

Annual Report

(2009 - 2010)



People's Science Institute



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PEOPLE'S SCIENCE INSTITUTE ANNUAL REPORT 2009-2010

I. NATURAL RESOURCES MANAGEMENT

The Centre for Natural Resources Management (CNRM) previously known as Center for Participatory Watershed Development at PSI conducts a variety of Research & Development (R&D) activities in the field of Natural Resources Management (NRM). It is mandated by CAPART (Ministry of Rural Development, Government of India), to provide training, development, research and communication support to government and non-government organizations engaged in watershed or NRM projects in the states of Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttarakhand and Uttar Pradesh.

The Centre's work in 2009-10 focused primarily on addressing food security through upscaling the System of Crop Intensification (SCI) in the Himachal Pradesh and Uttarakhand. An important new initiative was the technical support provided to the Government of Sikkim for watershed development works in the state. The Centre also facilitated the preparation of a Comprehensive District Agriculture Plan for Tehri Garhwal district and the process of preparing District Perspective Plans in the three BRGF districts (Tehri Garhwal, Chamoli & Champawat) of Uttarakhand.

I.1 ACTIVITIES

I.1.A System of Crop Intensification (SCI)

Paddy: People's Science Institute (PSI) embarked on a mission to promote the widespread use of the SRI technique in Uttarakhand and Himachal Pradesh. SRI is a new way of cultivating



paddy. It focuses on the root rather than the plant. Ensuring healthy roots ensures healthy and more productive plants. Fewer saplings/seedlings are planted per unit area reducing competition for nutrients and instead of keeping the fields flooded, the practice in SRI is to drain the water out after 3-4 days. This increases the supply of air, i.e., nitrogen, to the roots. SRI also recommends use of organic fertilizers. Thus farmers raise rice production substantially by changing the way they manage their plants, soil, water and nutrients, rather than by

increasing inputs such as fertilizer, water and agrochemicals. Getting more output with less cost enhances profitability. PSI also motivated farmers to successfully apply SRI principles to other grains like wheat, maize, *mandwa* (finger millet) and *rajma* (kidney bean) and termed it as SCI -



System of Crop Intensification a boon for enhancing farm productivity for greater food security for farming families.

In 2009-2010 PSI successfully mobilized 13,474 farmers (9,679 in Ukd and 3,795 in HP) to adopt SRI covering an area of about 551.5 ha (410.14 ha in Ukd and 141.4 ha in HP). The scaling up in both the states has been quite successful. Strong linkages have been established with local VOs, Agriculture Departments, KVKs, Agriculture Universities and Research Institutions for its promotion. PSI's previous experience with the SCI, especially in rainfed areas, was immensely helpful during the 2009 drought. The Institute's and POs' staff worked with the Master Trainers and Village Level Resource Persons to motivate farmers to practice SCI even in a drought situation. As a result of the drought, farmers were not able to transplant young saplings due to lack of timely rainfall. It led to seed mortality and a drop in the number of participating farmers and area covered. It restricted the use of weeders and increased labour cost and time. It also led to a lot of variability in adoption of the recommended SCI practices.

Despite the above problems, the crop cutting results undertaken in the farmers' fields across the two mountain states demonstrate the versatility of the SCI technique in improving the food security situation of the rural communities even during times of water scarcity. SCI paddy produced more effective tillers per plant, each plant had longer ears with more and heavier grains yielding 4.8 T/ha whereas conventional paddy produced only 2.5 T/ha showing an average increase of about 92 % in grain yield of SCI paddy over the conventional paddy crop. In addition there was about 67 % increase in straw yield from SCI paddy over the conventional paddy. SRI farmers have expressed immense satisfaction with the perceived benefits of saving seed, water, physical labour and increased grain and straw yields.

Wheat: PSI for the first time in the country initiated wheat cultivation adopting SRI principles and termed it as the System of Wheat Intensification (SWI) on farmlands in Uttarakhand and HP, under irrigated and unirrigated conditions during 2007. Less seed requirement, saving in water and high grain and straw yields motivated farmers to approach the institute for its further promotion in the subsequent years.

Therefore during 2009, PSI with financial assistance from SDTT, NABARD-Uttarakhand, WWF-ICRISAT and NABARD-HP mobilized more than 4,100 farmers from Ukd and HP to adopt SWI covering an area of more than 84 ha to address livelihoods needs and help achieve food security for small and marginal farmers. The average productivity of SWI went up from 2.9T/ha to 5.2T/ha, showing about 79 percent increase in grain yields. The straw yields from SWI crop increased by about 67 per cent.





Other crops: Like in most parts of India, the South-West monsoon is a crucial factor in determining levels of agriculture output and farmers' incomes in this region. Since farmlands of



the majority of households are rainfed erratic monsoon rainfall seriously affects their livelihoods. The overall rainfall deficit during 2009 in Ukd and HP was about 40 percent and 44 percent (up to August), respectively. To additionally cope with drought PSI mobilized 1645 farmers (1000 in Ukd and 645 in HP) adopt SRI principles on other crops (like finger millet, kidney bean, soya bean, maize, etc.) covering an area of about 46.6 ha (28.58 ha in Ukd and 18.08 ha in HP), in the different districts of these states. Direct seed sowing (1-2 seeds per hill) was recommended at a spacing of about 20 cm x 30

cm for finger millet and 25 cm x 30 cm for kidney bean, 30 cm x 30 cm for soya bean and maize along with at least two manual weedings. Organic fertilization was increased, which improved soil structure and functioning. Crop cuttings conducted in the farmer fields have showed an average increase in grain yield of 50 percent in finger millet, 69 percent in kidney beans, 29 percent in soya bean and 34 percent in maize from the SCI plots compared with conventional plots where soil and seed were the same.

Way forward: PSI is further committed for upscaling SCI's extension in Uttarkhand and Himachal Pradesh and promoting it in the severely drought hit Bundelkhand region during 2010-2011 with financial assistance from SDTT and WWF-ICRISAT. The major programme components are: a) undertaking trials and promoting SCI in four new districts of Bundelkhand region, b) upscaling SCI area coverage in all the districts of Uttarakhand, c) extending SCI to nine districts from the presently covered six districts in Himachal Pradesh and iv) conducting SCI research trials for developing farmers' friendly package of practices for different crops. The institute will extend SRI to at least 18,500 households in Uttarakhand, Himachal Pradesh and Bundelkhand, and expand the area coverage to 846 ha during the current year. The goal is to assist farming families attain greater food security.

Poster Set– A set of 5 posters on practical aspects and benefits of System of Rice Intensification was developed.

I.1.B Comprehensive District Agriculture Plan (C-DAP)

India's Planning Commission and the Ministry of Agriculture, Government of India nominated PSI as a Technical Support Institution for facilitating the process of preparation of C-DAP for Tehri Garhwal district of Uttarakhand, adopting bottom-up approach. PSI organized meetings with the District Administration and subsequently selected 16 Partner Organisations (PO). Orientation workshop with the POs was organized to develop district vision. At the block level Block Support Teams (BSTs) was formed by the POs in consultation with PSI and orientation workshops was held to train the BSTs members who later constituted Panchayat Level Resource Groups (PLRGs) at Gram Panchayat level. These PLRGs comprised of four



persons out of the following i.e. Gram Pradhan, Ward member, Progressive Farmer, Mahila Mangal Dal representative, respected retired village resident, or anyone else who can contribute to the needs assessments and planning for agriculture development in the area. There were a total of 3916 PLRGs. Primary data was collected by these PLRGs while secondary data was collected by the support team at PSI through meetings with Agriculture and allied departments staff. The primary as well as secondary data verified through triangulations and gram panchayat plans consolidated. The C-DAP was approved by Block Agriculture Planning Unit (BAPU) and District Agriculture Planning Unit (DAPU) on June 25th 2009 and govt. of Ukd submitted it to Planning Commission on 31st June 2009. The CDAP identified agriculture, horticulture, animal husbandry, fishery, watershed development, agro-forestry, community tourism and medicinal and aromatic plants cultivation as the main sectors for which rural farmers of this district proposed various interventions for agriculture growth of Tehri Garhwal. Representatives of Planning Commission in their feedback to the govt. of Ukd mentioned that the C-DAP prepared by PSI should be used as a benchmark document while preparing C-DAP of other districts.

I.1.C Backward Regions Grant Fund (BRGF)

The Planning Commission, Government of India and the Government of Uttarakhand nominated PSI as a TSI to facilitate participatory planning process for preparation of District Perspective Plans of the three BRGFs districts of Ukd namely, Champawat, Chamoli and Tehri Garhwal in accordance to Article 243 ZD (3)(d). The institute organized a sensitizing workshop for the block level officials and members of the Zilla Panchayat in Chamoli district during March 2008. After approval of the proposed work strategy by the three district administrations, it selected 33 Partner Organisations (POs) to initiate facilitation of participatory planning for 1870 Gram Panchayats, 4 Nagar Pallikas and 12 Nagar Panchayats of these districts. Two orientation workshops were organized during 2008 at Dehradun to carry out the activity of district level visioning exercises. Thereafter, Block Support Teams (BSTs) at the block level was formed by these POs after consulting PSI. A total of 4 orientation workshops, each of three days duration was held to train these BSTs members. After consultation with the gram sabha these BSTs constituted Panchayat Level Resource Groups (PLRGs). These PLRGs comprises of four persons out of the following i.e. Gram Pradhan, Ward member, Progressive Farmer, Mahila Mangal Dal representative, respected retired village resident, or anyone else who can contribute to the needs assessments and planning for agriculture development in the area. 253 capacity building programmes conducted to sensitize 7132 PLRGs for collecting panchayat level primary data. Secondary data was collected by the team at PSI through meetings with Agriculture and allied departments staff. The primary as well as secondary data verified through triangulations and gram panchayat plans consolidated. Now these plans will be discussed at the blocks for its approval.

