



Environment

Water Community



## Solution Exchange for the Water Community Consolidated Reply

*Query: Inputs for Water Mission of National Action Plan on Climate Change - Advice; Examples*

Compiled by [Nitya Jacob](#), Resource Person and [Sunetra Lala](#), Research Associate

Issue Date: 30 January 2009

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From [Himanshu Thakkar](#), South Asia Network on Dams, Rivers and People (SANDRP), New Delhi

Posted 29 December 2008

I work with South Asia Network on Dams, Rivers and People, Delhi, an NGO conducting independent research on these issues.

Climate change is a reality and we in India will face its impact soon, with the weaker sections bearing the brunt. To outline India's strategy to tackle climate change, the Prime Minister released the National Action Plan on Climate change (NAPCC) (please visit <http://pmindia.nic.in/Pg01-52.pdf>, PDF, Size: 18.1 MB to download the file). The Plan details eight Missions, one of which is the National Water Mission (NWM).

The nodal ministry for NWM is reportedly the Union Ministry for Water Resources. However, only a few initiatives are mentioned in the text relating to the Mission. On the policy front, it mentions the National Water Policy will be revisited in consultation with states to include basin level management strategies. It advocates "special efforts to increase storage capacity", which includes underground storage, but these need to be spelt out clearly and reflect a new approach, especially with regard to mega projects.

We feel the Mission has to take a proactive and radical look at policy, development and management options and approaches. It should reflect both successes and failures from 60 years of water resources management in India. The Mission has to take a cross-sector approach, for example, by mentioning linkages with the National Mission for Sustainable Agriculture or the National Mission for Sustaining the Himalayan Ecosystem.

So far, the drafting of the Plan has not been an open, consultative process, and a group of civil society organisations also stated this in a letter to the PM (<http://southasia.oneworld.net/todaysh headlines/india-unveils-action-plan-on-climate-change>). The consultations must include civil society and people at the grassroots, and the document must be made available in local languages. It is equally essential the comments from the public find place in the final Plan for a meaningful.

As this process has not been followed so far, we feel there is a complete lack of public inputs to the preparatory process of NAPCC and NWM. Given their magnitude, the preparatory process needs to be

more equitable, sustainable and democratic. For this, we request members of the Water Community to provide inputs on the following:

- What specific initiatives should be included in the NWM, considering the past water-related missions and the varying agro-ecological situations across India?
- What are the options and priorities to augment existing water infrastructure to reduce vulnerability to climate change?
- What should be a participatory process for formulation of NWM and NAPCC? Please also suggest which institutions should be part of the process.

Your inputs will help determine the actions that civil society and the government can take up in the context of water and climate change. We will also use the information in the publication, Dams Rivers and People, with due attribution.

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### Responses were received, with thanks, from

1. [S. A. Hirudia Raj](#), Andhra Pradesh Farmer Managed Groundwater Systems, Secunderabad
2. [Nitya Jacob](#), United Nations Children's Fund (UNICEF), New Delhi
3. [S. V. Vijaya Kumar](#), National Institute of Hydrology, Deltaic Regional Centre, Kakinada
4. [Jyotsna Bapat](#), The Energy Resources Institute, New Delhi
5. [Saugat Ganguly](#), Gamana, Hyderabad
6. [Virinder Sharma](#), DFID India, New Delhi
7. [Anupam K. Singh](#), Department of Civil Engineering, Nirma University (NU), Ahmedabad
8. [Puran Singh Yadav](#), Haryana Institute of Rural Development, Karnal
9. [Atul Rawat](#), DMV Business & Market Research Pvt. Ltd., Hyderabad
10. [Rajesh K. Sood](#), National Institute of Epidemiology, Chennai
11. [Swati Sharma](#), Saviours, Meerut
12. [Dinesh Kumar](#), Institute for Resource Analysis and Policy, Hyderabad
13. [Vishwanath Srikantaiah](#), BIOME, Bangalore
14. [V. D. Sharma](#), V. B. S. Purvanchal University, Jaunpur
15. [Pradeep Mohapatra](#), UDYAMA, Bhubaneswar
16. [B.C. Choudhury](#), Wildlife Institute of India, Dehradun
17. [Vijay L. Ghugey](#), Nisarg Vidnyan Mandal, Nagpur
18. [Uday Bhawalkar](#), Bhawalkar Vermitech Pvt. Ltd, Pune

*Further contributions are welcome!*

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### Summary of Responses

Members suggested a set of initiatives for the National Water Mission (NWM) envisaged under the National Action Plan for Climate Change (NAPCC) and recommended organizations for specific activities in response to the query. Local level initiatives for water modeling and management at the basin and sub-basin level, that mark a departure from the approach in earlier water policies, is one of the important activities members suggested for the National Water Mission (NWM). The restoration of existing local water management and storage structures can take precedence over creation of large new ones.

Communities can be part of the planning, executing and monitoring process for activities to mitigate the impact of climate change.

There is a **need for region-specific initiatives** based on the agro-climatic conditions to govern water use by different sectors in line with water availability and seasonal variations. Further, a basin-level approach to water management is more desirable than a territorial one, but will require closer and better coordination between different ministries and state governments. For this, there could be a separate ministry of water resources development. Impediments to investments in the water sector can be removed to spur growth. NWM may establish agro-metrological stations at the local level to monitor the impact of climate change.

Growing less-water intensive crops and soil and water conservation, as has been demonstrated by BIRD-K in [Karnataka](#) can mitigate the impact of climate change. Water audits to ensure industry uses water judiciously will become increasingly important as it competes for a larger share of water. This will necessitate hydrological and groundwater models at the sub-catchment level covering an area of around 1,000 sq. km. under an appropriate policy.

An important part of mitigation needs to take place at the local level, including better sharing of information. Regional knowledge hubs are needed for sharing information on local and traditional water management practices, such as those initiated by Tarun Bharat Sangh, [Rajasthan](#), Anna Hazare, [Maharashtra](#) and the N M Sadguru Water and Development Foundation in [Gujarat](#). Many such initiatives trap rainwater where it falls; rooftop rainwater harvesting can become mandatory to increase the amount of available rainwater. NWM can aim at introducing user charges for the operation and maintenance of water supply systems by local communities.

The impact of climate change on water resources need to be studied before committing to long-term, large-scale mitigation programmes. There are many factors that influence the seasonal availability of water in river basins and many of them have nothing to do with climate change. This can even be beneficial to agriculture in some cases. Climate change may induce changes in cropping patterns, and farmers will have to learn from those in other regions how to grow suitable crops. NWM can adopt a process-driven approach that takes local specifics into account, as has been done to elaborate the adaptation measures needed to reduce the impact of annual floods in [Mumbai, Maharashtra](#).

To **augment water infrastructure and reduce vulnerability** to climate change, members suggested a mix of new investment in medium and large schemes, and the restoration of existing infrastructure at the local level. The emphasis in both cases is on decentralized schemes to provide water that communities can be run and looked after, in their given the agro-climatic location.

Farmers can be encouraged to take up basin- and local-level watershed management to augment local water supply, as well as water conservation and organic farming to combat climate change's effects. They can also be encouraged to adopt water saving irrigation methods such as sprinklers and drip irrigation systems, and switch to crops that are less water-intensive. NGOs and civil society organizations have played, and can continue to play, an important role in promoting these practices.

There is a close link between water availability, sanitation and the environment, and the Mission can provide infrastructure for sanitation as well as water supply suitable for local conditions. In many cases, facilities provided under the Total Sanitation Campaign are unusable owing to a lack of water. Use of modern technology for developing water resources, desalinization and reducing pollution are some of the other ways to augment water infrastructure.

Members felt the **process of drafting** the Action Plan and Mission has tended not to be very participatory or open. A larger number of public consultations, along with information campaigns using the mass media, would create an effective dialogue with people and help elicit their inputs. NGOs and

academic institutions can facilitate this using their linkages with local people in their areas of operation. These institutions can be part of the process of formulating the Missions' detailed plan of activities as they are in touch with the grassroots and therefore ensure community participation, and have an understanding of the larger issues of climate change.

The government can also hold regional consultations, divided because of river basins rather than states, to include the public, local bodies, NGOs, research institutions and the water supply and irrigation departments. These will be aimed at developing detailed action plans under the Mission.

Sounding a note of caution, members said NAPCC should conduct studies to assess the real impact of climate change on India's water availability before launching any programmes under the missions. There are many aspects of this phenomenon that scientists and policy makers have not understood and many gaps in the information available in India.

