IWMI-TATA Water Policy Research Program

Phase II: 2006-2010

Annual Report 2009

IWMI
International
Water Management
Institute

IWMI-TATA
Water Policy Program

Foreword

Of all the water use sectors in India, as in many other developing countries, agriculture is by far the dominant user of freshwater. Irrigated agriculture has been fundamental to the country's agricultural development and national food security. In recent decades groundwater has emerged to be an important source of fresh water. At present about 85% of groundwater is used only for irrigation. Groundwater accounts for as much as 70-80% of the value of farm produce attributable to irrigation. Groundwater is now the source of four-fifths of the domestic water supply in rural areas, and around half that of urban and industrial areas. Studies carried out in the past under the IWMI-Tata Water Policy Research Program has clearly shown the increasing overexploitation of groundwater that is occurring in both rural and urban areas. The problem is not only that farmer's are mining aquifers faster than they can be replenished, but as water levels drop; pumps are also sapping an already fragile and overtaxed electricity grid.

A major challenge faced by India's farmers is the need to increase food production to the tune of 300 mt by 2020 to feed the estimated population of 1.30 billion (2020). To meet this food demand, farmers need to produce 50% more grain. Thus agriculture must significantly improve its water use efficiency and productivity.

Since 2000, the IWMI-Tata Water Policy Research Program (ITP) jointly funded by the Sir Ratan Tata Trust and the International Water Management Institute has made significant contribution by addressing some of the critical issues relating to water management in India. Importance of water saving technologies and the need for their increasing adoption, in the face of the present water starved scenario, has been recognized by the program. Identifying appropriate water saving technology and promoting its sustainable use through information dissemination and policy recommendations has been undertaken in various parts of the country.

This Annual Report 2009 outlines the activities carried out by ITP and highlights some of the key policy impacts of the research carried out in 2009. The report also lists some of the major capacity building programs and workshops that were held to disseminate key research findings. I congratulate Dr. Palanisami and his team for the good work carried out under the program in 2009 and for compiling this report. I look forward to ITP in 2010, building on the work done to date and translating major research findings to propose appropriate policy interventions for effective management of the scarce water resources in the country.

Madar Samad
Regional Director, South Asia
IWMI, Hyderabad.

Preface

Sir Ratan Tata Trust (SRTT) extended its funding for the second phase of the IWMI-Tata Water Policy Research Program (ITP) for the period 2006-10 and the following are the major areas of action: a) Research focusing specifically on water sector issues concerning underprivileged communities and backward regions in the country, b) Idea-incubation for livelihoods enhancement efforts using water as a central input, supporting the Trust in their water sector partnerships, c) Dissemination and raising public awareness, d) Widening the network of research partners and e) Policy influencing

Regarding the activities in 2009, 24 research studies were initiated of which 8 studies have been completed and of the 16 ongoing studies, 10 were initiated during November 2009. Four student fellowships and one internship program were supported under ITP to build research capacities of young researchers.

Two capacity building and outreach programs were launched this year – i) Drip irrigation capacity building program, covering 100 villages and 1000 farmers in Tamilnadu; ii) Micro Irrigation in hill regions of Uttarakhand covering 12 locations with micro sprinklers and drip systems. Both programs are progressing well with the involvement of different stakeholders. Three policy workshops were successfully conducted focusing on climate change and water, micro irrigation and hill water management. Three new donor funded projects have been initiated- focusing on climate change impact in Godavari; climate change and adaptation strategies in Krishna Basin and irrigation subsidies focusing on Andhra Pradesh state.

To disseminate ITP learnings, several publications – books, booklets and research reports are planned and will be published during 2010.

We hope the report will be useful in appraising the ITP activities to all our partners and SRTT as well. Partners can further use some of the ITP activities for up-scaling them in different locations.

K.Palanisami
Director, ITP
January 15, 2010

Contents

1. Introduction

1.1 IWMI Tata Water Policy Research Program – An Overview

IWMI-Tata Water Policy Research Program is a collaborative initiative between a research institution and a corporate body, the International Water Management Institute (IWMI) and the Sir Ratan Tata Trust (SRTT). This partnership emerged from a shared concern regarding the growing water stress in different parts of India.

International Water Management Institute (IWMI)

IWMI is one of 15 international research centers supported by the network of 60 governments, private foundations and international and regional organizations collectively known as the Consultative Group on International Agricultural Research (CGIAR). It is a non-profit organization with a staff of 350 and offices in over 10 countries across Asia and Africa and Headquarters in Colombo, Sri Lanka.

IWMI's Mission is to improve the management of land and water resources for food, livelihoods and nature.

IWMI's Vision, reflected in the Strategic Plan is to be a world-class knowledge center on water, food and environment.

IWMI targets water and land management challenges faced by poor communities in the developing world/or in developing countries and through this contributes towards the achievement of the UN Millennium Development Goals (MDGs) of reducing poverty, hunger and maintaining a sustainable environment. These are also the goals of the CGIAR.

Research is the core activity of IWMI. The research agenda is organized around four priority Themes including

- Water Availability and Access
- Productive Water Use
- Water Quality, Health and Environment
- Water and Society

Cross cutting activities in all themes include, assessment of land and water productivity and their relationship to poverty, identification of interventions that improve productivity as well as access to and sustainability of natural resources, assessment of the impacts of interventions on productivity, livelihoods, health and environmental sustainability.

IWMI works through collaborative research with many partners in the North and South and targets policy makers, development agencies, individual farmers and private sector organizations.

Web: www.iwmi.cgiar.org

Sir Ratan Tata Trust

Set up in 1919, the Sir Ratan Tata Trust situated in Mumbai, is one of the oldest philanthropic institutions in India, and has played a pioneering role in changing the traditional ideas of charity. Through its grant making, the trust supports efforts in the development of society in areas of rural livelihoods & communities, education, enhancing civil society & governance, health, arts & culture.

For more information on the trusts institutional support and program areas, log on to: http://www.srtt.org/prog-rural.html

While the issues and problems related to water have been well articulated by several researchers and organizations over time, the IWMI-Tata program aims at evolving fresh perspectives and sustainable solutions by drawing from the vast research carried out across the country and present in the form of policy recommendations to the policy makers at the national, state and local level.

The IWMI – Tata Water Policy Research Program (ITP) was launched in 2000 and operated from the IWMI Tata office at Anand, Gujarat till 2006 after which the office moved to the IWMI South Asia Regional office at Hyderabad.

ITP objectives are two fold –

- To engage Indian scientific/academic institutions in addition to in-house researchers in a practical agenda to identify, analyze and document relevant water-management approaches and current practices. This program brings in the multi-disciplinary perspective in the analysis of water related problems.
- To help policy makers at the central, state and local levels, address the water challenges – in areas such as sustainable groundwater management, water scarcity, and rural poverty – by translating research findings into practical policy recommendations.

To achieve the above objectives several appropriate outreach vehicles have been identified and they include –

- Policy publications and research papers.
- Policy roundtables, consultations and workshops.
- Funding of research projects.
- Funding of projects that encourage collaborative activities and cooperation across the Indian research community.

Since its inception, ITP has worked on 26 research themes in the water sector and brought out four books, over 80 research papers in national and international journals and over 300 discussion papers. About 160 studies have been completed so far. ITP has partnered with close to a 100 organizations to carry out research, field implementation programs, build capacities as well as to share information among partners. This network mode of operation continues to be part of ITP.

Based on the success of the earlier two field interventions (NGI and CInI), ITP has undertaken two field intervention / capacity building programs – TNDRiP in Tamilnadu and a field research and implementation of MI in Uttarakhand in 2009.

2. ITP Highlights of 2009

Several new initiatives emerged during 2009 in all areas of ITP focus, namely – research, outreach and policy. Activities in partnership with other institutions were many during this period. Some of the highlights of 2009 are mentioned below.

1. **Research:** 24 contracts were issued in 2009 to conduct research on issues of policy relevance. Policy recommendations from research studies carried out during 2006 to 2008 were summarized. Four fellowships and an internship were awarded of young researchers. Several workshops and conferences were organized in collaboration with partners to share research findings.
2. **Partner Links:** Early in 2009, collaborative research and policy studies were initiated with SRTT partners. This has evolved in the last few months with an LOU signed with the organization, Himmotthan and work on Micro Irrigation (MI) already underway in Uttarakhand. LOU is under preparation for working with the NGO, CInI in Jharkhand. Logistics are being discussed for ITP's involvement in the North East and is likely to be initiated, early 2010.
3. **Publication:** In addition to publishing ITP research findings in national and international journals of repute, several other publications are in the pipeline. With 2010 being the consolidating year for ITP Phase II, focus will be on dissemination and policy discussions based on research findings from ITP studies. A draft report based on the policy recommendations from ITP studies carried out during 2006-08 is under circulation for feedback. Two policy briefs based on the ITP studies, one on Groundwater Issues and the second on Micro Irrigation are ready for publishing. Several ITP books are under various stages of publishing, the details of which are given in the respective section of this report.
4. **Policy:** Policy interface has been initiated with selected state Government. Specific mention of the links with the following requires mention -a) Govt. of Tamilnadu, b) Govt. of Uttarakhand, b) Ministry of Water Resources, GOI, c) Indian Council of Agricultural Research (ICAR).

   Details of linkages and leverage from ITP research into government programs are detailed out in the respective sections.

ITP Steering Committee

A 5 member ITP Steering committee (SC) was formed in July 2008 to provide support and timely guidance where appropriate to the ITP research work through regular reviews. The ITP SC met three times in 2009 - in February, May and November. The November SC meeting also reviewed the ITP Research Output during Phase II.

ITP Steering Committee in Progress

3. Initiatives

3.1 Research Initiatives

ITP Phase II activities were designed with the intension to conduct practical research on a range of water sector issues; identify and make policy impacting recommendations to the policy makers. Some of the action points are as listed below:

- Research focusing specifically on water issues concerning underprivileged communities and regions in the country
- Idea-incubation for livelihoods enhancement efforts using water as a central input
- Dissemination and raising awareness
- Widen network of research partners
- Policy influence

While the work plan for 2008-09 focused on expanding research and pilot ideas, the focus during 2010 will be on dissemination and policy influence.

3.1.1 Research

i] Status of 2009 Studies

Under contract research, a total of 24 individual consultancies were awarded during 2009 and the status of the studies is provided in Table 1. While the final reports for 8 studies have been submitted, the remaining studies are under progress.

Table 1 : Status – 2009 ITP Research Contracts

No.	Topic	Contract awarded to	Status
		Completed Studies	
1	SRI: How effective under different irrigation sources and farm size categories	Dr. C. Vijayalakshmi Dr. Karunakaran	Draft report completed
2	Prospects of micro irrigation in canal command areas	Dr. Devender Reddy	Draft report completed
3	Impact of dug well recharge schemes	Dr. P. Natesan	Draft report submitted
4	State Water Sector Intervention: Current Status, Emerging Issues and Needed Strategies		

(Contd...)

(Contd...)

4A	Karnataka	Dr. M.G.Chandrakanth	Draft report completed
4B	Tamilnadu	Dr. D.Suresh Kumar	Draft report completed
4C	Andhra Pradesh	Mr. Rahul sen	Draft report completed
4D	Gujarat	Dr. R. Parthasarathy	Draft report completed
4E	Maharastra	Dr. A. Narayanamoorthy	Draft report completed
	Ongoing Studies		
4F	Rajasthan	Dr. Manohar S Rathore	work progress
5	Privatization of Water Servicing: How effective will it be? – Case of the Water Project by Tirupur Area Development Corporation Limited (NTADCL), Tamilnadu	Dr. K. Palanisami Dr. P. T. Umashankar	work progress
6	Financial Performance of India's irrigation Sector: A Macro Level Analysis	Dr. A. Narayanamoorthy	Work progress
7	Water Management Research and Upscaling the Interventions	ITP Team	Work progress with 3 WTCs and 10 Water management schemes.
8	Tank Irrigation in India: What Will be the Next Best Alternative? – A Meta Analysis	ITP Team	Work progress.
9	Climate change and food security of India: Adaptation strategies in the irrigation sector	Dr. P.K.Aggarwal	Work progress (70% done)
	Studies Initiated in November 2009		
10	NREGA Impact on Rural Water Security: Proposal for an Exploratory Study in Gujarat, Madhya Pradesh, Rajasthan, and Tamilnadu	Dr. Tushaar Shah, Dr. Madar Samad, Dr. K. Palanisami	Work Progress
11	Gujarat studies:		
11a	Assessment of the Restructuring of Gujarat Agricultural University	Dr. Tushaar Shah, Dr. K. Palanisami	Work initiated
11b	A Study of organizational restructuring of Gujarat Electricity Board.	Dr. Tushaar Shah, Dr. K. Palanisami	Work initiated

(Contd...)

(Contd...)			
11c	Study of Gujarat's Krishi Mahotsav Program	Dr. Tushaar Shah, Dr. K. Palanisami	Work initiated
11d	A study of impact of Maharashtra Water Resources Regulatory Authority (MWRRA)	Dr. Tushaar Shah, Dr. K. Palanisami	Work initiated
11e	Organizational study of Water and Sanitation Management Organization (WASMO), Gujarat	Dr. Tushaar Shah, Dr. K. Palanisami	Work initiated
12	Whether Corporate NGOs approach for Rehabilitation of Urban Tanks will be up-scaled? A case study of urban tank rehabilitation	Dr. A. Raviraj	Contract issued
13	Macro-level Impact Assessment of Decentralized Water Harvesting and Groundwater Recharge in Saurashtra	Shilp Verma and Avinash Kishore	Contract issued
14	System of Rice Intensification – Adoption and Constraints in Kerala	Dr. S. Shanmugasundaram	Contract issued
15	Study of the Guidelines and Operational Procedures adopted by Different States in the Implementation of the Micro Irrigation	Dr. S. Raman	Contract issued

3.1.1 (a) Research Studies Awarded in 2009 – Completed

Study Title 1

SRI: How effective under different irrigation sources and farm size categories

C. Vijayalakshmi and R. Karunakaran

The issue is how the farmers are responding to SRI over years? If there are dis-adopters, what are the major constraints in their adoption in a sustained manner? How the SRI is responding to different irrigation sources such as canal irrigation, well irrigation and conjunctive use with ground water, as water control is varying across the sources and regions? What is the actual impact of SRI on the farm income, resource utilization, labour displacement, changes in the cropping system, and changes in other

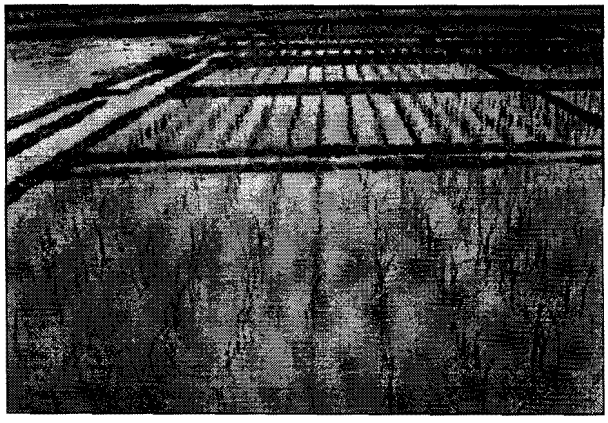
socio-economic variables? The sustainability of SRI method and the constraint in adopting various components of the SRI technology are not explored and documented well.

Methodology

Considering the different irrigation systems in the state, 10 districts were selected for the farm survey representing all type of irrigation sources *viz.*, canal, tank, well/ tube well and conjunctive uses for paddy cultivation. In each district, based on the coverage of SIR method two blocks were selected and in each block 25 SRI farmers were selected randomly from two or three villages spreading in the blocks. Besides that in each block, five non SRI farmers were selected for comparison. Totally 500 SRI farmers and 100 non SRI farmers were selected from selected 10 districts in Tamil Nadu. The data related to 2008-09. The paddy cultivation and adoption and coverage of SRI method of paddy cultivation were collected for 2007-08 & 2008-09 in all three seasons viz., Kharif (June – Sept), Rabi (Oct- Jan) and Summer paddy (Jan –March) from the selected farmers on recall basis.

Major findings

- 52 % SRI farmers are large farmers, since they were promoted by the department of Agriculture
- Among the SRI adopters more than half the paddy area was allotted under SRI method
- 55 % farmer used less than 5 kg seed instead of 2 kg/ac
- Every year about 10% new farmers convert to the SRI method
- Most (73%) of the farmers used 18-20 days old seedling instead of 14 days old 4 leafs seedling by SRI
- Most of the SRI farmers have better level of adoption of SRI components in the ground water irrigated paddy system
- 6.6% followed square planting as per the recommendation
- Almost 87% farmers do one / two cono weeding one way due to non adoption of square planting and lack of skilled labour availability
- Most (63%) used row planting (22.5 cm b/w line and <20cm spacing between plants) against 22.5 x 22.5 cm by SRI.



SRI Field

SRI – Proper water control

8 months. Wide publicity has been made by the nodal agency and NABARD in the local language so as to reach the farmers for proper implementation of the scheme.

The cumulative progress for the last four months since July2009 indicates that no appreciable work has been done in Vellore, Erode, Krishnagiri, Tiruvannamalai, Perambalur, Karur, Madurai, Theni, Virudhunagar, Sivagangai, Ramanathapuram, Thanjavur and Thiruvarur districts. The average percentage of achievement against the beneficiaries identified in all the districts is 3.8%. Effectiveness of the dug well recharge structures were carried out in the best and poor performing districts in coordination with the nodal agency and local farmers. 28 locations in Trichy, Salem, Kancheepuram, Tiruvallur, Dharmapuri and Krichnagiri districts were inspected.

There were certain major bottlenecks in identifying the beneficiaries in the implementation of the scheme. The farmers have to be tuned up to conceive the scheme and after that the application has to be forwarded through the VAO with the information of their land holding details. The rejected applications are sent back to the nodal department or even back to the farmer for rectification causing delay. There is absolutely no mechanism to enquire about the status of the application form.

The time when the money is credited to the accounts of the beneficiaries is of paramount importance and even after crediting the amount the farmers are extremely reluctant to begin construction work for some reasons.

Though NABARD was able to release the amount to the beneficiaries through the banks, some banks, particularly State Bank of India and Indian Bank, are not crediting the amount in time even after one year.

The CGWB has a very limited role to play. It is involved in giving technical assistance for the scheme. New models coming up in certain districts due to variation in hydrogeological conditions is being designed and placed in the SLSC for approval. But beyond this, the organization is in no way involved in the process of the scheme.

The design of the structure though varies depending on the hydrogeological conditions, not implemented in full shape in most of the locations verified. There is no proper Catchment for water collection and inflow into the structure.

Though official machinery is involved in implementation of the programme, the farmers/public is not fully convinced/shown interest in implementation. Programme target is so heavy and the nodal agency could not be able to monitor the implementation due to lack of supporting staff. Field officers in certain districts are not showing enough interest in implementation of the scheme. Unless they have a close contact and coordination with the farmers it is very difficult to achieve the target. There should be some holdings in implementation of the scheme by the farmers so that effective steps can be taken by the field officers. There are many free as well as subsidy schemes are available for the farmers in the state and if there is political and administrative will then the scheme can be achieved to its objective. The beneficiary and the nodal agency should be made responsible for successful implementation of the scheme.