I.1.D Feasibility of implementing a Payment for Environmental services (PES) scheme for silt control in the catchment in the Giri River above the Renuka Dam' Project

Winrock International India (WII) approached Peoples' Science Institute (PSI), Dehradun for support regarding assessing the provision of watershed services identifying indicators in two micro-catchments namely Chail and Renuka regions of Solan and Sirmour districts respectively of the Giri River in the eastern Himachal Pradesh, upstream of the Renuka, for the HP forest department. The study was conducted to assess the scope for designing and implementing a Payment for Ecosystem Services (PES) mechanism for controlling soil erosion and enhancing the provision of watershed services as well as other environmental services for improving the livelihoods of local communities. Four villages in the Chail region, i.e. Mahog, Jhajha, Kurgul and Takrana and one village (Andheri) in Renuka region were selected. The Andheri village is under Mandoli forest beat and Renuka Forest Range.

Field visits were conducted to identify spring micro-catchments and infiltration zones and to suggest a simple management plan, aimed at maintaining and enhancing springflows. The collateral benefits of reducing erosion, the debris/silt load from the catchments in the baseline scenario and with-treatment scenario, erosion levels in selected micro-catchments in the study area, and silt load reduction potential and water discharge enhancement potential through stream-channel and stream-bed treatment options were assessed during the field trips. Options identified and interventions recommended for treatment across different zones in the selected micro-catchments.



I.1.E Springshed conservation and development programme (Dhara Vikas) in water scarcity areas of Sikkim

WWF-India requested PSI to offer its consultancy services covering six months on springshed conservation and development programme (*Dhara Vikas*) in water scarcity areas of



Sikkim. A two member senior PSI team conducted reconnaissance field surveys of twelve springs catchments under eight blocks of South Sikkim, West Sikkim and East Sikkim districts and assessed the present status and identified appropriate catchment treatment interventions to rejuvenate the springs. The team conducted capacity building exercises through training workshops and field demonstrations for a group of persons identified by RR&MD which included Field Facilitators, Block JEs, Bare Foot Engineers (BFEs) and selected SIRD personnel on

concept of plan springshed development, techniques involved, plan preparation and



measurements that needs to be recorded for spring rejuvenation. It reviewed springshed development plans prepared by the *dhara vikas* team and provide technical inputs for its improvement. An exposure visit was also organized for the stakeholders of *dhara vikas* to treated watershed catchments for an insight experience on springs rejuvenation in Ukd and HP. PSI's team recommended staggered contour trenches, silt detention trenches, field bunds, live hedge rows, plantation of fruit and fodder trees and grasses in selected sites for spring rejuvenation. At few places even brush wood dams were also recommended. Joint review meeting of along with Joint Secretary RM &DD, WWF and *dhara vikas* Team (which included ACFs, SIRD Training coordinator and FFs) was also conducted for successful implementation of proposed interventions and to dovetail other programmes. PSI's team also conducted periodic field trips to monitor quality of physical activities in the catchment of the springs.

I.1.F Undertake wealth ranking exercises under Livelihoods & Landscapes Programme

The Energy Research Institute (TERI) requested PSI to be its part partner under the Livelihoods and Landscapes Programme (LLS) to undertake wealth ranking exercises to identify the sources of income and village wealth status. PSI conducted focus group discussions, individual household analysis and pairwise ranking and scoring in the four pilot villages namely, Thaska, Salehpur, Jhanda and Pammuwala under Sadhaura forest range, in Yamunanagar district of Haryana. It was found that government service is the main indicator of rich wealth while daily labour indicated very poor wealth status. Rich wealth group comprises of 16%, average group 25%, poor group 38% while the remaining 21% households came under very poor wealth group. Majority of government employees are from Thaska and Salehpur villages while none of the households are in government service from Pammuwala village.

I.1.G Baseline data and DPR preparation under Livelihoods & Landscapes Programme

TERI requested PSI to be its part partner under the Livelihoods and Landscapes Programme (LLS) to undertake field survey for collection of baseline data and prepare detailed project report (DPR) for the four pilot villages namely, Thaska, Salehpur, Jhanda and Pammuwala under Sadhaura forest range, in Yamunanagar district of Haryana. The team at PSI applied PRA tools and conducted individual household survey to gather baseline data. Focus group discussions, analysis of results and its presentations with different stakeholders' comprising communities, government departments, panchayats lead to finalization of the DPR. The primary focus is on reducing drudgery and raising household incomes is through construction of drinking water facilities, irrigation development, soil & water conservation, fodder development, dairy development, agronomic and horticultural measures, and secondary income generation activities like mushroom cultivation.

I.1.H Impact Assessment Studies of Watersheds

NIRD nominated PSI as their nodal center for North India to conduct impact assessment (IA) studies of the watersheds under the Drought Prone Areas programme (DPAP) and Integrated Watershed Development Programme (IWDP) covering Himachal Pradesh and Jammu & Kashmir. Sample watersheds were selected for the IA study, based on the percentage of community land, SC/ST population and irrigation land after consulting NIRD. For Himachal



Pradesh, a sample of 35 watersheds (30 under IWDP and 5 under DPAP) covering an area of 18,695 ha in seven districts of Himachal Pradesh were selected whereas, for Jammu & Kashmir, 10 micro watersheds covering 8000 ha in Sunderbani block of Rajouri district were selected.

In all the sampled watersheds of HP, there has been a major investment for conservation of water and soil. Spring recharge and recharge of ground water at places have been observed. However a majority of the water harvesting structures benefitted large medium farmers (LMF) rather than small or marginal farmers (SMF). Construction of erosion prevention structures has been reduced some soil erosion which has benefitted both LMF and SMF. There has also been some investment on improving fodder availability. Almost no direct investments have been made across watersheds on diversifying crop patterns or related investments for productivity enhancements. New interventions like vegetable cultivation around water harvesting structures constructed have been initiated. Watershed communities have shifted from draft animals to milch animals and similarly from small ruminants to milch animals. Impact of horticulture crops could not be assessed since it was under the gestation period. There has been lack in people's participation as indicated by the absence of village level institutions in the watersheds. No benefit sharing mechanisms were observed. The Watershed Development Fund (WDF), a main component for sustaining the programme was locked up with the panchayas. It is not being used for maintenance and repair of structures.

In the sampled watersheds of Rajouri district, J&K, there has been some investment for conservation of water and soil and in isolated cases on fodder development. No investments have been made in the watersheds of this district on crop diversification or any other crop productivity enhancements. Some conservation of water due to construction of water harvesting structures in the watersheds under WDP has been recorded. A majority of these water harvesting structures are benefitting limited individuals rather than the community as a whole. There is insignificant improvement in the availability of green fodder in the IWDP watersheds. There has been total lack in people's participation during implementation of the IWDP as indicated the total absence of village level institutions in the watersheds. It is to be mentioned here that benefit sharing mechanisms totally lacks in the watersheds. Here too the WDF is not being used for maintenance and repair of structures.

I.1.I Training Programmes

The centre generated 1136 trainee days under watershed development programmes, micro level planning and social audit under MGNREGS in 2009-10. Several community based organizations (WCs, VDCs, SHGs, UGs and MMDs), Panchayat Pradhans and WDT members along with Watershed Development Coordinators (WDCs) of Mid-Himalayan Watershed Development Project, BDOs from Kangra, Bilaspur, Solan districts of H.P and beneficiaries of the SWAN project, HP were trained during the year.

I.2 REMARKS

CNRM is the largest group in PSI. It brings more than 60% of the Institute's income and employs about two-thirds of its staff. CNRM is constantly assisting and facilitating the rural communities in development of their resources though participatory microplaning followed by



building sustainable institutions and finally promoting adoption of low input developmental interventions to ensure food security and livelihoods development. Participatory micro planning and village level institutions are the strong areas of this unit. System of crop intensification initiated primarily to ensure food security and increase annual household's incomes for the farming families in the selected mountain watersheds of Uttarakhand and Himachal Pradesh is the prime applaud able programme of this center.

As pressure mounts on this center for expanding its activities, a major challenge before it is to recruit qualified, capable, articulate and creative young people who can lead the expanding programmes. The center is playing a significant role in PSI's attempts to be more self-reliant by attracting significant funds for its development support functions.

II. DISASTER MITIGATION AND RESPONSE

DISASTER RISK REDUCTION IN KOSI BASIN

As a part of a disaster risk reduction and preparedness strategy in the Kosi Basin (Bihar), PSI had proposed to prepare a Decision Support System (DSS) that could help official and non-official disaster management agencies to take effective action for disaster preparedness and quick rescue and relief response in the event of a flood disaster. The main activities undertaken were:

1. **A Vulnerability Analysis:** Visually inspect the embankments, meet with local people and identify weak stretches which are most likely to fail in the future. This exercise was done in the months of May-June 2010, when the river discharge was low. Vulnerability analysis has been done for both eastern and western Kosi embankments. Fig 1 shows a stretch on the western embankment which is likely to breach. Efforts are on to make temporary spurs to protect the embankment.

2. **Create a Decision Support System (DSS):** This has two components:

- (i) **Geo-referenced Village Information System (VIS):** VIS for 21 districts (North of Ganga River) including districts in the Kosi basin has been completed. Readymade interactive maps of all these districts are now available on the VIS website (www.villageinformationsystem.org). In these maps each village boundary is shown. For each village the entire Census 1991 and 2001 data are attached. This system can is very



A Vulnerable stretch on the western embankment

useful for efficient governance especially in case of disasters like floods, earthquakes, etc. In case of floods, this system can be used to identify the area that will be affected by a given flood scenario, along with its complete demographic details, village by village, e.g., number of men, women, children, infrastructural details, etc. It would also identify local areas of high ground where schools or other public buildings could be constructed which could provide shelter in the event of floods.

