

**Welcome Address Of Mr. D H Pai Panandiker, Chairman, ILSI-India
At International Conference On , Climate Change And Implications For , Water
Resources & Nutrition Security, By International Life Sciences Institute (ILSI-India)
& Center For Integrated Modeling Of Sustainable Agriculture And Nutrition Security
(CIMSANS), November 15-16, Bangalore**

I have great pleasure in welcoming you to this Conference on Climate Change and implications for Water Resources and Nutrition Security organized by International Life Sciences Institute- India and Center for Integrated Modeling of Sustainable Agriculture and Nutrition Security. I must express my gratitude to the Ministry of Earth Sciences, ICAR, Ministry of Agriculture, Ministry of Water Resources and the Ministry of Environment and Forests for co-sponsoring the Conference.

We have with us Dr. Dave Gustafson, Director of CIMSANS, Dr. Sonali McDermid of NASA/GISS, USA, Dr. Thomas C Pagano, Modeling Hydrologist, National Flood Forecasting Unit , Australian Bureau of Meteorology, Australia, Dr. Francis Chung, Principal Engineer, California Department of Water Resources, California, USA , Dr. Reiner Wassmann, IRRI, Philippines, Dr Shiroma Mahipala, Principal Research Scientist, Urban Water Systems Science, CSIRO Land and Water, CSIRO Land and Water, Dr. Mark W. Rosegrant, Director, Environment and Production Technology Division, International Food Policy Research Institute (IFPRI), Washington DC, USA , Ms. Rita Singh, Director, Food Security Partnerships, Monsanto, and USA who have travelled long distances to participate in this Conference. We have also experts from different parts of India who will make presentations on different dimensions of climate change. My sincere thanks to all of them.

Climate change has been a hot topic for quite some time. The first international forum where the issue was extensively discussed was at Kyoto in 1997 and agreement was arrived at to reduce greenhouse emissions. In the past 15 years more discussions have taken place, more extensive data has been presented and more elaborate models have used to make predictions with higher degrees of confidence. Introducing the latest state- of-the-science report of the Intergovernmental Panel on Climate Change on 27th September this year the UN secretary general said “The heat is on. We must act”.

But even if the world begins to moderate greenhouse gas emissions and follow low carbon growth path, warming resulting from past accumulations, will continue well into the century. Warming of the climate system, it is reported, is ‘unequivocal’ even though there was no significant climate change in the past 15 years. Sweeping changes are already occurring across the planet and these will only intensify.

Climate change predictions are based on the models which have improved but cannot be precise in terms of time, regions or impact. Earth System Models used by some of the scientists predict that global mean temperature will go ‘out of bounds’ by 2047 with an uncertainty rate of plus or minus 14 years.

Climate change, so far, in spite of the increase in temperature, rise in sea levels, or extreme rainfall events has been beneficial. A group of 21 economists have estimated that climate change has increased welfare by about 1.5 per cent of world GDP per year. But as temperatures rise further, costs will rise and benefits shrink. After 2050-70 global warming will be a net cost to the world. It is also true that animals and plants will adapt to climate change as they have done in the past. But as a study by University of Arizona shows adaptation rate is 1oC per million years. That is too slow to catch up with climate change that we will witness in the present century.

Adaptation to climate change will therefore call for innovation to continue with progress in the changing environment. The fallout of climate change is wide-ranging but this Conference will discuss its impact on water resources and agriculture and identify ways to mitigate and counter the adverse consequences and to even use the changed environment to advantage.

In India, 60% of the arable land is rain-fed and depends heavily on the behavior of the monsoon. IPCC anticipates that North India is likely to heat up more than the Southern part of the country while the entire subcontinent may see longer rainy seasons in the second half of the present century. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase.

The Northern Rivers are glacier fed. While glacier in North-Western Himalayas and in the Karakorum range have been stable, most Himalayan glaciers where a substantial part of the moisture is supplied by summer monsoons have been retreating and will threaten stability and reliability of Indus and Brahmaputra. The Ganges however will be less dependent on glaciers and more on monsoons. Browning of forests in eastern Himalayas has already started.

It is likely that the dry areas will be drier resulting in droughts. In 2002-03 more than half of India's cropped area was affected by drought with a huge fall in production. Droughts will expectedly be more frequent in North –West India, Jharkhand, Orissa and Chhattisgarh.

Since summer monsoons will be highly unpredictable with frequent droughts, flooding and cyclones, it will be necessary to have an efficient hydro-meteorological system for weather forecasting, drought and flood warning as also for conservation of water, its economic use for irrigation and civic purposes.