The design of the structures as approved in the State Level Committee is not followed in nearly 35-40% of the locations visited which seems that no proper guidance and physical monitoring is done. The demand for an increase in the subsidy amount has been a common one from almost all quarters. The subsidy amount should be region and context specific. The scheme can be implemented on demand driven approach.

The difficulty to monitor the status of the application forms can be solved by computerization and putting the data in the Geographical information System(GIS) platform which will be possible for both the farmer and the government official to trace the current status of the application and to identify the bottlenecks in the system. The farmers should well aware of the importance of the programme. Once if the farmers realize it, then even the schemes can be maintained by themselves like massive roof top rainwater harvesting programme implemented in Tamilnadu state. If the communication campaign is carried on a sustained and continuous basis through use of multiple media, then the response and construction of the structures might increase.

State level water reform studies – 4

Study Title 4A

State Level Water Sector Interventions – Karnataka State

M. G. Chandrakanth

Karnataka has an estimated flow of 1695 TMC of surface water and 485 TMC of groundwater every year. The positive gap is due to lack of infrastructure to store the rain / river water. Groundwater utilization according to volume exceeds 70 percent of supply or availability. The demand for irrigation is estimated using the crop water requirement. About 29 percent of the cropped area of Karnataka is irrigated. The demand for industrial use is 16.62 TMC in Krishna Basin and twice of this is taken for the State. The demand for livestock is similarly estimated using the 28.82 TMC for Krishna Basin. The demand for domestic water is estimated considering 100 LPCD. The supply of groundwater for 2020 is assumed to reduce by 25 percent.

In Karnataka 1695 TMC of surface water forming 78 percent of the total volume of water irrigates fifty percent of the irrigated area of 16,85,548 ha while the remaining 485 TMC of groundwater forming 22 percent of the total volume of water irrigates the rest 50 percent of the irrigated area. This shows the lopsided distribution of surface water compared to groundwater resources. Thus *prima facie* there are compelling reasons to bring efficiency of water use both in surface irrigation and groundwater irrigation. Groundwater farmers are relatively more efficient than the surface water farmers as 485 TMC of groundwater forming 22 percent of water is spread on 50 percent of irrigated land. And have spread 1695 TMC of surface water, forming 78 percent of water on 50 percent of irrigated land. Thus 1/4th of total water (=groundwater) is used on half the irrigated land and 3/4ths of total water (=surface water) is used on the other half of irrigated land in Karnataka.

Karnataka state depends on groundwater for irrigation to the extent of 51 percent. Drip irrigation is feasible for groundwater irrigation and thus, the state has a vast scope to promote drip irrigation since 51 percent of the irrigated area is under groundwater irrigation. Thus the State depends almost equally on groundwater and surface water for irrigation

Cost of groundwater irrigation

The cost of establishing groundwater wells varies widely in proportion to well failure, depth of drilling, etc, from Rs. 35,000 for dug wells in northern dry zone to Rs. 200000 for bore wells in eastern dry zone.

Economics of crops

The cost of irrigation using surface water and groundwater for common crops indicates that the cost of surface irrigation (charged by the Irrigation department) indicates that the greatest profit is from sugarcane followed by potato, tomato and paddy is one of the least profitable crops consuming one of the largest volumes of water. The cost of groundwater taken as the amortized cost of investment on all wells on the farm, divided across the average life/age of the wells at a social discount rate of 2 percent, indicates that the cost of irrigation is the largest for sugarcane followed by paddy, banana, coconut, arecanut crops.

Watershed investment

The average cost of watershed development is Rs. 8397 per ha and the State has delineated 18180 micro watersheds covering an area of 2405187 ha.

Micro irrigation

Among the different crops economically amenable for drip irrigation, the potential exists for coconut (131704 ha) followed by arecanut (77434 ha) , mulberry (47180 ha), pomegranate (10,000 ha) where the water saving ranged from 33 to 40 percent realizing an increase in productivity ranging from 25 to 45 percent. Karnataka state, has disbursed subsidies of Rs. 260 crores for 164,000 hectares of horticulture crops since 1991-92. The total area under micro irrigation is 164000 ha forming 10 percent of the total area under horticulture. The Central scheme offers 50 per cent of the cost of micro-irrigation system or a fixed amount, whichever is less as subsidy. Thus, Centre's share is 80 per cent and the State meets 20 per cent. Karnataka is offering in addition, 25 per cent to the already existing 50 percent Central subsidy, thus totaling 75 per cent, in order to encourage micro irrigation to horticulture. Among the districts, 100 per cent subsidy is given to Bijapur and Kolar districts.

Irrigation investment in Perspective

In major irrigation, the potential area for new investment is 18,80,000 ha averaging Rs. 1.25 lakhs per ha. In minor irrigation, the potential area is 9,67,000 ha averaging Rs. 78,106 per ha in tanks. Considering the borewells, the potential area is 781340 ha averaging an investment of Rs. 1,00,000 per irrigation well

Major problems facing the state's irrigation sector

a. Demand for new irrigation infrastructure has reduced fund allocation for O and M, rehabilitation and modernization of existing irrigation works, reclamation of water logged and problematic soils

b. Due to delays in construction of field channels, land leveling and poor farmer participation in the PIM, there is widening gap between potential and actual area irrigated

c. The storage capacities of 40,000 minor irrigation tanks is reduced due to siltation and poor upkeep

d. Productivity of irrigation is below potential. Sub-optimal distribution of water and lack of integration of irrigation services with agriculture services have resulted in low yields, low cropping intensities and has prevented diversification of agriculture. Land development and agricultural extension have not kept pace with the creation of irrigation potential.

e. An estimated 40 percent of the electrical power goes to IP sets in Karnataka. Thus electricity is almost provided free of cost to farmers in Karnataka. However farmers bear the brunt of negative externality due to interference of irrigation wells leading to initial and premature well failure.

Study Title 4B

State Level Water Sector Interventions – Tamilnadu

K. Palanisami and D. Suresh Kumar

The annual water potential of the state is 46540 Mcm and the estimated demand is 54395 Mcm and will go up to 57725 in 2050. Net irrigated area is fluctuating from 2.4 to 2.8 m.ha over years. Major issues relating to the state are groundwater over-exploitation, poor performance of the tanks and slow take off in micro irrigation. Detailed studies were conducted to address these issues and the major recommendations are outline below:

Watershed developments and groundwater management

- Intensify watershed developmental activities, especially in overexploited and critical blocks on a priority basis so that dysfunctionality of wells will be minimized. The abandoned wells should also be used for groundwater recharge.
- Water saving techniques, such as drip/sprinkler irrigation, should be introduced to all commercial crops, and all extension officers should be trained who, in turn, can train farmers in installation and maintenance of the systems. In addition, capacity building programs at the village level should be initiated to benefit all farmers in the villages.
- A watershed program with recharging options should be implemented in areas with rainfall ranges of 700-1,000 mm/year.
- Combining five to six micro-watersheds will enhance the benefits of watershed programs.

Interventions in Tank Irrigation

Even though the number of tanks is about 39,200, it is not known how many are still functioning. The results of the study had indicated that in less-tank-intensive regions, about 64% of Public Works Department (PWD) tanks and 76% of the Panchayat Union (PU) tanks are defunct. In tank-intensive regions, about 2.6% of PWD tanks and 1.2% of PU tanks are defunct, showing that there is still a potential to make the tanks a better investment entity.

Conversion of tanks to percolation ponds

As rainfall has been varying much over the years, several tanks are functioning as percolation ponds, recharging the wells in the tank command. A partial budget was worked out using a 15-tank sample in the southern districts with the aim of comparing the financial gains and losses by cultivating paddy and sugarcane crops. Normally, a farmer with a command area under a tank with well conditions and having 2 ha land prefers to cultivate 1 ha each of paddy and sugarcane. The same farmer in the tank-only situation could cultivate only paddy in the 2 ha. Farmers with wells would be able to get a net income of about Rs. 49,000/ha compared to other categories. Total number of wells in a tank command can be increased by 25%.

Investment options in canals, wells and tanks

The rates of return will be high for small system tanks (20.6%), followed by large system tanks (20.3% In general, system tanks offer 19.8% return over the investment. Shallow tube wells within the surf command and dug-wells within the surface water command have an internal rate of return (IRR) 20.7% and 19.3%, respectively. The rate of return to dug-wells within the surface command will 12.2%. Both watercourse and main system improvement will have 14.1 and 13.9% returns, compa to a 6.1% return over the investment on unimproved types. Similarly, improvement of watercou could yield 13.4% followed by improvement of the main system (13.2 %) and unimproved ty (6.2%) (Table 1).

Table 1- Financial evaluation of future investment strategies in Tamilnadu

Source	Benefit: Cost Ratio		IRR (%)
	10%*	15%*	
Reservoirs	0.77	0.58	6.1
Unimproved	0.77	0.59	6.1
Main system improvement	1.27	0.94	13.9
Water course improvement	1.28	0.95	14.1
Wells			
Dug-wells	1.06	0.90	11.7
Within surface systems	1.46	1.10	19.3
Outside surface systems	0.76	0.57	6.0
Deep tube wells	0.96	0.75	8.1
Within surface systems	1.13	0.76	12.2
Outside surface systems	0.81	0.55	6.8
Shallow tube wells	1.37	1.13	18.0
Within surface systems	1.55	1.27	20.7
Outside surface systems	1.39	1.15	18.1
Tanks			
System tanks	1.49	1.22	19.8
Medium/large	1.52	1.25	20.3
Small	1.55	1.27	20.6
Non-system tanks	0.76	0.50	5.8
Medium/large	0.78	0.52	6.2
Small	0.80	0.52	6.4

* Discount rates.

Current water use efficiency: Canals: 35-45%; Tanks: 30-50%; Wells: 40-65%. Given the scope of introducing water management technologies in canals, tanks and wells, it is possible to save about 919 ha.cm i.e., 20% of the total water supply.

Study Title 4C

State Level Water Sector Interventions – Andhra Pradesh State

Rahul Sen

Water Use Efficiency

Against the total estimated surface water resources potential of 7.30 million ha in the state, a potential of 4.95 million ha has already been created by 2006-07. However, the utilized potential is less than the created potential. In 2006-07, the potential utilized was about 3.86 million ha through existing major and medium irrigation projects and about 0.88 million ha through minor irrigation tanks a total of 3.86 million ha. In this scenario, water use efficiency in irrigation occupies a very critical position in improving the performance of the irrigation projects. Duty achieved for some of the major irrigation projects in the state for the year 2007-08 shows that a majority of the DCs achieved duty between 5-10 acres/mcft, although about 30% of them achieved duty more than 10 acres / mcft. The DC wise comparison of the shift in duty achieved between 2006-07 and 2007-08 in some major irrigation projects in the state shows that while overall 142 DCs increased their duty between these two years, 117 DCs also showed decrease in the duty achieved during the same period. The decrease in duty is most observable in the Krishna Delta System, Nagarjuna Sagar Right Canal and Pennar Delta System.

Watershed Programs

A major watershed program for development of all the degraded lands in Andhra Pradesh over 10 years was launched during 1997 as the 10 Year Perspective Plan which envisaged to develop 10 million ha of degraded and wastelands, with an outlay of about Rs. 40,000 million from 1997 to 2007 at the rate of 1 million ha every year.

The Andhra Pradesh Rural Livelihood Project (APRLP) funded by DFID marked an innovative departure from the conventional watershed approach in the state, in applying the 'Watershed Plus' agenda, whilst remaining committed to the basic principles of watershed development. It attempted to achieve a more equitable local distribution of the benefits, through social mobilization, institution-building and improved livelihood opportunities, through the introduction of a sustainable rural livelihoods approach (SRL). Pursuing this approach led to interventions which addressed the non-agricultural livelihood needs of poor people, including food security, drinking water supply, savings and credit, transport, communications, non-land based income generation, and access to health and education services. The project provided critical SRL support to the on-going watershed program work in 5 districts (Anantapur, Kurnool, Mahabubnagar, Nalgonda and Prakasam) through financial support in 2,000 watersheds that come under the District Water Management Agency (DWMA). APRLP had seven components viz., capacity building for primary and secondary stake holders; innovations to enhance the impact of watershed works; lesson learning and policy influence; convergence; gender and equity; watershed and watershed plus SRL initiatives and; participatory technology development. Finding that APRLP approach is well placed to deliver sustainable livelihoods to the poor under the watershed program the State Level Management Committee approved the up scaling of APRLP approaches to all other districts in Andhra Pradesh from 2003. There are about 4000 ongoing watersheds in the state in which the APRLP strategies are now beginning to be followed.

Future Investment Strategies

Expected area irrigated and projected investment in irrigation by 2014

Type of Project	Expected irrigated area in lakh acres	Expected investment in crores
Major	93.76	156,457
Medium	9.83	3,536
Minor	6.27	6,270
Total	109.86	166,263

Expected area irrigated and projected investment for modernization of major and medium irrigatic projects

Project	Irrigated Area in lakh acres	Amount Rs. in crores	Expected year of completion
Godavari Delta System	10.00	3400	2012-13
Krishna Delta System	13.00	4600	2012-13
Pennar Delta System	2.50	900	2011-12
Nagarjuna Sagar Project	22.00	4400	2013-14
Nizamsagar Project	0.50	550	2012-13
Tunga Bhadra Project (HLC / LLC)	2.50	850	
Total Major	50.50	14700	
Total Medium	1.7+	400+	

Expected area irrigated and projected investment for minor irrigation projects

Project	Irrigated Area in lakh acres	Amount Rs. in crores	Source of Fund
New Minor Tanks	6.27	6,270	Jalyagnam
Revival (APCBTMP)	6.25	1100+	WB and State
Total	12.52	7,370+	

Study Title 4D

State Level Water Sector Interventions – Gujarat State

R. Parthasarathy

The state of Gujarat located at the western end of the Indian peninsula is the second highest contributor to the country's Gross Domestic Product. Gujarat has been classified as water stressed state with per capita availability of fresh water at 1137m3 (less than 1700 cu m per year).

Gujarat's total water resource potential is 50,000 MCM (Million Cubic Meters) of which the surface water is about 38,000 MCM (76 percent) and groundwater is about 12,000 MCM (24 percent). The stage of ground water development in Gujarat is 76% (CGWA). As per the Gujarat Water Resources Development Corporation (GWRDC) report of 2002, the total utilizable groundwater recharge in the State is 15079.77 MCM per annum, out of the gross annual recharge of 15873.44 MCM. The groundwater recharge rate per unit area is the highest for South and Central Gujarat (0.235 MCM/sq km), followed by Saurashtra and North Gujarat (0.188 MCM/sq km) and lowest for Kachchh (0.015). There has been a decline in the total utilizable groundwater, from 17365.40 MCM in 1984 to 12848.27 MCM in 1977. The decline is 35 to 40 percent in North Gujarat and some tribal districts.The major changes in the status of groundwater resources affecting in the state are: i)There has been a prominent change in Groundwater development in North West Arid (63%), South Gujarat (48%), and Southern Hills (64%). ii) The number of districts falling in "Over-exploited category" with more than 100% groundwater development has increased from one in 1991 to five in 2004 and all the districts belong to North Gujarat.

The effective storage potential created by surface water schemes in the State is 12012 MCM, against a total surface water potential of 38533 MCM. The potential surface water utilisation in the State is only 31.1 per cent. With the completion of all the ongoing and proposed major, medium and minor schemes including the Sardar Sarovar Project (SSP), the potential level of utilisation is expected to further go up to 56.5 per cent.

The TAHAL Committee report of the Government of Gujarat visualized a considerable gap between the supply of and demand for water in the State. The supply of water was estimated at about 800 MCM/ year in 2025 against the demand of water at around 1462.2 MCM/year. The water deficit would be about 662.2 MCM/year.

Irrigation is the major user of surface water in the State. As a result of major investments in large irrigation schemes, the net area irrigated by surface sources grew steadily from 78,600 ha in 1960-61 to 641,700 ha in 1996-97 to approximately 30,00,000 ha in 2001 . In 1996-97, the gross area irrigated by surface water sources was 0.771 M ha, nearly 21 per cent of the gross irrigated area in the State. Again, nearly 71 percent of the area irrigated by surface water is in South and Central Gujarat. Saurashtra has 16 per cent, North Gujarat has 12 per cent and Kachchh has hardly one per cent of the state's total area irrigated by surface water.

The state has 39.40 lakh hectares of potential through surface irrigation of which 17.85 lakh hectares (about 45 per cent) have been actually brought under irrigation. The state has 25.48 lakh hectares potential irrigation through groundwater sources of which 18.17 lakh hectares (about 71 per cent) are actually covered under irrigation. This proves that there is larger scope for surface irrigation in the state. Groundwater resources are rather limited and some of these are more or less fully exploited.

The state and central governments (other private initiatives) have taken administrative and policy initiatives/ interventions. More recently, the Government of Gujarat's 'check dam' scheme – under which government contributes 60% of the resources required to build a check dam if the village comes up with the other 40% – has provided a further stimulus to the popular water harvesting and recharge movement. Some 12,000 check dams of various sizes have been constructed under this scheme. This study further analyzes the other interventions in water sector and suggests strategies.

Study Title 4E

State Level Water Sector Interventions – Maharashtra State

A. Narayanamoorthy

1. Maharashtra's total irrigation potential is 8.96 mha (4.10 mha from MMI, 1.20 mha from MIS and 3.65 from MIG). State accounts only 6.40% of country's total irrigation potential, but its GCA accounts for 11.45% and rural population accounts 7.53% in 2000-01. Up to 2002, 2.88 mha irrigation potential has been created by MMI, but only 60.05% of its created potential is utilised. This is very low compared to the national level average (85.02%). Through MIS, 1.59 mha potential has been created, but only 65.41% was utilised up to 1999-2000.

2. As regards the investment in irrigation sector, the share of irrigation and flood control expenditures increased from 14.87% in 3rd plan to 33.36% in 9th plan in Maharashtra. Investment made on irrigation is the largest in Maharashtra compared to any other states in India. Up to 9th plan, Rs. 236.22 billion has been spent only on irrigation, which accounts for 17.36% of India's total investment on irrigation.

3. A total of 4050 large dams completed in the country as of 2002, the state accounts for 36 % of it. Between 1971 to 2000, about 38 large dams completed per year in the state. It was only 8 during 1951 to 1970. At the end of June 1999, state has completed, 33 major, 177 medium and 2032 minor projects. Besides, 27 major, 86 medium and 281 minor are under construction. As per 2002 data (CWC), state has a live storage capacity of 35.01 BCM, the 2nd highest capacity in the country. Despite these, share of irrigated area to GCA is only around 17% as of today.

4. Water rates have been revised regularly (1989, 1994, 1998, 2001 & 2006) by the state and rates are very high as compared to other states. But, the recovery rate declined from 166% in 1974-75 to 4% in 1998-99, due to huge per hectare working expenses. Recovery increased from 40% in 1999-2000 to 119% in 2004-05. Water rates have been revised since September 2000 and the charges have been increased by 15% every year.