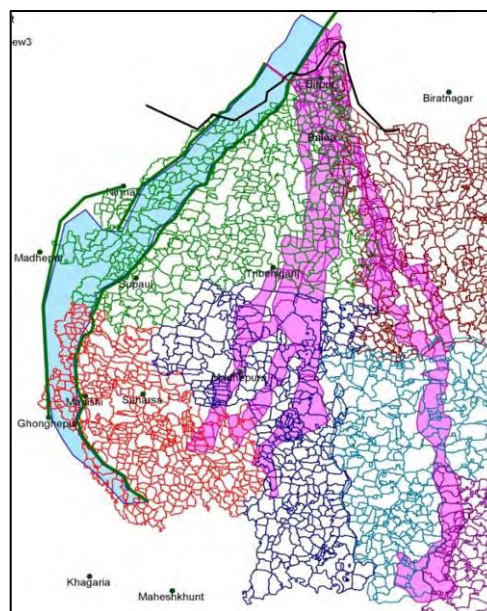
- (ii) **Inundation Analysis:** Once the vulnerable stretches are known, estimates were made of the likely extent of flooding, i.e., the area that would be flooded and the depth of flooding at various locations by assuming different flood levels (discharges) in the river and the length of the breach. This has been done for eastern Kosi embankment.

An inundation map of the 2008 Kusaha breach was prepared with the help of Google earth imagery. The following can be interpreted from this map for a known discharge:

- a. **The area of inundation.**
- b. **The number of affected villages** along with their details like population, agricultural land, infrastructure, etc. Fig 2 shows the extent of Kusaha flood along with village boundaries of affected district.
- c. The time taken by the flood water to reach a particular place. **This is therefore a device for making early warning** and perform evacuation activity once a breach occurs.
- d. **The location of safe places where temporary shelters or school-cum-flood shelters can be constructed** for the affected population.

To check the accuracy level of the model the following was done:

1. Field verification regarding ground levels of the selected points was done. Information regarding the arrival time of flood was collected from the villagers and matched with our timings.
2. The actual imagery of NRSA (available for 22Aug, 2008) was superimposed over this map. It was observed that the match was about 80%.



Extent of Kusaha Flood as mapped by PSI

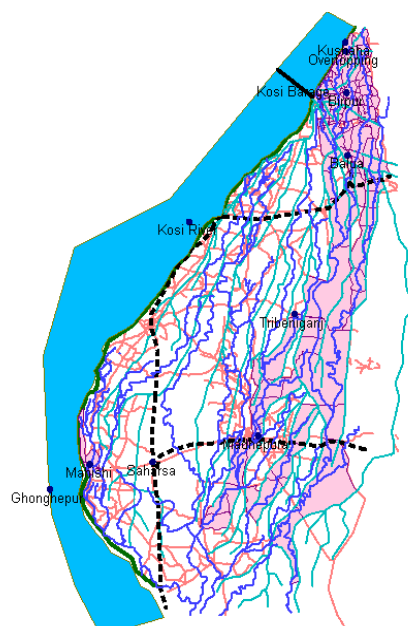


Fig. a

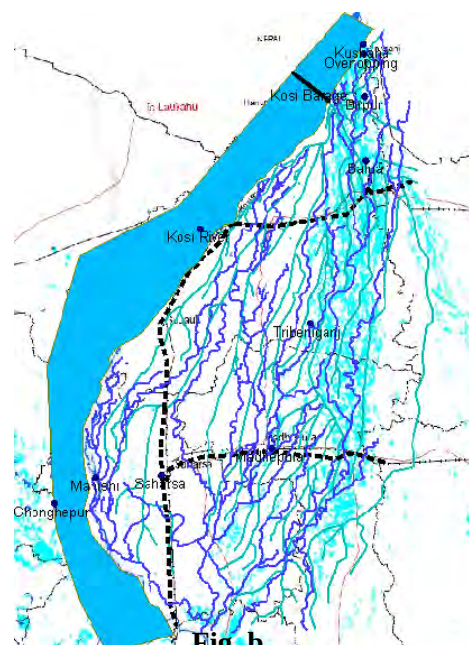


Fig. b

Comparison of the simulated flood affected area (pink in Fig. a) delineated by the prototype Early Warning System and the actual area (blue in Fig. b) flooded in August 2008 flood shows an excellent match.

On the above basis, a similar map was prepared for 1984 Navhatta floods and it was also matched with the available sources. The match was again about 80%.

THE WAY FORWARD

The system has a potential to accurately predict the possible flood affected areas in case of a breach in embankments. The following needs to be done:

1. Identify vulnerable stretches on the embankments on yearly basis
2. Develop Early Warning System for all river systems
3. Develop higher precision system using higher resolution satellite imageries which will help in identifying location of water discharge points like culverts, bridges, siphons, etc., and impact of lower order physical structures. It will also help in developing using lower contour intervals
4. Identify safe zones by cross checking through ground verification.
5. Update the system on continuous basis

III. ENVIRONMENTAL QUALITY MONITORING

The Environmental Quality Monitoring Group (EQMG) at PSI monitors environmental pollution and its impacts and builds the capacities of VOs and communities to gather and interpret pollution data and plan for mitigating pollution related problems. It also assesses the environmental impact of development projects. It operates a well-equipped laboratory in Dehra Doon.

In 2009-10 EQMG's activities centered primarily to monitor water quality of rivers, fluorosis mitigation programme and providing technical support services to organizations along with a number of other small public interest projects and activities.

Activities:

1. Technical Support to WaterAid:

EQMG's technical support service to partner organizations (POs) of WaterAid was continued this year also. In collaboration with WaterAid, over the past four years EQMG trained over 100 master trainers of 50 POs in Uttar Pradesh, Madhya Pradesh, Jharkhand, Bihar, Chhattisgarh, Orissa, Karnataka, Tamilnadu and Andhra Pradesh in monitoring drinking water source quality and its management. The MTs gathered the water quality data. It was mapped on a web-accessible GIS platform specially developed for this purpose. Measures to manage water quality were proposed and demonstrated, including household level water treatment options on a pilot scale in the areas that faced water quality problems.

Among the water quality problems, fluorosis -- due to high fluoride concentration in drinking water -- has been emerged as a major problem in Khurdha and Nuapada districts of Orissa, Dhar district in M.P. and Warangal district in A.P. Options for provision of safe drinking water (low or free from fluoride) were proposed in these areas. (For more details see the section below)

2. Fluoride Monitoring and Fluorosis Mitigation Programme :

Under the fluorosis mitigation programme, EQMG proposed plans for provision of safe drinking water to victim of fluorosis in many areas of Dhar (M.P.), Khurdha and Nuapada districts (Orissa) and Warangal district (Andhra Pradesh) in previous years. EQMG also proposed a detailed plan for 21 villages in Sonbhadra district, (U.P.) facing problem of high fluoride concentration drinking water. In 2009-10, EQMG gave priorities to implement the plans proposed in the previous years and to assess the impact of its intervention. Vasudha a WaterAid partner organization started to implement the proposed plans in Dhar district with the technical support of EQMG and Banwasi Seva Ashram in Sonbhadra district.



Dhar- EQMG proposed a plan for provision of safe drinking water for 11 villages in Dhar district based on its study. Vasudha implemented the proposed plans in 5 out of the 11 villages while in the remaining 6 villages the implementation was still in progress. EQMG conducted a study in the plan villages to assess the intervention's impact. In the study fluoride concentration was monitored in drinking water and the urine of the villagers. The monitoring was conducted before undertaking the intervention in April 2009 and six months after the intervention in November 2009. The study covered 10 villages: 4 in which intervention had taken place, 5 in which the intervention had not occurred yet and one control village. In all 432 individuals were monitored.



The results showed a significant difference in fluoride concentration in the urine samples of the subjects before and after intervention in the 4 villages where intervention had occurred. The mean urinary fluoride value before intervention was 7.63, 4.21, 6.6, 2.45 and 4.88 mg/l in Kali ki rai, Ahmadpura, Bahadra, Matlabpura and Anuppura respectively. After intervention the mean values were 6.57, 2.76, 3.73, 1.58 and 5.85 respectively. In implementation villages Kali ki rai, Ahmad pura, Bahadra and Matlab pura the mean urinary fluoride concentration had decreased but it had increased in the control village Anuppura.

Table: Impact of the intervention

SN.	Name of village	Total Subjects	Mean concentration of fluoride in urine sample (mg/l)		Standard Deviation of Mean Values	
			Before intervention	After intervention	Before intervention	After intervention
A	Intervention village					
1	Kali Kirai	21	7.63	6.57	5.65	3.46
2	Ahmadpura	46	4.21	2.76	3.09	2.27
3	Bahadara	36	6.6	3.73	4.71	2.43
4	Matalabpura	16	2.45	1.58	1.23	0.88
B	non- intervention Village					
5	Anuppura	26	4.88	5.85	2.44	4.57

Conclusion:

Mostly villages of Dhar district are critically affected with Fluoride contamination in ground water. 40-50 % children are affected with dental fluorosis. Although no skeletal fluorosis cases have been observed but risk might be increase with increase in dependency in HP water in the area. The urinary fluoride value in non effected village ranges from 0.01-2.21 mg/l while it was ranging in between 0.51 – 37.9 mg/l in fluoride affected 9 villages. Mean urinary fluoride value in safe water supply villages reduced and non-inplementation villages it increses. The increase in urinary fluoride values in non implementation village is an alarm for Decesion makers, Implementation agencies and other concerned organisations.



Sonbhadra, U.P. - BSA implemented a proposed plan in two villages Chetwa and Ammadad with technical assistance of EQMG in this year. Under the plan, BSA distributed Domestic Defluoridation Kits based on activated alumina for removal of fluoride from drinking water to 90 families of the above two villages. The kit was given to those families suffering from fluorosis and had high risk to be exposed by high fluoride concentration in drinking water. EQMG assisted BSA in assembling the defluoridation domestic kit and monitoring and managing its output water quality and establishment of recharging facility. BSA staffs were trained for monitoring of water quality of kit, recharging of kit and operation and maintenance of recharging center. A facility for recharging of defluoridation domestic kit was established in the premises of BSA.