Each mission of the action plan can take an integrated approach in its activities. For example, NWM has to work in tandem with the Missions on Agriculture, Himalayan Ecosystems and others. NAPCC is an opportunity for an integrated approach to the several environmental challenges facing India cutting across departments and ministries. It is also an opportunity for NGOs and civil society to be involved in a meaningful way in the development process. For this to happen, the implementation process has to be consultative and open.

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## Comparative Experiences

### Gujarat

**Raj Samadhiyala the Rainwater Harvesting Initiative Helps Survive Droughts, Rajkot** (from [Puran Singh Yadav](#), *Haryana Institute of Rural Development, Karnal*)

Fifteen years ago Rajkot faced a major water crisis. The groundwater table had receded to a depth of 250 metres. By 1985, villagers started to build check dams and tanks by using funds under the District Rural Development Authority programme. Now the village uses remote sensing technique and geographic information systems to locate subsurface dykes to store water. As a result it survived the drought of 2002 and agricultural production has gone up as well. Read [more](#)

### Maharashtra

**Mumbai Deals With Floods and Climate Change, Mumbai** (from [Jyotsna Bapat](#), *The Energy Resources Institute, New Delhi*)

Mumbai once faced frequent floods, with an adverse impact on commuters and slum residents. The city which once faced 7-10 flooding events, floods could be reduced to 2-3 events. This involved the cleaning and repairing of existing storm water drainage system, as mitigation measures. Yet, the additional cost of making Mumbai totally 'flood free' was too high. To deal with it, adaptation measures of annual O&M of drains were taken up. Flood have now been reduced and the project is reviewed every 10 years.

**Village Shows the Way for Water Groundwater Conservation, Hiware Bazaar Village, Ahmednagar District** (from [Puran Singh Yadav](#), *Haryana Institute of Rural Development, Karnal*)

Hiware Bazaar village implemented a Panchayat resolution that dictated that no borewells could be used for irrigation. The resolution also called for reviving shallow dug wells for irrigation, rejuvenating them through upper catchment treatment. Villagers dynamited the bedrock to create fissures and allow water to percolate into the aquifers, leading to enhanced groundwater percolation and conservation. Consultations among the gram sabha (village assembly) proved key to the initiative's success. Read [more](#)

### Rajasthan

**Water Parliament Established by Tarun Bharat Sangh Leads to Community-Driven Water Conservation, Alwar District** (from [Puran Singh Yadav](#), Haryana Institute of Rural Development, Karnal)

Tarun Bharat Sangh established a Water Parliament in the Arvari river basin. People from 72 villages in the basin are represented in the parliament, which encourages soil and water conservation, decides cropping patterns and the amount of water withdrawals. It also raises funds for maintaining water bodies that have been restored in each village. The river system has now become perennial as a result and groundwater levels have risen substantially. Read [more](#)

## International

From [Sunetra Lala](#), Research Associate

**Restoration of the Lower Danube Green Corridor Helps in Adapting to Climate Change, Danube River, Europe**

Conversion of the Danube floodplains for farming and other development had seen them cut off by dykes, thus exacerbating flood peaks. Climate change is expected to increase the frequency of floods. The WorldWide Fund's (WWF) work here in 1992 to attenuate floods included restoration of biodiversity and floodplains, improvement in water quality and enhancing local livelihoods. By 2008, 14.4% of the floodplains had been restored, reducing vulnerability to floods and climate change. Read [more](#)

**Restoration of Flows in the Great Ruaha River Reduces Water Scarcity and Vulnerability to Climate Change, Tanzania**

Until 1957, the Great Ruaha was a perennial river, when rainfall in the lowland portion of the catchment declined, with impacts on the livelihoods of people and on the riparian environment. WWF's work to restore flows in the River commenced in 2003, working with the communities, focussed on better catchment management and poverty reduction. As a result year since 2004, the river has seen year-round flows, thus reducing the vulnerability of people to water scarcity and climate change. Read [more](#)

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## Related Resources

### *Recommended Documentation*

**Rehabilitation and Management of Tanks in India - A Study of Select States** (from [Nitya Jacob](#), United Nations Children's Fund (UNICEF), New Delhi)

Report; Asian Development Bank; New Delhi; 2006

Available at <http://www.adb.org/Documents/Studies/Tanks-India/rehabilitation-management-tanks.pdf> (PDF; Size: 746 KB)

*Concludes that water tank rehabilitation has a great impact on the livelihood options of the landless and marginal farmers, and can also help in adapting to climate change*

**Inter-Governmental Panel on Climate Change (IPCC) Fourth Assessment Report - Working Group II Report "Impacts, Adaptation and Vulnerability"** (from [Anupam K. Singh](#), Department of Civil Engineering, Nirma University (NU), Ahmedabad)

Report; by Martin Parry, Jean Palutikof, and Paul van der Linden; Intergovernmental Panel on Climate Change; Cambridge University Press; United Kingdom; 2007

Available at <http://www.ipcc.ch/ipccreports/ar4-wg2.htm>

*Discusses the impact of climate change on freshwater resources, coastal ecosystems and the inter-relationship between climate change adaptation and mitigation*

**Hiware Bazaar: Community Stewardship of Water Resources** (from [Puran Singh Yadav](#), Haryana Institute of Rural Development, Karnal)

Article; by Nikhil Anand; India Water Portal; Maharashtra; July 2007

Available at [http://www.indiawaterportal.org/tt/wbr/case/seed\\_watr.pdf](http://www.indiawaterportal.org/tt/wbr/case/seed_watr.pdf) (PDF, Size: 344 KB)

*Describes how community imposed regulations lead to groundwater conservation and can be a strategy to adapt to climate change and the resultant water shortages*

From [Uday Bhawalkar](#), Bhawalkar Vermitech Pvt Ltd, Pune

**Eco-Logical Water Treatment and Sanitation using BIOSANITIZER Ecotechnology**

Article; by Uday S. Bhawalkar and Sarita U. Bhawalkar; Bhawalkar Ecological Research Institute; SACOSAN Conference; New Delhi; November 2008

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-29120801.doc> (DOC; Size: 160 KB)

*Notes how pollution of water sources can be mitigated by using BIOSANITIZERS, which can help in dealing with reduced water availability as a result of climate change*

**Eco-Logical Water Treatment and Sanitation using BIOSANITIZER Ecotechnology**

Presentation; by Uday S. Bhawalkar and Sarita U. Bhawalkar; Bhawalkar Ecological Research Institute; SACOSAN Conference; New Delhi; November 2008

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-29120802.ppt> (PPT; Size: 668 KB)

*Describes how BIOSANITIZER is a safe and ecological method of removing water pollution, which may see an increase because of climate change*

From [Vishwanath Srikantaiah](#), BIOME, Bangalore

**Climate Change Towards Climate Resilient Development**

Article; by KR Viswanathan VSM; Swiss Agency for Development and Cooperation; Jimmy Memorial Lecture; Bangalore; 2009

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-29120803.doc> (DOC; Size: 52 KB)

*Discusses the various adaptations that will be required to deal with climate change, including changes in water management and policy under NWM*

**Sustainable Agriculture in Relation to Climate Change**

Presentation; by R. Dwarakinath and Arun Balamatti; AME Foundation; Bangalore; 2009

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-29120804.ppt> (PPT; Size: 22.9 MB)

*Discusses the changes which will have to be made in agricultural practices, including water usage patterns to deal with climate change, and need to included in NWM*

**Securing Livelihood of Vulnerable Community through Enhancing Adaptive Capacity to Climate Change in Semi Arid Regions**

Presentation; by S. C. Jain; Action for Food Production; Bangalore; 2009

Available at <http://www.solutionexchange-un.net.in/environment/cr/res-29120805.pdf> (PDF; Size: 7.2 MB)

*Discusses how livelihoods can be secured through integrated water management practices, which can also help deal with climate changes in arid areas*

From [Sarah Figge](#), Solution Exchange

**Climate Change Meeting Sets Out Key Proposals for Asia-Pacific Region's Response**

Press Release; by United Nations Economic and Social Commission for Asia and the Pacific; Bangkok; January 2009;

Available at <http://www.unescap.org/unis/press/2009/jan/g01.asp>

*Details about the Asia-Pacific Business Forum on Climate Change, which provided a forum for promoting new partnerships and for exchanging ideas for combating climate change*

### **World Water Forum Precom Highlights Impacts of Climate Change on Water Scarcity**

Press Release; by CLIMATE-L.ORG; Swiss Agency for Development and Cooperation; Switzerland; January 2009;