5. Area under drip method of irrigation (DMI) increased from 236 ha in 1986-7 to 0.344 mha in 2005-06 in the state. State accounts for over 50 % of India's area. Districts like Nashik, Jalgaon, Solapur, A. Nagar, Pune and Sangli accounted for over 60% of drip area. Crops like banana, grapes, sugarcane, citrus crops and pomegranate accounted for 75% of drip area. Water saving is 29-47%; productivity increase is 19-29%; electricity saving is 896-2430 kwh/ha in crops like banana, grapes and sugarcane. Investment on drip is economically viable even without subsidy at 15% discount rate. However, area under DMI accounts only 11.7% of NIA, while the potential area for DMI comes to1.95 mha.

Policy Recommendations:

1. Priority needs to be given to those projects, which are in near completion stage (over 75 percent construction completed) by allocating the required money. If needed, no new project should be taken up for the next five years or till the completion of all the on-going projects.

2. It is essential to classify different irrigation schemes/projects in the state according to their level of performance (sickness). Ideally, sickness of the projects should be judged by the performance in achieving its objectives. Remedial measures can be planned after making such categorization.

3. The entire irrigation sector of Maharashtra is currently managed by five IDCs established by the state government. However, the IDCs have been facing lot of difficulties in making resources from the market by issue of bonds and debentures due to the certain reasons. This is already making sever impact on the progress of irrigation development in the state. Therefore, the state government should appoint a high level committee to find out ways and means to get out of this serious problem.

4. Efforts need to be taken to increase the utilisation percent of irrigation potential by increasing investment on the minor-hardware aspects of irrigation development.

5. Though the financial recovery of the sector has improved significantly since 1999-2000 due to various reasons, continuous efforts are needed to sustain this trend. Increased working expenditure has been one of the main reasons for the poor recovery rate in the past. Therefore cost cutting measures need to be strictly followed by rationalizing the staff strength for each one-lakh hectares of command area. A two-part tariff can also be introduced, wherein all lands included in the command area should pay a flat annual fee on a per hectare basis for 'membership' of the system which entitles them to claim water and a variable fee linked to the actual extent of service (volume or area) used by each member, as suggested by Vaidyanathan Committee Report on Pricing of Irrigation Water.

6. Drip irrigated area accounted only for about 11 percent in the net irrigated area as of 2004-05. Since drip irrigation has proved to be an efficient water saving and yield enhancing technology, all potential areas need to be brought under drip method of irrigation through properly designed development programmes. Presently the rate of subsidy is fixed uniformly for both water-intensive as well as less water-intensive crops. This needs to be restructured and the rate of subsidy fixed based on the crop's water consumption. Sugarcane, which consumes major share of water in the state, is highly suitable for drip irrigation. Drip irrigation can also be promoted in all those areas/ regions where there is over exploitation of groundwater.

7. It would be worthwhile to introduce drip on canal irrigation necessarily where sugarcane is grown since sugarcane consumes major quantum of stored water. By constructing farm ponds or making use of existing wells in the command area, canal water can be stored and the same can be used for drip system. Pilot projects should be introduced on major projects (where water availability is poor) under Water User's Associations so that with the experience of its functioning, it could be replicated on a large scale on all major projects for sugarcane and other crops.

3.1.1 (b) Research Studies Awarded in 2008-09 – Ongoing

Study Title 4F

State Level Water Sector Interventions – Rajasthan State

Manohar S Rathore

The multi location study of the State Level Water Sector Intervention in Rajasthan is being carried out along the similar lines as the above mentioned studies in other states. With the Rajasthan State analysis still in progress, the report is yet to be finalized by the respective partner.

These six state level analysis will contribute towards providing a larger picture of the impact of the various water sector impacts at a National level.

Study Title 5

Privatization of water servicing: How effective it will be? – Case of the Water Project by New Tirupur Area Development Corporation Limited (NTADCL), Tamilnadu

K.Palanisami and Uma Sankar

Project operation

In 1995, the special vehicle New Tirupur Area Development Corporation Limited (NTADCL) was set up as public limited company, with equity holders consisting of Government of Tamilnadu, TACID (TamilNadu Corporation for Industrial Infrastructure Development), Tirupur Exporters Association (TEA) & Infrastructure Leasing & Financial Services (IL&FS). Floated as the first public-private partnership in the water sector, this BOOT experiment has been operational since August 2005.

The key features of the project are: 56 k pipeline from the Cauvery river; a water distribution network of about 350 km; raw water and sewerage treatment plants; pumping stations; and conveyance facilities. The intake of water is at the river Bhavani and a water treatment plant is located at the water source. The clean water is then transported 56 kms (through steel pipes which are 1400 & 1200 mm dia) to the Master Balancing Reservoir. The villages located alongside the pipeline – Kanchikoil (2.7 MLD), Perundurai Chennimalai (8.4 MLD), Uthukali (3.9 MLD) – and the Netaji Apparel Park (1.0 MLD) are being supplied water. The water from the Master Balancing Reservoir is then supplied to the distribution stations through three feeder mains. Feeder Main-I supplied to the Tirupur Municipality and Feeder Mains II and III supplies to the Tirupur Local Planning Area.

Pricing

The Village Panchayats are paying the O & M cost to the TWAD Board. The Panchayats pay at the rate of Rs. 3.50 per 1000 litres. NTADCL charges differing prices for water used for domestic purpose and water used for industrial use. The charges are Rs. 3 per kilolitre (KL) for villages, Rs. 5 per KL for domestic use in the Tirupur Municipality and Rs. 45 per KL for industrial and commercial consumers. The project was implemented with an assessed quantum of water of 108 MLD per day but it is reported that the actual water withdrawal by the Tirupur industries even after one year is estimated at 75 MLD on normal weekdays. The water rates have again been revised in February 2007 to Rs. 35 per 1,000 litres.

Current performance

The project cost is about Rs 1023 crores with a project period of 30 years. Started operation in 2005 and now it is in the 4th year of operation. The accumulated loss is about Rs.177 crores with Rs.70 crores in 2008-09 itself. Original capacity was 185 mld with industrial units to take 130 mld at a price of Rs.55/kl and rest by domestic sector at a price of Rs.3.5/kl. Actual cost of supplying water by NTADCL including pumping, treating is about Rs.41.70/kl. However, the current performance is that NTADCL supplies about 100 mld and the domestic sector consumes about 45 mld and the industrial sector consumes about 55 mld (which is about 1/3 of the planned quantity). Hence the losses are about Rs.5.2 crores/month.

Major reasons for low capacity utilization:

a) Economic slow down which affected the exports;

b) State govt. not enforcing the law to regulate the exploitation of groundwater directly by the industries. Many industries use the groundwater and hence less demand for NTADCL water.

Study Title 6

Financial Performance of India's Irrigation Sector: A Macro Level Analysis

A. Narayanamoorthy

It has been more than a decade since the Vaidyanathan Committee submitted its report on pricing of irrigation water in India, which suggested, among others, periodic revision of water rates so as to cover at least the operation and maintenance costs of irrigation projects. During the last 15 years, i.e., after submission of the Vaidyanathan Committee report, many changes have been introduced in the pricing, financing as well as other areas of irrigation sector. A few states have also initiated bold reforms in the irrigation sector so as to bring radical changes in the overall performance of the sector. Some states have revised the water rates expecting that it would help to improve the financial recovery. A few states have transferred the management of the systems from state agency to water users group by enacting act to bring overall improvement in irrigation sector, including financial recovery. Can the revision of water rates alone help to increase the revenue and recovery rate? Why is the financial recovery of the irrigation sector poor in India? Is the poor financial recovery same across different states and time points? Is there any relationship between revision of water rates and financial recovery at different time points? Is it correct to say that the increased operation and maintenance expenditures are the main reason for poor recovery? Since there are no detailed studies covering these issues in the recent years, in this study, an attempt is made to study the overall financial performance of the irrigation of sector covering national and state level data from mid-1970s to mid-2000s.

The deadline for completing the study is February 2010. Most data and the literature needed for the study has already been compiled. During the first three months of the study, all the relevant literature relating to the financial aspects of irrigation sector has been systematically compiled. The study covers all the major states for analysis to better understand the varied financial performance. Therefore, most of the state-level secondary data required for all analysis, from mid-1970s to mid-2000s, has been compiled. Data on water price, investment on irrigation, operation and maintenance charges, receipts from irrigation sector, etc., have been collected from various publications of Central Water Commission, Ministry of Water Resources. We are currently processing and analysing the data.

The preliminary analysis of the study shows that despite substantial increase in investment on irrigation sector over the years, there has been no improvement in the financial recovery of irrigation and multipurpose river valley projects of India. The financial recovery (measured in terms of percentage of gross receipts to working expenses) of the irrigation projects was close to 100 percent during mid-seventies, but it reduced to mere 4.7 percent in 2003-04 at all India level. While the recovery rate is generally low (less than 30 percent since early 1980s) across all the States, the less developed states like Madhya Pradesh and Orissa appears to have performed better than the relatively rich states like Punjab, Haryana and Tamil Nadu. However, the financial recovery rate of Maharashtra and Gujarat has improved substantially since 1999-2000 because of certain bold measures introduced to improve it. It appears from the national level data that substantial increase in the working expenses of the irrigation sector and poor and unrevised water rates are the main reasons for the reduced financial recovery in India's irrigation sector.

Study Title 7

Water Management Research and Upscaling the Interventions – ITP Team

(Farmers participatory Action Research Program "More crop and income per drop of water")

The Farmers participatory Action Research Program (FPARP) has been initiated by the ministry of water resources during 2007-08 kharif seasons onwards in arid, semi-arid, hill and irrigated areas of the country as per the guidance of Dr. M.S.Swaminathan. FPARP have been initiated throughout the country with the help of agricultural universities, ICAR research institutes, ICIRSAT and WALMIS. As such 63 institutes in 23 states covering 2001 villages are undertaking 5000 action research programs. Each program covers a minimum of one hectare and is being implemented in a participatory mode with the farm family having a sense of ownership of the program. The total cost of 5000 FPARP is about Rs.25 crores.

The major technologies and interventions identified and implementing in the FPARP are System of rice intensification, Micro irrigation with fertigation, soil health, integrated farming system, crop diversification and multiple uses of water, credit-insurance and market reforms. Total number of results obtained till end of December 2009, is 2365 out of 5000. The impact of the program was studied by using the results obtained from the action research site in various states.

Due to the FPARP interventions, there was appreciable enhancement in water saving at farm level in various crops ranging between 23 to 89 %. Maximum water savings was recorded in wheat crop demonstrated at Jarkhand (89%), followed by Uttarakhand (69%), Haryana, Himachal Pradesh and Punjab states (67%). Likewise considerable proportion of water savings under FPARP were recorded in Apple (25%) and Paddy (27%) demonstrated in Jammu & Kashmir and Assam states respectively. The higher level of water saving was achieved under FPARP due to the reduction in water use as well as number of irrigation to the crops.

The savings in the water under FPARP demonstrations was reflected in the enhanced returns and income from the crops. The additional yield recorded in the FPARP demonstrations over conventional methods across crops had varied over states. For eg., paddy in Tamil Nadu had 404 kg/ha as additional yield; for wheat, the additional yield ranged between 1950.6 Kg/ha and 324.2 Kg/ha in various states. The productivity per unit of water under FPARP ranged between 40 and 257 Kgs/cm covering various crops. It was maximum (257 kg/cm) in the case of vegetable cowpea and it was minimum in the case of Apple (40 kg/cm) respectively in Karnataka and J&K states. The difference in the performance of FPARP over

Conventional method in terms of productivity per unit of water ranged from 23 kg/cm (for Apple) to 349 Kg/cm (for Cowpea).

The additional income ranged between Rs.1952 to Rs.19450/ha covering various crops in various states of India. Wheat in Jarkhand reported for the highest income (50%) followed by Apple in Jammu and Kashmir (39 %) and Wheat in Maharastra (37 %). The lesser increase was recorded for paddy crop (10 %) in Tamil Nadu. The FPARP were also evaluated in terms of its capacity to generate income per unit of water used for various crops. The results reveal that the income generated per unit of water used was higher under FPARP over Conventional method and it ranged from Rs.67 to 2198/cm. The income per unit of water under FPARP over conventional method was maximum in the case of Paddy crop demonstrated at Assam (Rs.2198/cm) followed by vegetable cowpea (Rs.1945/cm) and it was minimum in the case of Apple raised at J&K (Rs.67/cm).

In case of chickpea in Andhra Pradesh, the yield increase was 28% and water use efficiency increase was 7 %. In the case of groundnut, the yield increase was 16% and water use efficiency was 15%. Application of micro nutrients has enhanced the yield from 24% bin wheat to 58% in mustard. The increase in water use efficiency was 8 % in wheat to 12% in chickpea. The water use efficiency for the season as a whole has increased from 5 to 15%.

Study Title 8

Tank Irrigation in India: What will be the Next Best Alternative? A Meta Analysis ITP Team

Southern India is noted for the intensity of tanks. Unlike the northern region, the rivers in the south are mostly seasonal and the plains are not very extensive. Further, the geology is not favourable for groundwater storage. The local topographic variations have been effectively exploited to impound rainfall in tanks which are used to raise irrigated rice crop and simultaneously serve as means of improving groundwater recharge in their command areas. There are about 120,000 tanks in the southern region consisting of Andhra Pradesh, Tamilnadu and Karnataka states (Agarwal and Narain 1997).

Increasing water storage is a key adaption response to water shortages in tanks. The experience of irrigations tanks, water harvesting structures dating back centuries across much of peninsular India, illustrates both the potentials and challenges of this adaptation response. Although there are over 208,000 tanks in India, irrigating about 2.3 m.ha in 2000-01, the net area irrigated by tanks declined by 29 % between 1990-91 and 2000-01.

This study reviews the challenges faced by tank irrigation and examines options for improving their performance. Both cross section data covering about 100 tanks and the review of the past studies have been used for the work. The major recommendations from the field studies and review studies include: revenue mobilization through multiple use of tanks, augmenting groundwater resources in the tanks through additional wells in the tank command area, tank sluice management, integrating social forestry and desilting, and tank modernization (mostly selected tank modernization rather than package modernization as was done under the earlier EEC tank modernization programs. These policies will enable these systems to meet increasing needs for water storage under climate change.

Since small and marginal farmers account for the majority of tank farmers and cultivate about 70% of the lands in the tank irrigation systems, sustaining the tank irrigation potential is highly warranted. Most of the studies reviewed highlighted the needed policies in tank management. Translating the options into policies includes mainly investment policies on partial tank desilting. The management policies include the water management aspects for crop production such as irrigating at 5 cm depth and crop diversification in water deficit tanks, and legal policies include the removal encroachment in the tank foreshore areas.

Study Title 9

Climate change and food security of India : Adaptation strategies in the irrigation sector

P.K.Aggarwal

Globally averaged temperature of the air is projected to rise by 1.1-6.4°C over the next 100 years depending upon the development scenarios. Although there is considerable uncertainty in precipitation projections for future, it is likely that precipitation in India may increase by 10-15% over long term. However, this is likely to be accompanied by increased rainfall intensity and fewer rainy days leading to more floods and droughts. It is projected that gross per capita water availability in India will decline considerably over next few decades due to climatic changes, decreasing water tables, and increasing population.

With 70% of the global water withdrawals and 90% of the global water consumption, the irrigation sector is the dominant water use sector at the global scale. Countries such as India where food demands continue to rise, it may be necessary to expand irrigated area. However, the amount of water available for irrigation is likely to show considerable decline in future due to increasing demands from urban areas and from other sectors of economic development such as industry. In fact, in recent past, a declining trend in groundwater tables has been noticed in many parts of the India due to rapid exploitation of groundwater. In north-western India, ground water tables have declined by almost 33 cm/yr. Changes in temperature and precipitation associated with global warming will further alter recharge to groundwater aquifers, causing shifts in water table levels. Increase in global warming generally is expected to result in increase evaporative demand, despite an increased CO_2 mediated resistance to stomata conductance in C3 plants. It is projected that net irrigation requirements could therefore increase. Production of increased quantity of food with decreasing availability of quality irrigation water would, therefore, be a big challenge for the agricultural community. There is a need to identify the possible adaptation strategies that would simultaneously consider the background of changing demand due to globalization and population increase and income growth, as well as the socio-economic and environmental consequences of possible adaptation options.

Some of the promising adaptation strategies for irrigation water sector at the farm/field level include accelerated adoption of temperature buffering and water saving technologies such as use of laser leveler system, field bunding for in situ rain water conservation, timely planting in residual soil moisture, zero tillage/raised bed, and surface mulching. Adaptation to environmental change could also be in the form of water pricing policies. Rational pricing of surface and groundwater, for example, can arrest its excessive and injudicious use. Availability of assured prices and infrastructure could create a situation of better utilization of groundwater. Policies that promote installation of shallow tubewells in eastern and north-eastern India, promote efficient use of water in north-western India, and promote better maintenance of existing water structures throughout the country could be effective adaptation strategies to climate change.

3.1.1 (c) Research Studies – Initiated in November 2009

Study Title 10

NREGA Impact on Rural Water Security: an exploratory Study in Gujarat, Madhya Pradesh, Rajasthan, and Tamilnadu

Tushaar Shah, Madar Samad and K. Palanisami

Brief background of the project

The new UPA government has substantially enhanced its commitment to NREGA and decided to embrace the entire country under it. This arguably makes NREGA the world's largest rural livelihoods security program. However, NREGA may also well be the world's largest rural water security program. Well over 50% of the NREGA funds are being invested in water related works—water harvesting and conservation, revival of traditional water bodies, drought-proofing, irrigation canals, irrigation facilities on the farm lands of SC/ST and other disadvantaged groups, and such like. This means that NREGA will continue to invest Rs 15-20 thousand crore every year in constructing or rehabilitating water structures of the kind chosen by village communities, under their own supervision, and with their own paid labor. MoWR's Accelerated Irrigation Benefits Program (AIBP) has come into much questioning recently, with a critic quipping "No acceleration, little irrigation, minuscule benefit" (SANDRP 2006). However, by concentrating water investments at the user end, NREGA may finally give the country a real and much needed "Accelerated Irrigation Benefits Program".

However, for such large investments in rural water-related rural infrastructure, it is critical also to assess NREGA for the level and quality of water security it provides to rural communities for various needs—drinking water supply, sanitation, fishery, ecological benefits and, above all, irrigation. The research outlined in this IWMI proposal aims to develop a protocol and methodology for assessing the water-security-impacts of NREGA in a problem-solving format with a strong focus on identifying ways to enhance and improve the water-security impacts of NREGA investments.

Objectives of the study

- Study the implementation of water-related works under NREGA in 30 villages from 6 districts, one each in Gujarat, Rajasthan, Madhya Pradesh, Andhra Pradesh, Tamilnadu and Karnataka
- Analyze the logic as well as the dynamic underlying the selection of works
- Treating the works as NREGA outputs, analyze the 'outcomes' (filling up of WHS's; if wells have water, etc) and final 'impacts' on local water security
- Identify alternative pathways to improve outcomes and impacts of NREGA supported water works
- Identify implementation strategies to maximize high-performing water assets and minimize non-performing ones

Scope of the study

IWMI has identified, from each of the study states, five districts where overall NREGA investments have been the highest during 2007-8 as shown in table 1. Our intent is to select one of these sets of districts

from each state depending upon the location of the research partner we identify. Once the districts are identified, IWMI will choose, in consultation with research partners and NREGA administration, five villages from each district for our proposed study which will include qualitative study with PRA tools as well as a small sample survey.