3. **Technical Support to Banwasi Sewa Ashram:**

EQMG provided technical assistance to Banwasi Sewa Ashram for monitoring environmental quality in the Singrauli region. BSA is a reputed VO in eastern UP. It has been funded by the Central Pollution Control Board (CPCB) to carry out environmental quality monitoring of Singrauli region which is located near 13 coal mines and thermal power stations which generate 14000 MW of electricity. This area has been declared as a problem area by CPCB. EQMG carried out ambient air quality (heavy metals), groundwater and surface water quality monitoring and studied the impact of environmental pollution caused by the coal mines and thermal power stations on vegetation and human health.

EQMG trained BSA laboratory staff to undertake field monitoring and laboratory analyses. It also supervised the trainees' work in the field and the laboratory. Data gathered from the monitoring were interpreted and compiled. The major study findings are:

1. Ambient air quality in the area has deteriorated significantly in respect of significant high RSPM and SPM and SO₂, fluoride and mercury. It is surmised that emissions from the STPPs and TPP surrounding the periphery of the Rihand reservoir have contributed substantially to the air quality deterioration in the area.
2. Dala Bari had the worst ambient air quality; high RSPM and SPM due to the operation of a large number of stone crushers & quarry activities.
3. Industrial effluents, STPPs ash ponds' overflows of and waste water and leachates from coal mines are being discharged without adequate treatment and proper maintenance of quality into River Rihand and the Rihand reservoir.
4. Consequently the water quality of the River Rihand and Rihand reservoir has deteriorated in respect of TSS, fluoride and mercury.
5. Fluoride concentrations substantial higher than the permissible concentration 1.0 mg /l in all the 5 monitored village ponds was reported. Mercury concentration was also reported significantly higher than the permissible.

4. **River Water Quality Monitoring:**

4.1 Impact of Dams on water Quality: EQMG carried out a basin level assessment of the cumulative impacts of all the different projects proposed or constructed in the Bhagirathi valley.

This study was carried out in two parts:

- Analysis of benthic macro-invertebrates.
- Analysis of chemical and physical parameters

Applying physico-chemical tests is the most widely followed method for monitoring the quality of water bodies. To supplement physico-chemical techniques of water quality assessment, bio-monitoring, using benthic macro-invertebrates as indicator organisms, has emerged as an important tool in understanding the overall health of an aquatic ecosystem, and to ascertain the cumulative impact of the pollutants on it.

Twelve sampling locations were identified on river Bhagirathi, upstream and downstream of dams and in the dam reservoirs; on two tributaries Assiganga and Varuna before their confluence with the river Bhagirathi; on river Dhauliganga upstream (Raini) and downstream (Vishnuprayag) of the Tapovan-Vishnugad project; upstream (Dhari Devi Temple) and downstream (Srinagar) of the Srinagar HEP on river Alaknanda.



The hydro power plants under construction on Dhauliganga, Alaknanda and Bhagirathi rivers have affected the physico-chemical properties and reduced the number of sensitive benthic macro invertebrate species. There is a sharp drop in the suspended solid load downstream of dams and barrages. This sedimentation that occurs in the upstream of dams is leading to changes in the river ecology. Also, this will lead to a decrease of silt deposition in the plains and a subsequent loss of fertility. This study indicates that the cumulative impact of the construction of a series of dam on a river could be quite serious and it tremendously affects the ecology of the river. This is indicated by the low number of benthic



organisms observed d/s of Maneri Bhali –I, but even these disappear and no benthic organisms being are observed downstream of either Maneri Bhali –II or Tehri. No presence of benthos were observed in the river stretch from Uttarkashi to downstream of Tehri. This can be considered as a threat to the ecology of the river. The temperature of the river water and ambient air was observed to be quite high in and around Tehri, this could probably be due to release of methane from the large dam reservoir.



4.2 Water Quality Monitoring of River Ganga at Haridwar: EQMG team has carried out a study of the water quality monitoring of river Ganga in Haridwar. There is a continuing discharge of untreated wastewater and effluents from various drains directly into the river. The outfall from the sewage treatment plant (STP) at Jagjeetpur alone releases about 129 million litres daily (MLD) into the Ganga with a fecal coliform concentration of about 34 million/100ml!

We took samples from 10 drains falling into river Ganga at different locations in Haridwar on January 2nd and 3rd, 2010 along with samples of the river water at 3 locations. Results mentioned below:

Fecal Coliform count and Daily discharge of sewer drains joining the River Ganga in Haridwar

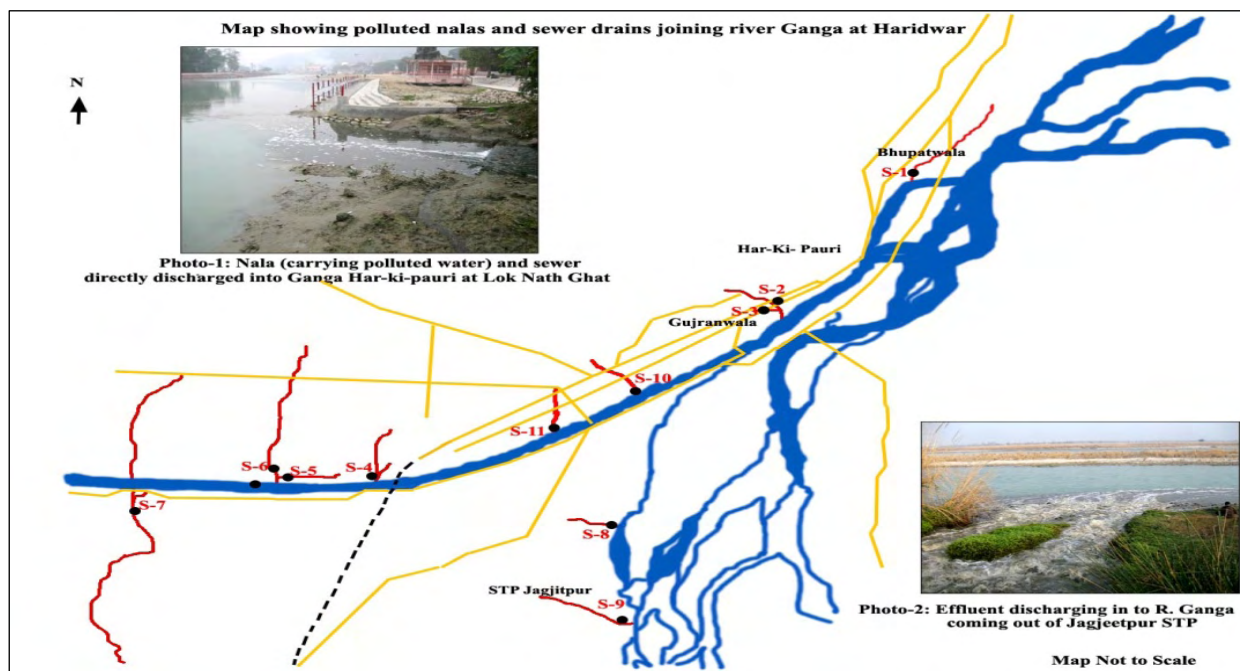
Site Code	Location	FC (million/100 ml)		Daily discharge (MLD)	
		July, 2009	January ,2010	July, 2009	January ,2010
S-1	Sewer outfall into the Ganga d/s of Har-ki-pauri at LokNath Ghat	31.29	28.3	2.4	6.9
S-2	Laltarao bridge Nala outfall d/s Gujrula Bhawan	41.09	8.0	8.6	0.86
S-4	Kassaban Nala, Jwalapur outfall	29.98	30.4	17	20.3
S-5	Sewer drain at Jwalapur, Balmiki Nagar	34.68	40.6	12.4	14.68
S-6	BHEL Nala at Jwalapur	35.69	28.1	13.8	18.14
S-7	Ranipur drain d/s Sanskrit Bhawan ,Ranipur mod	51.79	23.1	5.1	4.8
S-8	Jagjeetpur Nala(Kankhal Nala) near Matri Sadan	11.79	8.5	NM	2.1
S-9	Jagjeetpur STP outlet	30.89	33.89	18 (as per STP capacity)	129
S-10*	Nala near Rishikul	2.35		0.86	
S-11*	Awas Vikas Nala near at Khanna Nagar	3.56		6.04	

Abbreviations:, FC-Fecal Coliform, MLD- million liter per day, *- these drains are measured only in Jan 2010, NM- not measured

Fecal Coliform count of River Ganga at three locations in Haridwar (Jan 2-3, 2010)

Site Code	Location	FC (no. /100 ml)
R-1	At Saptrishi	1000
R-2	Har ki Pauri	1500
R-3	Jagjeetpur	7500000
Standard for outdoor bathing (organised) (As per CPCB)		500 MPN/100 ml

Abbreviations: FC-Fecal Coliform, CPCB: Central Pollution Control Board



4.3 Self purifying capacity of river Ganga, Yamuna and Tons: Viruses that infect and replicate within bacterial cells are known as bacteriophage. A number of distinct bacteriophages are known to infect and replicate in bacteria that are commonly found in human faeces, such as *E. coli*; these types of bacteriophage are known as coliphage. Coliphages are easily detected in water samples where human fecal contamination is present. While not a threat to humans, occurrence of coliphage has been correlated with the presence of human enteric viruses. We have shown that direct plaque assay of water samples can effectively demonstrate the presence or absence of coliphage, and may be utilized as an alternative method to assess water quality.

EQMG studied the self-purification capacity of various Uttarakhand rivers like - Bhagirathi, Yamuna, Tons and Alaknanda. The results shows that the capacity of fecal coliform removal is highest in Bhagirathi river at Sukhi where almost 97% fecal coliform bacteria removal occurred on the fourth day. This efficiency gradually decreases in the lower stream than the upper stream of the reservoirs. In the Tehri reservoir water the fecal coliform removal efficiency was found to be 41.8%. Yamuna river at Lakhamandal ghat shows almost the same removal near Manikarnika ghat in river Bhagirathi and also with the river Tons u/s of Ichhari Dam. Alaknanda at Srinagar has almost the same fecal coliform removal capacity of river Bhagirathi d/s location of Dharasu power station. Most of the bacteriophages remain in the sediments, but in a reservoir the stagnation of water leads to less removal in reservoir water rather than the upstream locations.

