

Climate change adaptation in water management for food security: Proceedings of a consultation meeting

India Water Partnership

A consultation meeting was held by the India Water Partnership with the purpose of presenting a draft research paper prepared by Dr. Santosh Kumar, National Institute of Disaster Management on "Climate change adaptation in water management for food security: Recent developments in India". The meeting held on 22nd November, 2012 at the Institute for Human Development, New Delhi was followed by a discussion which included comments and suggestions of the experts and participants.

The consultation meeting was chaired by Prof. S R Hashim, President, India Water Partnership who was accompanied by Dr. Akhilesh Gupta, Adviser & Head, Climate Change Programme, Department of Science & Technology, Government of India and Dr. A D Mohile, Chairman, International Commission for Irrigation and Drainage & Central Water Commission as the main panelists. The key presentation was delivered by Dr. Santosh Kumar, National Institute of Disaster Management.

Dr. Veena Khanduri, Executive Secretary, India Water Partnership in her welcome note thanked the experts and participants who had sent in their comments and suggestion for finalization of the research paper which was to be submitted to the Asia Pacific Adaptation Network (APAN). While providing the background to the consultation Dr. Khanduri noted that the United Nations Environment Programme (UNEP), in partnership with key UN and other international organizations facilitated the formation of Global Adaptation Network (GAN), in response to the recognition of the need for relevant and usable knowledge as a prerequisite for successful climate change adaptation efforts. The APAN was launched in 2009 as the first regional network under GAN. The Network aims at building capacity, facilitating policy, planning, access to finances and actions, and knowledge dissemination in climate change adaptation.

IWP along with the other Country Water Partnerships is working with APAN on climate change adaptation issues since 2011, Dr. Khanduri stated. Under Phase-I of the assignment, IWP identified the national implementing partners and major issues and challenges faced by India in a consultation on "Water, Agriculture and Climate Change" organized on 9th February, 2012 at Institute for Human Development, New Delhi. The consultation was attended by Government of India officials (Planning Commission, ICAR, National Rainfed Area Authority, Central Water Commission, National Institute of Disaster Management), research institutions, lead Universities of Delhi and prominent Delhi based partner NGOs of IWP.

Under Phase-II of the APAN assignment, a research paper on "Climate change adaptation in water management for food security: Recent developments in India" has been prepared and is being discussed. Dr. Khanduri noted that the research paper has been prepared based on the following issues:

- a) Identify and review recent policy developments in relation to Climate Change Adaptation (CCA) in India, with special reference to water sector including an examination of the CCA policy already developed.
 - b) Major Issues in relation to CCA in India with reference to water sector based on Issue paper already developed and in discussion with the main institutions identify priority issues, classifying them based on National Action Plan for Climate Change and National Water Mission viz:
 - Ability to meet food production demands.
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- Ensuring adequate water availability for agriculture.
 - Mitigation of food scarcity related socio-economic impacts.
 - Increasing awareness and mobilizing communities for CCA.
- c) Examine scientific/technological innovation in relation to aspects such as forecasting, decision support systems, information sharing and dissemination, infrastructure design techniques/options, water saving technologies, cropping regimes etc.
 - d) Community empowerment and awareness creation on CCA with special reference to vulnerable groups such as rain fed farmers, Institutional arrangements for local level coordination, poverty and resilience/ risk management - especially use of local knowledge, recognition of role of community organizations and gender issues.
 - e) Addressing vulnerability, contingency plans and management challenges.
 - f) Internalizing CCA as an integral component in the development agenda of water institutions.
 - g) Importance of capacity building on CCA of water sector institutions.
 - h) Economics of adaption
 - i) What are the gaps and constraints?
 - j) References/citations

The important focus is on what is being done in India and what needs to be further done? Since the scope of the study is very vast, it was decided to keep the research paper very focused, Dr. Khanduri stated.

Dr. S R Hashim in his introductory remarks added that the Regional Hub (RH) of APAN functions as a knowledge centre and provides technical assistance for adaptation. It assists and collaborates with its sub-regional Nodes (SRN) and thematic nodes to implement the APAN activities. There are SRNs in Pacific and Central, North-east, South-east and South Asia. The three thematic nodes represent Agriculture, Mountain and Water. In 2011, GWP South Asia was selected as the APAN's Thematic Node for Water in South Asia and India Water Partnership (IWP) is one of the Country Water Partnership under GWP-South Asia.

