

Ministry of Water Resources (MoWR) and
National Institute of Rural Development and Panchayati Raj (NIRD&PR)

**Workshop on
Impact of Climate Change on Water Resources
(May 21-22 ,2015)**

Proceedings

The Centre for water and Land Resources (CWLR) ,NIRD&PR has organized the workshop on "Impact of Climate Change on Water Resources " during May 21-22, 2015. This workshop was sponsored by Ministry of Water Resources. The following are the objectives of the workshop.

Objectives:

1. To discuss factors responsible for impact of climate change on water resources in the country and mitigating measures.
2. To support the development of national-level Policies on adaptation to climate change.
3. To analyse the training needs of the functionaries of water resource departments/various stakeholder in twin to climate change imperatives.

Considering the importance of water resources. The many issues and actions were discussed for two days deliberation in climate-resistant water management policies at local administrative levels. The workshop was organised on the following broad themes.

Technical Session – I : Climate change and water resources

Technical session – II : Climate change and its impact on agriculture

Technical Session - III : Planning for future response to water resources and climate Change

Technical Session – IV : Group Discussions

naugural session

The background paper of the workshop was presented by Dr. SIDDAYYA. In my presentation I had presented concern and cause for climate change and its impact on Water Resource. Three prominent visible signals of climate change are: (i) increase in global average temperature, (ii) change in regional precipitation patterns, and (iii) rise in sea levels. The three prominent signals of climate change convert into signals of regional scale hydrologic change in terms of modifications in water availability, changes in agricultural water demand, hydrologic extremes of floods and droughts, changes in water quality, salinity intrusion in coastal aquifers, modification in groundwater recharge, and other related phenomena. Dr Amit Gupta, in his presentation shared the salient features of National Water Mission (NWM) and emphasized the need for gearing up of all concerned functionaries for a coordinated effort to meet the objectives of NWM.

Session-I: Climate change and water resources: Chaired by Prof. K. Srinivasa Raju, BITS, Hyd

First topic was described experiences on extreme events such as droughts, earthquakes, Tsunami etc. There are five perspectives regarding climate change, namely, is climate change myth, something and new unexpected, is it sparse, major threat to human survival, adaptation way forward. It was explained all these aspects in a systematic way. It was described/discussed the earth's climate history, impact of mean global temperature, history of droughts, Biome Jigsaw chart, climate change vulnerability index, impact of sea level change and change in annual water availability and concluded with examples.

In next topic was discussed the impact of climate change on surface water bodies including rivers, dams; rainfall, reduced inflows into reservoirs, hydrological cycle. It was also suggested the necessity of alternative cropping, conjunctive use of water resources, intermittent irrigation, deforestation and afforestation in the context of climate change. It was stressed the necessity of participatory irrigation management, water budget aspects for sustainable water resources planning.

Issues

- Uncertain reservoir inflows due to change in hydrological cycle

- Timing of stream flow in rivers.
- Depleting ground water due to erratic monsoon.
- The quality of water supply in island and coastal regions is at risk from rising sea level and changes in precipitation.
- Increase in temperature has a direct impact on the runoff in snow fed rivers and on the evaporative demands of crop.
- Lack of weather stations at farm level for contingency planning.
- Contamination of water supply by over overflowing sewere systems, runoff of pollutants etc

Options and recommendations:

- Reservoir operation schedules should be modified suitably based on reservoir inflows.
- Effective measurement of reservoir water levels.
- Instrumentation under HPD.
- Automisation and modernization of canal system.
- Catchment protection
- Enforcement of WALTA.
- Implementation of PIM.
- Integrated water resource management
- Dispute resolution.
- Basin level management strategies; enhanced storage; rain water harvesting; equitable and efficient management structures; and optimizing efficiency of existing irrigation systems.
- Desalinization of coastal cities.
- Development of alternative cropping system with less consumptive use of water, larger sowing window etc.
- Accessibility of local weather data to farmers for better resource management.
- Recycling of wastewater to meet a large part of water needs in urban areas.
- Community awareness programme on water management strategies in relation to climate change and mitigation .

Session-II: Climate change and its impact on agriculture:

Chair : Dr. M. V. S. S. Giridhar (Head, CWR, IST, JNTUH)

All four session were covered the climate change and its impact on agriculture covering Climate change effect and its impact on agricultural productivity, Climate change and its effect on irrigation performance and Climate change effect on intensity and distribution of hydrological components across different landscapes.

Issues:

- To identify critical demand for irrigation for cereal crops, which has potential impact on productivity which effects long term food security?
- Equal distribution of time and space(Equitable), real time data is not available
- Change in cropping pattern due to change in water availability.
- Uniformity in utilization of water through water use efficiency (WUE) for crops which absorb or require less water for their growth.
- Use of water based on hand holdings through participatory approach to avoid over exploitation.

