IUCN WATER AND NATURE INITIATIVE

Final Report

Scoping Exercise for Mainstreaming the Ecosystem Approach into Integrated Water Resource Management, India

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Executive Summary

The Himal region in India extends over nine of the country's 33 states and covers the Western Himalaya and North-East India. This vast area is equally diverse, geographically, politically, socially and culturally. Ecosystems range from dry arctic deserts to wet, evergreen forests. Politically, many parts of the region are in a state of flux. The state of Jammu and Kashmir has now for many years been politically sensitive because of the tensions with neighbouring Pakistan. The newly formed state of Uttaranchal, once part of Uttar Pradesh, is less than two years old. It is still struggling to hold its own. North-East India is a unique region. From colonial times, it has been somewhat isolated from the rest of the country and is only recently opening up to outside intervention. The region offers tremendous scope for work with its diverse cultural and natural biodiversity including many different systems of indigenous systems of natural resource management. However, it is a politically sensitive region and appropriate clearances are required to work there.

Water and its management has been the key issue of focus for India. Watershed management projects have been in operation in the country for several decades. Three Ministries (Ministry of Water Resources, Ministry of Agriculture and the Ministry of Environment and Forests) have supported watershed and other water management schemes as part of their mandate. Many donor agencies have also supported similar programmes over the years.

It is hoped that water management will continue to remain a priority issue despite change in the central government two months ago. The signs are positive. The President in his address to the newly formed parliament stressed on the need for appropriate water management systems. The Finance Minster while presenting the new Union Budget (2004-2005) to the Cabinet announced the allocation for the establishment of a National Water Resources Development Project.

A key factor that could change the nature of support from many small donors is the Government of India's (GoI), June 2003, policy for bilateral development assistance. The policy essentially puts an end to grant as well as credit assistance from small bilateral donors to the GoI and State Governments. It indicates that small donor agencies can provide support to the Indian civil society and channel funds through multilateral organisations. The new government is yet to issue a statement on this.

Despite the thousands of existing watershed projects across the country and the endorsement of the term 'integrated water resource management' (IWRM) by the government in various official documents, including the Water Policy of 2002, the concept is yet to be implemented. There is a lot of scepticism by practioners and policy makers over the term and its application in India. EA approach to IWRM is practically non-existent, although components of it could possibly be seen in many projects being implemented. What are really lacking are the will and perhaps the capacity at various levels to implement IWRM. Watershed/IWRM programmes in India still remain very

much ‘government driven’, are implemented by different Ministries with differing agendas. People’s or community participation in these initiatives is more a token involvement to meet programme requirements. Ironically, there is a wealth of knowledge and experience in traditional water management systems throughout the country. It would be important to revive these systems and strengthen them for this approach to succeed.

A review of the main components of IWRM in India brings to the fore some interesting issues. Although, traditional watershed programmes have been operational in India for the past several decades, the crucial link to livelihoods has not been established in many. There has been some analysis by donors in other parts of the country, but few in the Himal region. The region is full of examples where traditional systems still exist or have been revived. Some of these systems have consciously ensured that benefits of water are distributed equitably across the community. However, the focus on water management with links to livelihoods remains weak, particularly in the Himal region. There is very little documentation, which leads one to conclude that perhaps there is little work being carried out in this area.

In recent years, the concept of payment for environmental services is being recognized and acknowledged, by academicians and practitioners. The role of forests in providing these services has been particularly highlighted. Watershed protection services have received comparatively less attention. But there is a growing realization that hydrological functions of land use are also of importance. This is especially true in the Himalayan context and some work is being carried out in the states of Himachal Pradesh and Uttaranchal. There is a need to take this work to all the Himalayan states and urge that this concept be incorporated into relevant policies.

Although India is a signatory of the United Nations Framework Convention on Climate Change (UNFCCC), it has not been very active in this sphere. There are few specific activities that are directed at water management adaptations to climate change. Of great concern is the effect of climate change on the Himalayan glaciers and the subsequent phenomenon of Glacial Lake Outburst Floods (GLOFs). Scientific research on this in the Indian Himalaya indicates that this is a major threat. However, there is no significant move by the government to monitor and mitigate this threat. There is a definite need for work in this area. Watershed programmes in the Himal region, do not generally look at adaptive strategies to floods and drought either. The region is particularly vulnerable to flash floods and landslides, and this makes it even more important to incorporate these aspects while developing an IWRM strategy for the area.

Two controversial issues for the country on the whole and this region in particular are those of the inter-linking of rivers and large dams. Both have met with a lot of opposition and with the new government, it is possible that the inter-linking project will be reviewed. Large dams still remain a contentious issue. What aggravates the situation is the inadequate Environment Impact Assessment carried out for large projects such as dams. More support to address this would be useful. Alternatives to large dams need to be reviewed. There is a need to look at some of the traditional water harvesting

structures/systems and see how best these could be revived and adapted for more efficient use.