Presentation by Dr. Santosh Kumar

Dr. Santosh Kumar in his presentation outlined the scope of the research paper. According to him it helped identify and review recent policy developments in relation to climate change adaptation in India, with special reference to water sector including an examination of the climate change adaptation policy already developed. The major Issues in relation to climate change adaptation in India with reference to water sector were – (a) Ability to meet food production demands (b) Ensuring adequate water availability for agriculture (c) Mitigation of food scarcity related socio-economic impacts and (d) Increasing awareness and communities for climate change adaptation.

There was also the need to examine scientific/technological innovation in relation to aspects such as forecasting, decision support systems, information sharing and dissemination, infrastructure design techniques/options and water saving technologies. He noted that community empowerment and awareness creation on climate change adaptation with special reference to vulnerable groups for poverty and resilience/risk management also needed to be reviewed. The paper also sought to addressing issues like vulnerability, contingency plans and management challenges.

Dr. Santosh Kumar noted that internalizing climate change adaptation was an integral component in the development agenda of water institutions. He highlighted the importance of capacity building on climate change adaptation in the water sector.

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The methodology adopted for the research study comprised of secondary review and the time involved was two months. The key point that needed to be discussed was “what is being done in India and what needs to be further done?” he noted.

Dr. Santosh Kumar noted that agriculture is still the backbone of the Indian economy. Nearly fifty five percent of the population survives on climate sensitive agriculture with 70 per cent dependence for livelihood. Agriculture sector is the key driving force for gas emission and land use effects cause climate change. It is a significant user of land and fossil fuel particularly in activities like rice production and livestock raising. The use of fossil fuel, land use and agriculture are the key source of climate change. This has serious implications in India on its water supply, food production, livelihood and biodiversity.

Dr. Kumar noted that India’s food demand would be 276 million tonnes by 2021 against current production of 230 million tonnes. Out of 329 million hectares of geographical area, 174 million hectares or 53 per cent is suffering from serious degradation. 144 million hectares are degraded through ravines, salinity, wind erosion, waterlogging, flooding etc. Another 30 million hectare is getting degraded due to haphazard grazing. It is also estimated that there will be reduction of wheat production in future by 4-5 million tonnes due to increase in temperature by 1 degree. Foodgrain production have gone up from 56 million tonnes in 1967 to 240 million tonnes in 2007-8 but declined to 210 million tonnes in 2011 raising concern for food security.

As regards water, Dr. Kumar stated that the per capita availability of water has fallen by 70 per cent since 1950. Water supply per capita in 2002 was 1902 cubic meters and is now expected to decline to 1401 cubic meter by 2025. The average per capita availability of water estimated to be 1600 cubic meters per year is expected to decline by 1000 cubic meters by 2050 as per current population projections.

India is a low water efficient country which gets 1197 mm rains every year i.e. 4000 billion cubic meters. However, 3000 billion cubic meters are lost as runoff and only 1000 billion cubic meters is available. India has 200 cubic meters storage capacity per capita. There is increased demand of water due to increasing population, urbanization, industrialization, economic growth, insufficient water use, high pollution, heavy use of groundwater leading to depletion. Apart from that there is glacier retreat in Himalayas. There is continuous depletion of groundwater. Water quality is affected by industrial waste, agrochemicals, erosion, soil degradation, domestic pollution and wetland degradation. Agriculture sector continues to demand more water. Droughts and floods are aggravating the supply of water. There is water crisis and conflict within the states and communities and industrial sector for water share. Regional conflict for share in Brahmaputra, Indus and Ganga river basin are worsening the situation. There is weak enforcement of legislation and public policy leading to further conflict of water rights.

The major areas that are going to be affected by climate change are I) water, II) food III) industry, society and settlement IV) health V) spices and natural resources. Climate Change Adaptation and Disaster Risk Reduction needs to be implemented through the policies of other sectors, in particular, those of agriculture, water resources, health, land use, environment, finance and planning.