Available at <http://www.climate-l.org/2009/01/world-water-forum-precom-highlights-impacts-of-climate-change-on-water-scarcity.html>

*Focuses on the negotiations for a global plan of action for adaptation to global climate change, that will affect the management of freshwater resources*

From [Sunetra Lala](#), Research Associate

### **Climate Change and Water Resources in South Asia**

Book; by M. Monirul Qader Mirza and Q. K. Ahmad; Taylor & Francis; United Kingdom; 2005; Permission Required: Yes, paid publication

Ordering information at <http://www.amazon.com/Climate-Change-Water-Resources-South/dp/0415364426>

*Addresses the most pressing water resources issues in South Asia, particularly in relation to climate change and the threat to water resources*

### **Hell and High Water: Climate Change, Hope and the Human Condition**

Book; by Alastair McIntosh; Birlinn Ltd; United Kingdom; July 2008; Permission Required: Yes, paid publication

Ordering information at <http://www.amazon.co.uk/Hell-High-Water-Climate-Condition/dp/1841586226>

*Explains how climate change and the resultant changes in water resource availability is a reality, and the efforts that are required to mitigate the impacts of climate change*

### **Climate Change Adaptation in the Water Sector**

Book; by Fulco Ludwig, Pavel Kabat, Henk van Schaik and Michael van der Valk; Earthscan Publications Ltd.; United Kingdom; 2009; Permission Required: Yes, paid publication

Ordering information at <http://www.styluspub.com/Books/BookDetail.aspx?productID=204896>

*Explains the different adaptation measures that will have to be taken up by different countries in the water sector to deal with climate change*

### **Water For Life - Lessons For Climate Change Adaptation From Better Management of Rivers For People and Nature**

Report; by Jamie Pittock; WWF International; Switzerland; August 2008;

Available at [http://assets.panda.org/downloads/50\\_12\\_wwf\\_climate\\_change\\_v2\\_full\\_report.pdf](http://assets.panda.org/downloads/50_12_wwf_climate_change_v2_full_report.pdf) (PDF; Size: 6.4 MB)

*Describes how better management of rivers in different parts of the world, involving local communities, has addressed vulnerability to climate change*

## **Recommended Organizations and Programmes**

From [Puran Singh Yadav](#), Haryana Institute of Rural Development, Karnal

### **Tarun Bharat Sangh, Rajasthan, Rajasthan**

Tarun Ashram, Bhikampura, Kishoree, Via Thangazi, District Alwar 301022, Rajasthan; Tel: 91-1465-225043; <http://www.tarunbharatsangh.org/programs/programs.htm>

*Promotes sustainable groundwater management in communities to augment groundwater resources, which will become important in order to adapt to climate change*

**Department of Drinking Water Supply, New Delhi**

Ministry of Rural Development, Government of India, 9th Floor, Paryavarn Bhawan, CGO Complex, Lodhi Road, New Delhi 110003; Tel 91-11-24361043; Fax: 91-11-24364113; [jstm@water.nic.in](mailto:jstm@water.nic.in); <http://ddws.nic.in/>

*Government agency responsible for providing drinking water and sanitation services to rural areas across India, which may become a scarce resource due to climate change*

**Central Soil Salinity Research Institute, Karnal**

Kachawa Road, Karnal 132001; Tel: 91-184-2290501; Fax: 91-184-2290480; [director@cssri.ernet.in](mailto:director@cssri.ernet.in); <http://www.cssri.org/programs.htm>

*Developed a model of wastewater management using eucalyptus plantation, a concept which could adopt NWM to address climate change*

**Indian Oil Corporation, New Delhi**

3079/3, J B Tito Marg, Sadiq Nagar, New Delhi 110049; Tel: 91-11-25260020; [sethis@iocl.co.in](mailto:sethis@iocl.co.in); <http://www.iocl.com/AboutUs/Profile.aspx>

*Developed a model of wastewater management at the Panipat plant, which the NWM could implement as well*

**Asian Development Bank (ADB), New Delhi (from [Nitya Jacob](#), United Nations Children's Fund (UNICEF), New Delhi)**

4, San Martin Marg, New Delhi, Delhi 110021; Tel: 91-11-24107200; Fax: 91-11-26870955 [information@adb.org](mailto:information@adb.org); <http://www.adb.org/India/default.asp>

*International development finance institution, produced a report on the impact of water tanks on the livelihood of farmers that can be included in NWM to help address climate related changes*

From [Atul Rawat](#), DMV Business & Market Research Pvt. Ltd., Hyderabad

**Accelerated Rural Water Supply Programme, New Delhi**

Ministry of Rural Development, Government of India, 9th Floor, Paryavarn Bhawan, CGO Complex, Lodhi Road, New Delhi 110003; Tel 91-11-24361043; Fax: 91-11-24364113; [jstm@water.nic.in](mailto:jstm@water.nic.in); [http://ddws.gov.in/popups/arwsp\\_pop.htm](http://ddws.gov.in/popups/arwsp_pop.htm)

*Scheme to assist the states with 100% grants-in-aid to implement drinking water supply schemes in rural India, which is to be addressed in the NWM*

**Rajiv Gandhi National Drinking Water Mission, New Delhi**

Department of Drinking Water Supply, Ministry of Rural Development, Government of India, 9th Floor, Paryavarn Bhawan, CGO Complex, Lodhi Road, New Delhi 110003; Tel 91-11-24361043; Fax: 91-11-24364113; [jstm@water.nic.in](mailto:jstm@water.nic.in); <http://ddws.nic.in/sustainability.htm>

*Safe drinking water scheme of the central government which will be included under the National Water Mission to combat climate change*

**World Bank, New Delhi**

70 Lodi Estate, New Delhi 110003; Tel: 91-11-24617241; Fax: 91-11-24619393; [smozumder@worldbank.org](mailto:smozumder@worldbank.org); <http://www.worldbank.org.in/WBSITE/EXTERNAL/COUNTRIES/>

*Source of financial assistance to developing countries, including India and has devolved participatory approaches for water management, which can be included in the NWM*

From [Vishwanath Srikantaiah](#), BIOME, Bangalore

### **Baif Institute for Rural Development - Karnataka (BIRD-K), Karnataka**

P. B. No.3 Kamadhenu, Sharda nagar, Tiptur 572 202, Karnataka; Tel: 91-8134-250658; Fax: 91-8134-251337; [birdktpr@gmail.com](mailto:birdktpr@gmail.com); <http://www.birdk.org.in/index.html>

*Responsible for watershed management projects in Kerala and has been involved in deliberating on issues included in the NWM of the NAPCC*

### **OUTREACH, Karnataka**

#109, Coles Road, Frazer Town, Bangalore 560005; Tel: 91-80-5545365; Fax: 91-80-5307533; [outreach@vsnl.com](mailto:outreach@vsnl.com); [http://www.onsiteindia.org/who\\_we\\_are.html](http://www.onsiteindia.org/who_we_are.html)

*Works in drought prone areas in South India, on issues of wasteland management, water management, etc, for consideration in the NWM*

### **AME Foundation, Karnataka**

No. 204, 100 Feet Ring Road, 3rd Phase, Banashankari 2nd Block, 3rd Stage, Bangalore 560 085; Tel: 91-80-26699512; Fax: 91-80-26699410; [amefbang@amefound.org](mailto:amefbang@amefound.org);

<http://www.amefound.org/programmes.htm>

*Promotes alternative farming practices by using innovative water management practices, which could be addressed in the NWM*

From [Sunetra Lala](#), Research Associate

### **The Climate Institute, Sydney**

Level 15/ 179 Elizabeth St, Sydney NSW 2000; Tel: 00-2-92525200; Fax: 00-2-92476555;

<http://www.climateinstitute.org.au/index.php?option>

*Aims to make a contribution to the current climate change policy debate, through evidence-based research on climate change and its impact on water resources*

### **Aspen Global Change Institute, USA**

100 East Francis St., Aspen, CO 81611, USA; Tel: 001-970-925-7376; Fax: 001-970-925-7097;

[agcmail@agci.org](mailto:agcmail@agci.org); <http://www.agci.org/about.html>

*Non-profit organization dedicated to furthering the understanding of earth systems and global environmental change, including climate change and its impact on water resources*

## **Recommended Portals and Information Bases**

**Rainwaterharvesting.org, Centre for Science and Environment, New Delhi** (from [Puran Singh Yadav](#), Haryana Institute of Rural Development, Karnal)