Deliverables

- Report on impact of NREGA on water sector
- Recommended strategies to maximize high-performing water assets and minimize non-performing ones

Duration: 1 year

Gujarat Studies – 11

Study Title 11a

Assessment of the Restructuring of Gujarat Agricultural University

Tushaar Shah and K. Palanisami

Brief background of the project

The erstwhile Gujarat Agricultural University was restructured into four different Agri-universities located in four different regions of Gujarat (Saurashhtra, North, Central and South Gujarat). Also the four independent universities underwent major reforms in their policies and received major boosts for building up of research facilities and infrastructure.

Currently the four universities have become vibrant, active and gained credence as centres of agricultural research and academic excellence. They have come to play an important role in the annual *Krishi Mahotsav* of the Gujarat government. This is a far cry from the nearly defunct state of affairs that existed prior to the restructuring.

Objectives of the study

- The study seeks to answer to understand this turnaround. How has this reformation taken place? What combination of policy measures, management reform and rebuilding resources has worked? What part has the restructuring of the agricultural university system played in the overall revitalization of the agricultural research and extension system in Gujarat?

Study Title 11b

A Study of organizational restructuring of Gujarat Electricity Board

Tushaar Shah and K.Palanisami

Brief background of the project

The erstwhile Gujarat Electricity Board (GEB) was restructured into in to seven different companies, each having separate functional responsibilities, in 2003 as part of the power reform process. Power generation, transmission and distribution were unbundled and handed over to different subsidiary organizations with Gujarat Urja Vikas Nigam Ltd (GUVNL) being the overall holding company.

The organizational restructuring was not limited to splitting up of GEB into different entities. A process of organizational change was followed. There were conscious attempts at training and developing HR to meet the requirements of the new customer driven focus. The power infrastructure was beefed up and reconfigured especially in the rural sector. Through this process of change a once loss-making public utility service has now experienced a turn around. Not only has the power sector scenario in Gujarat improved the financial health of GUVNL and its subsidiaries have also shown dramatic improvement and stands as a successful example of power sector reform in India.

Objectives of the study

- The study would involve understanding how this turnaround has been affected, tracing the change process and its different aspects – regulatory, financial, human resource etc., understanding the problems and challenges faced in carrying out the reform process and lessons it might hold for other states grappling with their own power sector reforms.

Study Title 11c

Study of Gujarat's Krishi Mahotsav Program

Tushaar Shah and K. Palanisami

Brief background of the project

In 2005, the Gujarat government launched an annual month long event called 'Krishi Mahotsav'. Since then every year for a month just before the start of the *kharif* season the agricultural and other allied departmental staff, the government extension machinery, scientists and staff from the agricultural universities and private agri-business units come together to spread technical, scientific, and other related information on agriculture practices to every village in the state.

Each of these *Krishi Mahotsav* has been a combination of '*Krishi Melas*' (agricultural fairs at the *taluka* level having a variety of stalls, seminars and talks) and the '*Krishi Raths*' (tractors turned into colourful *raths* with IEC material). These *raths* carrying agricultural scientists, literature, kits, implements, vaccination cover all 18,000 villages of Gujarat carrying out agricultural extension in a mission mode giving a much needed fillip to the lab-to-land rhetoric.

The government claims all-round improvement in productivity and adoption of new agricultural technology and practices ever since the *Krishi Mahotsav* came into being. Gujarat agriculture has been undergoing a boom, and studying what role this unique mode of agricultural extension has played in bringing about this agrarian growth is crucial.

Objectives of the study

- The study would aim to understand questions such as what has been its impact, and in what form? What form of IEC was used, to what effect? What has been the role of various agencies? What would be required to sustain these efforts and in making it more effective?

Study Title 11d

A study of impact of Maharashtra Water Resources Regulatory Authority (MWRRA)

Tushaar Shah and K. Palanisami

Brief background of the project

Water sector reforms have been underway in India for the last decade or so, especially in the irrigation sector. The need for reform has been necessitated by the fact that the water sector by and large is marked by inefficiency in usage, distribution losses and poor quality of infrastructure all of this underlined by the absence of 'rational' tariffs and cost recovery. Water as a resource is also marked by inequitable distribution, over-exploitation and unsustainable use in many areas.

Maharashtra which has had a history of water related movements, became the first state to enact a water resource regulatory Act (The Maharashtra Water Resources Regulatory Authority (MWRRA) Act 2005), and also the first, and till date the only state to actually set up the Authority. MWRRA has the ambitious aim of ensuring "judicious, equitable and sustainable management, allocation and utilisation of water resources". Its main involve determining entitlements, establishing tariffs, reviewing projects and addressing other water sector concerns. MWRRA also seeks to establish and regulate water trading to ensure that water goes to the highest value user. As the Authority tries to balance the social and economic objectives of its regulatory role it has attracted a number of supporters as well as detractors.

Objectives of the study

- To understand what lessons does the MWRRA experience hold for other states contemplating similar measures and for the water sector reform process in general?

Study Title 11e

Organizational study of Water and Sanitation Management Organization (WASMO), Gujarat

Tushaar Shah and K. Palanisami

Brief background of the project

Water and Sanitation Management Organization (WASMO) has been hailed as an 'institutional innovation' which has fostered community engagement and empowerment for decentralization of water supply and sanitation services in Gujarat. WASMO was launched as a Special Purpose Vehicle by the Government of Gujarat with support from the Royal Netherlands Embassy.

WASMO's domain of activities covers drinking water management, community mobilisation, rural sanitation, capacity building and water resource management. WASMO has been recognized in various quarters as a successful institutional model for managing key public services. So far it stands as a unique example in government led efforts at decentralized, community managed water supply and sanitation management in India. A key factor in the success of WASMO has been the use of synergistic partnerships with a diverse set of agencies (PRIs, NGOs, government bodies and international agencies) at all levels of functioning.

Objectives of the study

- A detailed organizational study of WASMO would aim to uncover the strengths and weaknesses of this model, understand what institutional mechanisms are at play, what kind of innovations were required and what is the feasibility of adopting such a unique model elsewhere.

Study Title 12

Whether Corporate NGOs approach for Rehabilitation of Urban Tanks will be up-scaled? A case study of urban tank rehabilitation

A.Ravi Raj

Brief background of the project

South Indian states are known for the intensity of tanks mainly for irrigation and other domestic uses like bathing, washing etc., About 9% of the tanks are in the urban and semi-urban areas. Increasing urbanization coupled with industrialization during the past few decades are depleting water ecosystem goods and services in most of the cities in India. Under the Government budget allocation for tank renovation, these tanks are not usually considered as they are not used for irrigation. Environmentally these water bodies serve the purpose of an open space in the crowded urban localities. One function of ponds (which has only recently attracted the attention of environmentalists) is that they serve as receptors for rainwater harvesting and maintaining local ground water levels. Thus urban water bodies are a special component in water use management, to which little attention has been paid.

Objectives of the study

- Whether corporate NGO initiative will be a relevant intervention in urban tank rehabilitation?
- What key lessons for upscaling this intervention in urban (tank) regions could be learnt?

Specific tasks

- Collection and analysis of meteorological data
- Collection and analysis of data related to hydrology and hydrogeology
- Estimation of catchment area and land use survey
- Periodical collection and analysis of surface water samples in supply channel, water bodies during various seasons
- Collection and analysis of ground water samples in upstream and downstream to water bodies
- Collection of demographic details and other socio-economic data
- Group interviews with community and government departments will also be undertaken.

Deliverables

- Delivering an urban tank rehabilitation model with roles and responsibilities of different stakeholders
- Ground water management options in urban environment to tackle the water scarcity situations during summer.

Duration: 6 months

Study Title 13

Macro-level Impact Assessment of Decentralized Water Harvesting and Groundwater Recharge in Saurashtra

Shilp Verma and Avinash Kishore

Brief background of the project

It started sometime in the late 1980's when Saurashtra, along with several other parts of the country faced three successive droughts (1986-87-88). A few farmers, in their desperation for irrigation under extreme conditions, resorted to diverting rainwater into their wells from nearby canals and streams. Such a practice was contrary to the general understanding and received wisdom, which sanctioned against putting silt-laden rainwater into dug-wells, for fear of clogging the cracks and fissures which are the source of groundwater in this hard rock terrain. The "*experiment*" worked and while scores of villages despaired under drought conditions, the few enterprising farmers found water in their wells till months after the rains were gone.

Nothing succeeds like success, and within a few years, the entire Saurashtra peninsula was undertaking measures to divert rainwater into the ground, not only through "dug-well recharge", as initiated by the pioneering farmers, but also by means of de-silting community ponds and tanks, building *check dams*, deepening drains, converting cart-tracks to rainwater drains to prevent the rainwater from going out of the village. Sheth (2000) estimates that more than 230,000 dug-wells were recharged in Saurashtra by *Swadhyayis* before the end of 1994.

In the year 2000, GoG initiated the *Sardar Patel Sahbhagi Jal Sanchay Yojana* (Sardar Patel Participatory Water Conservation Program - SPPWCP) to support and enhance these efforts. The scheme was launched with simplified procedures for approval of projects and release of funds and 60 percent capital subsidy on construction of check dams. The scheme received an overwhelming response: already by 2002, Gohil (2002) noted that a total of 13,000 check dams were built under this scheme; by June 2007, more than 40,000 structures had been built under the scheme. Altogether, 90,000 check dams have been built in Gujarat under different government schemes along with 35,000 *boribundhs* and 171,000 *khet talavadis* (farm ponds)[1]. Of the 90,000 check dams, nearly half (44.3 percent) have been built in the seven districts of Saurashtra (Amreli, Bhavnagar, Jamnagar, Junagadh, Porbandar, Rajkot and Surendranagar) where farmers showed maximum interest in recharge structures.

Objectives of the study

- To assess the impact of recharge structures on both surface and groundwater irrigated area and crop output across Saurashtra in both good and bad rainfall years

Deliverables

- A database with time line data on cropping pattern, crop yields, production and prices, annual rainfall and number of recharge structures for all 107 talukas of Saurashtra. This database will be really useful for any future study in the region and will be a valuable public good.
- A first of its kind paper (20-30 pages) analyzing the impact of recharge structures at the regional level.

Duration: 6 months

[1] NGOs, religions trusts and other charitable organizations have significantly added to this number by building more check dams, even without this support from the government. According to Joshi (2002), a single NGO, Saurashtra Jaldhara Trust (SJT), supported more than 20,000 check dams in about 450 villages, and organized free supply of 200,000 bags of cement for this purpose.

Study Title 14

System of Rice Intensification – Adoption and Constraints in Kerala

S. Shanmugasundaram

Brief background of the project

Kerala requires 47 lakh tones of food grains to feed 318 lakh people . The current level of production is just 6.42 lakh tones. Dissemination of advanced technology on rice cultivation was the need of the hour. SRI in India gained momentum from 2000 onwards and was introduced in Kerala during 2003-04. Attempts to popularize SRI were made by Kerala Agricultural University, State Department of Agriculture and NGO's like Mithra Nikhethan KVK, MS Swaminathan Research Foundation, RASTHA etc., In reality the Technology could not be adopted by farmers in Kerala during the Kharif season because the control of water could not be regulated due to heavy rain starting from June onwards.However the technology can be very well adopted in the Rabi and Summer season depending on the area.

Farm trials conducted in Kerala reported mixed response in terms of performance of SRI.. Sindhu *et.al* (2007), Joseph *et.al* (2007), Anitha (2007), Jiji (2008) findings did not record any merits for SRI compared to best management practices. Vishnudas (2006) reported an yield increase of 60% by adopting SRI cultivation in Wyanad District of Kerala.

At present SRI has been:

- Included as a component of demonstration in Farmers Participatory Action Research Programme (FPARP) and Rashtriya Krishi Vigyan Programme implemented by Kerala Agricultural University at Regional Agricultural Research Station Pattambi, Palakkad District.
- Given emphasis to promote in the 11th Five year plan guidelines of the State Planning Board, Trivandrum
- Included as a main component of demonstration in the National Food Security Mission (NFSM) implemented by State Department of Agriculture in Palakkad District of Kerala.

Hence the present study is proposed to explore the status of SRI cultivation in Kerala.

Objectives of the study

- To study the profile of SRI practicing farmers
- To assess the nature and extent of adoption of recommended SRI cultivation practices.
- To study the reinvention and discontinuance of recommended SRI practice
- To study the economics of SRI cultivation
- To identify the problems and constraints encountered by farmers in SRI cultivation.

Deliverables

- Gap in adoption of SRI Technological Units would be arrived
- Reasons for Rejection or discontinuance or continued adoption of SRI technology assessed

- Nature and Extent of modification made under SRI cultivation
- Economics of SRI cultivation with conventional method assessed
- Constraints in the adoption of technological units of SRI is arrived

Duration: 4 months

Study Title 15

Study of the Guidelines and Operational Procedures adopted by Different States in the Implementation of the Micro Irrigation

S. Raman

Brief background of the project

Water use efficiency is presently estimated to be only 38 to 40% for canal irrigation and about 60% for ground water irrigation schemes. Irrigation, being the major water user, its share in the total demand is bound to decrease from the present 83% to 74% due to more pressing and competing demands from other sectors by 2025 A.D. and as such, the question of improving the present level of water use efficiency in general and for irrigation in particular assumes a great significance in perspective water resource planning. Accordingly, to improve the water use efficiency water saving technologies has been wide spread in India. The country stands 27th in terms of adoption of micro irrigation devices (sprinkler and drip). The present spread of water saving technologies covers 0.9 and 0.26 m. ha under sprinkler and drip irrigation respectively. The rate of adoption of micro irrigation has increased in the recent past due to the subsidy provided by the Indian government to improve the water use efficiency. Capital-intensive nature seems to be the main factor for the slow progress made in the adoption of these new technologies. Also the guidelines being followed in different states also influence the level of adoption. Hence it is important to examine the types of guidelines or procedures adopted in different states in promoting the micro irrigation.

Objectives of the study

- To compare the guidelines/procedures being followed in selected states in promoting the micro irrigation systems
- To suggest the ways and means of promoting the micro irrigation in the selected states

Specific Tasks

- Discussion with Government official, farmers, drip companies and NGOs at various levels to understand and analyse the procedures being following the selected states of India.
- Document the guidelines/procedures adopted in different states
- Discussion of preliminary results with ITP team and recommend the suitable procedures that could be upscaled in other states.

Drip Irrigation in Gujarat

Deliverables

- Shot-listing the efficient guidelines/procedures being adopted in the state (s).
- Guidelines/procedure for effective implementation of the Micro irrigation in other states.
- In addition to the project reports, it is required to share all the secondary and the primary data collected from different states on the subject.

Duration: 4 Months

3.1.2 Partner Network and Research Links

During the SC meet in February 2009, it emerged that ITP could network with SRTT partners and through mutual consultation undertake relevant research on water issues. Following this the ITP team met SRTT partners at Mumbai, in March '09. The partners included – North East Initiative, Himmotthan (Mountainous regions of Uttrakhand) and CInI (Central India Initiative).

Intense discussions and field visits by ITP team to the three regions led to developing concept notes for the identified studies. In the months that followed, the project MI in Uttarakhand has seem much progress and the NE and CInI projects will be initiated in 2010. A status report on the initiatives in the three regions are given below.

1) **Himmotthan link – Uttaranchal:** The initiative to introduce drip and other MI technology in the hill state has already been initiated and Mr. Anup, ITP engineer is working on this project in collaboration with the partner organization – Himmotthan. The two programs planned for the region are as mentioned below-

   i.) Preparation of a report on Water Sector Planning for Uttarakhand focusing on the potentials and limitations for water resource development and management in State

   Implementation: ITP in partnership with Himmothan and other agencies. DCAP will also be involved.

   Period of study: 6 -9 Months

   ii.) Intensifying agricultural development through drip and other micro irrigation systems in different slopes and altitudes

   Implementation: By ITP in partnership with Himmothan, IDE, CSWRCTI and local NGOs

   Period of study: 12 – 16 Months

2) **CInI:** The LOU with the partners for the studies mentioned below is being drafted. Concept notes have been prepared and discussed with the partner organization.

i) Kharif Paddy Stabilization: SRI Adoption Benefits and Concern

Implementation: ITP in partnership with CInI and other partners

Period of study: 12 – 16 Months

ii) Climate Change – Impact on Agriculture, Mitigation and Adaptation Plan to Safeguard Livelihoods in the Tribal Region

Implementation: ITP in partnership with CInI and other partners

Period of study: 12 – 16 Months

3) **North East Initiative:** Research Study in the North East region will be initiated from Jan 2010 on the issues mentioned below.

i.) Intensification of Terrace and Jhum Cultivation

Implementation: Field partners could include ICAR, NEPED, Naandi Foundation, ACAWDAM, Pune.

Period: 1-2 years

ii.) Development of Water Harvesting Model Structures for domestic and agricultural use

Implementation: Expertise of ICAR Dimapur will be used.

Period: 1 year. Monitoring would be undertaken for a 2-3 year period and suitable local stakeholder would be involved.

iii.) Drip Irrigation for Orchard Crops in Dimapur Region

Implementation: ITP would work through Waadi approach of community organization in coordination with the Naandi Foundation. Dimapur.

Period: 1-2 years. The monitoring the field sites over a 2-3 year period will also be done by the SRTT/ITP team.

4) **ITP Linkages with ICRISAT:**

i.) K.Palanisami is associating with the watershed evaluation programs with Suhas P. Wani, Principal Scientist (Watersheds) and Regional Theme Coordinator, Asia (GT-Agroecosystems), ICRISAT.

ii.) Ms. Rita Singh, Secretary, Dept of Land Resources, GOI released the manual written by K.Palanisami, D.Suresh Kumar and S.P.Wani "Impact Assessment of Watersheds" Report no. 53, Global Theme on Agro-ecosystems, ICRISAT on Aug 25, 2009 at ICRISAT, Hyderabad.

iii.) K.Palanisami is associating with the climate change project with Cynthia Bantilan, Principal Scientist and Global Theme Leader, GT - Institutions, Markets, Policy & Impacts, ICRISAT. Also delivered a lecture cum hand on exercise on Economics models in water resources planning during the Master Class on Impact Assessment, at the Social Sciences Division, ICRISAT, Hyderabad. March 23, 2009.

3.1.3 External Funded Research

ITP has successfully initiated collaborative research with external funding agencies during 2009. A short descriptive write up along with progress note where relevant is provided below:

A. Assessing irrigation subsidies provided in Andhra Pradesh, India

Budget: US$ 24,000

Donor: International Institute for Sustainable Development (IISD). Canada

Time period: 6 months

B. Climate Change: Vulnerability and Adoption measures under Godavari and Krishna Basins

Budget: US$ 21,425

Donor: Bioforsk, Norway.