The groundwater resources of the Himal region are abundant. At the national level, despite a Central Groundwater Authority, there is no real governance of groundwater. There is a growing concern of groundwater contamination from various parts of the country but few efforts to address this. Watershed programmes/projects rarely take this into consideration. Another concept which is endorsed but not incorporated into planning or implementation is that of 'environmental flows'. There are no guidelines that facilitate this. There is very little debate and very sparse literature that looks at this issue.

Community participation, especially of women and the poor has been a key issue of the government and is repeatedly emphasized in all its policy documents/guidelines. However, watershed/IWRM programmes most often do not address these, since very often implementers don't know how to. There is a change of mindset required for true community participation to take place. The capacity, most often of the implementers needs to be built to address issues of gender and equity.

Important for the implementation of IWRM/watershed programmes is also the information base. The need for good information is emphasized in various policy documents and there are also several institutes in the country, which maintain conventional water related databases and provide training/capacity building for information technology. However, it is unclear how these information systems can contribute to EA planning and implementation.

Mainstreaming EA into IWRM requires an integrated inter-sectoral approach. This is rarely seen in India. In the case of IWRM it is even more complex since three central ministries implement watershed programmes. It is unusual for these Ministries to work together or collaborate. Watershed programmes thus remain isolated initiatives.

IUCN does not have a base in India. It would be competing against many government agencies, several donors, as also several hundred NGOs who have been implementing watershed related programmes in the country. IUCN also has an image of a conservation organization and it would quite a challenge for it to establish itself in the water domain. However, if IUCN could support a unique programme that looks at the EA approach to IWRM then it would be at an advantage. There is also a tremendous need to build capacity in this area, facilitate the exchange of information and finally demonstrate this concept in the field for which IUCN may be the appropriate institution.

Despite the lack of the EA approach to IWRM in the Himal region of India, there are many interesting initiatives, traditional systems and supportive legal and other mechanisms that could be examined for future work. This report attempts to consolidate related information for the region and finally suggests ways for IUCN intervention and support.

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Section1. THE HIMAL REGION IN INDIA

The Himalayan region in India is more than 2800-km in length and 220 – 300 km in width. Nine of India's 33 states and parts of four others fall within the Himalayan region, with a population of approximately 51 million (6% of Indian population). The total area of this region is approximately 591,000 sq.km, which is 18% of India's total area. Of the nearly 59 million ha 8.3% area is under agriculture, 41% under forest, and 34.1% under pastures. Agriculture is the primary occupation of the mountain people throughout the region (IUCN 2001).

The Himal region in India can also be divided into The Western Himalaya and the North-East Himalaya.

The Western Himalaya

The region extends over three hill states of north India *viz.*, Uttaranchal, Himanchal Pradesh, and Jammu & Kashmir (**Fig. 1**). Geographically this region forms a contiguous landmass with the Tethyan zone that lies in its north. However, the rain-shadow zone (i.e. trans-Himalaya) that lies north of the Great Himalayan massif especially in Jammu & Kashmir and Himanchal Pradesh and has been separated from this region.

The hill states of Western Himalaya share international boundaries with Pakistan, China and Nepal. The region has 50% of the country's forest area and supports 40% species endemic to the Indian subcontinent. The Western Himalayan region is of great hydrological significance. This region forms the source, and major catchments of the rivers Indus, Sutlej, Ganga, Yamuna, Sharada and their numerous tributaries, which form the life line for over 300 million people in the north India including Indo-Gangetic plains. Even the Brahmaputra originates within a distance of less than 150 km from the northern boundary of the Western Himalaya. The presence of extensive glaciers and snowfields strongly govern the hydrology and climate of the region. Here glaciers may descend as low as 2800 m. This region is also known for a large number of natural lakes (both glacial and non–glacial) that make the landscape features its ecology all the more interesting.