<http://www.rainwaterharvesting.org/rural/Raj-Samadhiyala.htm>; Tel: 91-11-26066854, 26059810, 29955410, 29955781, 29956394

*Provides information on water recharging experiences, including Rajkot which was successful in surviving droughts due to its quality water management practices*

**India Environmental Portal: Knowledge for Change, Centre for Science and Environment, New Delhi** (from [Sunetra Lala](#), Research Associate)

<http://indiaenvironmentportal.org.in/>; Tel: 91-11-26066854, 26059810, 29955410, 29955781, 29956394

*Promoted by the National Knowledge Commission, the portal provides extensive information about various environmental issues, including water recharge in India*

## **Recommended Upcoming Events**

**Delhi Sustainable Development Summit – Towards Copenhagen: An Equitable and Ethical Approach, New Delhi, 5-7 February 2009** (from [Sarah Figge](#), Solution Exchange)

Sponsored by The Energy Resources Institute, New Delhi. Information available at <http://dsds.teriin.org/2009/index.htm>; Contact Mangala Dubey Tewari; Associate Fellow; Tel: 91-11-24682100; [mdtewari@teri.res.in](mailto:mdtewari@teri.res.in)

*The Summit will seek to reinforce the climate change agenda and will provide a platform for various stakeholders to formulate to arrive at an agreement*

From [Sunetra Lala](#), Research Associate

### **Managing Waste in a Changing Climate, Australia, 4-6 March 2009**

Sponsored by Tasmanian Department of Economic Development & Tourism, Tasmania. Information available at <http://www.taswasteandclimatechange.com.au/>; Contact Kylie Hood; Delegate Enquiries; Tel: 00-287465044; [kylie@wmaa.asn.au](mailto:kylie@wmaa.asn.au)

*Provides an opportunity for industry, etc to examine waste management practices and the importance this has in addressing the impacts associated with climate change*

### **Climate Change: Global Risks, Challenges and Decisions, Denmark, 10-12 March 2009**

Sponsored by University of Copenhagen, Copenhagen. Information available at <http://climatecongress.ku.dk/>; Contact Jane Søgård Hansen; Tel: 00-45-35324251; [jsha@adm.ku.dk](mailto:jsha@adm.ku.dk)

*An international scientific conference organised by IARU as part of the official preparation for the UN Climate Change Summit (COP 15) to be held in Copenhagen in 2009*

## **Related Consolidated Replies**

**Climate Change Adaptation in Water, Agriculture and Coastal Areas, from Preeti Soni, Energy and Environment Division, UNDP, New Delhi (Experiences).** Water Community and Food and Nutrition Security Community, Solution Exchange India, Issued 31 December 2007

Available at <http://www.solutionexchange-un.net.in/environment/cr/cr-se-wes-food-27110701.pdf> (PDF, Size: 56 KB)

*Discusses the larger context of climate change, shares environmental impact findings and mentions experiences with climate resilient water, agriculture and coastal management practices*

**Gendered Adaptations to Water Shortages and Climate Change, from Meenakshi Kathel, United Nations Development Programme (UNDP), New Delhi (Experience).** Gender Community and Water Community, Solution Exchange India, Issued 26 March 2008

Available at <http://www.solutionexchange-un.net.in/gender/cr/cr-se-gen-we-s-global-15120701.pdf> (PDF, Size: 202 KB)

*Shares experiences and examples for developing gender sensitive adaptation strategies for combating the effects of climate change, diminishing livelihoods and water shortages*

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## **Responses in Full**

**[S. A. Hirudia Raj](#), Andhra Pradesh Farmer Managed Groundwater Systems (APFMGS), Secunderabad**

With regard to the National Water Mission of the National Action Plan on Climate Change (NAPCC), I feel the following issues need to be addressed to give the mission more teeth:

The major issue related to the NAPCC, which needs to be included, is the capacity building of communities on changes in the micro climatic conditions, monitoring these changes and the devolution of strategies for adaptation to climate change. There is also a need for the establishment of agro-met stations at block/mandal/village level depending on the region-specific conditions. Capacity building of communities and decentralised water management systems at the micro/macro basin level is also a

necessity. The networking of institutions focused on water related issues, including the civil society/WUAs and line departments will also go a long way in making the National Water Mission a success.

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**Nitya Jacob, United Nations Children's Fund (UNICEF), New Delhi**

The National Action Plan on Climate Change (NAPCC) is a comprehensive overview of how the government plans to tackle the challenge of climate change. It gives details of eight missions, including the National Water Mission (NWM) and outlines what each will achieve. Specifically, under NWM, the Plan mentions the following objectives:

1. Studies on management of surface water resources
  - a. Estimating river flows in mountainous areas
  - b. Customizing climate change models for regional water basins
  - c. Extending isotopic-tracer based techniques for monitoring of river water discharge to all major river monitoring stations
  - d. Developing digital elevation models of flood prone areas for forecasting floods
  - e. Mapping areas likely to experience floods and developing schemes to manage floods
  - f. Strengthening the monitoring of glacial and seasonal snow covers to assess the contribution of snow melt to Indian rivers that originate in the Himalayas
  - g. Establishment of a wider network of automatic weather status and automated rain gauge stations
  - h. Planning of watershed management in mountain ecosystems
2. Management and regulation of groundwater resources
  - a. Mandating water harvesting and artificial recharge in relevant urban areas
  - b. Enhancing recharge of the sources and recharge zones of deeper groundwater aquifers
  - c. Mandatory water assessments and audits; ensuring proper industrial waste disposal
  - d. Regulation of power tariffs for irrigation
3. Upgrading storage systems for freshwater and drainage systems for wastewater
  - a. Prioritizing watershed vulnerabilities to flow changes and developing decision support systems to facilitate quick and appropriate responses
  - b. Restoration of old water tanks
  - c. Developing models of urban storm water flows and estimating drainage capacities for storm-water and for sewers based on the simulations
  - d. Strengthen links with afforestation and programmes and wetland conservation
  - e. Enhancing storage capacities in multipurpose hydro-projects and integration of drainage with irrigation infrastructure
4. Conservation of wetlands
  - a. Environmental appraisal and impact assessment of development projects on wetlands
  - b. Developing inventory of wetlands, especially those with unique features
  - c. Mapping of catchments and surveying and assessment of land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements, and human activities and their impact on catchments and water bodies
  - d. Creating awareness of people on the importance of wetland ecosystems
  - e. Formulating and implementing an regulatory regime to ensure wise use of wetlands at the national, state and district levels
5. Development of desalination technologies
  - a. Seawater desalination using reverse osmosis and multistage flash distillation to take advantage of low-grade heat energy

- b. Brackish water desalination
- c. Water recycle and reuse
- d. Water purification technology

As Himanshu points out, the NWM has to be fleshed out fully with operational procedures, etc., and assigned a nodal ministry. The Mission looks at water as an input, not the driver, for adaptation measures under other missions. However, water availability is going to be one of the biggest impacts of climate change as a result of erratic rainfall and glacier melt.

The NAPCC sets out measures to adapt to these realities. However, it is silent on mitigation. This assumes a Business As Usual approach that may influence the operationalisation of NWM. A section on mitigation measures, worked out with experts from outside the government through a public consultative process, will be extremely useful to balance the approach of NWM. There are mitigation measures mentioned under the other missions on sustainable habitat, energy efficiency, solar mission, and green India, but NWM needs mention of specifics.

For example, at the grassroots level, paddy cultivation is one of the large contributors to green house gas emissions as it produces a lot of methane. Using the System of Rice Intensification, this can be significantly reduced, and so can water consumption. However, there is no link between the objectives of NWM and the Mission on Sustainable Agriculture.

Further, the multipurpose hydro-projects suggested as an adaptation measure, have been found to be carbon negative (they add to the CO<sub>2</sub> emissions, rather than cutting down on them) as submerged vegetation decays and releases methane and other GHGs for years. Climate change research has already demonstrated that water absorbs and retains heat more than landmass; therefore, large water bodies created by these projects may actually assist climate change. They are unsuitable for any mitigation. Further, they are extremely energy intensive to build and maintain. While there is the argument hydroelectric power is cleaner than thermal, the overall cost-benefit analysis should be studied before the suggestion at 3(e) above.