Duration: 8.5 months

The major activities include:

- Methodology finalization & hiring staff
- Secondary data collection, entry and field visits
- Data entry and checking
- Technical brief on climate change challenges
- Main farm survey (pre-testing, revising & collection)
- Model runs & Finalization of the models
- Water use measurements on selected farms
- Discussion of the results & draft deliverables
- Draft for the journal publication and technical briefs

Progress of the project

Bioforsk, Norway and IIT, Delhi has linked the ITP for the conduct of the shorterm study on Climate change impacts in Godavari basin. Secondary data collection was started from all the 6 states (Maharashtra, Madhya Pradesh, Orissa, Andhra Pradesh, Chattisgarh and Karnataka) of the Godavari basin. To evaluate the methodological issues in downscaling the vulnerability index and change in productivity estimates to Manjeera sub basin, Medak district of Andhra Pradesh was selected due to the semi arid climate and water scarcity.

Field visits were organized with the project partners for the selction of the pilot area during the period. Various typologies (lift, tank, canal and bore well irrigations) were visited during the field visits and focus group discussions were carried out in two villages (China ghanapur and Machavaram). Socio-economic questionnaire was developed with the help of Bioforsk team and will be pretested in the pilot area according to the said typologies.

C. Sustaining Rice Production in a Changing Climate: Testing climate uncertainties and validating selected adaptation techniques in farmers fields

Budget: NOK 1 300 000 (US $ 200,000)

Donor: Norwegian Embassy, New Delhi and Bioforsk.

Duration: 3 years

CLIMARICE II "Sustaining Rice Production in a Changing Climate" an interdisciplinary project with multi partner involvement was launched by the International Water Management Institute (IWMI) and its partners at the ICRISAT campus on 23rd November 2009.

The project is aimed at reducing uncertainties by validating the adaptation measures in close collaboration with farmers and other stakeholders. By demonstrating applicability of selected adaptation technologies and building stakeholder capacity to implement them in their fields, the project focuses on integrating science and policy.

The three year project will cover Krishna basin in Andhra Pradesh and Cauvery basin in Tamil Nadu. The project is supported by the Norwegian Ministry of Foreign Affairs through the Royal Norwegian Embassy, New Delhi. Other partners in the Project include – Bioforsk, Norway; IPRC, Hawaii; TNAU, Coimbatore along with IWMI, Hyderabad.

Progress of the project

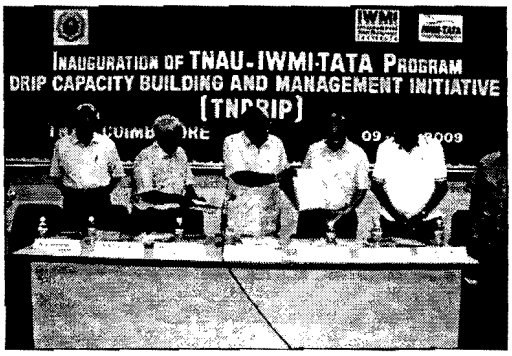
The project team has visited fields under Krishna and Cauvery basins to understand the area, farming systems, irrigation and discuss with farmers. The various activities taken up by the farmers were recorded and provided an opportunity for the partners to get an overview of the implementation schedule. On November 26, the detailed work plan for the first year (2010) was prepared.

3.2 Outreach Programs and Capacity Building

1. Drip Irrigation Capacity Building and Management Initiative for Maximizing Productivity and Income (TNDRIP Initiative)

ITP initiated the new out reach program called TPDRIP in Tamilnadu state with the main aim of enhancing the capacity of the drip irrigation adopted farmers during 2009-10. The project will be implemented in association with the Tamilnadu Agriculture University, Coimbatore.

The drip capacity building and action research program (TNDRIP Initiative) was initiated on 09-09-09. Mr. R.Vijayakumar, Principal Secretary to Govt. inaugurated the program in the presence of Vice chancellor, TNAU, Madar Samad, Director, South Asia Office, IWMI and Tushaar Shah, Senior Fellow, IWMI.



Release of water policy highlights by Dr. R. Vijay kumar

TNDRIP Inauguration

This program covers 100 villages and 1000 farmers in Coimbatore and Erode districts in Tamilnadu State, India. The main objective is to sustain the drip farmers through capacity building programs with backup action research activities. The project partners include Tamil Nadu Agricultural University and Jain irrigation systems.

The key activities include the following:

- Staff selection and setting field office
- Initiation workshop
- Preparation of work plans with partners
- Training programs to project staff
- Establishment of village demonstration units
- Preparation of capacity building manuals/bulletins
- Field action/training programs in the villages
- Farmers group formation for upscaling the interventions, marketing etc.,
- Partners meet and workshops

The project advisory committee is formed with the following members:

1. Vice – Chancellor, TNAU – Chairman
2. Director, ITP – Member Secretary
3. Director, WTC, TNAU – Member
4. Director, Extension Education (DEE), TNAU – Member
5. Dr.E.Vadivel, Professor, Precision Farming, (DEE), TNAU – Member
6. Dr. S.Narayanan, Vice – President, Jain Irrigation Systems, Coimbatore – Member
7. Superintending Engineer , Agrl Engineeing Department, GOTN, Coimbatore– Member
8. Deputy Director of Horticulture, GOTN,Coimbatore - Member
9. 3 Leading farmers – Members

Work progress:

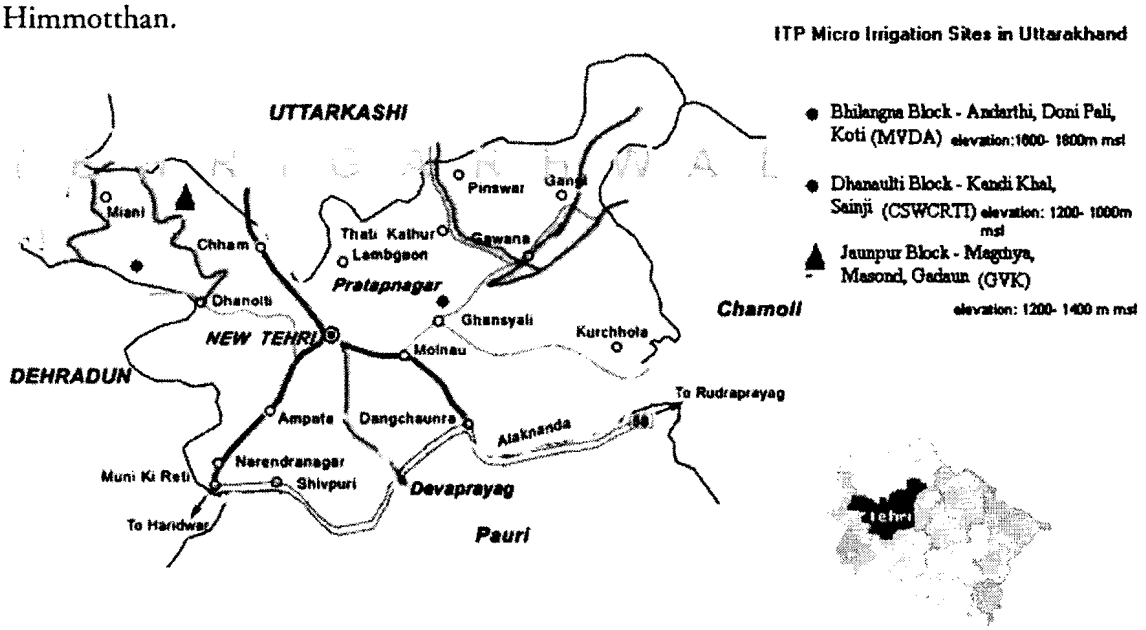
A) Training to the field staff has been initiated in 3 locations

B) Preparation of the drip kit is going on.

C) Village selection has been completed for Coimbatore district,

2. Micro-irrigation systems in different crops, slopes and altitudes of Uttarakhand

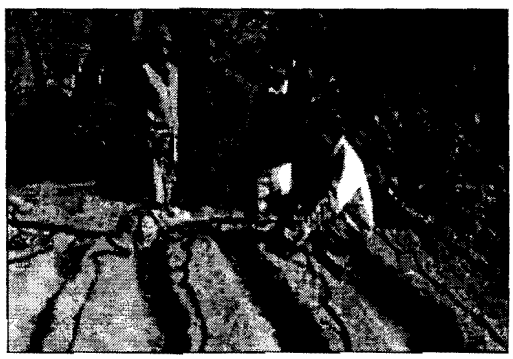
Mr. Anup Das, ITP Engineer is based at Uttarakhand and implementing the MI project in collaboration with Himmotthan.



map source: www.uttara.in - the official portal of Uttarakhand Govt.

Budget For Micro Irrigation Systems Initiative in Uttarakhand - ITP

No.	Item Description	No. of units	Unit rate (Rs.)	Total (Rs,)
1.	Cost of Drip Systems	7 (each site 7 naali- 7x200 q.mt. on an average)	26,600	1,86,200
2	Cost of Micro sprinkler Systems	5 (each site 5 naali- 5x200 q.mt. on an average)	17,500	87,500
3	NGO/ CSWCRTI staffs supervision of MIS	4 x10 =40 person days	4,000	1,60,000
4	Documentation & Stationery/printing, etc.	–	50,000	50,000
5	Contingency	@ 5% of above		4,83,700
	TOTAL			**5,07,885**



MI Training in Uttarakhand

Drip in Uttarakhand

Budget for Micro Irrigation Initiative under ITP- Uttarakhand					
District	**Location**	**Site details**	**Area & Type of System**	**Crop selected (Winter- Oct/Nov- Jan/Feb)**	**Cost of System as per design & estimate (Rs)**
Tehri Garhwal	Maghdia village (elevation: 1200 mt above MSL)	Area- 576 sq. mt. (3 *naali* approx.)	0.5 *naali* drip system2.5 *naali* micro sprinklers	Drip-Brinjal Sprinkler-cabbage/CF,	17444
Tehri Garhwal	Gadaun village (elevation: 1250 mt above MSL)	Area- 1210 sq. mt. (6 *naali* approx.)	6 *naali* drip system 1000 lit UPVC (tank required)	Drip- Onion, Potato, Radish, Palak	19531
Tehri Garhwal	Masaund village (elevation: 1400 mt above MSL)	Area- 1200 sq. mt. (6 *naali* approx.)	3 *naali* drip system 3 *naali* micro sprinklers	Drip-Garlic, onionSprinkler-coriander, palak, rai, radish	20143
Tehri Garhwal	Koti village (elevation: 900 mt above MSL)	Area- 842 sq. mt. (4.21 *naali* approx.)	1.85 *naali* drip system 2.36 *naali* micro sprinklers (1000 lit UPVC tank required)	Drip-Cabbage, Onion, Garlic Sprinkler- coriander, palak, rai/mustard	21621
Tehri Garhwal	Andarthi village (elevation: 1300 mt above MSL)	Area- 680 sq. mt. (3.4 *naali* approx.)	1.24 *naali* drip system2.17 *naali* micro sprinklers	Drip- Onion, GarlicSprinkler-coriander, palak, rai/mustard	20625
Tehri Garhwal	Doni village (elevation: 1600 mt above MSL)	Area- 800 sq. mt. (4 *naali* approx.)	2.48 *naali* drip system1.52 *naali* micro sprinklers	Drip- Elaichi, Cabbage Sprinkler- Pea, coriander, Ginger, Onion, garlic	24465
Tehri Garhwal	Sainji village (elevation: 1000 mt above MSL)	Area-1200 sq. mt. (6 *naali* approx.)	6 *naali* drip system (1000 lit UPVC tank & 150m flexi pipe required)	Drip- capsicum, radish, carrot, Cauliflower flower	22437
Tehri Garhwal	Kandikhal village (elevation: 1200 mt above MSL)	Area-1400 sq. mt. (7 *naali* approx.)	2 *naali* drip system 5 *naali* micro sprinklers	Drip- Onion Sprinkler-Pea, coriander, palak	24109

3.3 Student Fellowship & Internship Program

IWMI-TATA Water Policy Research programs "Short Term Research Studentship Program" emerged with the core idea to encourage interested students to be involved in collaborative research under the IWMI TATA Program (ITP). The main objective of this program is to provide an opportunity to undergraduate/graduate science students to familiarize themselves with water research - methodology and techniques, by being associated for a short duration with ongoing research program or by undertake independent projects.

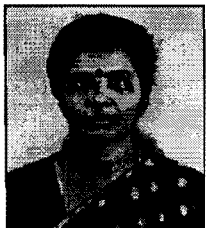
The program awards limited number of studentships to deserving students on a regular basis. The duration of the studentship will be for a maximum period of 6 months. Interest in the fellowship has been good and several queries have come-forth. The research fellows supported during this period and the details of their study are provided below. A summary of the studies undertaken are provided below.

Short-term Student fellowships

No.	Student	Topic	Report Status
1.	Mrs. Ananthini	Tank irrigation and conjunctive use	Submitted
2.	Ms. Jessy Preeth Glory; Ms. Lekshmy; Ms. Nivedita Shridhar; Mr. Vijayanand	Land use changes and their impact on ground water quality in coastal ecosystem with bioshields- a case study in Nagapattinam district of Tamil Nadu.	Submitted
3.	Mr. V.Gandhiraj	Changin.g Phase of Irrigation Tanks in South India: A Case of Tamil Nadu	Work progress
4.	Mr. Aroopjyoti Tripathy	Urban water use and demand in Bhubaneswar	Submitted

ITP Studentship Summary Reports

1. Management of Tank Irrigation with Ground Water use in Tamil Nadu


Mrs. Ananthini

The demand for agricultural products increases with increasing population over the years resulting in increased demand for both surface and groundwater. Among the surface water sources, tanks are facing more water shortages over years. As a consequence of the decline in tank irrigation, the land productivity is observed to be low under tanks compared to other sources of irrigation, indicating the poor performance of the tank irrigation systems in the state. Even though several factors have influenced the tank performance, the level of their influences has varied across locations. Hence, it is important to find out alternate solutions to arrest or reverse the declining performance of tanks by supplementing with well irrigation. Keeping this in mind, the study was undertaken with the major objective comparing the tank irrigation in three different typologies *viz.*, Tank only, Tank with wells and Wells only situations and the specific objectives are i) to study the tank performance and the levels of farmers participation and ii) to identify the strategies for tank modernization options under increasing groundwater irrigation in the tank command areas.

The study was undertaken in three districts of TamilNadu state, *viz.*, Madurai, Sivagangai and Coimbatore. From the three selected districts, 30 tanks and 750 farm households were randomly selected for the study. As there were no tanks without wells, the 30 tanks selected randomly were categorized into three different typologies based on the farm households depending upon the source of water supplies, *viz.*, Tank only, Tank with wells and Wells only for this study. Thus this categorization was primarily based on the percentages of households depending on the type of water source. The sample size consists of 173 farm households using tanks as the only source of water for irrigation (typology I), 246 farm households using tank with wells as the source of water for irrigation (typology II) and 250 farm households using wells as the source of irrigation (typology III). The collected data were analyzed at tank level and at farm level using regression models and stabilization value model to fulfill the objectives of the study.

Income of the sample respondents

The average income of the selected sample respondents from various sources in different situations is presented in the main text. The average income per ha of the Tank only farmers from crop cultivation was Rs 17,599 whereas it was Rs 46,993 in Tank with wells situation and Rs 1,17,366 in Wells only situation. The income from agriculture crops alone contributed nearly 26 per cent, 50 per cent and 73 per cent of the total income of the farmers in Tank only, Tank with wells and Wells only situation respectively. The contribution of income from non-farm activities was 29 per cent in Tank only whereas 26 per cent in Tank with wells and eight per cent in Wells only situation. The income from off farm activities contributed 18 per cent in Tank only, 11 per cent in Tank with wells and five per cent in Wells only situation. The income from livestock contributed 18 per cent of total income in Tank only situation. In Tank with wells and Wells only situation it was only seven per cent and nine per cent respectively. The contribution of tree resource to the total income of farmers was nearly 10 per cent in Tank only situation whereas it was six per cent in Tank with wells situation and four per cent in Wells only situation.

In Tank with wells situation, all three categories of farmers (marginal, small and large) received more than double the income compared to Tank only situation from crops alone. Similarly the farmers in the Wells only situation earned more than double the income compared to Tank with wells situation from crops. The results confirmed that the income is directly related to the assured water supply. In Wells only situation, farmers are cultivating high value crops as there is minimal risk in water supply. This is the reason for getting higher income. But in Tank with wells situation, majority of the farmers cultivated rice as the first crop and high value crops as their second choice. This is the reason for getting considerably lower income in Tank with wells situation compared to Wells only situation. Hence, it could be concluded that the income from agricultural crops was the main source of income among the selected farmers in all the situations. Further a significant portion of the income was also from the non-farm and off farm activities. Hence any efforts in improving the tank irrigation performance will keep increase the income from crop activities.

2. Carbon Sequestration Through Bioshields in Mitigation of Climate Change in Coastal Ecosystems


Ms. Jessy Preeth Glory


Ms. Lekshmy


Ms. Nivedita Shridhar


Mr. Vijayanand

IV.B.Tech Energy & Environmental Engg AEC&RI, TNAU

A 'bio-shield' is a vegetation belt along coastlines that would protect India against future coastal storms, cyclones and tsunamis. This bio-shield movement will confer multiple benefits to local communities as well as to the country as a whole. These plantations play a double role. While absorbing the force of severe storms and tsunamis and thus protecting the coastal population against loss of life and property, also the 'bio-shield' could act as a 'carbon sink' by absorbing emissions of the greenhouse gas carbon dioxide. In coastal area, the water availability is always a problem and as such the surface water is inaccessible due to the soil characteristics and people use the ground water for domestic and crop production and thus ground water plays an important role in sustaining the livelihoods of the coastal people. During summer the water level goes down and people walk many kilometers in search of water. As per the recent statistics of PWD, in Nagapattinam district, four blocks viz., Kollidam, Kuttalam, Sembanarkoil and Sirkali were classified as over exploited wherein more than 100% utilization have taken place and Mayiladuthurai block is in semi-critical condition and stage of development is between 70 and 90 %(PWD, 2004). Under these circumstances, Tsunami occurred in the coastal districts of Tamil Nadu and particularly the Nagapattinam district is the worst affected both in loss of life and property and the agricultural lands have been left out of cultivation for more than a year due to the salts deposited in the cultivable lands and in the ground water making the agriculture impossible. The State Government and NGO's working in the area have taken up rehabilitation process to reduce the salt content in the lands to render it suitable for cultivation. The study will also focus on the ground water quality enhancement due to the rehabilitation process and also due to the presence of bioshields.

Objectives

- Mitigation of natural calamities such as Flood and Tsunamis using bioshields.
- To evaluate the carbon sequestration potential of bioshield before and after Tsunami in the study area.
- Evaluation of ground water quality enhancement due to rehabilitation process and due to the presence of bioshields

Study Area

Nagapattinam is one of the coastal districts in Tamil Nadu. It was carved out of the Thanjavur district in 1997. Located between The District of Nagapattinam lies on the shores of the Bay of Bengal between Northern Latitude 10.7906 degrees and 79.8428 Degrees Eastern Longitude .It stretches from River Coleroon in the north to Kodikarai in the south.