Climate change will affect disaster risks in two ways: i) through the likely increase in weather and climate hazards and ii) through increases in the vulnerability of communities to natural hazards, particularly through ecosystem degradation, reductions in water and food availability, and changes in livelihoods.

In India, the combined pressure of urbanization, economic development and industrialization would only be intensified by the risk of climate change. Adaptation and mitigation should be considered jointly since climate proofing and vulnerability reduction goes hand in hand to reduce vulnerability to natural disasters. Climate change is one of the main driving forces of change for water resources management, together with demographic, economic, environmental, social and technological forces.

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If solutions are created in isolation major challenges that these driving forces create may become self-defeating.

On government policy and programmes, Dr. Kumar stated that there is a need to examine the relevant national policies. He began with an account of the National Water Policy, 2012 and 1987. The policy envisages strategies covering groundwater development, water allocation priorities, drinking water, irrigation, water quality, water zoning, water conservation, flood control and management. The NWP of 2002 of India has taken into account the problems faced by drought (and flood) prone areas and has set concerned parameters (section 1.5). The section on Water Resource Planning (section 3.1 and 3.2) has emphasized on non-conventional methods for utilization of water such as through inter-basin transfers, artificial recharge of ground water and desalination of brackish or sea water as well as traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting. NWP sheds light on reforestation and prioritizing water resource management. The new proposed version of National Water Policy 2012 tries to recall water as an ecosystem service; however, neither provides adequate linkage with other environmental and natural resources policies nor with the disaster management policy. Emphasis of the NWP on watershed based practices is of direct relevance to this topic besides other means of water conservation and management for drought risk mitigation and drought proofing. The traditional water resource management systems should be revitalized which would need manpower provided by the affected population who would in turn find employment. The rural employment schemes can be converged with this aspect to improve the livelihood of thousands.

Dr. Kumar then discussed the sustainable agriculture and rural development policy. The Agricultural Development Strategy of 1999 focused on sustainable agriculture and rural development (SARD). The strategy is essentially based on the policy on food security and alleviation of hunger. Soil and water conservation programmes have been launched in response to the need for conservation and rehabilitation of degraded land. There is need for prevention of soil loss from the catchments and promotion of multi-disciplinary integrated approach to catchment treatment. Dr. Kumar also underlined the need for improvement of land capability and moisture regime in the watersheds and promotion of land use to match land capability. The Integrated Wastelands Development Project (IWDP) has been started by initiating area-specific projects taking into account land capabilities, site condition and local needs, and ultimately aims to promote optimal land use for both ecological and socio-economic needs.

Early warning of drought is an important requirement for tackling its adverse impacts. Currently the prediction or early warning of drought is carried out mainly based on following rainfall predictions: (i) Long range rainfall prediction of seasonal total rainfall by IMD using parametric and power regression models and dynamic stochastic transfer models; (ii) Medium range rainfall prediction by National Centre for Medium Range Weather Forecasting; (iii) Short range rainfall predictions by IMD based on Indian National Satellite (INSAT) data supported with weather and agro-met observations.

The Desert Development Programme (DDP) covers both the hot desert regions of Gujarat, Rajasthan, and Haryana and the cold desert areas in Jammu & Kashmir, and Himachal Pradesh. It is functional in 131 blocks of 21 districts in 5 States covering an area of about 0.362 million sqkm and a population of 15 million. The Drought Prone Area Programme (DPAP) was launched in 1973 in arid and semi-arid areas with poor natural resource endowments. The objective is to promote more productive dryland agriculture by better soil and moisture conservation, more scientific use of water resources, afforestation and livestock development. Some other programmes include - Food for Work Programme (FWP), National Rural Employment Programme (NREP), Rural Landless Employment Guarantee Programme (RLEGP), Integrated Rural Development Programme (IRDP), Accelerated Rural Water Supply Programme (ARWSP), Indira Awaas Yojana (IAY), Jawahar Rozgar Yojana (JRY), Employment Assurance Scheme (EAS) - to assure hundred days of employment during lean agricultural season in drought prone, tribal and hilly areas .