I feel the role of civil society and gram panchayats is much underplayed in the NWM. These together are the largest stakeholders in any programme to adapt to climate change, yet they remain little more than spectators. They are the best to implement the NWM's objectives as spelt out above as most activities will devolve to the village level through gram panchayats. The new approach to programming is community involvement from the planning stage. A significant mitigation measure that NGOs and communities can effectively implement is restoring their own water bodies – tanks, johads, pukkars, etc., across the country. NWM has to consider a bottom-up implementation strategy to be effective.

Regarding priorities under NWM, decentralized provision of water (3b) through restoration of local water structures ought to head the list. A report by the Asian Development Bank, quoting a study under the IWMI-Tata Water Policy Programme in 2004–2005 concluded that tank rehabilitation has a great impact on the livelihood options of the landless and marginal farmers. The involvement of self-help groups in tank rehabilitation and funding for income generating activities has a marked effect on their livelihood. The tanks are likely to be more sustainable when all the villagers become members of a tank users' group, that a local NGO can promote.

India has thousands of tanks and ponds, which, if rejuvenated, will contribute significantly to not only increasing food production but also to providing a variety of livelihood options to the rural poor, especially women. This appears to be the more cost-effective option than creating new irrigation works. It also provides water where it is used without transport costs and in an equitable manner. Restored tanks help in augmenting surface and sub-surface water storage capacity. Larger tanks, covering several hundred acres, act as wetlands with resultant environmental benefits. They are important for flood control, absorbing excess river flows till the water is needed by the local populace.

Regarding community involvement, I feel the vernacular press, commercial FM radio stations, community radio stations and increasing literacy present an opportunity to educate and involve people in making decisions regarding climate change adaptation. NGOs can play a major role in developing material, under guidance of a central agency, in local languages. They can also play a large role in community education and mobilization. The actual implementation of activities under NWM could be in the hands of PRIs, overseen by NGOs, and funded by the government. A network of organizations from the state to the taluk level can be created for training and material development, working in tandem with the administration and local governments (zilla, block and gram panchayats).

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**[S. V. Vijaya Kumar](#), National Institute of Hydrology, Deltaic Regional Centre, Kakinada**

Himanshu Thakkar has come up with an interesting and a relevant issue. The following are my opinions on the same:

**What specific initiatives should be included in the NWM, considering the past water-related missions and the varying agro-ecological situations across India?**

There is a need to undertake hydrological modeling for all basins at sub-catchment area level of about 1000 sq. km for a monthly time scale and increasing the time resolution to hourly scale for the present and changed meteorological and climatic conditions. The output from such a study needs to be linked to an appropriate groundwater model for all the urban areas and important aquifer systems for present and changed meteorological and climatic conditions.

**What are the options and priorities to augment existing water infrastructure to reduce vulnerability to climate change?**

There is a need to develop seed varieties that have reduced cropping period and less water requirement for water deficient circumstances and seeds which can withstand inundation and flooding for water excess conditions. Interlinking of rivers need to be assessed for climate change circumstances. All water infrastructure operations and planning need to be revised with a scope to have suitable balancing reservoirs or integrate the existing tanks as part of system.

**What should be a participatory process for formulation of NWM and NAPCC? Please also suggest which institutions should be part of the process?**

Participatory process should be up to the NGO level as most of the NGOs have considerable interactions with communities on water related matters and are aware of the ground realities. Academic institutions at the national level, State Centres of water resources under Universities, Central and State Water resources/ Irrigation/groundwater/Municipal water supply/Rural water supply departments, Water related autonomous institutes like NIH, NWDA etc. and NGOs need be a part of the process.

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**[Jyotsna Bapat](#), The Energy Resources Institute (TERI), New Delhi**

For any climate change issues, the context is decisive. I am aware of two NGO members who are part of the PM's advisory Council on Climate Change (CC) with appropriate gender representation. They are making efforts to awareness and dissemination to people.

Second, I agree that the NWM has to be central and very rightly the Union Ministry of water resources is handling it. The approach of infrastructure investment for storage capacity and basin level management through lined canals etc. for ensuring sustainable water for various uses, including agriculture, is consistent with the CC action plans of economic social development with poverty alleviation as over riding principal. Continuing past efforts of water missions will have limited impact as the context has changed.

In the new context of CC we anticipate increase in frequency of water stress situation be it heat waves, draughts, bush-fires, tropical cyclones, tornados, hailstorms floods and storm surges with increased frequency. We need to achieve a level of water related infrastructure development, including adopting technologies that allow scarce water to be used efficiently in agriculture, to reduce our vulnerability and safe guard us and our agriculture.

Regarding the formulation of NWM, a process driven approach that will allow for local specifics to be taken in to account will work. Let me clarify with the example of Mumbai city that I had worked on about 20 years ago. Mumbai has three months of monsoons and we as a team of multidisciplinary specialists modeled the various parameters to determine that it causes 7 to 10 'flooding events' annually in 1990. The maximum adverse impact is on daily commuters, and 'submerged slum' residents. These floods could be reduced to 2-3 events with Rs. 200 cr. (1990 prices) (34cr. per event \* 6 events). This involved the cleaning and repairing of existing storm water drainage system, as **mitigation measures**. The additional cost of making Mumbai 'flood free' was too high.

So to deal with it, needed **adaptation measures** of annual O and M of drains, opening public schools for one night with meal provision, to accommodated stranded commuters and dwellers of submerged slums were added. Thus mitigation and adaptation go hand in hand and there is a tradeoff. This exercise took us 6 months and completing the project took another two years. This needed continuous review and redesign every 10 years, but with climate change this review will have to be frequent.

Thus in every local context the process of: defining the event, estimating it frequency, cost of the event, acceptable frequency of event, tradeoffs between mitigation and adaptation strategy, including finances needed, and action-plan, can be created. But the actual disasters and action-plan will be context specific. Creating it will be responsibility of local government with support and ownership by local community. This will need their capacity building. Thus the objectives of economic social development, is met, with poverty reduction as overriding, to climate change mitigation and adaptation measures, in the context of water.

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**[Saugat Ganguly](#), Gamana, Hyderabad**

Please find below my reflections on the query:

**Specific initiatives to be included in the NWM:**

Water Auditing has been given due importance in the text, even making it mandatory but its implementation strategy has to be clearly chalked out, giving more power to the regulating authorities to crack down on violators.

As industries are a major user of water and its share in exploitation of ground and surface water is going to increase in future, water auditing for the industries should be stressed upon to make them more responsible towards using water judiciously. Eco-labeling of products needs to be encouraged to make the industries adopt clean technology, which ensures less water consumption and also less pollution.

Field level data on water resources will make water budgeting more precise. There is no special mention on the plan about the need to increase in availability of field level data on water resources.

**Options and priorities to augment existing water infrastructure to reduce vulnerability to climate change:**

As indigenous knowledge on water harvesting systems plays a major part in making water harvesting efforts successful, regional knowledge hubs/information centers should be set up to document and store the age old practices of water harvesting. It is understandable that with changes in weather pattern and water resources the age old practices of a region may no longer be suitable for that particular region but

the same practices can be applied in an area which due to the effects of climate change now has a condition suitable for rainwater technology.

Climate change might bring in changes in cropping pattern in many regions, educating the farmers in coping with the change is very important. The farmers need to be aware of the possible changes in rainfall and weather pattern in future and be prepared to shift to completely different kinds of crops.

**Making the process for formulation of NWM and NAPCC participatory:**

For making the process of formulation of NWM and NAPCC fair, it has to be made more participative. Regional consultations, where all the stakeholders are properly represented will have more impact than a centralized process dominated by a few individuals. The regions can be divided based on river basins (as envisioned in the NWM in drafting the policy), states sharing boundaries, or even regions from contiguous states which have the same kind of weather pattern and water resources.

The institutions to be a part of the process should be local bodies, NGOs, research and educational institutes from the same area and the water supply and irrigation departments. Inputs from all the regional consultations should be used as a framework while formulating the NWM and NAPCC.

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**Virinder Sharma, DFID India, New Delhi**

Thank you for initiating this issue regarding the status and quality of National Climate Change Plans, which many countries (even some states in India) are formulating. However the integration of climate change (CC) plans into development planning, convergence amongst ministries and engagement of Finance and Development Ministries is a more difficult area.

I would like to raise a fundamental issue about the NWM under the NAPCC. Most of the objectives under the NWM are supposed to be dealt by the coordinated action of GoI Ministries and states but the institutional architecture for coordination and convergence is largely missing or if there is a set up it is usually ruined by multiplicity of agencies/committees with different set of guidelines, funding sources and outputs.