Options

- Water harvest structures awareness status in demand and supply side
- Sprinklers encouraging water conservation and water transfer
- Local metrological observations or canal discharge measurement devices.
- A crop which requires less water will be preferred over more water requirement.
- WUE at critical plant growth. KVK should create awareness among farmers and resource allocation according to need

Recommendations

- Date of sowing should be altered according to water availability i.e. selection of variety. Mixed cropping to catch the minimum income
- Sensor should be provided to measure RH, Maximum, Minimum water level, Soil moisture. This can be achieved through GIS & remote sensing modeling. This should be as a part of National water policy which can help stake holders of water resource.
- Adopt cropping pattern which suits according to water availability. Example: Red gram to maize.
- To mandate KVK to adopt a schedule critical irrigation periods of major crops (Cereals)
- The resource allocation among participatory group should monitored & monitored through local governance/ elected body members i.e. transparency participation

Session-III: Planning for future response to water resources and climate change:

Chair : Dr N H Rao, NAARM, Hyd.

Management of Water Resources for combating Climate Change: Climate change is a serious risk to poverty reduction and threatens to undo decades of development efforts. The study believes that, 'Community Centred Governance' is the key to address the climate change and livelihood issues of poor and vulnerable people.

Climate Change Score Card (CCSC) is an adaptation of the Community Score Cards (CSC), a well-known social accountability tool (Sekhar and Nair 2008c, NRHM 2000). CSC consolidates people's opinion and facilitates an informed dialogue between communities and the local governance structures. Conventionally, a CSC aims to bridge the dialogue between two main actors: the people and the state. In the case of climate change there are not two, but three important dimensions: the people, the state and the environment. To account for this, systematic integration of information on local governance and local climate science and livelihoods will be made in the CCSC. The CCSC will support communities to prioritize issues and provide a platform for dialogue with relevant decision makers.

The semiarid regions are characterized by frequent droughts, low and erratic distribution of precipitation with high coefficient of variability, and climate change. In these areas, groundwater irrigation is a lifeline especially for the households where there is no assured source of surface irrigation. Since, surface irrigation has not been able to meet the increased demand; groundwater development witnessed a remarkable boom especially after green revolution. Of late, groundwater resource has been progressively depleted causing economic scarcity and chaos. As a result, the deepening/drilling of deeper wells is unabated with high energy use intensity to pump groundwater from deeper wells. In the process, farmers have been incurring huge investments on deep bore-wells with exponential rise in the cost of well drilling and maintenance beyond the reach of small farmers. About 70% of the world irrigated area is concentrated in South Asia and India is one of the largest pumpers of groundwater for irrigation (twice that of the USA and six times that of the EU). Over the past 5 decades, the groundwater based irrigation exploded exponentially leading to alarming decline in groundwater level. As a result, one of the consequences has been increased demand for energy required to extract the water from deeper wells. In addition, scarcity of the groundwater pushes farmers towards drip/sprinkler irrigation, which also requires electricity thus contributing to the growing energy demand. This has led to insecurity in water-energy-agriculture-livelihood linkage with climate change. Water scarcity is going to become a widespread in India in future due to increasing demand for water from different sectors apart from growing population, urbanization and economic development (agri, industry, power, domestic, dairy). Further, due to continuous mining of groundwater for different uses and users without adequate recharge efforts has led to enormous water stress and this has affected the sustainability of water supplies significantly.

Climate change will increase the variability of already highly variable rainfall patterns, requiring greater investments in managing both scarcity and floods. Thus the key challenges to be addressed inter alia include how to sustain food security and improve income of the farmers without further depleting groundwater resource with climate change? How the water and energy savings can be achieved through technologies, markets, institutions and governance? Where are the potential areas for improvement? Whether through technological, institutional or policy change?

In order to address the scarcity of groundwater in the wake of climate change some of the viable options such as water transfer between basins, micro irrigation methods, altered agronomy of crops need to be evaluated, In addition, efficient use of ground water resources will need to be incentivized. Further, improvements in irrigation systems, water harvesting techniques, and more-efficient agricultural water management approaches can offset some of the risks. Climate change would significantly affect the temporal and spatial availability of water resources. In this regard, the energy sector has also been

projected to face the impacts of climate change in both its production and consumption capacities. Thus the policies being made in water and energy sectors should address the concerns of each other in an integrated way.

