Gadgil and Devasia reply:

Ashish Kothari's comments are well taken. IPR specifications are meant to disclose fully how a particular invention was arrived at and to enable another party skilled in the art to practice it. Our suggestion that the specification include information on the biological resource, country/ies of origin and common public knowledge fits in well with this purpose of specification. Once this information is specified, it is straightforward to ask for evidence of prior informed consent of the country/ies and community/ies. It may or may not be advisable to ask for this as a part of the specification by countries which are not yet parties to the Convention on Biological Diversity.

The issue of country of origin needs to be discussed in some depth. The issue of further evolution of genetic variation after introduction of a species outside the country of origin is significant and needs serious scientific assessment. However, the whole purpose of the Convention of Biological Diversity would be defeated if there is to be no tracing a country of origin prior to December 1993.

We do not share Ashish Kothari's optimism that we may yet decide that no intellectual property rights would be allowed on life forms and biotechnologies. GATT insists on IPR's on micro-organisms, microbiological processes and plant varieties. Already there are well established IPR's on products based on biological molecules. Of course, philosophers can and should continue to debate these issues, but scientists and technologists would be more fruitfully occupied in working out policies which would best serve the interests of our country and our people under the regime imposed by India's accession to GATT.

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NEWS

Report on 'Global analysis, interpretation and modelling (GAIM) science conference'

The global environmental concerns have attracted considerable attention, particularly issues such as climate change, global warming and the ozone hole problem. At the heart of these concerns are the several experimental observations, many theoretical studies and quite a few computer models of global change. An international conference on global data analysis and assessment, modelling of biogeochemical systems and their relationship to physical climate as well as interpretation of current trends in data and modelling could not have been held at a more opportune time.

The recently concluded GAIM Science Conference, organized by the International Geosphere–Biosphere Program, September 25–29, 1995, Garmisch–Partenkirchen, Germany brought together over 300 scientists from 44 countries in a major effort to advance the study of the coupled dynamics of Earth system using both empirical studies and computer models. A significant participation from the developing countries was made possible thanks to the generous funding from the German government and the National Science Foundation, USA. There were about twelve participants from India.

The focus was on biogeochemical cycles, as well as the identification and assessment of natural and anthropogenic changes in the various subsystems of the Earth. The research findings reported covered real-time and proxy or indirect measurements of past and present changes in global systems. These findings also relate to changes in the climate system and its interaction with biological systems such as forests, wetlands, ocean biota and other ecosystems. The sessions were grouped by time periods into four major sections: Paleo (more than 20,000 years before the present, i.e. 20 ky BP), Historical (2 ky BP or so), Contemporary (last few decades) and the Future. A special session on global systems integration addressed the problems of combining the interactions and feedbacks of biogeochemical subsystems into whole-earth models.

Studies of paleo-climate, as inferred from indirect measurements, show that climate change is largely the reaction to forcings such as orbital, solar and volcanic dust with superimposed noise. Several parameters have been identified from paleo data which can be used, in principle, to estimate such forcings. It was reported that quasi-oscillations such as the El Nino–Southern Oscillation and the Monsoons change their character with changing climate, so that new types of variability may develop and play an important role in future climate. It was pointed out that it is necessary to arrive at a quantitative understanding of the North Atlantic mode switches during the glacial and to examine whether under warmer climate, the enhanced water vapour transport to higher latitudes might induce similar changes in deep water formation and distribution of heat over the globe.

Methane, a radiatively active trace gas, is of great significance in understanding past climate conditions. Apart from the recent anthropogenic increase, the most striking feature reported on the methane profiles is the general coherency between the CH_4 and climate changes. The large CH_4 changes observed over the various time scales are thought to result from variations in the hydrological budget over the continents, affecting the extent of wetlands – the main natural source of the gas. The comparison of CH_4 changes, during the last deglaciation and during the Holocene, with the paleo-climatic data

on continents suggests that low-latitude wetlands were mainly responsible for these changes and that the role of high latitude wetlands became important after about 3 ky BP.