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There is a need for improvement in agriculture through modifying cropping patterns and introducing drought-resistant varieties of crops. Management of range land with improvement of grazing lands, improved grazing patterns, introduction of feed and protection of shrubs and trees needs to be looked into. Dr. Kumar also noted that there was a need for development of water resource system with improved irrigation, development of improved storage facilities, protection of surface water from evaporation, and introduction of drip irrigation system. Animal husbandry activities could also help in mitigation with the use of improved and scientific methods, increasing outputs without destroying the eco-system.

The outcomes of climate change were highlighted by Dr. Kumar and he stressed the need for greater integration in research, specific programmes and better infrastructure. He also discussed the areas where status quo continues like in unemployment, lack of early warning systems, high migration, high dropout rates in school and high incidence of droughts.

Dr. Kumar noted that there is a national as well as international consensus that the impetus on hydropower and bio-fuel generation might have adverse affects on freshwater ecosystems which might decrease the ecosystem resilience of the affected regions to climate change.

On climate change and food security in India, Dr Kumar cited a study by the Indian Agriculture Research Institute (IARI) which stated that the impact of climate change with increased temperature and decreased radiation will lead to decreased productivity in rice in the North Eastern region. Sometimes sudden events like the floods in Thar Desert in 2006 or relatively slow events like the incursion of sea water into inland Orissa over the last two decades has caused stress in regional food production. There is a knowledge gap in the existing technology. There is a major mismatch between water supply and water demand for agriculture in India.

Some of the persisting problems are (a) poor land availability due to very high pressure on land; (b) very little additional land that can be brought under irrigation; (c) high degree of land fragmentation; (d) poor public investments in rural infrastructure including irrigation and electricity; (e) ecological constraints due to floods; and (f) overall lack of institutional and policy reforms in agriculture sector.

Monsoon delays and failures inevitably lead to a reduction in agricultural output, thereby deepening food insecurity. The Steering Committee report on agriculture for the Eleventh Plan (GoI, 2007a) identified the possible reasons for deceleration in agriculture since the mid-1990s as deceleration in public and private investment in agriculture and rural infrastructure including irrigation, technological change, diversification of agriculture, and fertilizers.

Dr. Kumar talked about the key components of capacity development for adaptation. On access to markets and food security he said that there was a need to improve access to international food markets. The country will benefit not only in the natural resources sector but the national food security situation too can be enhanced. There is a scope for improvement in the acquiring processes like in electronic tendering, bidding, advanced credit and hedging products, according to Dr. Kumar. Another necessity is a well managed food reserve to dole the country out of emergency situations. An international coordinated global food reserve could reduce pressures to achieve grain self-sufficiency.

An ideal climate smart agricultural landscape of the future would enable farmers to use new technologies and techniques to maximise yields and allow land management to protect natural systems with natural habitats integrated into agriculturally productive landscapes, Dr. Kumar noted.

He also shared the case study of Indo Gangetic Basin in which disaster management strategies have been suggested in river basin management. The need to use micro-irrigation as a means to save water in irrigated agriculture was stressed. The need for coordination among federal and provincial governments, research institutes, and national and international organizations was highlighted. The strong linkages between climate change, disaster and development were also discussed. The 700

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million rural population that depends upon agriculture for subsistence and livelihoods is a serious concern for India. We need to focus on climate sensitive sectors like agriculture, forestry and fishing.

It is an important finding that water scarcity is not just a matter of the amount of rainfall but the policy and practices of holding the water where and when it falls. With less than 100 hours of rainfall in a year in the country, the key challenge is to store, reduce the distribution leakages of this precious water for the dry season ahead. Individuals and communities have steadily given over their role almost completely to the state even though more than 150 years ago no government anywhere in the world provided water. We need to take a policy shift to bring change from dependent syndrome to empowerment approach.

At present 68.35 per cent of the land of India is a wasteland of which 50 per cent is non forest land and there is a possibility of conversion to fertility. There is a need for a policy to ensure water entitlement along with the food entitlement. Enforcement of groundwater users law needs to be done in the changing environment scenario. Drought and flood management programme need to be interlinked. There needs to be more focus on small details like bridge between crops, enhancing livestock productivity, exploiting the manure and irrigation potential of treated wastewater and sustaining growth in fisheries.