The key environmental challenges in India have been sharper in the past two decades. Climate change is impacting the natural ecosystems and is expected to have substantial adverse effects in India, mainly on agriculture on which 58 per cent of the population still depends for livelihood, water storage in the Himalayan glaciers which are the source of major rivers and groundwater recharge, sea-level rise, and threats to a long coastline and habitations. Climate change will also cause increased frequency of extreme events such as floods, and droughts. These in turn will impact India's food security problems and water security.

To combat the adverse effects of climate change on agriculture, the developed technologies like real-time irrigation scheduling in addition to rainwater harvesting, groundwater recharge pits, farm ponds, shade nets cultivation, green houses cultivation, low tunnel green houses, mulching, drip with fertigation, use of electronic devices like Kisan raja to cell phone operation of motors, use of solar pumping systems, Modern skimming wells technology for coastal regions and crop diversification are promising and identified climate resilient measures to assure food and nutritional security.

Issue and Solutions

Issue: Evapotranspiration increase due to climate change.

Solution: Use Shade nets cultivation / Greenhouses for taking up low to medium height crops.

Issue : High Intensity rainfalls are being received

Solution : Catch it where it falls through, farm ponds, staggered/continuous trenching, mulching. To avoid breaching of natural open channels like drainage channels, redesign them/ increase their dimensions. Treat the catchment areas to avoid soil erosion and siltation of the downstream water bodies, like tanks, reservoirs, canals etc.

Issue: Spatial uncertainty in rainfall distribution

Solution : Basin to Basin linking is required.

Issue: High emission of green house gases

Solution: Increase Agro forestry and social forestry, in addition to shifting of rice cultivation method from transplanted rice to direct seeding of paddy.

Use of solar energy/Bio-energy etc. to reduce emissions.

Issue: Water and fertilizer use efficiency under changing climate.

Solution : Use Drip irrigation systems with Fertigation and mulching.

Issue: Poor Monitoring of water flows

Solution : Use ICT technologies like electronic sensors and remote sensing monitoring.

Issue: Monitoring of Climate Change is poor in India.

Solution : Establish Mini Weather stations with high spatial resolution.

Issue : Uncontrolled / Unregulated Construction / drilling of bore wells.

Solution : Form GWUA (Ground Water users association) and water pricing being crop water requirements.

Issue: Non-Point Source of Pollution into groundwater

Solution : Monitor through groundwater modeling studies and promote organic farming.

Recommendation to "Planning For Future Response To Water Resources And Climate Change".

- Capacity Building: The capacity building through trainings should be taken up for the following stake holders of water sector in India, Water Users Association members, Irrigation Engineers in I&CAD and Agricultural officers in Dept. of Agriculture

- Technology Transfer: TOT through enhanced extension services and more subsidies to farm ponds and shade nets cultivation should be taken up.
- Institution- Industry – Incumbent relationships should be established between State Agricultural Universities, Department of Agriculture and Irrigation and Drainage departments and the stake holders, i.e. farmers. Encourage use of electronic devices in agricultural water management and soil moisture, nutrient and disease stress of the plants. Water pricing should be done for the water consumption beyond crop water requirements.

Technical Session–IV

In these session all the delegates were made into three groups and requested them to highlight the major issues and concerns in their respective areas. They were further requested to identify the capacity building (CB) requirements against the issues mentioned, so that future training programmes can be built around these CB requirements. Accordingly, all the delegates have come out with their respective group reports and presented in the last technical session.

The programme concluded with a common point that, there is a need to have such common platforms in future so that the functionaries belonging to different departments of water, can come together and share their views , for Climate change and its impact on agriculture in the country.

Conclusion:

Altogether 35 officers from different National Institutes, Universities, Department of water resources, Department of Panchayati Raj and NGOs specially, those who are all involved in management of water in different use in the country. The participants were exposed to different issues and options such as Climate change effect on intensity and distribution of rainfall over the geographical areas, surface water bodies and adaptation, groundwater and adaptation, rivers, rivulets, dams and lakes etc., catchment area protection, water use efficiency of different irrigation systems, conservation, allocation distribution of water resources across region under climate change and participatory irrigation management and education of climate change effect to various stakeholders.

Keeping in view of the above issues, a National Workshop is proposed at NIRD&PR with the objectives namely, To discuss factors responsible for impact of climate change on water resources in the country and mitigating measures. To support the development of national-level Policies on adaptation to climate change. To analyse the training needs of the functionaries of water resource departments/various stakeholder in twin to climate change imperatives. Lastly, all the participants were divided into three groups to discuss the issues, options and also to give recommendation for future plan of action to combat the effect of climate change on water resources

Workshop Team: Dr.Siddayya, Dr.U.Hemantha Kumar, Dr.Ch.Radhika Rani and Dr.Prabhakar.