It seems that the climate change lens (under the NAPCC) is now being used to address these malignant areas, which have not been addressed due to multiplicity of authorities/Institutions and inadequate attention to the core institutional or governance changes. Many forums on Integrated Water Resources Management (IWRM) and Sustainable Development have identified most of these issues earlier, but with little coordination and weak outcomes.

Due to the international importance, positive direction in India is that the Prime Ministers Office has taken the responsibility for the coordinated National Action Plan on CC (NAPCC) and 8 cross cutting Mission Reports are being developed by the sectoral Ministries (this could not happen for the Biodiversity and Environment National Plans in India).

Agreed that CSOs and even states have not been consulted on the NAPCC and this needs to be done extensively and in a phased manner. Also we could spend a lot of time discussing specific technical issues around hydro power, dams, mitigation, adaptation, wetlands, watershed development etc., but not on how to institutionalise change.

Overall, there is need to track the implementation of the India NAPCC and the formulation of the 8 Mission Reports, if we are to achieve the outcome of the NAPCC, i.e. integration of Climate Change into development planning.

Following areas would be important:

- level of convergence between Ministries/agencies,

- decision making structures (on technical and governance issues);
  - drivers (and barriers) of change;
  - internal incentives for staff and front line deliverers;
  - integration of schemes/ programmes and related funding mechanisms
  - willingness to take tough decisions on change management within institutions/agencies
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**[Anupam K. Singh](#), Department of Civil Engineering, Nirma University (NU), Ahmedabad**

In response to the email by Himanshu Thakkar on climate change, below is a short note on the water resources situation in Gujarat. I hope this article provides some points for further discussions, suggestions and comments among members.

### **Climate Change, Implications and Actions on Water Resources in Western India**

A recently released Inter-governmental Panel on Climate Change (IPCC) Working Group-II report says that food and water shortage are going to increase in Asia. Increasing extreme weather pattern and related disasters are already taking their toll on crop yields, and it is projected that close to 50 million extra people are at risk of hunger by 2020. Furthermore, it suggests that an increase in mean temperature of 2°C could result in 4-10% decline of cereal production in South Asia till 2010. In India, climate change is a reality and we will face its impact soon, as culminated into National Action plan on Climate Change (NACC) of Government of India. NACC document details eight missions, and two of them being National Water Mission (NWM) and National Mission on Strategic Knowledge on Climate Change (NSKCC).

It is much likelihood that climate change may alter rainfall, natural resources base, environment and ecology resulting into economic, social and livelihood of the people. Water stress is being cited as one of the most urgent environmental problem causing severe drought and intense flooding in several locations. The research results from various global climatic models are of the view that rainfall intensity and amount will increase by 5-20% in Western India. This claim was independently verified by author for Sabarmati river basin using number of time series models for selected locations.

In semi-arid Western India, the conflict of water supply and demand is more intense, as per capita annual water availability of 960m<sup>3</sup>/capita is far below the national average of 1880m<sup>3</sup>/capita. The distribution of annual water availability among various sub-regions is skewed, varying from 1270m<sup>3</sup>/capita in southern Gujarat to 600 m<sup>3</sup>/capita in North, 606 m<sup>3</sup>/capita in Saurashtra and 730 m<sup>3</sup>/capita in Kutch region. In this region, water demand is increasing steadily, due to setting-up of neo-industrial zones and tax-saving incentives provided for industrialisation. This necessitates need for an appropriate action at policy, planning and implementation stages in order to prevent long-term damages on regional and local hydrological cycle.

At policy level, the National Water Policy should be revised to include basin level management as compared to administrative territorial strategies. There are several successful basin level planning and management examples; not only from Europe, but also from India. This strategy advocates special efforts to control water resources, increase storage capacity, and clearly indicate future projects and their probable impacts. Tapi river basin can be considered as an example of integrated water resources management, which displays diversity of ecosystem, different socio-economic conditions and an interstate river between three states in Western India. This can provide a good water governance model for regional economic co-operation in India.

Emergence of proposed basin level institutional mechanism for effective plan implementation and delivery should be given immediate attention. Climate change is still at its infancy stage, therefore an added focus on local understanding of climate change, adaptation and mitigation strategies, and natural resources conservation are important. Immediate efforts towards seeking solutions to gaps in knowledge, technology and resources are required. Furthermore, developing a computer based decision support system (DSS) for a basin will facilitate decision makers and engineers with strategic decisions and rule settings for water management.

NSKCC is still at the formation level; consultation for national or regional level plans has not been an open ended process. Involvement of experts, research institutions, civil society organisations, and affected citizens has been limited. Therefore, future consultations must involve these target groups and comments from public must find mention for effective implementation. Hence preparatory as well later implementation process needs to be more open, democratic and sustainable. Therefore establishing multi-sectoral and multi-stakeholders relationship can be of immense help, as listed below:

- Science and technology can be instrumental in providing research solutions to support climate change knowledge and decisions.
- Academic institutions support research on climate hazard, possible adaptation change and capacity building can be incorporated in curriculum and regional consultancy projects.
- Community based organisations can be relevant for awareness and capacity building needs of vulnerable sections of the society. They can act as centres of dissemination, good governance practices, and lessons learned from implementation.
- Corporate sector can support special designed projects in climate change mitigation and pro-people initiatives.
- State and local government can administer convergence climate change related threats and provide supportive environment for various actors and implementers. Consistent engagement of government with minimal disruption from policy can lead to sustained efforts towards climate change.

This paper locates climate change efforts and activities in the broader canvas. The inclusion of local level actions, various tools, technologies, institutions and organisations aims for a holistic vision on sustainable development.

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**Puran Singh Yadav, Haryana Institute of Rural Development, Karnal**

The idea of preparing the National Action Plan on Climate Change including the National Water mission in itself is a big one, which needs to be given a deeper and analytical thought by all concerned. The human race is facing a great challenge for survival - imagine life without water and soaring temperatures!

India is a big country with varied agro-climatic zones. It offers great scope for conservation of every thing. However, 70% of rainwater goes as run off and we have not been in position to harvest it despite all our good intentions. I would like to make some suggestions for NWM:

1. To make a policy for water harvesting on the basis of success stories of watershed development with the involvement of village communities in different parts of the country. Along with big multi-purpose water storage dams, small water harvesting structures should be promoted and sustained. We should conserve every drop of water, wherever, it falls.

2. There should be a policy for revival of all the traditional water harvesting bodies in the villages. A large number of small water harvesting structures (Check dams, Nala Bunds, other locally suitable structures) should be in place all over the country. Rajendra Singh of Tarun Bharat Sangh (TBS) claims to have revived the five rivers in Rajasthan. Anna Saheb Hazarae has created a model of balanced development with watershed as a key component. Jadeja in Rajkot has created a model of water conservation. We can see water flowing throughout the year in the nalas of Jhabua district of Madhya Pradesh, which were once dried up.
3. The multinationals should not be allowed to exploit groundwater beyond a certain limit. Each one should have a water-harvesting plan for the area in which they are set up and be asked to conserve water for their requirements. There are examples that water harvesting technologies in Rashtrapati Bhavan have helped recharge underground aquifers.
4. To put a limited ban on water guzzling crops like paddy cultivation. Imagine the scenario, when people of Mahendergarh and Rewari District of Haryana, which are water scarce areas, (categorized as desert areas) start growing paddy. Less water consuming crops should be promoted.
5. Government of India has been implementing various programmes of watershed development through different ministries. These programmes should be coordinated/implemented through one ministry. There should be separate Ministry of Water Resources Development.
6. Rivers should be included in the Central list. The Central authorities should take decision over the distribution and utilisation of water resources in the country.
7. There should be an intensive afforestation drive in the country, which not only helps water recharge but will also help in controlling rising temperatures. The Aravalis, Himalayas, and all river banks should be intensively covered with plantation.
8. Waste Water Management should be part of the National Water Mission. CSSRI Karnal developed a model of wastewater management with euclyptus plantation. IOC Refinery (Biholi) Panipat , Haryana has developed a good model of wastewater management for others to emulate.

Therefore, the NWM should compile all such good practices/success stories and should base its policy recommendations on the basis of these stories. These are real stories, which the communities have created. Please visit [www.ddws.nic.in](http://www.ddws.nic.in) for such success stories.

All educational institutions (Universities, Colleges, Schools, and other institutes/Government Offices) should resort to roof top rainwater harvesting. All vacant lands under these institutions should be covered with intensive plantation. It should be mandatory for all.