Fecal coliform removal by various river water samples

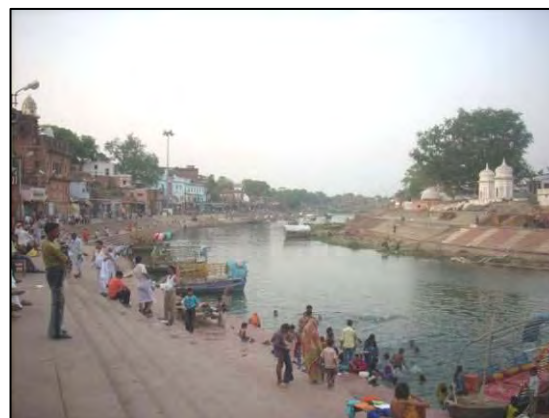
Sample details	Total No. of Colony	% removal		
		24 h	48 h	72 h
R. Bhagirathi				
R. BHAGIRATHI at Sukhi	123	42.51	71.78	96.98
R. BHAGIRATHI U/s of Maneri I reservoir	136	25.00	46.32	59.56
R. BHAGIRATHI D/s of maneri I	120	14.17	26.67	43.33
R. BHAGIRATHI near manikarnika Ghat	134	16.42	32.84	63.43
R. BHAGIRATHI d/s of Josiyada barrage	132	21.97	38.64	50
R. BHAGIRATHI D/s of Dharasu Power House	143	14.69	29.37	42.66
Tehri Reservoir at koti	122	15.57	21.31	41.8
R. BHAGIRATHI d/s of Tehri at Kyari	140	31.43	42.14	50.71
R. Tons				
R. TONES U/s of Ichhari Dam	124	18.55	36.29	62.1
R. TONES D/s of Ichhari Dam	135	19.26	34.07	50.37
R. Yamuna				
R. YAMUNA at Lakhamandal Bridge	133	24.06	44.36	60.9
R. Alaknanda				
R. ALAKNANDA at Srinagar	148	16.89	31.08	43.24

Note: 200 ml sample and 0.5 ml sewage has been inserted

4.4 Water Quality monitoring of River Mandakini in Chitrakoot, MP During Deepawali

Mela: River Mandakini originates from Satna district of MP. After covering 75 km it falls in to the river Yamuna at Rajapur in Chitrakoot district, UP. Livelihood in the vicinity depends entirely on this river. The Pindra Water Supply Scheme is the biggest water supply scheme in MP and PATHA water supply scheme, said to be the biggest rural water supply scheme in Asia, are based on the Mandakini river.

Chitrakoot dham is one of the famous pilgrim place located in the bank of Mandakini. During Deepawali around 10-12 lakh pilgrims visit this holy place and take a dip in the river. The EQMG





team with the help of local organizations Kalp Briksh Sewa Sanstha and Mandakini Raksha Manch carried out water quality monitoring during 14-17 October 2009 at three locations.

The result shows that the quality of the river was not even suitable for bathing. Fecal coliform counts at the three stations (Jankikund, Promodhvan and Ramghat) range from 3400MPN/100 ml, to 22000 MPN/100 ml which is many times the permissible standard (500 MPN/100ml). BOD at Pramodvan and Ramghat is higher than the permissible 3mg/l. The quality of the water gradually degrades with the increase of the number of tourist or pilgrim places and their gathering. On 14th October the fecal coliform count at Jankikund was 3400 MPN/100 ml while on Oct 17th it increased to 60000 MPN/100 ml. At Pramodvan it measured 3700 MPN/100 ml on Oct 14th and on the 17th it rose to 73000 MPN/100 ml. At Ramghat the count rose from 22000 MPN/100 ml on 14th October to 184, 000 MPN/100 ml on the 17th. The rise in the BOD from Janki Kund to Ramghat is entirely due to the outfalls of the city drainage.

Table: Water Quality of Mandakini River during Deepawali mela

Sampling Location: Jankikund

SN.	Sampling Date	Parameters				
		pH	Turbidity (NTU)	DO (mg/l)	BOD (mg/l)	FC (MPN/100ml)
1	14.10.09	8.2	10	6.0	2.2	3400
2	15.10.09	8.1	11	7.6	3.2	3800
3	16.10.09	8.0	15	7.6	3.3	4200
4	17.10.09*	7.9	11	7.4	3.6	38000
5	17.10.09**	7.9	15	7.4	4.6	60000
Std.		6.5-8.5		5.0	3.0	500

* Sampling in morning, ** sampling in evening, Std.-standard for outdoor bathing, Water Quality Criteria and Goals, CPCB, 2002

Sampling Location: Pramodvan

SN.	Sampling Date	Parameters				
		pH	Turbidity (NTU)	DO (mg/l)	BOD (mg/l)	FC (MPN/100ml)
1	14.10.09	8.1	5	7.6	3.4	3700
2	15.10.09	8.1	5	8.8	4.2	4100
3	16.10.09	8.1	10	8.7	4.4	6200
4	17.10.09*	7.9	11	8.2	5.0	42000
5	17.10.09**	7.8	10	8.5	5.9	73000
Std.		6.5-8.5		5.0	3.0	500

* Sampling in morning, ** sampling in evening, Std.-standard for mass bathing, Water Quality Criteria and Goals, CPCB, 2002



Sampling Location: Ramghat

SN.	Sampling Date	Parameters				
		pH	Turbidity (NTU)	DO (mg/l)	BOD (mg/l)	FC (MPN/100ml)
1	14.10.09	8.0	20	8.0	4.6	22000
2	15.10.09	7.8	12	5.7	4.9	28000
3	16.10.09	7.8	27	5.0	9.8	42000
4	17.10.09*	7.9	35	5.0	18	102500
5	17.10.09**	7.6	39	6.0	37	184000
Std.		6.5-8.5		5.0	3.0	500

* Sampling in morning, ** sampling in evening, Std.-standard for outdoor bathing, Water Quality Criteria and Goals, CPCB, 2002

6.0 Vehicular air pollution in Dehradun

EQMG has conducted some routine studies to monitor the air quality status of Dehradun in the past years. PSI has also conducted health surveys and air monitoring studies at regular intervals and has been informing the general public about the state of air pollution in the city and its impact on public health. PSI has urged the concerned government departments officials for action.

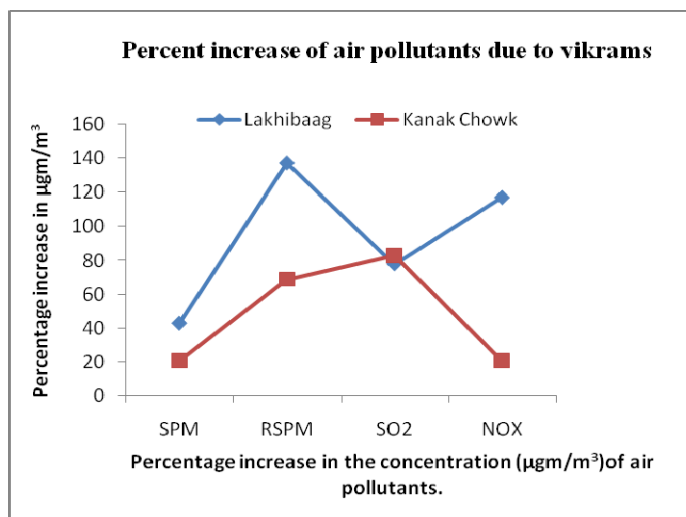
Up in arms against the administration's proposed decision to phase out vikrams, vikram owners kept off the roads on 23rd October, 2009. To measure the contributions of vikrams to the air pollution levels in the city, EQMG did a study on 23rd October, 2009 and when the strike was called off. The study monitored the pollution levels in a definite time period at Kanak Chowk and Lakhibaag.

A perception survey was conducted simultaneously where the Doon residents were questioned about the changes they experiencing on both the days in terms of pollution levels (dust, smoke, noise etc.) , traffic regulation , chaos due to traffic congestion and the frequency in getting local conveyance . Views from over 79 individuals were obtained from a number of sites including Rajpur road, Saharanpur Chowk, Lakhibaag, Prince Chowk and Kanak Chowk. 63% of the individuals said that there was a clear reduction in the air pollution (dust, smoke) and noise levels, 66% thought that there was a marked decrease in the chaos created during normal days. About 53% of the individuals surveyed found travelling more comfortable either by foot or vehicle on October 23rd and 23% lower traffic congestion or jams.

Just over a third of the commuters expressed an inability in reaching their destinations (office, school, college, duty) on time because of the absence of transport. Individuals complained about being overcharged by auto drivers on the day of the strike. Apart from this 52 % found that other means of local transport also helped. Over 14% experienced no difficulty in travelling due to the vikrams strike.

The ambient air quality results obtained confirmed the peoples' perceptions. The results are shown in the table below and plotted in the figure alongside. The study showed over 21 – 137 % of contribution due to vikrams in the air pollution level of the monitored stations. The maximum impact was an over 137% increase in the concentration of respirable suspended particulate matter at Lakhibaag. Lakhibaag is a major traffic zone as it links the railway station as well as ISBT and hence there is a constant flow of traffic at this point.

From the two day study conducted at Saharanpur Chowk, Lakhibaag, Prince Chowk, Kanak Chowk and Rajpur Road, it can be interpreted that the diesel driven vikrams are one of the contributing sources of pollution at these major traffic zones. Proper technological interventions in the present system of transport and improvement in the traffic management could bring about a major pollution reduction at the traffic congestion points.



Contribution of vikrams in the air pollution level at two major traffic zones of Dehradun (23rd and 26th October, 2009).