Dr. Kumar also talked about the need to have more gender sensitive interventions with specific gender budgeting approach for addressing the vulnerabilities.

Discussion

Dr. Akhilesh Gupta noted that for climate change adaptation the socio-economic part needs to be an imperative. Of the eight missions, four are on adaptation and that only goes to show how important adaptation is in a country like India. The crux of the national action plan is that India cannot afford to compromise on development and that economic growth needs to continue. At the same time we need to address the sustainability issue and the core country issues. We need to achieve higher human development index and all these things will be possible only through mainstreaming climate change with development process.

Climate change itself is an issue. We do not have to work on climate change in isolation. In the Xth plan, money allocated for climate change adaptation was 2.4 per cent while it is 4 per cent in the XIIth plan. This money is not directly visible. In climate change mission the allocation of money is not much. Adaptation itself is given very high priority in five areas – agriculture, water, health, environment and disaster management. All of them are important but agriculture and water are very important and linked. One per cent of GDP in India is lost every year owing to natural calamities. This is a huge amount for a country like India. This is a complex area and covers a huge range of issues not just financial/ organizational/ socio-economic issues but goes deeper into our practices and traditions. That makes it more complex and challenging. One adaptation practice applicable at a place cannot be adapted to the other.

Food security issue too is linked to so many things. We have increased our food production from 50 mt in 1950's to 240 mt at present. In the last six years there has been either stagnation or huge fluctuation year by year. Are we in a stage where we can say that production is linked to monsoons? Are we too dependent on monsoons? We found that to a large extent the country has been successful in becoming monsoon resilient. There are pockets in the country which will continue to have dependence on monsoons in the absence of other sources of freshwater.

We need to have proper crop management systems. Efforts are being made under the National Mission for Sustainable Agriculture wherein a lot of wheat and rice varieties are being developed. This may help in meeting the food production target.

The chance of extreme weather event is very high in states like Orissa, Chhattisgarh, Jharkhand, Bihar etc. Today early warning systems are there only for floods, droughts and cyclones. The plan is

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to introduce this for the entire range of disasters from next year onwards. There are a lot of losses due to landslides, cloudbursts, thunderstorms etc.

Water management is another important concern. How is the rise in population going to impact the per capita availability of water? Whether there is climate change or not, precipitation itself will be the major concern. Climate change is definitely going to affect the per capita availability of food. The per capita availability of food in India is 550 gm/ day as against 980 gm/ day for China and 2850 gm/day for the US. We consume very less. The Human Development Index for India is 0.62 whereas that for the US is 1. We need to take a call on this and this is a very important area.

Agriculture and water are critical areas. All four national missions have water and agriculture somewhere.

Government is fully aware of the fact that an issue like adaptation cannot be handled by it alone. There are five million NGOs in the country and without their help and support adaptation is not possible.

Dr. Mohile in his remarks stated that there is a very large scope particularly in eastern India for bringing in more land under irrigation. He said that the water sector in India faces many challenges. Most of them are drivers for change in the way we manage our water. The growing population, economic development and urbanization are three factors which are fast changing the qualitative and quantitative demand for water. Climate change is important but perhaps not as important as in developed countries where the abovementioned three factors are not as important and climate change takes the first place.

Now there is no doubt unlike 15 years back that global temperatures are rising; this is an accepted fact by all in the scientific community also. Even now the effect of climate change and other factors on hydrology and agriculture is a little nebulous.

We talk a lot about mitigation and adaptation but the link between the two is very thin. Adaptation or mitigation at the lowest level of the user is automatically being done. Our farmers are not fools – they know how to change crops. This has been taking place in other contexts if not due to climate change. In wheat dominated areas, temperature change may lead people to shift to rice or other kharif crops. This may lessen the blow of climate change.

Extreme events are a more serious concern and engineering & agriculture management strategies need to be changed. Our focus could be on these issues. Storage is a key issue. Importance of buffer stock will increase because of variations from year to year. One can get over a bad year if there buffer stock is available.