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**Atul Rawat, DMV Business and Market Research Pvt. Ltd., Hyderabad**

India has about 16 percent of world population and she is the seventh largest country in the world. In India, the annual precipitation including snowfall is estimated 4000 Billion cubic meter, whereas the average availability of water in the country is 1869 billion cubic meter. Out of which, the estimated utilizable water resources are 1122 billion cubic meter (690 BCM of surface water and 433 BCM of replenishable groundwater).

Despite efforts of the government through various drinking water missions like the Accelerated Rural Water Supply Programme and the current Rajiv Gandhi National Drinking Water Mission, for supply of safe and adequate drinking water to the population, India still has a large population which are 'not

covered'. There is a long way to go before India can reach the requisite 40 litres per capita per day norm for the growing rural and urban population.

### **Specific initiatives to be included in the NWM**

India has abundant water resources with wide regional disparities in its distribution. Any mission for provision of potable water should focus on region specific initiatives since each region in India has its unique agro-climatic condition and related variability in rainfall and ground water conditions.

The NWM should generate region-specific plans based on the agro-climatic conditions. India is facing the disastrous consequences of unchecked use of bore wells and pump sets in the fertile plains of Punjab. Hence, the pre requisite of any plan for provision of water should be that which is locally suitable, environmentally sustainable and economically feasible for the community with specific linkage to their livelihoods.

In areas where monsoon rainfall is abundant, the aim should be to generate awareness and increase the use of rain water harvesting systems for household, agriculture and commercial purposes. In arid regions, the focus should be on water conservation measures for the community and incentives can be made available for recycling and conservation measures.

There is visible rural-urban divide in the provision of water in India. Also within urban areas, the provision is far from uniform. The slum population, which comprises more than 50% in cities like Mumbai, has less than 10% access to drinking water, which leads to environmental degradation and health hazards. The NWM should encompass specific initiatives for these populations, which can be linked, to the Urban Renewal Mission of the government, which aims at basic services to the urban poor.

### **Priorities to augment existing water infrastructure to reduce vulnerability to climate change**

To augment the water infrastructure the government should focus more on community owned water infrastructure systems for drinking water and sustainable agriculture in rural areas based on decentralized planning. The design, operation and management of such systems should be entrusted with the local population to generate commitment and sustainability through people's participation at grassroots level. For example the 'Jal Nirmal' programme of the World Bank which is a demand-driven programme based on the sustainable development approach for the provision of rural water supply in Karnataka has achieved tremendous success in its reach through people's participation.

NWM should aim at introduction of user charges for the operation and maintenance of infrastructure systems by the community wherever feasible. There is also a need to introduce competition in the basic water services, by encouraging the private sector and cooperatives to introduce environment friendly check dams and micro watershed systems.

There is a close linkage between water availability, sanitation and health and environment. The NWM should envisage provision of infrastructure for sanitation facilities along with provision of water supply systems, which is suitable for the local environment. The target-oriented Total Sanitation Campaign has in many places provided toilet facilities, which are not 'usable' due to scarcity of water. This has resulted in environmental pollution, and high incidence of diseases among communities.

The water canals need to be built from water storage areas to low water availability areas. Another major area, which needs the attention of the public and private sector, is research and development for infusing better technological options for developing the water resources. There is urgent need to clean up many of the water canals and water bodies, which have become threats to healthy environment due to different types of pollutants. Hence Water Quality monitoring and conservation of water bodies require immediate attention by the government.

Water desalination operation is still in its infancy and with a long coastline India needs to develop infrastructure for water recycling and desalination processes to meet the unmet and growing demand for water. There is also need to generate awareness and educate people about the need for rainwater harvesting and tank regeneration.

### **Evolving a Participatory process for formulation of NWM and NAPCC**

The participatory process for formulation of NWM and NAPCC should involve the international, public, private and civil society organizations for formulating the policies. The policies can be based on the model schemes of international organizations like the World Bank in order to avoid the pitfalls. Further, the civil society organizations need to be engaged at the local level to generate awareness and people's participation.

In the National Action Plan for Climate Change (NAPCC), the government has envisaged eight national missions to fight climate change. These missions covers various areas such as solar, energy efficiency, sustainable habitat, water, sustaining the Himalayan ecosystem, green India, sustainable agriculture and strategic knowledge for climate change. Government needs to align the objectives of these missions as all the missions are working for the common goal, which is to reduce the emissions and reduce the effects of climate change. The success of the National Water Mission is also interlinked with the successful implementation and achievement of the other seven missions. Success can be achieved only by aligning these programmes in a holistic manner and through concerted and coordinated efforts of various departments of the government.

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### **[Rajesh K. Sood](#), National Institute of Epidemiology, Chennai**

Planning to bear the impact of climate change is important although we may not be able to prevent it but can be definitely mitigate the impact by being prepared.

Here are some ideas for action:

- The Himalayan region provides water supply and other climatic services. With unpredictable weather patterns, water pollution, water scarcity, and resultant threats to agriculture and food security and livelihoods, we need to take measures to conserve water.
- Rooftop water harvesting has been mandatory in Himachal Pradesh, a hill state in north India, but yet to see a sizeable number of buildings with water harvesting systems.
- The current sanitation model is water intensive, and with impending shortages appears unsustainable, we need to look into ecosan and dry toilets on a larger scale in the TSC.
- Pollution of water streams uphill, leads to further depletion in usable water and mechanisms for community based waste management systems needs to be worked out.
- Drip irrigation systems need to be made available and affordable, to boost agriculture in the water crisis scenario; presently use of this technology is limited to few personal and some demonstration projects and accessible only to the haves.
- Unsustainable extraction of groundwater needs to be regulated. One tube well makes all shallower hand pumps go dry.
- Forest cover is crucial for agro-climatic services of Himalayas, but local communities need to be given enough rights and stakes through non-timber produce - forest based livelihoods, so that they have a stake in conservation of the forest cover. Present policies do not give traditional rights to local communities, which lead to a lack of ownership and depletion of forest cover.

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**Swati Sharma, Saviours, Meerut**

Although the National Action Plan for Climate Change (NAPCC) is deficient on a number of counts, everyone agrees that the action plan is of prime importance to an India that has wedded itself to the idea of 9% annual GDP growth in the foreseeable future.

As India's population increases and more and more areas become urban, the demand for water has been increasing for domestic, industrial, irrigation and other uses as well. More and more basins are coming under scarcity conditions and frequent conflicts between upstream and downstream users have become the order of the day. This needs intervention in the form of people's education and participation to conserve as much water as possible.

There has been inadequate development of physical infrastructure during the 8th Five Year Plan due to reliance that was placed on private sector investment which did not materialise in adequate measures. It is necessary that impediments and delays are speedily removed. In particular the legal, procedural and regulatory framework has to be suitably revised in order to create a conducive environment for making such investment both possible and viable.

Some of the recommendations with regard to the National Water Mission are as follows-

- Water supply and domestic sewage management schemes should be integrated and for this, it is necessary that water supply programmes are not taken up without simultaneous approval of sanitation/wastewater disposal programmes.
  - The assigned target of 100% coverage in water supply can be achieved in impediments like inadequacy of funds are removed and an autonomous system with economic viability is encouraged.
  - A discipline of maintenance of the systems needs to be instilled to avoid leakages and waste of water.
  - Improved low cost technologies have to be developed and adopted to save cost of construction and maintenance.
  - Wherever feasible, artificial recharge and rainwater harvesting have to be encouraged.
  - In rural areas, where piped scheme is operational or is proposed to be developed, the local government and users committees should participate in the development and maintenance of water supply systems.
  - Rivers, which are used as a source of drinking water, also receive most of the pollution load. Hence, more action plans to arrest the pollution of rivers need to be drawn and implemented.
  - Use of treated municipal wastewater for irrigation and fodder cultivation should be encouraged by local authorities. The revenue obtained can be used to supplement the sewage treatment costs.
  - Reuse of treated municipal wastewater may be enhanced by industries.
  - Public awareness needs to be created for reducing water consumption; women's participation is to be encouraged to the maximum as they are major users.
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**Dinesh Kumar, Institute for Resource Analysis and Policy, Hyderabad**

I think Mr Himanshu Thakkar has brought in an important issue for discussion. After reading several responses to that I am motivated to write this note.