S.N	Pollutant	Without vikrams on the roads	With vikrams on roads	% contribution of vikrams
1.	Lakhibaag			
	SPM ($\mu\text{gm}/\text{m}^3$)	246	352	43
	RSPM ($\mu\text{gm}/\text{m}^3$)	76	180	137
	SO ₂	23	41	78
	NO _x	24	52	117
2.	Kanak Chowk			
	SPM ($\mu\text{gm}/\text{m}^3$)	264	319	21
	RSPM ($\mu\text{gm}/\text{m}^3$)	88	149	69
	SO ₂	18	33	83
	NO _x	38	46	21

Other Activities

Drinking Water Samples Analysis: EQMG operates a state of the art laboratory in Dehra Doon. It is equipped with sophisticated instruments like atomic absorption spectrophotometer (AAS), gas chromatograph, respirable air and gas sampler, flame photometer, spectrophotometer and a TKN assembly. It undertakes testing of drinking water samples on



request from citizen's groups, VO's and government agencies. In 2009-2010, over 231 drinking water samples were tested by the EQMG lab. These samples came from the SWAJAL programme and institutions like Lal Bahadur Shastri National Academy of Administration, Doon School, Janhit Foundation, Meerut, Neer Foundation, Meerut, Organic Clover Pvt Ltd and others.

Water Quality testing of Dehradun: EQMG undertakes monitoring of water quality supplied to Dehradun city from time to time. A monitoring study was conducted in 5 areas. The samples were collected at three points - head of supply, middle and tail. The pH, EC, total hardness, calcium hardness, chloride, residual chlorine and fecal coliform were determined.

The monitoring results show that non-potable drinking water quality was being supplied at almost all the locations. Fecal coliforms were observed in all the 5 areas monitored. It was not found at the middle point of Khurbara water supply and the head and middle point of Chukhuwala water supply. Residual chlorine (RCL) was BDL in two areas, viz., Indra Nagar and Rajpur Road. RCL in the remaining three areas water supply was also quite low at the head point. Significant high total hardness and calcium concentration were observed in all the 5th water supply monitored.

Soil Sample analysis: Soil samples of Center for Natural Resource Management analyzed by the EQMG. Various parameters like pH, Nitrate, Organic Carbon, Organic Matter, Phosphate and Potassium were analyzed in the EQMG lab.

Sale of Water Testing Kits: EQMG produces two types of water testing kits, viz, comprehensive and domestic. In 2009-2010, it sold 68 kits, out of which 45 were purchased by NIH Roorkee. 55 refills of kits were also sold during the year.

Training on ambient air quality monitoring: EQMG has provided 5 days training on ambient air quality monitoring to the two staffs of Consulting Engineering Services Pvt Ltd., Delhi.

Training on drinking water quality: EQMG has provided 3 days training on drinking water quality and its various aspects to the community people, students and members the Sri Bhuvneshwari Mahila Ashram , Uttarkahi.

Internship programme: Various intership programmes were organized during April-June '2009 on EQMG. Students from Alpine Institute of Management & Technology, Indian Institute of Social Welfare and Business Management, Kolkata, IIT Delhi were carried out their internship on various environmental aspects such as -

- **An Industrial Impact on Water Sources at Surrounding Pharmacity, Sellaqui Area:**

Students from Alpine Institute of Management & Technology to prepared an inventory of existing industries in Pharma City- Sellaqui and observe existing practices for disposing of liquids and industrial waste in that area. To assessment of environmental quality in surrounding of Pharma City-Sellaqui and also collect some secondary information about existing industries and going to established in future in the area solid.



- **Study to Assess the Status of Drinking Water Quality of Dehra Doon City:**

EQMG has monitored the quality of various drinking water supplies in Dehra Doon city to assess various physiochemical parameters and bacteriological contamination in different point of water supply.

- **Qualitative soil nutrient analysis and Manure use in SRI technique:**

Identification of soil nutrition (basically N,P, Organic carbon) before application of organic manures(Panchgavya, Amrit ghol,Matka Khad), vermin compost used in SRI(System of Rice Intensification method) to identify nutritional content(basically N,P,Organic carbon) of these organic manures used in SRI method. After application these manure as per SRI method find out the impact on vegetation and Identify individual impact of Panchgavya,Amrit ghol,Matka khad and vermin-compost.

IV. INNOVATIVE PROJECTS

1. MIS for Himmotthan Society

People's Science Institute (PSI) had developed a web-GIS based Management Information System (MIS) for Himmotthan in 2007. The main objective of the MIS was to create an interactive web-GIS based system that would aid quick analysis and interpretation of spatial and non spatial data. Though the system had been developed and tested, it was not operationalized due to various reasons. Also, after the development of MIS, new projects and new villages have been taken up by Himmotthan. Therefore it was proposed to refine, update and maintain Himmotthan MIS on the web. The project started in December 2009. The activities undertaken are:

Updating GIS Maps: GIS maps for old projects had already been prepared during the first phase. Himmotthan provided the list of villages for four new projects (IFLDP, HVLV, Catchment Area Treatment and Micro-Irrigation) in the month of January, 2010. These villages were located district wise and project wise on the geo referenced maps. Each village was given a unique code. Once all the villages were located, they were colour coded according to the project for visual grasp of geographical spread of each project within a district.

Creation of databases: For census database, data was extracted from the census 2001. It was normalized to suit the desired format. Baseline data for all the four projects were provided by Himmotthan. It was converted into a compatible database to link it with spatial data. The project information of all the new projects was updated.

Web publishing: The spatial data (geo-referenced maps) along with its attribute data were then published on PSI's web-server. The published maps were customized for better visual appearance and easy navigation. GIS tools like location, direction, and attribute data retrieval were incorporated with all the maps. Facilities like query analysis and print were also provided.



The updated project information of all the four projects is now available on the web. Software development for online data entry and progress report generation of the IFLDP project is in progress.

2. Development of web-GIS based information system for Uttarakhand Livelihood Improvement Project for Himalayas (ULIPH)

Uttarakhand Livelihoods Improvement Project for the Himalayas (ULIPH) has been working in more than 900 villages in five districts of Uttarakhand since 2004. Its main objective is to improve livelihood of the poorest of the poor in a sustainable manner by creating better livelihood opportunities and strengthening of their institutions. It requested PSI to develop a web-GIS based information system with geo-referenced maps and updated information to improve the overall information infrastructure as well as presentation of this information at the local and state levels and to aid quick analysis and interpretation of data. The project started in the month of November, 2009. Following activities have been undertaken

Creation of geo-referenced maps: ULIPH provided the list of its project villages. In total there are 959 project villages spread in five districts – Almora, Bageshwar, Chamoli, Tehri and Uttarkashi of Uttarakhand. District wise each project village was located in geo-referenced maps of respective district.

Creation of database: Simultaneously work on database preparation was started. The data for village profile was obtained from census 2001. These data were normalized and a unique code was provided for each village. ULIPH initially provided baseline data for 142 villages. The two databases were then linked to the geo referenced maps and tested. Four databases – village profile, baseline, SHG and enterprises were prepared

Web Publishing: Once the databases and the maps were finalized and confirmed by ULIPH, the maps and database were linked and then published in PSI's web-server. The maps were made colourful for visual appeal and the system was customized to suit the needs of ULIPH. The entire system was put into the public domain through the web. A separate web page was designed for easy access and navigation.

A test system with village profile and base line database was uploaded in January, 2010. Changes suggested by ULIPH were made and the final system was uploaded in March 2010. The data and the geo-referenced maps can now be accessed online through www.villageinformationsystem.org/ajavika

The Kosi Project: IP group also developed VIS for 22 districts of north Bihar as part of the Kosi Project. The details of the work are provided earlier by the CDMR group.



V. RIVER CONSERVATION GROUP

The River Conservation Group's was formed in 2008 with the following objectives:

- To develop a knowledge base about the current state of India's rivers, the threats facing them and methods to minimize these threats
- To disseminate this information among various stakeholders
- Advocate sustainable use of rivers

Over the last year, the river conservation group has focused on analysing the effects of hydropower generation, developing a methodology to assess environmental flows, and analysing the state of water resources throughout the Himalayan region. In addition, a study was also carried out on the impact of climate change on livelihoods in the mountain areas of Uttarakhand.

Details of the projects undertaken by the river conservation group are as given below:

1) **Towards rational hydropower development in Uttarakhand:**

Uttarakhand is being promoted as an 'Urja Pradesh'. The Government of India has promised 'power for all by 2012', while the state government looks at hydropower projects as the quickest means of bringing 'development' to the mountain people. The people protest that their interests are being sold by the state. The rivers quietly cease to flow.

In order to address this pertinent issue, the river conservation group has undertaken a study of the impact of hydropower on the River Ganga under the 'Living Ganga Project', funded by the WWF and the HSBC climate partnership. This project has three components:

- *To assess the status and impact of proposed hydropower development in the Uttarakhand Himalayas:*

In this project, a comprehensive situation analysis report of hydropower development in Uttarakhand is being developed. It aims to explain what the hydropower development plan entails, analyse the plans and their impacts, and recommend ways of minimizing the negative impacts.

The literature and data available has been analysed and the initial draft of the report has been forwarded to the funders. A list of dams has been updated as per information now available.

- *To study the impact of hydropower development on water quality:*

Hydropower development invariably means the obstruction of a river. The flow in the river is retained upstream of the dam or barrage along with all that the river brings. These sediments, leaf litter, micro-organisms, and pollution are accumulated upstream, while downstream the river is robbed of this matter. What is the effect of these changes on the quality of the water? How does it impact the ecosystem?

To answer these questions, it is first necessary to quantify the changes that are occurring. EQMG has collected water samples at 12 locations along the Bhagirathi and Alaknanda river



systems and analysed them to determine if there is a measurable difference in water quality upstream and downstream of a dam. Samples have been collected in the pre-monsoon, monsoon, post-monsoon and lean flow periods. The results have been presented above in the EQMG group report

- *To develop a method for assessment of environmental flows of Himalayan rivers:*

It is proposed to refine and extend the methodology proposed by Smakhtin et al¹ to Himalayan rivers in Uttarakhand for which hydrological data are available. The purpose of this assessment is to help the society and the state move towards rational methods of river management. The refinement will be related to the determination of Environment Management Classes (EMC) of Himalayan rivers. Though most researchers² concede that EMCs should factor in a number of parameters related to the river's aquatic biota, water quality, catchment characteristics and the cultural, social and other uses of the river, cultural and social parameters are absent in the classification framework proposed by Smakhtin. PSI will develop a more comprehensive classification framework to include the social and cultural parameters that will then be applied to rivers like the Ganga, Yumuna and Mandakini in Uttarakhand.