Climate change will have direct impact on biology of plant growth from temperature, CO₂, etc as also the indirect impact from soil conditions, seed, water, fertilizers and pesticides technologies, plant entomology and so on. The leaked draft report under development by IPCC predicts 2 per cent reduction in world crop production each decade since the gains at higher latitudes will be more than offset losses in the tropics. Demand for food grains, on the contrary will increase 14 per cent. The expanding food deficit will raise prices which will hit the poor in developing countries the hardest.

There are two ways the food deficit can be bridged. First, by bringing more land under cultivation. This is possible only by cutting down forests which will aggravate climate change. The other is to improve productivity and cropping pattern.

A number of crop growth simulation and mathematical models have been developed by IARI, for instance, for different crops and for different regions. These models take into account temperature, CO₂ levels, rainfall and solar radiation. Increased temperature reduces yield; increased fertilizer effect of CO₂ raises yields. In the net there is a loss. Generally, with temperature rise yields fall less in Northern India, more in rain-fed areas and in warmer climates.

How will the main crops be affected? Take rice. With temperature increase rice production will drop. Eastern regions will be most impacted by increased temperature and decreased radiation resulting in lower grains and shorter maturity periods. The benefit of higher CO₂ will be offset by increased temperature. In the net there would be loss in production. Wheat crop is sensitive to temperature and yields drop when it exceeds 34°C.

Millets are hardy crops and there is negative relationship between temperature and yield. It is therefore important to develop new varieties of crops which can withstand biotic and abiotic stress. The International Research Institute for Semi Arid Tropics (ICRISAT) has focused on pearl millet, sorghum, chickpeas, pigeon peas and ground nuts. The Bhabha Atomic Research Centre has also developed new crop varieties with increased yields, disease resistance, early maturity and water stress tolerance. A number of Universities are also engaged in similar research activities.

To the extent improvement in yields is difficult, cropping pattern may require to be changed. In some of the regions rice may be replaced by millets which can withstand higher temperatures. This would mean change in food habits or more international trade induced by climatic disadvantage.

This change in agricultural systems to increase availability of food is critical to match the increase in demand for food following population expansion and food security compulsions. Climate change will make food security difficult and expensive if timely steps are not taken to increase food production.

Apart from the overall impact of climate change early attention will have to be given to regions which are more vulnerable to climate change.

- Coastal States, particularly east coast and Gujarat will be vulnerable to cyclones
- About 40 million hectares of land mass, mainly in the north, will be vulnerable to floods
- Sixty-eight percent of the area sown will be vulnerable to droughts

The message that comes out from the studies about climate change and the impact of climate change on water resources and agriculture is that monsoon may be of longer duration but extreme events like drought, floods and cyclones will be more frequent; the contrast between wet and dry lands will increase; crop yields will be lower because the benefit of CO₂ fertilization will be more than counterbalanced by higher temperature resulting in lower yields.

These adverse impacts will be severe by the middle of this century. That may create an impression that climate change is still far off, at least another three decades. Besides, there is also skepticism about climate change because in the last 15 years no increase in temperature has taken place

in spite of the CO₂ accumulations. The danger is that skeptics can delay or defeat any action on the part of governments and the people. It needs to be recognized that even if greenhouse gases are reduced climate change will still prevail from past accumulations. Therefore it is important that action is initiated now to adapt to climate change and ensure water and food security.

A number of countries have already begun adaptation efforts. Bangladesh in South Asian region has one third of the people making changes in livelihood, planting different crops and seeking other sources of income. To initiate advance action for adaptation it is necessary that climate change be factored into national development policies. The Prime Minister of India has entrusted this work to eight different missions and it can be hoped that significant ground work will be undertaken to mitigate and adapt to climate change impact.

New initiatives will have to be taken for precision in climate change predictions with improved modeling, weather predictions have to be linked to agricultural activities, research has to be undertaken to develop new varieties of crops which can stand droughts or survive in flooded fields, cropping pattern will have to be gradually diversified, new methods of irrigation have to be devised to economize on water and also incentivize efficient use of ground water, new pests and weeds will develop and models for pest population dynamics will have to be adopted. And so on. All this will take time. The sooner the action is initiated to adapt to climate change while mitigating greenhouse emissions, the better it will be for a secure future.

The technical agenda is with you. It is divided into 9 different sessions spread over two days. Apart from the presentations by the eminent speakers we will also appreciate comments and suggestions from participants. On Sunday we will have a meeting of the Drafting Committee to draw up recommendations of the Conference for adaptation to climate change in respect of water resources and agriculture. I look forward to a focused discussion on a subject so vital for the wellbeing of the people.