Dr. Mohile stressed the need for carry over storages which carry over water from one year to the next like Bhakra/ Aswan dam. Carry over storages are nothing but buffers of grain.

Our main focus in the context of climate change should be on income redistribution/ poverty alleviation in the face of climate change. Water transfer as mentioned in the national water policy is one such mechanism. It is a way through which income distribution takes place. In drier areas population density seems to be more than the capacity to sustain the population. In poor areas, this would alleviate poverty and give improved incomes.

In the field of water management we were near about at the top till the early 1970s but lagged behind due to the IT revolution. Large use of GIS/ IT and real time management may be the key.

Dr. Mohile suggested that we should be very cautious about that we cannot depend on international market for food security. Food security very dear to us and we do not have a critical commodity like oil to ensure that people give us foodgrains.

On legal and institutional issues there is a need for bold decision making by the government; this is lacking because of weak governmental processes.

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To conclude, water sector challenges are many. Climate change is one such challenge. The crux of solving these challenges including of the waters sector is to recognize the large linkages and interdisciplinary studies, improved technologies, continuous research, continuous policy modification.

Mr. R K Khanna, Central Water Commission stated that the National Water Policy is a good document but is advisory in nature. It is not backed by an act. The difference between MoWR and MoEF is that the latter is backed by acts and laws, while the MoWR is not. The NWP has been modified several times but still remains advisory in nature. The water resources bureaucracy takes the EIA notifications more seriously than the NWP. There is a lack of an institutional mechanism and coordination between Ministries/ Departments is absent. There is a need for an empowered mechanism backed by a law, Mr. Khanna stated. He gave the example of the Water Quality Assessment Authority that was constituted by the Government of India with the Secretary (Environment) as Chairperson and the MoWR as Secretariat. The idea was to improve coordination between the Ministries. This did not happen and both Ministries keep passing the buck to each other. Meetings are not held on time. The water sector is suffering because of lack of implementation and poor coordination. NGO involvement should be encouraged by the Government in a sincere manner.

Dr. Arun Sahdeo, National Institute of Disaster Management made a couple of points from the administrative, implementation and planning point of view. He said that food security cannot be considered in isolation of food production. Thirty to forty per cent of food is lost in the food chain in our country and that can be made available. On developmental paradigm, he said that we are moving from an agrarian based to manufacturing/ industrial development. Food security is important and not just food production in the market. Large number of people do not have access to food while we have food available in markets.

Climate change leads to internal refugees (displacement) of people. This may create social strife/ tension. In such scenario how food/ water/ internal displacement can be linked? Studies can be done on these aspects.

Again, care should be taken to understand the water usage under the two different sets of farming – subsistence and commercial. Companies like Reliance are acquiring a lot of land nowadays; their water usage is entirely different than that of subsistence farmers. This will change the entire agricultural scenario as well as the usage of water in the agricultural sector, according to Dr. Sahdeo.

Ms. Suruchi Bhadwal, The Energy Research Institute (TERI) stated that a lot can be done on the demand side and not merely the supply side. In the case of adaptation, small scale pick pocketed projects cannot be effective and there is a need for large projects. Scalability will be an issue. There is a need to mainstream climate change adaptation into policy processes. At least in areas where some kind of technology can be implemented, scaling up should be done. More research is needed to identify which type of technologies/ projects will benefit whom.

There is an excellent array of policies/ programmes in our country. There is a need to study them and develop new ones. On usability of water resources, she said that field studies by TERI in West Bengal and Maharashtra indicate that there is a need for development of water grids analogous to inter basin transfers within the same state. In the agriculture sector, while drip irrigation is picking up, most parts of the country still use flood irrigation. The level of uptake of technology is quite low. There is a large scope that the government can incentivize such programmes.

In the national action plan on climate change, mitigation sectors are well defined/ well structured but that is not the case with the adaptation sectors. According to Ms. Bhadwal, mitigation is easier than adaptation.

Question of food availability is fairly complex, she noted. Projections of IARI and IFPRI suggest that enough food will not be available to the masses. There will be greater import dependency, food

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pricing will become an issue and poverty will increase. This will create a gap between those who have and those who do not have food. Role of women and its implications need to be understood as they play a major role in agricultural activities, according to Ms. Bhadwal.