A preliminary paper has been written detailing the necessity of including cultural and spiritual factors in environmental flows. The River Conservation Group is working towards the creation of an index of quantifiable and globally-relevant parameters that can be added to the list of ecological indices for determining the environmental management class of a river. While the parameters will be applicable across all river basins, field research is being concentrated on the Bhagirathi basin.

2) Assessment of the cultural flow component of environmental flow requirements for the Bhagirathi:

The environmental flow requirement of a river is that amount and variability of flow that allows the river to carry out its environmental functions. Human beings have settled by the banks of rivers and established civilizations. The calendar of populations settled in floodplains is in sync with the ebb and flow of the river. Festivals have been created to commemorate these changes in seasons and floods. It is necessary to acknowledge this deep connection floodplain communities have with their river. In addition, acknowledging the communities' flow needs is necessary to include them in the process of developing an environmental flow regime for a river.

PSI is a part of the WWF consortium set up to assess the environmental flow requirements of the Ganga. This consortium assessed the environmental flow requirements of the stretch of the Ganga from Gangotri to Kanpur. This stretch was divided into the following zones:

These zones with the associated sections are:

¹ V. Smakhtin et al: Developing Procedures for Assessment of Ecological Status of Indian River Basins in the Context of Environmental Water Requirements, International Water Management Institute, Colombo, Sri Lanka, (IWMI Research Report 114), 2007Ibid

² M. Dyson, G. Bergkamp & J. Scanlon: Flow: The essentials of environmental flows, IUCN, Gland, 2003



Zone 1	Gangotri to Rishikesh	Kaudiyala
Zone 2	Demonstration	Narora
Zone 3	Narora to Farrukhabad	Kachla Bridge
Zone 4	Kannauj to Kanpur	Bithur

The study was conducted in Zone 1, 3 and 4. The total number of respondents were 265 (Rishikesh: 60, Kachla Ghat: 105, Bithoor: 100). Keeping in mind the complex nature of the study a multi method approach was used with both qualitative and quantitative research methods used in conjunction with one another. In addition to the desired levels of flow, an attempt was made to define reference conditions for the river from a cultural point of view.

At the conclusion of the field surveys and a literature review, a comprehensive report was prepared. This report details the methodology and established reference and desired flows for all three zones in both high and low flow conditions. In addition, the management objectives for these zones are also described. This report is the outcome of stakeholder meetings and discussions. The document outlines flow requirements from a spiritual/cultural point of view. The flow requirements are mentioned in terms of depth at the banks, depth at channel, and width.

3) Documenting Climate Change in Uttarakhand:

Several recent studies³ suggest that climate change may be a reality. Most of these are scientific reports on melting or receding glaciers in the Indian Himalayas and projections of their impact on stream discharges. But the economy of the region is largely dependent on its natural resource base and climate-sensitive livelihoods like subsistence agriculture, pastoralism and forestry. Thus there is a need to identify the changes that are currently visible in the mountain regions, analyze them and help the local communities to adapt to them.

PSI, with the support of Himmothan, has undertaken a study to document changes that may be related to climate change in the mountain districts of Uttarakhand. It has been carried out in two valleys in the higher reaches of Uttarakhand. It highlights adaptations and livelihood changes happening in the chosen sites, and creates a baseline for future monitoring for climate change efforts.

A literature review has been done and reconnaissance surveys in three valleys have been conducted. A brainstorming meeting was held with several experts working on climate change, in order to determine the parameters that should be studied. Field surveys were carried out in the Bhagirathi and Pindar valleys of Uttarakhand.

Observations from the field surveys:

The two valleys visited are experiencing stress due to both anthropogenic factors as well as those due to climate change. Separating them is a challenge, as in some cases is identifying the cause and the effect. Among the anthropogenic factors, increasing population and market demand are accelerating environmental degradation and a shift in agricultural practices.

³ IPCC: Climate Change 2007: The Physical Science Basis: Summary for the Policymakers, Contribution of the Working Group I to the Fourth Assessment Report of the IPCC.



Climate change is leading to a decrease in winter rainfall, lack of freezing temperatures and increase in the frequency of extreme weather events.

The Bhagirathi valley is primarily dependent on orchards, tourism, pastoralism and agriculture. Of these, the apple orchards are most vulnerable to climate change. The lack of cold winters is leading to a decline in the fruit. In addition, untimely hailstorms are also decimating the crop. Increasing aridity is also leading to a proliferation of pests.

Villagers in the Bhagirathi valley have also begun cultivating tomatoes and other vegetables. However, the relative influence of market demand and of climate change needs to be assessed. In the Pindar valley, aridity is the main factor leading to a decline of crops. Most farmers here grow wheat and potatoes and only one farmer in Khati had begun to cultivate vegetables other than potatoes.

The pastoralists in either valley have not deviated significantly from their traditional calendar. However, they reported a lessening in snowfall. Many of the shepherds described an absence of snow where earlier they would find it. Pastoralism on the whole is decreasing, with fewer people electing to rear goats. However, the interviews suggest that a shift in focus to providing services to tourists may be the cause rather than climate change.

The residents of the valleys mentioned a decrease in the availability of herbs and other non-timber forest products. However, in this case too, the relative influence of over-exploitation and climate change is a matter for further study. However, changes in flowering times are directly influenced by the changing climate. The early flowering of rhododendron in the Pindar valley is directly linked to rising temperatures. Similarly, the observed lack of regeneration in oak (at Dharali), and deodar (Mukhba, Jaspur) can be indicators of a lack of the freezing temperatures required by the seeds⁴.

Observations from the weather data analysis:

Weather data for four stations in Uttarakhand over a 100-year period was obtained and analysed. The analysis of the shift in temperature and rainfall indicates that there is an increase in maximum temperatures and a decrease in minimum temperatures. The increasing aridity has far-reaching consequences for the ecosystem.

The analysis done of shifts in the occurrence of high and low temperatures strongly indicates that weather is becoming increasingly unpredictable. Both temperature and precipitation trends are shifting from the normal. Monsoons too are occurring later than they earlier did. This coupled with the increasing aridity and fewer freezes means that the traditional means of agriculture is no longer viable. It is necessary to adapt to these changes in the weather. However, merely shifting the agricultural calendar will not serve the purpose, as this will not account for the increasing variability.

⁴ Rana, J.C. and Sharma S.K, Impact of climate change on western Himalayan region and adaptive strategies thereof, presented at **National Conference On Forestry Solutions: Strategies For Mitigation And Adaptation Of The Impacts Of Climate Change In Western Himalayan Mountain States, Shimla, HP, November 19 to 21 2009**



This uncertainty in the weather is a strong argument for focusing on increasing the resilience of the communities and ecosystems to enable them to adapt to unpredictable change.⁵

4) Preparation of Situational Analysis report on 'Water resources in the Himalayan region':

PSI has conducted a study on the status of water in the Himalayan region of India funded by the Planning Commission, GOI. This study is a broad assessment of the overall situation of water resources in each Himalayan state, which include the eight North-eastern states, Uttarakhand, Himachal Pradesh and Jammu & Kashmir. Though these states are considered to be water sufficient and have a higher forest cover in comparison to other Indian states, in recent years these states have witnessed acute water shortages even droughts and forest fires. Agriculture is the mainstay of these Himalayan states and irrigation is hit the worse due to water scarcity.

This report seeks to give a broad overview of the demand, supply, water balance and critical issues that need to be considered in this sector. Recommendations will be made with special reference to; prioritizing water uses, ensuring adequate supply of safe drinking water to all, fulfilling irrigation and livelihood needs, identifying potential for safe and sustainable hydropower production, safeguarding aquatic ecosystems and traditional water harvesting systems, integrated water resources management with special reference to the required policies, legal and institutional frameworks.

For the purpose of data collection PSI visited all the north-eastern states, J&K and Himachal Pradesh. Relevant stakeholders from civil society and government departments were met and an attempt was made to understand the overall scenario. A draft of the report was developed in December 2009. Using this, a brief overview of the water resources in the Himalayan region was sent to the Planning Commission in the same month.

5) Save the Rivers Campaign:

The villages of Uttarakhand have been witnessing a steady decline in the water levels of rivers, wells, lakes and springs. Hydroelectricity projects have led to discontinuity in the rivers resulting in damage to the ecosystems as well as to people's livelihood. The existence of both glacier-fed and spring-fed rivers in Uttarakhand is under threat and along with it that of the communities it sustains. Government policies too have viewed water as a commodity and not as a community resource. Therefore in 2007 village communities, concerned citizens of Uttarakhand and social activists began a campaign to articulate and represent the concerns of the affected communities. PSI played a pivotal role in launching the NBA and has partnered with several organizations and activists in Uttarakhand since 2007.

A need was felt for an effective campaign which would have a two-pronged approach consisting of both research and advocacy. Research is required so that the campaign is fact- and knowledge-based. Advocacy in the larger sense means combining mobilization of public

⁵ Tompkins, E. L. and W. N. Adger. 2004. Does adaptive management of natural resources enhance resilience to climate change? *Ecology and Society* 9(2): 10. [online] URL: <http://www.ecologyandsociety.org/vol9/iss2/art10/>



support and persuading decision makers of the campaign's point of view. PSI's plans to mobilize more public support, build regional, national and international networks are being funded by the India Friends Association, a US based organization.

1. Creating informed public opinion: A critical part of campaigning for river conservation is spreading awareness about the issue. Very often, communities and other stakeholders need to be reminded of all that is at stake. With this end, PSI publishes a series of calendars each highlighting a river in Uttarakhand. The 2009 calendar focused on the Gori Ganga. While the images celebrated this scenic river, the accompanying text spoke of the threats to its continued existence.