- It is high time that we revisit the “finding” that climate is changing, and that we in South Asia are going to be affected very severely by its impacts. The reason, I am afraid, we don't seem to have sufficient empirical and scientific data to come to this conclusion – except anecdotal evidences. If at all data is available, at what level these are available: at the regional level, at the sub-continent level or at the micro level? I think citizens of the country have the right to know that first. The “climate change crusaders” have the responsibility to put this data in the public domain and should go far beyond the typical “climate model predictions”.
- “Over-reactions” based on poor information, not backed up by good science, might cost a lot to the society, as much as the phenomenon itself.
- Everyone in the streets seems to talk about climate change. If climate change is going to be a reality, how is it likely to unfold? Or when we say “climate change” what are we really referring to? Is it change in temperature; rainfall/rainfall pattern; humidity; solar radiation etc.? Perhaps, some experts in the community can elucidate this.
- What is the impact of this climate change on the hydrology? We must remember that we in India experience very significant climatic variability (inter-annual). Not only the rainfall, but the mean daily/monthly temperature also changes from year to year. The stream flow varies from year to year in the same basin and the ratio between minimum and maximum runoff is 1:200 for some basins! But, this is not treated as “rainfall change, temperature change or stream flow change”. The extent of inter-annual variability changes from region to region. Under such a condition, what is likely to be the impact of temperature rise on rainfall or stream flows? Is it going to change the frequency of occurrence of “extreme events” or reduce the rainfall across years?
- Perhaps that would determine the change needed in the design of water resource systems – high inter-annual variability would call for increasing the multi-annual storage of reservoirs (answering to Shri Himanshu)
- There seem to be a general belief among the folks that climate change is going to adversely affect crop yields. While temperature increase can potentially affect wheat and rice yields in tropical Asia (going by crop model predictions), the point is that this very impact depends on the degree of change in temperature (whether it is 1 degree or 2 degrees). Again, increase in Co2 levels would have positive impact on wheat and rice yields. So, we must know, to what extent they are going to change to assess the net impact on crop yields. There are as many crop yield models which have predicted increase in rice yield as those which have predicted reduction (for Bangladesh, Indonesia, Thailand; Philippines etc.)! Again, the impact is not likely to be uniform across regions within countries.
- Climate change model generally predict positive impact of climate change in temperate climate and negative impacts in tropical climate on yield of major cereals. So, this can change the balance in international food trade. The global impact on food availability would be decided by who all are actually producing more food today, and how they would be impacted.
- From the point of view of managing our water resources, we need to understand the real impact of such a change on crop water requirements, particularly when it is argued that

temperature rise would reduce the crop duration (less time required for crop to mature) in case of wheat, for instance. "What happens to water use efficiency" is the question here.

- It would be dangerous if we pick up one parameter and do modelling to make "doomsday prophecies" as different associated parameters will have different impacts on hydrology, crop yields etc. More than the total rainfall, its pattern would influence the runoff rates.
- If anyone (from the community or from outside) can provide (if not conclusive, some concrete) evidences on "climate change phenomenon" happening in a part of this sub-continent (using data on rainfall or its pattern; ETO; solar radiation etc., soil moisture regime etc.) which use time series data, that would be of great use to take the discussions forward. In my view, this is what the water community badly needs.
- First, we may also like to ask questions about the accuracy of the models which predict climate change, and then those models which use the "predicted climate variables" to predict hydrological regime change or changes in crop yield. The society needs much greater expertise to do that. This is precisely what the people in the advanced societies do. Then we can look around for real evidences of the predictions in terms of yield reduction, flow regime changes. Well, there are no simple solutions. Here again, attributing to phenomenon like stream flow reductions to climate change would be too pre-matured, as that can happen because of land-use changes or change in water use hydrology also.

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### **Vishwanath Srikantaiah, BIOME, Bangalore**

Himanshu Thakkar's questions are pertinent and were discussed at a recent workshop organised jointly by several NGOs including BIRD-K, OUTREACH and AME in Bangalore.

Since they have been working on the issue of watershed management, organic farming and water conservation, amongst others they had a few questions for themselves and with the audience to share and I am summarizing them for you. This included:

- How can the activities of the farmers help mitigate the impacts of climate change? That is can the sequestration of carbon, reduction in Green house gas emissions like methane et al be enhanced so that the farmers do their bit to reduce global warming.
- How can small and marginal farmers in arid and semi-arid areas of India build resilience to the climate change impacts coming and already upon us?

Resilience strategies included a series of good practices around soil and water conservation, for example the works of BIRD-K in building trench cum bunds for every plot, including individual and networked farm ponds, tree and horticulture based farming, fodder crops and animal husbandry, multi cropping and moving away from mono crops, recharging aquifers and switching to traditional and new climate resilient crops like millets. Systematic water balance initiatives for villages, rooftop rainwater harvesting for households, multiple sourcing of water, rejuvenation of open wells were already being done and were seen as climate resilience strategies.

Sequestration strategies were not clear and the group wanted to further understand:

- How soils could be used to sequester carbon
- How trees could be used to help fight warming
- How bio gas based plants could reduce methane emissions and provide energy

The group will coalesce into a network around climate change and livelihoods in semi-arid India with a particular focus on small and marginal farmers and I would be happy to share the presentations made by various speakers on that day of the workshop.

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**V. D. Sharma, V. B. S. Purvanchal University, Jaunpur**

I would like make a few suggestions regarding the National Water Mission envisaged under the National Action Plan on Climate Change:

- Small dams/barrages/ponds should be made so as to collect rainwater
  - Rainwater should be promoted for drinking and cooking only, and to restrict its use to these purposes
  - Groundwater should be used only for drinking and any individual or agency wasting groundwater should be punished
  - Irrigation should only be done using sprinklers using rainwater accumulated in ponds, lakes and other surface bodies
  - Soft drinks or mineral water producers should not not be allowed to use groundwater or river water
  - MNCs should not be allowed to trade water whether it is groundwater or river water. They may be allowed to collected and trade rainwater
  - Wastage of water should be made a punishable offence
  - The project of interlinking rivers should continue. It may give fruitful results.
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**Pradeep Mohapatra, UDYAMA, Bhubaneswar**

Climate is a reality, and fear and vulnerability are getting accelerated and this will affect the rich and poor, and urban and rural areas. There must be evidence-based work at community levels linking policy and practice. Moreover, this has to be taken up by the NAPCC by integrating across the ministries as has rightly suggested by members.

Hence, it is important to:

- Map communities at risk
- Integrate governance and development
- Need for common action for disaster-climate justice-livelihoods-environment
- Need for evidence based work at community

We expect there must some changes in attitude of all concerned if we want a change and if people matter.

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**B. C. Choudhury, Wildlife Institute of India, Dehradun**

In the context of climate change and the anticipated changes in the flow pattern of snow-fed rivers, and changes in the precipitation regime and in rain-fed rivers of India, a significant change in the use of

surface water and cropping patterns are also expected. We need to keep this in mind for planning for the future.

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**Vijay L. Ghugey, Nisarg Vidnyan Mandal, Nagpur**

We are working with people and villages situated on the fringe of a forest. Recently, we carried out some soil-moisture conservation as part of watershed management by involving our youth members from Nagpur city and villagers. We are doing this work without any financial support from funding agency and, therefore, have limitations. Our suggestion is that NWM should also support such initiatives.

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**Uday Bhawalkar, Bhawalkar Vermitech Pvt. Ltd, Pune**

Please refer to the attached papers <http://www.solutionexchange-un.net.in/environment/cr/res-29120801.doc> (DOC; 160KB) and <http://www.solutionexchange-un.net.in/environment/cr/res-29120802.ppt> (PPT; 668KB) that give details of the promising BIOSANITIZER Ecotechnology that offers interesting possibilities such as:

- Eco-friendly water treatment without use of electricity and chemicals, with no production of any residue during this process
  - Use of this water to trap greenhouse gases and achieve ecosanitation (use of garbage and sewage for agriculture) and non-toxic pest control
  - Conversion of seawater into coconut water-like tasty water that can climb against gravity and recharge the groundwater, providing nourishment to plants on the way
  - Groundwater, thus charged, overflows into surfaced water; this ensures that our rivers and lakes continue to be filled up, as in the past
  - Use of this water ensures healthy soil, food, animals, man and overall culture
  - Treatment of industrial solid, liquid and gaseous wastes, trapping greenhouse gases during the process and production of resources
- 

***Many thanks to all who contributed to this query!***

*If you have further information to share on this topic, please send it to Solution Exchange for the Water Community in India at [se-wes@solutionexchange-un.net.in](mailto:se-wes@solutionexchange-un.net.in) with the subject heading "Re: [se-watr] Query: Inputs for Water Mission of National Action Plan on Climate Change - Advice; Examples. Additional Reply."*

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