Much attention was paid to the signatures left by past climate changes in the form of distinct isotope ratios, reflecting the interplay of physical, chemical and biological processes. It was argued that global change research can make substantial progress through more systematic use of the isotope data. It was noted that a global network of monitoring stations is necessary to improve our estimates of sources and sinks of greenhouse gases.

Reports of computer simulations using orbital conditions for the period 6 ky BP showed enhanced seasonal cycle in the northern hemisphere, with a stronger African–Asian summer monsoon. These simulations indicate that changes in precipitation and temperature are large enough to influence distribution of vegetation. Vegetation sensitivity experiments indicate that northward expansion of grasslands in North Africa could have enhanced monsoon precipitation. The general conclusion from sensitivity experiments using various atmospheric general circulation models is that biogeophysical feedbacks substantially amplify the response of the coupled system to orbital forcing.

It was reported that a study of the lake records for 6 ky BP, point to a major expansion of the Afro-Asian monsoon. These studies also show that the climate of 6 ky BP was significantly different from today with respect to the regional water balance. Since 1992, there has been an international effort to establish a database of lake records or the record of how lakes have responded to changes in water balance as is seen in geological and bio-stratigraphical investigations of lake sediments. This effort is motivated by the possibility of using lake data as a record of past hydrological changes for climate model validation. The new global lake data set is a unique paleo-climate data resource containing records from nearly 700 sites worldwide.

The terrestrial biosphere has a central role in the climate and biogeochemical systems. The exchange of water, energy and carbon between land surfaces and the atmosphere drives many planetary scale processes. Many computer simulation models have been developed to understand global biospheric processes, and to evaluate their potential response to human activity. Results from all the three major classes of global terrestrial biosphere models—(1) atmospheric general circulation models, (2) equilibrium vegetation models and (3) terrestrial biogeochemical models, were discussed. Since it is difficult to address some of the complex issues using separate classes of models, it was emphasized from the experience of recent model comparisons, particularly the experience of Vegetation/Ecosystem Modelling and Analysis Project, that the requisite next step in model development is the creation of integrated dynamic ecosystem models.

Some of the presentations departed from the tradition of considering vegetation as an invariant aspect of general circulation models of climate and signified a reflection of the growing realization that vegetation is, indeed, an integral part of the climate system and that changes in vegetation structure and function can influence climate. It was reported that changes in climate as a consequence of vegetation behaviour do occur at comparable scales. The average influence of global terrestrial vegetation is small. Interestingly, in some regions such as the tropics, this can be of similar magnitude and even cause regional changes in opposition to the expected change in global average.

Records of atmospheric CO_2 concentration show that the global carbon cycle produces signals in the atmospheric CO_2 on several time scales. The seasonal cycle of atmospheric CO_2 in the northern hemisphere, which predominantly reflects changes in the growth and decay of terrestrial plants, exhibits varied amplitude and phase. The largest signals are associated with pulses of warming which peaked in 1981 and 1990. In the arctic, a biennial signal correlates with temperature.

Changes on short time scales were probably present in the past as well. There are, however, reasons to believe that some recent signals on these scales may point to an unusually rapid warming over the past 30 years, especially at high latitudes. It was argued that the presence of seasonal, biennial and decadal signals in atmospheric CO_2 linked to variations in climate parameters, offers a valuable testing ground for terrestrial carbon cycle models. It will be possible to do this successfully if the models can be forced by real time data rather than climatic averages. A special session on developing countries underscored the importance of tropical and sub-tropical regions in the study of global environmental change and noted that the success of global change research will depend on both expertise and data from all parts of the globe.

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COMMENTARY

India's manganese nodule mine site in the Central Indian Ocean

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Almost a decade and a half back, India had launched a massive exploration programme for manganese nodule deposits in the Central Indian Basin located 5 km below the ocean surface to achieve the goals of self-reliance in strategic metals like copper, nickel and cobalt. Even though little late compared to a few other countries like USA, Japan, erstwhile USSR, Germany and France to undertake this challenging venture, India achieved it in a short span of time (1980–1987), and our claim for a Mine Site Development in the Central Indian Basin (CIB) got registered with UNCLOS (United Nations Council for Laws of Seas) on 17 August 1987 (refs 1,2). After exploring nearly 4 million km^2, Indian