The district forms part of the Cauvery river basin and delta. For administrative purposes, the district is divided into seven taluks namely Sirkali, Mayiladuthurai, Tharangambadi, Nagapattinam, Kilvelur, Thirukkuvalai and Vedaranyam. These are further divided into 11 blocks namely Mayiladuthurai, Kuttalam, Sembanarkoil, Sirkali, Kollidam, Vedaranyam, Thalainayar, Nagapattinam, Keeliyur, Kilvelur and Thirumarugal. The district has a coastline stretching to 187 kms

Need of the Study

Casuarinas are present over a major part of the coastal regions. Many studies over the damage reduction due to the presence of bioshields have been going on but studies on the effect of bioshield presence on water quality have been literally non-existent .Our study focuses on the effect of bioshield on the quality of water. The parameters studied were the EC,pH,Ca,Mg,Na,K,HCO3,CO3,Cl,SO4,NO3,TDS ,TH. These parameters sufficiently suggest the variation in quality of the water between bioshield and non-bioshield region.

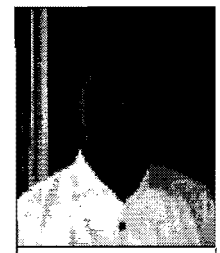
Methodology

The primary objective of our study is to analyse what effect the bioshields have on the water quality of the given region and hence accordingly we have collected samples from bioshield and non-bioshield region. Other data were collected from various sources. The data collection was done in the following manner. The samples were collected from the study area of Nagapattinam district.

Rehabilitation measures (Agro)

- Deep ploughing and land Leveling: In all the selected fields deep ploughing was carried out twice, using rotavators or manual labour, before sowing, and field bunds were reformed/ strengthened, land smoothening/leveling was carried out wherever necessary.
- Spreading and incorporation of sand/clay deposit: In some of the fields, farmers with the support of other NGOs, collected the top layer of deposits and heaped it in the field. With the consent of the farmer, this was spread evenly and incorporated in to the soil by deep ploughing.
- Removal of cyperus and other weed species: Especially in the clay deposited fields, the growth of cyperus weed was abundant, and these were uprooted and ploughed Providing proper drainage facilities: In many of the fields the water drainage was blocked with debris and sediments. These were removed and clean drainage was were restored
- Sowing and in situ ploughing of green manure species (Sesbania aculeata)
- Leaching: It was carried out in the fields wherever seawater had intruded and stagnated, thereby causing an increase in the soluble salts concentration.
- Application of Farm Yard Manure (FYM) and Biofertilizers:
- Selection of salt- tolerant varieties: Paddy varieties that can tolerate salt water intrusion,
- Gravity drip system was introduced to enhance water use efficiency of the farm ponds.

3. Changing Phase of Irrigation Tanks in South India: A Case of Tamil Nadu


Mr. V.Gandhiraj

In the past few months I visited all the 38 villages served by Chembarambakkam tank (CBT) to understand the present position of tank irrigation management. Also, I have collected village level data such as geographical area, wetland, dry land, poramboke, cropping pattern and supplemental source of irrigation such as wells in the ayacut for the period 2007-08 and 2008-09. Based on these data, I am in the process of writing a consolidated report to be sent to IWMI soon. With the help of village level survey, I have classified the villages into source wise irrigation. Also it is identified the villages which are irrigated by a single sluice and multi-sluices. This is helpful to undertake further in-depth survey to be carried out soon.

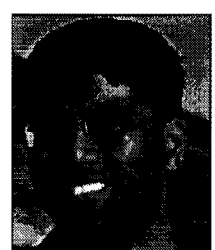
The Chembarambakkam Tank solely irrigates 16 villages; other 19 villages solely irrigate by wells. Some 15 villages are irrigated by both tank and wells. The present survey indicates that 19 out of 38 villages are mostly urbanized, that is, more than 75 % of ayacut land is urbanised; and 11 villages are partially urbanised, where the urbanisation process is around 50 %.. The ayacut land is mostly cultivated with crops like paddy, banana, mango and vegetables. The above details are helpful to select the sample village for household survey, which is necessary to understand the changing scenarios in the tank command.

Based on the available information, I have classified the villages into different reaches of the ayacut. For this purpose the sluices were arranged based on its sill level, its location in the tank bund. Also further categorization is made based on the two indicators such as villages solely irrigated by a single sluice and the extent of urbanisation. The former is important because most of the tank related and agriculture-based information would be effectively collected if we take samples out of it. In the case of multi-sluice villages these aspects could not be possible.

A detailed work report will be submitted to IWMI-TATA in a month's time.

4. Urban Water Management in the City of Bhubaneswar, Orissa

Role of Various "Institutions" and Implications Towards Policy and Decision Making


Mr. Aroopjyoti Tripathy

In the last decade, Bhubaneswar has become one of the fastest growing cities of India, with a population of 647,302 (2001) and an area of 135 km^2. But this population growth and development is leading to water stress in the city, one indicator being the rapid decrease of ground water level in the city. Even though Bhubaneswar happens to be a planned city, it lacks water supply infrastructure and proper waste water drainage and treatment infrastructure. There is very little public participation; neither has conservation practices like rainwater harvesting been given much importance. The water policies of the state mostly aim at the water use for the irrigation and industrial purposes, but not much has been included about domestic and drinking water usage in the policies. Activities like digging of bore well is not restricted, which adds up to the ground water depletion problem.

This project is a descriptive study, aiming at understanding how the different institutions play their role in managing, distributing and using water resources in Bhubaneswar. And to understand if and what

capacity building measures and policy amendments are necessary, aiming at sustainable water use and integrated water resources management in the city.

In case like that of Bhubaneswar, when we are thinking about expansion and modernization we need to be planning ahead of time, regarding sustenance. The study showed that a paradigm shift in attitude is needed in both, the government and the general public. People need to be aware about the issue of water and the need of water conservation. In a fast growing city like Bhubaneswar the government needs to plan for the current water supply taking the future demand into view. All sectors of the society including the consumers, suppliers and the policy makers need to work together to ensure that water resources are management sustainably with every one being able to meet with their water demands. More and more stated preference studies need to be done to see what the people think about the current policies and the scenario of water. More and more awareness programs are required to encourage people to themselves participate in projects for sustainable water resource management. A bottom up approach should be used in accessing the problems related to water and policies must be implemented and amended as per the requirement of the people. Taking the importance of water into consideration and the stated preference of the consumers, government should develop a regulated framework of decision making where it takes the responsibility of water completely into its hand. It should be ensured that every institution gets uninterrupted 24 hours of water supply, at their door step. But it should also be ensured that every institution is made accountable for the water is uses and the water it wastes.

STUDENT INTERNSHIP REPORT

Disseminating Scientific Information: *Evaluating the IWMI-TATA Water Policy Program's Annual Partners' Meet*


Victoria Hewitt


Sachi

Victoria Hewitt and Sachi Lake, two undergraduates from Princeton University who interned with IWMI during July and August 2009, conducted an evaluation of the IWMI-TATA Water Policy Program (ITP) Annual Partners' Meet (APM).

The objective of the evaluation was to answer the following questions:

1) What has been the impact of the APM during the past 8 years?

2) In what specific ways has the APM been successful? In what specific ways can it improve?

3) To what extent is the APM meeting ITP's goals?

To answer these questions, 27 face-to-face interviews, 5 phone interviews, and an on-line survey were conducted by Ms. Hewitt and Ms. Lake. The answers have been broken up categorically in the report. Here, we give a prose-summary.

Goals

The founder of ITP envisioned a program that would bridge the gap between Indian academics and Indian policy makers. To that end, the current goals of ITP are two-fold: (1) Identify, analyze, and document water management approaches and current practices through a multi-disciplinary approach, (2) To help policy makers by translating research findings into policy recommendations.

The APM has been very successful at meeting the first goal. Hundreds of pieces of research have been presented over the course of the years from a wide variety of presenters. The APM has been particularly successful in meeting the "multi-disciplinary" aspect of its first goal. When asked what made the APM unique among water conferences, the overwhelming response was that it brought together individuals from many different backgrounds.

Overall, the APM has been an unsuccessful tool for impacting government policy makers. The APM is a large conference that, while multi-disciplinary, is still largely research-based. Policy makers are not directly targeted, in part simply due to the large number of attendees and papers presented at the APM. There is also a dearth of ITP publications that translate research into specific policy recommendations.

Impacts

The APM has served as an incubator for programs, particularly the Central Indian Initiative and the North Gujarat Initiative. Attending the APM influenced the specific stakeholders who attended namely academics, NGO representatives, policy makers, and students. Academics received valuable feedback on their work, NGOs and students had a platform to present their work, and policy makers saw what questions were being asked by the top minds in India's water sector. ITP publications before and after the APM were valuable resources, particularly for academics. The ITP itself was a capacity-builder for the team-members involved in planning and organizing the APM and the APM was a capacity builder for young attendees.

Success/Improvement

Particularly during the peak year, 2005, the APM was known as the "Who's Who" of India's water sector. This reputation was built on the ways the APM had been successful. The most commonly cited success of the APM was the multi-disciplinary background of attendees and presenters. The diversity of attendees led to sometimes heated, yet almost always valuable discussions, which were also a high point of the conference for many. The APM was well managed, and as the years progressed, the number of top-quality research papers presented increased.

Logistically, interviewees wanted more time for discussion and a limited number of sub-themes to enable deeper discussion on each. Also requested was greater quality control over the papers presented and more concrete end-of-meeting results. Attendees wanted benchmarks to evaluate the APM from year to year, and wanted more communication from ITP between APM's. Interviewees also thought ITP could improve in targeting policy makers.

Recommendations

To improve ITP's impact on policy makers, we recommend holding smaller, more frequent workshops targeted at specific policy makers as well as, when possible, involving policy makers in the planning and direction of research subjects. We also suggest ITP translates current and past research pieces into targeted, practical policy recommendations.

We suggest ITP publish a synthesis report of the conference, as well as re-starting the ITP Water Policy Brief series. The ITP website should be updated and include links to ITP publications.

ITP should continue to hold extensive pre-APM planning workshops, as well as continue to increase the quality control over papers. We suggest limiting the number of sub-themes discussed as well as papers presented, and where possible, reducing the number of parallel sessions. More time at the APM should be devoted to discussion.

We believe these suggestions will increase the APM's success as a multi-disciplinary water conference in India.

3.4 Policy Initiatives

Policy research is an integral part of the ITP program and in Phase II major focus has been on policy research and making recommendations for policy interventions towards sustainable water management. ITP studies since 2002 have contributed to this effort.

The ITP approach in policy interventions is to focus on the most pressing and key issues that need to be changed at the state level and proposing policy change to achieve the desired change.

The work on policy influences involved the following:

- Preparation of policy briefs and its dissemination to relevant administrative, political and user groups/organizations
- Provide relevant information & support material to user groups
- Help formulate memoranda and assisting State functionaries etc.,
- Raise awareness of State functionaries through workshops, field visits etc., in selected States on selected themes
- Link up with ongoing programs and offer technical support both at Central and State level.

Some major policy interventions to help formulate memoranda and assisting State functionaries during the year 2009 are mentioned below –

a) Draft strategy paper prepared to the Ministry of Water Resources, GOI on More crop and income.

b) Discussed with State Planning Commission, Govt. of Tamilnadu and major recommendations were given.

TAMILNADU: POLICY INTERFACING AND IRRIGATION DEVELOPMENT: A synthesis paper on State Irrigation Investment Strategies. Presented at the State Planning Commission-Govt. of Tamil Nadu.

c) A water policy highlights was also released on 09-09-09 by Dr R.Vijaykumar, Principal Secretary (Planning and Development), GOTN.

d) A Bulletin highlighting the major recommendations on irrigation sector of Tamilnadu has been completed and is in circulation.

e) Discussed with Addl. Chief Secretary, Govt. of Uttaranchal and preparing the water policy document.

4. Output and Impacts

4.1 Publications 2009

i] Book Chapter/Journal Articles (also those under review)

1) **A book on Water Management – in 10 languages**

Addressing the water issues in agriculture, a Q &A format document developed in English is being translated to vernacular, for wider dissemination, by subject and language experts from various states. The progress of the work is given below –

Status of Translation Books

The draft report for the following states have been completed and in the printing stage.	
Dr. Mukund Joshi	Kannada
Dr. Raman	Gujarati
Dr. M Devendra Reddy	Telugu
Dr. Kamalam Joseph	Malayalam
Dr. Himanshu C Kulkarni	Marathi
Dr. S Mahendran	Tamil
The draft report for the following states is under preparation:	
Dr. A, K. Singh	Hindi
Dr. Ashwini Kumar	Orriya
Dr. P.S.Minhas	Punjabi
Dr. Raman	English

2) **A policy brief on "Livelihood Enhancement Opportunities in North East India – Possibilities for up-scaling"** by G. Ananda Vadivelu is under review.

3) **A book "Tanks in Eastern India: A Study in Exploration"** authored by Niranjan Pant and R.K Verma is in the final stages of lay out and will go for printing shortly after meeting the IWMI publications norms.

4) **A synthesis report on key Policy Recommendations based on ITP studies drafted** by Vidya R. Presently under review.

It draws upon the collective policy finding from the research carried out during the period 2006 to 2008 under the IWMI-Tata program.

5) Details of the books that are being edited by ITP consultant Mr. Venkataramani

a. **Groundwater Management in India**

This is a comprehensive analysis of the groundwater situation in the country. In thirteen chapters written by eminent water resources specialists and managers, it succinctly presents the overall groundwater situation in different parts of the country and also advocates policy measures to re-charge the alarmingly dwindling water-tables in acute water-scarce regions.

b. **Surface Water Management in India**

This is a compilation of lucid analysis of the surface water situation in the country. In fourteen chapters written by eminent water resources specialists and managers, it delves deeply at into surface water situation in different parts of the country and also advocates policy measures to improve the precarious situation in acute water-scarce regions.

The chapters offer unique insights into ground realities and burning issues of surface water situation in the country, and calls for effective and efficient means of tackling the issues at the local, regional and national levels.

The book is essentially targeted towards water managers and policy-makers, and will be an invaluable guide for water researchers as well.

6) **ITP Brochure**

An updated ITP brochure will be available for circulation by early 2010.

ii] ITP Contribution to Book Chapters/Journal Articles

Peer Reviewed Publications: .

1. Palanisami, K., S.Senthilvel and T. Ramesh. 2009. Water Productivity under Different Scales under Canal, Tank and Well Irrigation Systems. in Upali Amarasinghe, Tushaar Shah and R.P.Malik (eds). *Strategic Analysis of the National River Linking Project (NRLP) of India. Series 1. India's Water Future: Scenarios and Issues.* IWMI, Colombo.

2. Palanisami, K. 2009. Water Markets as a Demand Management Options: Potentials, Problems and Prospects. in Seleth, R.M. (ed) *Strategic Analysis of the National River Linking Project (NRLP) of India. Series 3. Promoting Irrigation Demand Management in India: Potentials, Problems and Prospects.* IWMI, Colombo.

3. Karthikeyan Chandrasekaran, Suresh kumar Devarajulu and Palanisami Kuppannan. 2009. Farmers' Willingness to Pay for Irrigation Water: A Case of Tank Irrigation Systems in South India. *Water*, 1(1), 5-18; doi:10.3390/w1010005.

4. Palanisami, K., Suresh Kumar, D., and Wani, S.P., 2009. A Manual on Impact Assessment of Watersheds, Global Theme on Agro-ecosystems, Report no. 53, ICRISAT, Patancheru, Hyderabad, India

5. Suresh Kumar, D and Palanisami, K.2009. An Economic Inquiry into collective Action and Household Behaviour in Watershed Management. *Indian Journal of Agricultural Economics*, vol.64, No.1 Jan-March 2009.

6. Palanisami. K., and D. Suresh Kumar. 2009. Impacts of Watershed Development Programmes: Experiences and Evidences from Tamilnadu, *Agricultural Economics Research Review.* Vol. 22 (Conference Number) pp 387-396

7. Palanisami, K., D. Suresh Kumar, S. P. Wani and Mark Giordano. 2009. Evaluation of Watershed Development Programmes in India Using Economic Surplus Method. *Agricultural Economics Research Review.* Vol. 22. No. July-December. pp 197-207

8. Palanisami, K., is one of the Lead authors of the IAASTD publication on Chapter 4. International Assessment of Agricultural Knowledge, Science and Technology for Development. 2009. Global Report. Chapter 4. (eds.) Beverly D.mcIntyre. et.al., Outlook on Agricultural Change and its Drivers., IAASTD. Washington D.C.

9. Palanisami, K., P. Paramasivam, C.R. Ranganathan, P.K. Aggarwal and S. Senthilnathan, 2009. "Quantifying Vulnerability and Impact of Climate Change on Production of Major Crops in Tamil Nadu, India", *From Headwaters to the Ocean-Hydrological change and Watershed Management,* Taylor & Francis Group, London, U.K, ISBN 978-0-415-47279-1 pp 509-514.

10. Senthilnathan,S., K.Palanisami, C.Ranganathan, and Chieko Umetsu, 2009. "Deficit Rainfall Insurance Payouts in Most Vulnerable Agro Climatic Zones of Tamil Nadu, India", Inter-University Research Institute Corporation, National Institutes for the Humanities, Research Institute for Humanity and Nature, Japan. Pp 138-145. ISBN: 978-4-902325-40-9.

11. Palanisami. K, C. Ranganathan, S. Senthilnathan and Chieko Umetsu, 2009. "Diversification of Agriculture in Coastal Districts of Tamil Nadu – A Spatio-Temporal Analysis", Inter-University Research Institute Corporation, National Institutes for the Humanities, Research Institute for Humanity and Nature, Japan. Pp 130-1

12. Suresh Kumar, D and K. Palanisami. An Economic Inquiry into Collective Action and Household Behaviour in Watershed Management, Indian Journal of Agricultural Economics, 64 (1): 108-123. 2009.

Non-peer reviewed publications:

13. Palanisami,K., 2009. Irrigation Tanks: A New Way Forward? in P.Duraisamy and R.Srinivasan (eds.). *Indian Rural Economy* University of Madras, Chennai. pp. 83-112.

14. Geethalakshmi, V., K.Palanisami, P.K.Aggarwal and A. Lakshmanan. 2009. Impact of Climate on maize and sorghum productivity in Tamilnadu, in P.K.Aggarwal (ed.) Global Climate Change and Indian Agriculture. Indian Council of Agricultural Research, New Delhi. Pp.13-18.

15. Palanisami, K., C.R.Ranganathan, S.Senthinathan and P.K.Aggarwal. 2009. Impact of Climate Change on Crop Production in Tamilnadu using Ricardian Approach in P.K.Aggarwal (ed.) Global Climate Change and Indian Agriculture. Indian Council of Agricultural Research, New Delhi. Pp.19-23.

Others:

16. Palanisami. K, Krishna Reddy. K, and Vadivelu A., 2009. Challenges in Indian Irrigation Sector: Trends, Issues and Prospects. (Under review for IWMI Policy publication)

17. Palanisami. K, Krishna Reddy. K, Aananthini, Upali. K, Mark. G, 2009. Calculating the stabilization value of groundwater in tank irrigation systems (IWMI internal review for Publication).