Local communities in most cases are well aware of the threats to their rivers, but lack access to information. PSI organized public meetings at Pithoragarh, Dharchula, Darya, Chaituldhar, Munsyari, and Pipalkoti with the support of local grassroots organizations. Along with local communities, information about Himalayan rivers was disseminated to a larger audience throughout India through the medium of lectures in Dehradun and IIT-Powai, web outreach, and interviews with officials in the various Himalayan states. PSI also teamed up with the Citizens for Green Doon and disseminated information about the impact of hydropower during the Doon Referendum. The results of PSI's studies on water pollution in the Ganga were published in popular newspapers. In an effort to engage elected representatives, this article and the supporting data were also sent to members of the legislative assembly.

2. Mobilization of public support : PSI campaigned extensively to garner public support during Dr. G.D. Agarwal's fast. This campaign took the form of both web outreach and on-site outreach. Interviews and articles in the popular media were also utilized to create support for communities protesting against the damage caused by indiscriminate dam construction. A series of lectures on river conservation at IIT is helping inform and motivate future engineers and policy-makers.

3. Advocacy: PSI is working with HLEG and NGRBA. This ensures that the community's voice is heard by policy makers. This also ensures that their demands as well as the needs of the ecosystem are given due attention.

4. Strategic support to grassroots organizations: Two fellowships have been awarded to organizations working in Uttarakhand on spring conservation.

V. FINANCIAL REPORT

PSI's balance sheet and consolidated income and expenditure account for 2009-10, ending March 31, 2010 are attached as an Annexures 1a and 1b.



EXECUTIVE BOARD 2009-10

Dr G.D.Agrawal	Chairperson	Environmental Scientist
Dr K.S.Chawla	Treasurer	Geotechnical Engineer
Dr B.K.Joshi	Hony. Dean	Political Scientist
Mr Abhay Bhushan	Member	Information Technologist
Ms Madhu Sarin	Member	Architect
Dr Leela Visaria	Member	Sociologist
Dr Ravi Chopra	Director (Ex-Officio)	Scientist

PSI STAFF 2009-10

S.No.	Name	Date of Joining	Date of Leaving in 2009-10
1	Ravi Chopra	01.02.1988	
2	Debashish Sen	01.03.1988	
3	Rajesh Kumar	01.04.1988	
4	C. Tripathi	15.06.1988	
5	Salil Das	21.02.1990	
6	Anthony Basil	09.10.1992	
7	Pushpa Juyal	21.12.1992	
8	R.S. Prasad	01.11.1994	
9	Dinesh Sharma	02.10.1997	
10	D.N. Dwivedy	17.08.1998	
11	Rajesh K. Sharma	20.08.1998	
12	Vikram Singh	01.02.2000	
13	Anil Kumar Gautam	01.03.2002	
14	Amita Sharma	01.04.2002	06.07.2009
15	Heera Lal	01.04.2002	
16	Subhash S. Rawat	01.05.2002	
17	Anil Tyagi	01.12.2002	
18	Deepak Negi	04.04.2003	
19	Ramesh Singh Rawat	16.09.2004	
20	Ramesh C. Tirpathi	03.11.2004	
21	Rajendra Bansal	03.10.2005	31.12.2009
22	Manoj Kumar	10.07.2006	
23	AnilKumar	03.10.2006	
24	Ajay Kumar	01.11.2006	
25	Pavitra Singh	01.11.2006	



26	Nidhi Barthwal	08.03.2007	
27	Menka Thakur	13.09.2007	28.12.2009
28	Asha Gupta	01.01.2008	07.09.2009
29	Mahendra Singh Rajwar	01.01.2008	
30	Saurindra Narayan Goswami	07.01.2008	
31	Alok Kumar Sah	01.02.2008	02.07.2009
32	Shiv Kumar	17.03.2008	
33	Desh Raj	21.04.2008	
34	Ajay Jairwan	01.05.2008	
35	Shankar Datt	05.05.2008	
36	Vimal Pandey	01.07.2008	
37	Priya Shukla	07.07.2008	
38	Mabel D. Gergan	25.08.2008	
39	Bharat S.Puspwan	01.09.2008	31.07.2009
40	Mitthan Lal	01.09.2008	
41	Pravin Kumar	01.09.2008	
42	Vijay Pal Singh	08.09.2008	
43	Chicu Lokgariwar	22.09.2008	
44	Devesh Semwal	01.11.2008	
45	Meena Yadav	07.11.2008	
46	Bhuwan Joshi	15.12.2008	
47	Pankaj Kumar	02.02.2009	18.02.2010
48	Vipin Kumar	02.02.2009	08.07.2009
49	Indrani Bardoloi	01.06.2009	
50	Birendra Mahapatra	01.06.2009	
51	Akshay Das	17.08.2009	
52	Pintu Kar	04.11.2009	
53	Alok Kumar Samaddar	16.12.2009	

PEOPLES' SCIENCE INSTITUTE
E-57, PANCHSHEEL PARK
NEW DELHI- 110016

BALANCE SHEET AS AT 31st MARCH, 2010

S.NO.	PARTICULARS	SCHEDULE	FOREIGN GRANTS	LOCAL GRANTS	CONSULTANCIES	TOTAL AS AT 31.03.2010	TOTAL AS AT 31.03.2009
I	SOURCES OF FUNDS						
	A. ENDOWMENT FUND		597,837.00	-	-	597,837.00	597,837.00
	B. REVOLVING FUND		1,914,000.00	128,500.00	-	2,042,500.00	1,288,500.00
	C. CAMPUS FUND		4,889,603.00	1,237,000.00	-	6,126,603.00	6,101,603.00
	D. CAPITAL FUND		694,155.55	2,047,704.34	84,505.30	2,826,365.19	2,570,839.59
	Opening Balance		157,806.01	(130,900.00)	(18,501.12)	8,404.89	255,525.60
	Add: Excess of income over expenditure		851,961.56	1,916,804.34	66,004.18	2,834,770.08	2,826,365.19
	Closing Balance		704,022.89	1,592,183.35	-	2,296,206.24	1,609,356.24
	E. GRANTS (to the extent unutilised)						
	TOTAL		8,957,424.45	4,874,487.69	66,004.18	13,897,916.32	12,423,661.43
II	APPLICATION OF FUNDS						
	F. FIXED ASSETS (at cost)	I	3,765,355.00	986,598.00	24,635.00	4,756,588.00	5,114,929.00
	less Depreciation						
	G. INVESTMENTS	II	4,297,836.00	1,981,250.00	-	6,279,086.00	3,400,000.00
	H. NET CURRENT ASSETS	III	919,705.45	2,419,980.69	540,093.18	3,879,779.32	4,459,718.43
	Current Assets, Loans & Advances		25,472.00	493,341.00	498,724.00	1,017,537.00	550,986.00
	Less: Current Liabilities & Provisions	IV	894,233.45	1,926,639.69	41,369.18	2,862,242.32	3,908,732.43
	NOTES TO THE ACCOUNTS						
	TOTAL		8,957,424.45	4,874,487.69	66,004.18	13,897,916.32	12,423,661.43

"As per our separate Report of even date attached herewith"



Date: 22-09-2010
Place: New Delhi

For PEOPLES' SCIENCE INSTITUTE

Ravi Chopra
RAVI CHOPRA
Director

Kanwarjit S Chawla
KANWARJIT S CHAWLA
President

A.K. Roy
A.K. Roy
Board Member



PEOPLES' SCIENCE INSTITUTE

CONSOLIDATED INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD ENDED 31st MARCH, 2010

PARTICULARS	FC AMOUNT AS AT 31-3-2010	LG AMOUNT AS AT 31-3-2010	CONSULTANCIES AS AT 31-3-2010	TOTAL AMOUNT AS AT 31-3-2010	TOTAL AMOUNT AS AT 31-3-2009
INCOME					
REVENUE:-					
Grants Unutilised C/f	843,842.89	765,513.35	-	1,609,356.24	6,201,524.42
Bank Interest	21,938.00	39,641.00	7,439.00	69,018.00	83,713.00
Consultancies	-	-	4,470,978.00	4,470,978.00	445,040.00
Donations Received	3,500.00	68,251.00	-	71,751.00	611,903.00
Grants received	1,456,866.00	14,223,446.00	-	15,680,312.00	20,377,576.00
Reimbursements	-	49,462.00	143,922.00	193,384.00	347,579.00
Publications, Posters & Maps	-	-	332,107.00	332,107.00	167,360.00
Return on Investments	333,401.01	191,073.00	-	524,474.01	325,084.42
Water Sampling & Kits	-	71,178.00	695,642.00	766,820.00	402,212.00
Projects Closed	-	-	-	-	1,505,789.38
Overheads transferred to General Fund	-	91,700.00	-	91,700.00	757,071.00
TOTAL (A)	2,659,547.90	15,500,264.35	5,650,088.00	23,809,900.25	31,224,852.22
EXPENDITURE					
Advertisement Expenses	-	11,189.00	-	11,189.00	288,540.00
Audit Fee	22,472.00	22,472.00	13,483.00	58,427.00	58,427.00
Bank Charges	2,118.00	9,864.00	2,610.00	14,592.00	33,599.00
Board & Lodging	1,946.00	33,936.00	22,345.00	58,227.00	75,040.00
Books, Periodicals & Data CDs	954.00	8,144.00	23,198.00	32,296.00	43,233.00
Computer Consumables	1,880.00	42,379.00	57,838.00	102,097.00	128,151.00
Depreciation	91,775.00	338,806.00	20,379.00	450,960.00	715,695.00
EPF Contribution	27,300.00	222,866.00	151,782.00	401,948.00	393,457.00
Fellowships	80,000.00	-	-	80,000.00	96,000.00
General Expenses	-	10,000.00	-	10,000.00	3,061.00
Grants to Other Organisations	420,000.00	5,664,390.00	-	6,084,390.00	8,683,055.00



Ravi Chopra
(RAVI CHOPRA)





For S. M. VARMA
Chartered Accountant
NEW DELHI
S. M. VARMA
FCA, CIA (USA)

For PEOPLES' SCIENCE INSTITUTE

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