Linnaeus failed to perceive speciation, including common descent of several species from an ancestral species and continuum of the process of extinction of species and origin of new species, as we understand at present. In recent years, since the dawn of genomics three decades ago, taxonomy has turned into systematics. DNA sequence data are now used, in addition to morphological and biochemical features, to diagnose the identity of an organism or its parts, as well as to determine its hierarchical/phylogenomic position among related species/populations. The use of DNA sequence information, together with the conventional taxonomical tools of description, annotation and curation have made the identification of any new species more or less foolproof.

Genome sequences have been worked out now from more than 1000 species and DNA sequencing work on non-model species is rapidly growing. Nature of DNA sequences that comprise eu- and heterochromatin in chromosomes is becoming known. Genetic regulatory networks are being revealed. Functional genomics aimed at finding the roles of RNA/protein/enzyme product of specific genes is helping in these developments. Genetic linkage maps of model organisms based on conventional morphological traits, biochemical characters and DNA markers are becoming greatly detailed. Syntenic analysis is helpful in developing comparative genetic maps between related species. Sequence analyses of individual genes specified by nuclear and organelle (mitochondrium and chloroplast) genomes is allowing the discovery of mutations present in paralogous and orthologous alleles of the given genes. Such information is allowing species-specific DNA barcodes. Comparative genomic analyses based on DNA sequences of several to many nuclear and/or organelle genes and map positions of these genes and algorithimic analyses of these data, aided by conventional taxonomic description, form a fairly rigorous technique to identify species and determine relatedness between species, genera and higher groups (families) in terms of evolutionary pathways from common ancestor(s). Notably, such analyses allowed separation of archae bacteria from other groups of bacteria. The challenging task ahead is to construct an eukaryotic tree depicting evolution among animal, plant, fungal and protist species, the major groups of eukaryotes. The science of phylogenomics has now become an integral part of taxonomy on the one hand, and genomic biology on the other.

The work of Linnaeus' organized knowledge about morphological features of identified and named plants and animals, has had a tremendous founding effect on all experimental biology. This will continue to serve as the foundation of modern genomic biology and experimental construction of new species for ecosystem services and for the benefit of human society.

SUSHIL KUMAR

National Institute for Plant Genome Research,
Aruna Asaf Ali Marg,
New Delhi 110 067, India
e-mail: sushil2000_01@yahoo.co.in