18. Synthesis reports on Micro Irrigation and Groundwater from the list of 2nd phase ITP studies.

19. Emerging Policy Recommendation on Water Management: Compilations from ITP Studies 2006-2008

20. Suhas P Wani, Benjamin Kumpf, TK Sreedevi, PK Joshi, KV Raju, Michael J Wilson, Amita Shah, PG Diwakar, K Palanisami, S Marimuthu, AK Jha, YS Ramakrishna, SS Meenakshi Sundaram & Marcella D'Souza, 2009. Integrated Watershed Management in India: Strategic Policy and Institutional Options, Global Theme on Agro-ecosystems, Policy Brief no. AES-01, ICRISAT, Patancheru, Hyderabad, India

21. Palanisami.K, C.Ranganathan, S.Senthilnathan and Chieko Umetsu, 2009. Diversification of Agriculture in Coastal Districts of Tamilnadu – A Spatio-Temporal Analysis, Inter- University Research Institute Corporation, National Institutes for the Humanities, Research Institute for Humanity and Nature, Japan. Pp 130-137. ISBN: 9784-902325-40-9.

iii] Participation and Paper Presentation in Workshops/Conferences/ Seminars

S. No	Title of the Paper	Name of Conference & Date	Authors
1.	Tank Irrigation: The New Way Forward	4th World Congress on Conservation Agriculture. New Delhi. Feb 6, 2009	Palanisami, K
2.	Climate change and impact on crop area and productivity in Tamilnadu using Ricardian models	CLIMAWATER, Inception Workshop, Hyderabad – 14th February 2009	Palanisami, K
3	Introduction of Micro Irrigation in the Canal Water Distribution – Evidences from Tamilnadu	National Workshop on Prospects of Micro Irrigation in Canal Command Areas, New Delhi. Feb 28, 2009	Palanisami, K
4	Tank Irrigation Potential in Tamilnadu	National Seminar on Rural Transformation, Chennai. March 19, 2009	Palanisami, K
5	Impact of Tsunami on the Farm households of Coastal Tamilnadu	IHDP Open Meeting 2009 Social Challenges of Global Change, Bonn April 27-30, 2009	Palanisami, K
6	Evaluation of Watershed Programs using the Economic Surplus Method	National Workshop cum Brain-storming on Rainwater Harvesting and Reuse through Farm Ponds, Central Research Institute for Dryland Agriculture (CRIDA), April 21-22, 2009	Palanisami, K
7	Future of Irrigation in Tamil Nadu and Investment Options	National Workshop: International Water Management Institute and the Challenge Program for Water and Food Project on "Strategic Analysis of India's National River Linking Project. April 7-8, 2009	Palanisami, K
8	Micro Irrigation: Economics, Potential & Outreach	Annual Conference of the Agricultural Economics Research Association on Technology, Environment and Livelihood Security, held at Tamilnadu Agricultural University, Coimbatore. Nov 19-21, 2009	Palanisami, K

(Contd...)

(Contd...)			
9	Sustainable Water Management in Hill regions- specific focus on Uttaranchal, India	Special session on Hill Water Management in India during the Indo-US Workshop on Emerging Issues in Water Management for Sustainable Agriculture in South Asia Region, December 10-12, 2009, Ooty, TamilNadu	Palanisami, K
10	Socio-economic vulnerability and climate change	Inception workshop of the CLIMARICE II project – Sustaining rice production in a changing climate: Testing climate uncertainties and validating selected adaptation techniques on farmer's fields, ICRISAT, Nov 23. 2009	Palanisami, K
11	Climate Change impacts on water resources and livelihoods	Workshop on Climate change, Vulnerabilities and Livelihood Resilience: Towards Sustainable Water Policy and Water Governance, MIDS, Chennai. Aug 26-27, 2009	Palanisami, K
12	Impact Assessment of Watersheds in India	Consultation Workshop on Common Guidelines for Integrated Watershed Development Program. ICRISAT, Patancheru, India, *25 August 2009*	Palanisami, K
13	Discussion paper Water – Agriculture-Food Security-Livelihoods- Adaptation	Integrated Impact Assessments and Vulnerability and Development of Adaptation Framework. Review of NATCOM Work Program, Ministry of Environments and Forests, Govt. of India. New Delhi. Oct. 13, 2009	Palanisami, K
14	Water Management Challenges (Special address given)	Indo-US Workshop on Emerging Issues in Water Management for Sustainable Agriculture in South Asia Region Ooty, December 10-12, 2009	Palanisami, K
15	Micro irrigation: Economics and outreach in Andhra Pradesh state, India	Paper submitted to Conference on Technology, Environment and Livelihood Security, held at Tamilnadu Agricultural University, Coimbatore. Nov 19-21, 2009	Krishna Reddy.K, Devender Reddy. M, Gurava Reddy. KVidya Ramesh

iv] Capacity building:

Dr. Palanisami, Director ITP supervised the following students during the year 2009

Two M.BA (Agriculture), TNAU thesis works were supervised during 2009

- Anushya, Consumer choice in the selection of products.
- Abirani, Brand selection by consumers (Spensers Ltd as a case study)

Ph.D thesis supervised during 2009:

Management of Tank irrigation and groundwater use in Tamilnadu, India by Ananthini, Ph.D student, Tamilnadu Agricultural University, Coimbatore.

Dr S.Nedumaran, Ph.D student co-supervised by K.Palanisami, has been awarded the Jawaharlal Nehru Award for Outstanding Post Graduate Agricultural Research. He received the award on July 16, 2009 in New Delhi. He has done his research in ICRISAT on watershed. The topic was A bio-economic Modelling Approach in Watershed Evaluation.

v] University Lectures:

Dr. Palanisami delivered the following lectures during the reporting period – 2009

1. Delivered a lecture cum hand on exercise on Economics models in water resources planning during the Master Class on Impact Assessment, at the Social Sciences Division, ICRISAT, Hyderabad. March 23, 2009.
2. Impact of Climate change on water and crop production. Lecture delivered at the Winter School on Impact Assessment Organized by Tamilnadu Agrl. University, Coimbatore. Dec 21, 2009.
3. Dr. Krishna Reddy delivered a lecture at the GTZ Summer Course "Sustainable Innovations in India" at EPTRI, Hyderabad on 13/05/2009. The major focus of the summer school was on Water Resource Management dialogue.

vi] Participation in ARM in IWMI, Colombo

Dr. K.Palanisami, participated in the Annual Research Meet at IWMI, HQ during Nov. 2-5, 2009 and shared with the IWMI scientists about the ITP activities.

vii] Policy interfacing:

1. Participated as member of the Technical Advisory Committee of the Irrigation Management and Training Institute of the Govt. of Tamilnadu on July 22, 2009 at Trichy, Tamilnadu.
2. Dr. Vijayakumar, IAS Principal Secretary, Planning Dept, GOTN released the ITP's water policy highlights " Policy Interfacing and Irrigation Development in Tamilnadu, India on Sep 9, 2009 at Tamilnadu Agrl University while launching the TNDRIP project of the ITP.
3. Ms. Rita Singh, Secretary, Dept of Land Resources, GOI released the manual "Impact Assessment of Watersheds Global Theme on Agro-ecosystems, Report no. 53, ICRISAT" in Aug 2009 at

ICRISAT. Representatives from different states participated. The manual by Palanisami, K., Suresh Kumar, D., and Wani, S.P will be useful for evaluation of watersheds using the new watershed guidelines.

viii] ITP Representation at Meetings and Conferences

- Palanisami, K chaired the Session on Valuation of Regulating Services of Ecosystems- Regional Perspective. SCAPES International Workshop organized by University of Liverpool and ATREE, Bangalore. June 15-16, 2009.
- Ananda Vadivel attended meeting with researchers from ANGARU and Wageningen University on 3rd March, 2009, wherein possible collaboration between ITP and the university regarding tank management were explored.
- Palanisami, K and Ananda Vadivel attended a SRTT organized meeting on 18th March 09 to explore collaboration with the North East Initiative of the trust.
- Vidya Ramesh participated in the workshop on Climate Change "Community centered initiatives to address the issues on Climate change" on 6 January 2009 at Bangalore, organized by Outreach, AME Foundation and BIRD-K.
- Vidya Ramesh attended the Workshop on CLIMAWATER project on the 14th of February 2009, at The Marri Chenna Reddy Human Resources Development Institute, Hyderabad.
    - o "CLIMAWATER" – Climate *change impacts on river basins in semi-arid areas in India: Mitigation and adaptation measures to address current and future challenges (2009-2011), is an integrated project that will be implemented jointly by the Indian Institute for Technology, Delhi (IITD) and The Norwegian Institute for Agricultural and Environmental Research (BIOFORSK), Norway, with financial support from the Ministry of Foreign Affairs, Norway.*
- Vidya Ramesh attended SRTT Partners meet on 19th March '09 at Mumbai to understand the ongoing work under Central India Initiative (CInI) and initially explore possible ITP links.
- Vidya Ramesh made a presentation at the CInI 1st Annual Partners Meet held during 25th to 26th May 2009 along with CInI in the Water Resource Development session.

ix] ITP Field Visits

- Palanisami, K and Ananda Vadivel during 6th to 10th May, visited Nagaland – Exploratory visit, which lead to the development of the Concept note.
- Palanisami, K and Ananda Vadivel during 12th to 16th May visited Dehradun- Exploratory visit, which lead to the development of the Concept note.
- Vidya Ramesh during 12 – 15th May, Visited Ranchi district, Jharkhand – Exploratory visit, which led to the development of the CInI Concept Note
- Vidya Ramesh on 27th May met the CInI team at their office in Jamshedpur to discuss the next step in developing work plan and budget to carry out research studies with CInI and their partners in the region.

- Krishna Reddy Kakumanu, on 21st August, visited Manjeera dam and surrounding villages with Ragnar Pedersen, Director of communication, Bioforsk, Norway. Group meeting was organized with the local farmers to gather the perceptions on climate change.
- Krishna Reddy Kakumanu on 23rd October and 3rd November, visited Manjeera command areas (Ezogipet, Kodur, Minipur, Choutpur, Ghanapur, Machavaram villages of Medak district, Andhra Pradesh) to select the pilot areas for the CLIMAWATER project
- Krishna Reddy Kakumanu on 29th and 30th October visited Piduguralla, Rentachintala mandals of Guntur district to select the villages for field visit on 21st November with Norway group for CLIMARICE II project.
- Krishna Reddy Kakumanu on 16th and 17th November visited Ghanapur and Machavaram villages under manjeera comand with the IIT Delhi and Bioforsk, Norway groups. Various typologies (lift, tank, canal and bore well irrigations) were visited and focus group discussions were carried out in two villages.
- Krishna Reddy Kakumanu on 21 and 22 November, visited villages under Nagarjuna Sagar Right Canal Command (Krishna basin) with the project partners (Norwegian Embassy, Bioforsk, IWMI, IPRC and TNAU) to understand the area, farming systems, irrigation and discuss with farmers regarding the climate change perceptions.

x] Other Relevant Meetings and Visits – Palanisami, K

- Chaired the Project Implementation Team of the Ministry of Water Resource, Govt. of India. Feb 5, 2009
- Participated in discussions with Dr S. P. Wani, Asia Program Leader, Watersheds on Sustainable management of watersheds in India. April 21, 2009
- Participated with the ICAR - CRIDA Technical Advisory committee meeting as Member of the Technical Advisory Committee meeting, Hyderabad. May 5, 2009.
- Participated as a member in the Saciwater's Board Meeting held on at Hyderabad, June 4, 2009

xi] ITP Publication Contribution from Tushaar Shah

Title	Authors	Year	Journal	Title of book	Editor
Climate Change and Groundwater: India's Opportunities for Mitigation and Adaptation	Shah, T	2009	Environmental Research Letters Journal 4(03):5005 (13pp)		
An Assessment of India's Groundwater Recharge Master plan	Shah, T	2009	Hydrogeology Journal (accepted for publication)		

(Contd...)

(Contd...)					
Crop per volume of diesel? The energy-squeeze on India's small-holder irrigation.	Shah, T, Dasgupta, A., Chaubey, R., Satpathy, M. and Singh, Y	2009	Book chapter	Groundwater governance in the Indo-Gangetic and Yellow River Basins	Mukherji, A., Villholth, K.G., Sharma, B.R. and Wang, J
Taming the Anarchy? Groundwater Governance in South Asia.	Shah, T	2009	Book		

xii) ITP Publication Contribution from Dinesh Kumar

Book Title	Authors	Publisher & Year
"Water Management in India: What Works, What Doesn't"	Dinesh Kumar	*Gyan Books*, New Delhi, 2009

5. Visitors to ITP Office

Dr. Ravikumar, Executive Director Outreach visited IWMI on 23rd January 2009 and discussed with Vidya R about the possibilities of developing linkages with ITP.

Mr. Peter Letitre, Director International groundwater resources assessment center visited IWMI office on the 28 May 09 and had discussions with Dr. Krishna Reddy, Vidya Ramesh, Ananda Vadivel and IWMI team.

Mr. S V N Rao, Principal Engineer Water and Environment, DHI (India) Water & Environment Pvt Ltd visited IWMI office on the 8th Jun 09 and had discussions with Dr. Krishna Reddy, Vidya Ramesh and IWMI team.

Dr. P. Murugesa Boopathi, TNAU Vice Chancellor, visited ITP to discuss project linkage possibilities between ITP & TNAU on TNDRIP capacity building program on July 13, 2009.

Dr. Aswanikumar, Director, Directorate of Water Management, Bhabaneswar visited ITP on 30th and 31st July 2009 and had discussions with Dr.K.Palanisami on water management issues.

Dr Sabine, Gunwald, Faculty, University of Florida visited ITP on July 31, 2009 for discussions on technology outreach with Dr K.Palanisami.

L. Vijayanathan, Senior Advisor – Environment, Climate and Energy, Royal Norwegian Embassy; Dr Udaya Sekhar N, Senior Researcher & International Coordinator, The Norwegian Institute for Agriculture and Environment (Bioforsk) and Ragnar Vaga Pedersen, Director of Communications, Bioforsk, Norway – visited ITP on 19th Aug 2009 to discuss the research proposal with ITP team.

Dr. R. Vijay Kumar, IAS, Principal Secretary to Government (Planning and Development), Tamil Nadu visited IWMI office on 14th October 2009 and held discussions with Dr. K Palanisami and the IWMI team.

Xevier Gine, Economist and Hanan G. Jacoby, Lead Economist from the Development Research Group, World Bank visited ITP on 15th Dec 2009 to discuss about Ground Water Scenario in Andhra Pradesh. Paul Pavelic, IWMI, joined the discussion.

Mr. Hanan G. Jacoby, lead Economist and Mr. Xaveir Gine , Economist , The World Bank visited IWMI office on the 15th Dec 09 and had discussions with Dr. Krishna Reddy.

6. Policy Workhops – Outcome

In the reporting period, 4 workshops were organized on relevant themes in association with other institutional partners. A brief write up of each of the workshop is given below.

Summary of the joint workshop by MIDS

IWMI – Tata Water Policy program on

"Climate change, Vulnerabilities and Livelihood Resilience:

Towards Sustainable Water Policy and Water Governance"

At MIDS on 26-27, August 2009

MIDS – IWMI – Tata Water Policy program Sponsored Workshop on *Climate change, Vulnerabilities and Livelihood Resilience: Towards Sustainable Water Policy and Water Governance,* was held in the Malcolm Adiseshiah Auditorium, Madras Institute of Development Studies (MIDS), Chennai during August 26-27, 2009.

Altogether 42 people attended the workshop who represented academic community, NGOs and bureaucrats.

Dr S.Janakarajan, professor at MIDS welcomed the participants and briefed the workshop goals. He emphasized that the climate change impact was going to fall disproportionately on the shoulders of the poor countries living in the African, South Asian and Latin American countries. He also indicated that it is likely to impact adversely the entire eco-systems, hydrological system, water resources, agricultural production and existing livelihood options.

Professor Anand Patwardhan, IIT, Mumbai gave the key note address on the theme, "Towards an integrated research agenda for adaptation: Science, Policy and Practice". He emphasized the asymmetry in distribution of climate change impacts on the rich and the poor. He indicated that mitigation was not enough and added that regardless of mitigation, the country is confronted with a more significant degree of anthropogenic climate change. He also argued that managing climate risk is important for sustainable development.

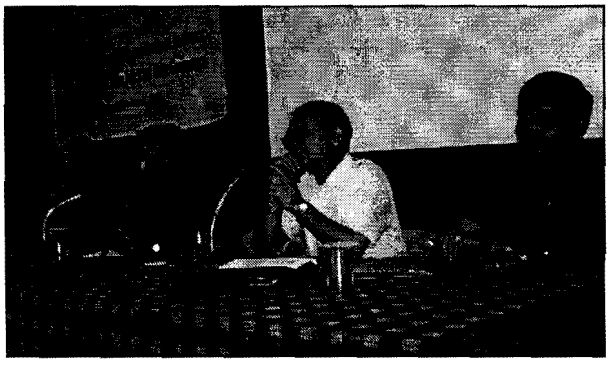
There were four presentations in the Technical session 1 which focused on the broad them climate change and eco-system vulnerability. The technical session 2 was devoted to discuss climate change impacts on water resources and livelihood. On the day-2, Technical session -3, there were three presentations on Climate Change Vulnerability Assessment: Moving beyond Indicators.

The Technical session 4 was devoted entirely for a presentation by Dr. Tushaar Shah who spoke on Climate Change and Groundwater: India's Opportunities for Adaptation and Mitigation'. He emphasized the role of groundwater banking in overcoming the threats posed by climate change. This was followed by a discussion initiated by Prof. Ramaswamy R. Iyer.

The final session was set aside for a panel discussion on global dialogue on climate change and climate justice. The panel discussion was initiated by Prof. S. Janakarajan followed by presentation of observations by the panelists, namely, Dr. Tushaar Shah, Dr. K.S. Kavikumar, Dr. Vijayakumar and Dr. G. Kumaravelu. This session was chaired by Professor Ramaswamy Iyer.

The major outcome of the workshop was the synthesis of the works done on the vulnerability methodology and quantification of the impact of climate change. The climate justice was well outlined and future lines of work were highlighted. The major recommendations include the following:

- There is an urgent to build a systematic data base on climate change, vulnerability of eco-systems and vulnerable sections of the population
- A systematic methodology needs to be developed in order to understand and document macro and micro level vulnerabilities]
- All efforts need to be made to systematize planning and development strategies of the government and mainstream climate change and adaptation strategy as a part of the government's approach to five year plans.
- Explore the possibility building partnerships at all levels regional, national and international levels – partnering with academics, NGOs, funding institutions, global multilateral organizations such as World Bank, ADB etc, Un institutions such as UNDP etc.