Dr. Sanjoy Bandopadhyaya, Indian Agricultural Research Institute said that there is no linkage of crop system/ soil system with water and agriculture management. There is a need to focus on early warning system for drought. The India Meteorological Department (IMD) has to be plugged into the system very tightly. We have to go agro-climatic/ agro-eco zone wise. What are the adaptive technologies available? What is the adoption rate? The amalgamation is not understood. People do not understand adaptive technologies well.

The entire water distribution network beyond the distributary level has collapsed in our canal systems, according to Dr. Bandopadhyaya. The losses from the distributary to farmers field is very high and stands at about 60-70 per cent. There is a need to put water efficient technologies to push water to the tail end of the canal systems.

Mrs. Kalpakkam Yechuri of All India Women Congress said that women face the brunt of disasters as men go out in search of livelihoods. An integrated gender sensitive approach is needed consequently.

Dr. K J Ananda Kumar, National Institute of Disaster Management suggested that the problem is basically of implementation. Climate change is one of the problems; let us solve other problems. There is a lack of coordination between Ministries and policies are not implemented. Research is not of use to farmers.

He pointed to the issue of regional disparities. Groundwater development in states like Bihar, Orissa and Assam is just fifteen per cent whereas the national average is 70 per cent. Poverty is linked to groundwater development as poor states have low groundwater stage. Punjab and Haryana that are wealthier states have higher groundwater development (often over-exploited). Why do we not come up with policies to address these issues?

He also said that interlinking of rivers is already there and there should be inter basin transfers within states. The efficiency of irrigation is going down, 30-40 per cent in surface water and 80 per cent in ground water. There is a need to work on that.

Dr. Abha Mishra, United Nations Development Programme stated that the issue of excess water is often overlooked. In Orissa, in particular there are lots of areas that are waterlogged for 4-5 months in a year and the peak agricultural period is lost because of that. Adaptation could also be a process of risk management or risk transfer; there are agricultural insurance policies that could help farmers. While looking at agriculture, we need to look at diversification of livelihoods for food security. ICAR is developing mixed farming practices and farmers need to be made aware of these. Food security is vital not just for humans but for livestock also. Dr. Mishra said that while developing adaptation approaches micro-analysis is required as within the same district there could be two problems – droughts and waterlogging.

Dr. Joseph Viruthiyel, Institute for Development Initiatives said that there is need to build climate resilient communities. He also suggested the need for incorporating good governance practices as cases in the research paper.

Dr. Veena Khanduri said that though we have captured many programmes, what we need to focus now is on where we are going to take up the lead. This is just a review of work done in our country on policy level and some implementation works. We came up with the insight that there is a lack of inter-sectoral linkage. She sought suggestions on how could adaptation work be taken up in a long term manner not just for project based implementation. Capacity building of community is required so that they can take this up in the long run. We also need to do micro-analysis at district level as

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suggested by Abha Mishra. We also need to see as to what kind of components can be taken up at the implementation level.

Prof. S R Hashim noted that water use efficiency is vital when dealing with the topic of climate change, food security needs, water availability and needs of urbanization. In water use efficiency, there is technology and management related issues. The type of crops you grow is very important. Whether you grow more of maize/ rice will make a lot of difference. In a water scarce situation, we can think of alternative food habits and crop composition. These are not things that cannot change. Groundnut came to India in 1935. Today large parts of the country depend on groundnut.

He also stressed on the need for a national perspective in light of the fact that states do not like to share water/ data on water with others. Also, food security cannot depend on external source as this can be used for arm twisting as had happened in the 1960s, he said. Also countries may not have the kind of foodgrain that is required at times; for example 5 million tons of foodgrains may not be available with any single country on a continuous basis. So, available prices may shoot up. In case of food security there can be a network with neighbouring countries, Dr. Hashim said.

Malnutrition and food insecurity can be caused by lack of awareness. Prevention of diseases and sanitary health problems are therefore important.

Dr. Khanduri extended the vote of thanks to the participants.

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