Experts at the Climate Change and Water Workshop – MIDS

Climate Change and Water Workshop - MIDS

Symposium on

"Micro Irrigation: Economics and Outreach"

as part of

17th Annual Conference of Agricultural Economics Research Association

19-21 NOVEMBER 2009

Tamil Nadu Agricultural University, Coimbatore-641003

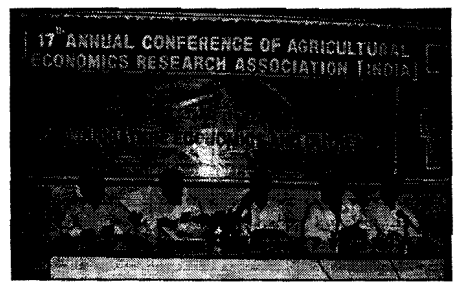
The special session on Micro Irrigation (MI) was jointly organised by the IWMI-Tata Water Policy Programme, IWMI, India and Agricultural Economics Research Association, New Delhi. Altogether four papers were presented in this session. Of the four papers, one was focussing on the macro level picture of water resources and the need for the adoption of micro irrigation in the country, while the second paper was a case study focussing on the experiences of Maharashtra state in adoption of drip method of irrigation. The third paper was on meta-analysis of micro irrigation covering 12 states invited by ITP (Himachal Pradesh, Rajasthan, Punjab, Haryana, Gujarat, Maharastra, Orissia, UP, Andhra Pradesh, Karnataka, Tamilnadu and Kerala). The fourth paper highlighted the industry perspective on micro

irrigation. All the four papers were essentially highlighting the importance of adopting the micro irrigation methods in India. It is emanated from the presentations that the micro irrigation is economically viable to farmers. Despite having many advantages over the conventional method of irrigation, its adoption and spread has been very limited in relation to its potentials so far in the country. A number of issues relating to adoption, subsidy, economics, operation and maintenance etc have been discussed in the session. The major recommendations emerged from the presentations and discussions are reported below.

- Capital cost needs to be reduced by providing infrastructure status to drip industries as well as by promoting research and development activities.
- Subsidy rates can be fixed based on the consumption of water by the crops and also by level of exploitation of groundwater. Subsidy should also be provided under Central scheme for sugarcane.
- There is a need to fix appropriate pricing of canal water and electricity to encourage the adoption of micro irrigation.
- There is a need for an autonomous single nodal agency at state level for implementation of micro irrigation projects as followed in APMIP in Andhra Pradesh.
- Capacity building on micro irrigation: trainers' training to develop resource persons throughout the state; training to unemployed village youths to reduce time lag in installation and for entrepreneurship development; and training to farmers on management and maintenance of drip system.
- It is essential to prepare implementation plan for MI projects by all states for five years and approve it in the first year itself.
- Delay in distributing the subsidies discourages the adopters and therefore arrangements should be made to distribute the subsidy immediately after installing the drip set.
- Micro irrigation industries should have adequate expertise in system design and agronomy, commitment for training the end users, commitment to work with public agencies for capacity building and should be able to supply total system to farmers.
- Uniform pricing should be adopted for all components of micro irrigation system across the states.
- A more concerted effort and public-private participation in research and extension is needed for spreading MI technology in the country.

Output from the Symposium:

Papers were received from the 12 states of Himachal Pradesh, Rajasthan, Haryana, Punjab, Gujarat, Orissa, Maharastra, Uttar Pradesh, Andhra Pradesh, Tamilnadu, Kerala and Karnataka. Totally 14 papers have been discussed. The papers are being compiled will be published as an edited book by ITP in 2010.



MI Economics and Outreach Symposium – Expert Panel

Special Session on

"Sustainable Water Management in Hill Regions of India"

as part of

Indo-US Water Management Workshop

10-12 DECEMBER 2009

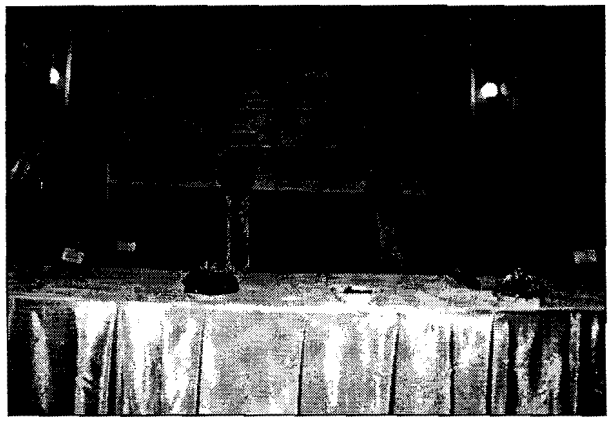
Soil and Water Conservation Research and Training Institute, Ooty

IWMI-Tata Water Policy Research Program and ICAR Soil and Water Conservation Research and Training Institute organized a special session on "Sustainable Water Management in Hill regions of India" as part of their Indo-US Water Management Workshop during Dec 10-12, 2009 at Ooty. Totally 7 papers were presented and 35 experts participated in the session.

Papers presented looked at the water use efficiency, water harvesting technologies, water management for sustainable agriculture and addresses micro level water resources management in Himalayan Region, Shivalik region, Eastern Ghats, North Eastern states and the hills of Sikkim and Darjeeling.

Output from the Symposium:

An edited book covering the Hill Water Management practices in different states of India and the potential for expansion will be published by ITP.



Expert Panel – Hill Water Management Workshop

Inauguration – Hill Water Management Workshop

IWMI organized the

CLIMARICE II *"Sustaining Rice Production in a Changing Climate"* Inception workshop

23rd November 2009

ICRISAT, Hyderabad

ITP – CLIMARICE II Inception workshop was held on 23rd November 2009 at the ICRISAT campus.

CLIMARICE II "Sustaining Rice Production in a Changing Climate" an interdisciplinary project with multi partner involvement was launched by the International Water Management Institute (IWMI) and its partners at the ICRISAT campus on 23rd November 2009.

The project is aimed at reducing uncertainties by validating the adaptation measures in close collaboration with farmers and other stakeholders. By demonstrating applicability of selected adaptation technologies and building stakeholder capacity to implement them in their fields, the project focuses on integrating science and policy.

The three year project will cover Krishna basin in Andhra Pradesh and Cauvery basin in Tamil Nadu. The project is supported by the Norwegian Ministry of Foreign Affairs through the Royal Norwegian Embassy, New Delhi. Other partners in the Project include – Bioforsk, Norway; IPRC, Hawaii; TNAU, Coimbatore along with IWMI, Hyderabad.

The Project was inaugurated by Sri S.K. Joshi, Principal Secretary (Projects), Government of Andhra Pradesh who extended his full support to the project and wished it success in achieving the designed outcomes. He shared his concern regarding uncertain rains leading to uncertainty in planning. He expressed the need for strong institutions; adaptive managerial systems and progressive science to help farmers meet the challenges of extreme floods and droughts – arising due to climate change. Recognizing the challenge in improving water use efficiency, he shared that the irrigation department has already initiated appropriate steps.

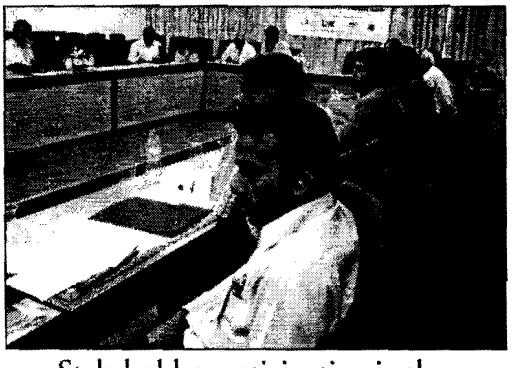
Mr. Sanjay Gupta, IFS, Special Commissioner, I&CAD in his special address took the case of the recent natural disaster due to floods in AP and highlighted the need for appropriate mitigation strategy during the occurrence of such events.

Ms. Inger Sangnes, Counsellor-Development, Royal Norwegian Embassy and L. Vijayanathan, Senior Advisor- Environment, Royal Norwegian Embassy have attended the Inception workshop and given a brief note on the importance of the climate change issues. Dr. Goswami, Director IITM, Pune; Dr. N. Udaya Sekhar, Bioforsk, Dr. Annamalai, IPRC Hawaii; Nils Otto Kitterod, Bioforsk, Norway and Dr, Jannes Stolte, Bioforsk made technical presentations based on climate modeling and stressed on the need for developing improved models and collection of accurate data from the field.

Farmers and NGO representatives present at the project launch welcomed the project and shared that they are experiencing uncertainties in the monsoon rains and there is a need to improve assured water supply to farmers. They expressed the need to involve local farmer groups and SHG's in the process to ensure greater level of adaptation.

Dr. Yella Reddy, Principal Scientist and Project Manager, APWMP and K.V. Rao, Senior Scientist, CRIDA, working on projects related to adaptation and mitigation to climate change in AP also shared their learning and expressed cooperation to the study.

Chief guest and Speakers



Stakeholder participation in the inception workshop-CLIMARICE

6.1 Policy Impacts and Linkages at different levels

6.1.a. National level

- ITP is engaged in the documentation and evaluation of the 5000 farm level water management trials on More crop and income per drop. The draft will be submitted to the MoWR, GOI soon.
- Also ITP is involved in the study of the ICAR's All India Coordinated Water Management Schemes. This will cover about 15 centres and returns to water management research will be studied.

6.1.b. State level

- Discussed with State Planning Commission, Govt. of Tamilnadu and major recommendations were given.

  TAMILNADU: POLICY INTERFACING AND IRRIGATION DEVELOPMENT: A synthesis paper on State Irrigation Investment Strategies. Presented at the State Planning Commission-Govt. of Tamil Nadu.

- A water policy highlights was also released on 09-09-09 by Dr R.Vijaykumar, Principal Secretary (Planning and Development), GOTN.
- Further, at state level, the policy intervention studies are being initated. Specifically Andhra Pradesh, Tamilnadu, Karnataka, Gujarat and Maharastra states are covered. Policy briefs will be prepared for each state. Also Gujarat state level studies (viz.,) and NREGS studies in states are progressing well.
- In addition, several regional level studies are being initiated. They include Water privatization study in Tamilnadu, SRI adoptation in Kerala and Tamilnadu, Micro irrigation in canal commands of Andhra Pradesh,

6.1.c. ITP studies & their Leverage with Govt. programs & Other Development Activities

ITP studies (year)	Major findings/ recommendations	Outcome/Leverages with other programs
1. Social benefit cost of drip irrigation in Tamilnadu (2007-08)	Findings: 1) Less than 10% of the drip farmers use the system effectively Recommendation: 1) Drip capacity building and action research with farmer participation necessary. 2) Feedback to govt. programs	1) A drip capacity building program (TNDRIP) initiated in Sep 2009 with 100 villages and 1000 farmers in Tamilnadu. 2) Drip firms and govt. depts.. participate in the program.
2. MoWR – Farmers participatory action research on More crop and income per drop in 5000 locations (2008-09)	Findings: 1) Among the water saving technologies only few are proven to be effective in the farmer's fields. Recommendations: 1) Need to upscale the proven technologies in selected locations.	1) MoWR, GOI is thinking about upscaling the proven/selected technologies in selected states through extension of the ongoing program. The project will cost around Rs 36 crores.
3. State water sector interventions (2008-09)	Findings: 1) O&M cost of the irrigation projects includes other uses and hence for irrigation alone it is over-estimated (upward biased) Recommendations: 1) O&M cost of the irrigation projects needs to be re-examined to revisit the subsidy in irrigation sector and also the water charges.	1) A separate study is being funded by International Institute for Sustainable Development (IISD) to examine this suggestion. Andhra Pradesh state will be covered for the study by ITP. Budget US$ 24,000. Separable cost remaining benefit (SCRB) method will be used.
4. Drip irrigation Mehalaya (2007-08)	Findings: 1) Drip irrigation increased the yield and water saving in orange and kiwi fruits. Recommendations: 1) Need to introduce micro irrigation in water scarcity hill environments such as Nagaland, Arunachal Pradesh etc.,	1) Helps the SRTT partners in Nagaland to prepare projects incorporating the micro irrigation as one of the components. 2) Already MI irrigation pilot projects have been initiated in Uttarakhand in association with Himmotthan. 3) In the NE, Naandi Foundation is showing interest to work with ITP on MI in the hills.
		(Contd...)

(Contd...)

5. Tank irrigation –issues and potentials (2008-09)	Findings: 1) Many of the Panchayat union tanks are performing poor. 2) Many tanks have wells above the threshold level Recommendations: 1) Possibilities for conversion of tanks into percolation ponds 2) Tank rehabilitation should include partial desilting, sluice management and supplemental irrigation.	1) Presented the results to the State Planning commission. 2) Policy framework was developed and released by the Principal Secretary, Planning and Development, GoTN in Sep. 2009. 3) ITP will be developing the methodology to select the tanks for such conversion.
6. SRI – Adoption and constraints (2008-09)	Findings: 1) Not all the components of the SRI practices are followed in the subsequent years. 2) Only successful in ground water irrigated regions followed by surface and groundwater (conjunctive use) regions Recommendations: 1) Given the labour scarcity, mechanical transplanting is to be explored. 2) Only in uplands with well water supplementation, the SRI be upscaled 3) Need studies on the soil analysis periodically to study the nutrition uptake.	1) The recommendations will be sent to Agrl Dept. GoTN and Project Director, IAMWARM, World Bank project which focuses on SRI.
7. Watershed impacts & policy interventions (2008-09)	Findings: 1) Watershed benefits are skewed and depends upon the rainfall, soils, crop-livestock pattern, implementing agencies etc. Recommendations: 1) Both consumers and producers surplus be evaluated 2) The evaluation should also incorporate the uncertainties in watershed project benefits.	1) An improved method of watershed evaluation using economic surplus method was developed. It also incorporates te rainfall pattern in the benefit calculations. 2) A manual on watershed evaluation incorporating these improvements were developed and released by Secretary, Dept. of Land Resources, GOI in Aug 2009 at ICRISAT. Representatives from different states participated.

(Contd...)

(Contd...)		
8. Synthesis of the watershed guidelines implemented by govt. departments (2008-09). Done in association with ICRISAT team	Findings: 1) Need to incorporate the following in the common guidelines: a. Micro watershed area (500 ha) should be increased for enhancing the benefits.b. Cost /ha is inadequate. Recommendations: a. Need more capacity building. b. Model watersheds should be developed.	1) The followings are expected to be incorporated while implementing the watershed programs. a. Watershed area around 1500 ha; b. increased cost Rs.12,000/ha c. ICRISAT is implementing the model watershed in selected regions. The common guidelines have incorporated most of the recommendations. (to be discussed and finalized with Dr. Suhas Wani)
9. Artificial recharge due to watershed investments (2008-09)	Findings: 1) The zone of influence is about 400 meters downstream and 150 meters upstream 2) The benefits are not uniform over years. Recommendations: 1) Need to develop water balance studies at watershed level. 2) Need to have model watershed at each district for measuring the key parameters such as zone of influence, siltation etc.,	1) The recommendations particularly the zone of influence has been incorporated in the watershed impact evaluation studies done in 10 watersheds. 2) Modeling using discharge and recharge aspects has been initiated using few watersheds in TamilNadu.
10. Impact of Climate change in agriculture, Tamilnadu state (2008-09)	Findings: 1)Climate change affects the yield and area under major crops in the state of Tamilnadu 2) Many regions are vulnerable to climate change. Recommendations: 1) Important to study the exiting adaptation strategies in different regions of the state and disseminate the successful adaptation strategies	The results were presented in the Norway sponsored climate change workshop in 2008 in Hyderabad. As a follow ups, funding is provided to do the vulnerability analysis in Godavari basin covering AP, Maharastra, MP, Karnataka and Orissa states. (US$ 20,000).Another study has been awarded to make similar analysis in Krishna Basin in AP state. The main focus will be applying the hydrology and climate and socio –economic models with appropriate dissemination strategies.IWMI/ITP will be doing this. (Budget: US$ 200,000)

7. Issues Encountered & Resolved

ITP was having less manpower during the beginning of the year and the recruitment process was initiated subsequently. Current technical staff strength is 4.

There was some delay in initiating the water management interventions in fragile hill environment covering mainly the northeast (Nagaland, Mizoram and Arunachal Pradesh states) and Uttaranchal. However, ITP team visit was made to Nagaland with Mr Rajesh Thadani, Advisor to NEI and SRTT members during May 2009. ITP team visit was also made to Uttaranchal and work plans were discussed with Himmothan team at Dehradun during the same month. Micro irrigation systems were installed in 12 locations in association with Himmothan and other 2 local NGOs. A visit to CInI region and discussion with the team took place during May 2009 by Vidya from ITP. While the LOU has been drafted, the work in the region is yet to be initiated. NEI and CInI are planned to be implemented in early 2010.

Policy interface was also not strong in the beginning of 2009. Subsequently, ITP team initiated the move with the GOTN state Planning Commission and had discussion in 2009. Following this the TNDRIP capacity building program was launched on Sep, 9, 2009 with the participation of Dr R.Vijaykumar, Principal Secretary (Planning & Development), GoTN and the policy highlights for Tamilnadu state was released.

As a follow up, the policy briefs are being prepared for Andhra Pradesh, Karnataka, Maharashtra, and Gujarat states. Also discussions have been initiated with CADA department with regards to the implementation of MI programs in canal command areas. Along these lines, ITP has also completed a study in the Alimineti Madhava Reddy Project canal command, Nalagonda district.

Even though, ITP is focusing on the key research areas, one of the concerns was whether ITP can go at micro level interventions or macro level interventions. Since both the levels are important as there will be convergence of activities, macro level studies have also been initiated covering selected states. They include SRI adoption levels, groundwater recharges through dug well recharge scheme, tank management (best) options, watershed program guidelines, micro irrigation implementation framework, climate change and NREGA impact.

Another aspect is how the ITP impact could be documented giving the road map for the study output. This is being attempted now.

7.1 ITP Staff Details

Dr. Krishna Reddy has been recruited as a Special Project Scientist and joined the ITP team from 11th May 2009.

Mr. Anup Das, an engineer joined ITP in August 2009. Based at the project area, Uttarakhand, in association with Himmotthan, he is working on introducing MI in farmer's fields.

Mr. G. Ananda Vadivelu, Special Project Scientist at ITP left on August 15th 2009 to pursue his career as Assistant Professor, at Institute of Economic Growth, New Delhi.

8. Future Plan of Action

ITP has invested significant chunk of time and resources to set the research agenda for ITP for the remaining part of the second phase, and to design strategies for achieving better impact of the research on policies and actions relating to water management in India.

ITP during 2010 will focus mainly on translating the key finding from the ITP research studies into implementable action plans by different stakeholders. Policy intervention through policy notes, policy dialogues and networking with strategic partners at Central as well as at the State level will take priority.

Building capacities of various stake holders through appropriate modes including fellowships, workshops, training and field visits is also seen as a major activity in the next year. Already the TNDRIP is considered as a success initiative. The bulletin on Water Management: Questions and Answers will be published in 7 states in the local languages.

2-3 Policy interaction and capacity building workshops will be organized exclusively for the policy makers and other bureaucrats in the water sector during 2010.

Work in Northeast will be initiated using the successful experiences gained from the Uttaranchal MI programs and also based on the success stories of the water management interventions documented as part of the ITP Hill Water Management Symposium conducted recently in Ooty in association with ICAR's Soil and Water Conservation Research and Training Institute, Dehradun.

ITP will also translate all the research studies carried out in different regions and will prepare a synthesis report and will be presented in selected states. To start with Andhra Pradesh, Mahatrastra and Gujarat will be covered during 2010.

Using the learning's obtained from the research studies completed under ITP; six publications (books) will be published during 2010. They include

1. Water Management – Question & Answer by K. Palanisami and S. Raman
2. Tanks in Eastern India: A Study in Exploration" authored by Niranjan Pant and R.K. Verma
3. Groundwater Management in India by ITP Team
4. Surface Water Management in India by ITP Team
5. Sustainable Water Management in Hill Regions of India by ITP Team
6. Micro Irrigation: Economics, Potential and Outreach by ITP Team