Fig. 1 The Western Himalayan Region

(Biodiversity Strategy Action Plan, Western Himalaya Ecoregion, unpublished)

North-East India

The North-East region of India comprises of the eight states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura (**Fig.2**) and has a geographical area of 2,62,382 sq. km. This accounts for about 8% of the total area of India. The region lies between 22º N and 29º 5´ N Latitudes and 88º 00' E and 97º 30´ E longitudes, and shares international border with Nepal, Bhutan, China, Myanmar and Bangladesh. The total population of the region, according to the 1991 census was about 31,954,000. The region is predominantly mountainous interspersed with valleys and river plains. The altitudinal variation ranges from the flood plains of Brahmaputra to high Himalayan peaks of about 8, 585 m above sea level. Associated with altitudinal variations is a wide range of climatic conditions. The region is characterized by heavy precipitation resulting in rich forest cover and biodiversity, fragile mountain ecosystems, high seismicity. There is a distinct drainage pattern marked by valleys dissected by the three major rivers Brahmaputra, Teesta and Barak and their tributaries. The North-Eastern region forms a distinct geographical unit in the country and is unique in many ways. It is home to over 225 tribal communities and thus is a treasure house of biological and cultural diversity. The high ethnic plurality has given rise to rich indigenous knowledge systems. The region still has more than 64% of the total geographical area under forest cover (Biodiversity Strategy Action Plan, North-East India, unpublished).

The North-East occupies a unique position by being at the confluence of south, southeast and east Asia. This location made it an important gateway between people of this region. However, it has been an isolated region, made more so after the partition of India in 1947. The creation of East Pakistan (now Bangladesh) resulted in a disruption of road and river communication. It left the region closed in by several international borders. Today, 2,62,000 sq.km. of this region is linked to mainland India by a 21 km. corridor (Menon et al 2003). Politically, this is still a strategic region and security clearance is still required by the Ministry of External Affairs for non-Indians to work in many of its parts.

Fig.2. The North-Eastern States

Water Resources in the Himalayan Region
[Note: This entire section has been taken from:
Bahadur, J. Water Resource Management in the Himalayan Region]
http://www.mtnforum.org/resources/library/bahaj98a.htm

Detailed scientific evaluations for Himalayan water resources do not exist. This may partly be attributed to an insufficient network of observations for both precipitation and stream discharge measurements. However, the available estimates show that the water yield from a high Himalayan catchment is roughly double that from an equivalent one located in peninsular India and this is mainly due to additional inputs from snow and ice melt contributions from high altitudes. But there continue to be discrepancies in the data collected, as is obvious from the figures given below.

According to the Irrigation Commission of 1972, 200 km3/yr are added to Himalayan streams from areas lying outside the catchment of national boundaries. Murthy (1978) estimates that the Himalayan water resources are 245 km3/yr; Gupta (1983) and Kawosa (1988) estimated that 8634 km3/yr is the total amount of water flowing from the Himalayas to the plains. Bahadur & Dutta (1989) reported that a very conservative

estimates gives at least 500 km3/yr from snow and ice meltwater contributions to Himalayan streams. Alford (1992) reports that the specific runoff in the Himalayas is at a maximum in an altitude belt of considerable human activity - 1500 to 3500m and this is about 515 km3/yr from the upper mountains. Bahadur (1998) revaluated that 400-800 km3/yr. flows down as meltwater contributions from the snow and glacier fields in the high mountain region as against earlier conservative estimates of 200 km3/yr to 500 km3/yr.

Himalayan Snow & Ice Reservoirs

The Himalaya - the abode of snow and ice contains over 50% of permanent snow and icefields outside the polar regions. This region covers an area of 4.6 million km2 above 1500m, 0.56 million km2 above 5400m and 3.2 million km2 above 3000m (Upadhyay 1995). The altitude of permanent snow line is highly correlated with the freezing level (Zero degree Celsius) altitude of the free atmosphere. (Bahadur 1998)

Indus - Ganga - Brahmaputra River Systems

World's largest highland-lowland interactive system consisting of three major Himalayan river systems i.e. Indus, Ganga and Brahmaputra whose long term average annual runoff is given as follows (Stone 1992).

A) AVERAGE ANNUAL RUNOFF OF INDUS, GANGA AND BRAHMAPUTRA RIVERS
(Stone 1992)

River Basin	Measurement Station	Average Annual Runoff km3/yr
Indus	Near Arabian Sea	207.8
Ganga	Hardinge Bridge	494.3
Brahmaputra	Bahudurabad	510.4
Total		1,212.5

B) ANNUAL SPECIFIC AND AVERAGE DISCHARGEOF WATER FROM HIMALAYAN MOUNTAIN WATERSHEDS
(Alford 1992)

Mountain River Basin Specific Discharge	Range of Annual (mm)	Average (mm)
Upper Indus	270-910	460
Upper Ganga	473-2818	975
Upper Brahmaputra	119-2587	1039

C) COMPARISION OF SPECIFIC WATER YEILD FROM MOUNTAINOUS AND WHOLE RIVER BASIN

River Basin	Moutainous Watershed (mm)	River Basin as a whole (mm)
Indus	460	163
Ganga	975	473
Brahmaputra	1039	922

Source: Bahadur 1998.

D) POTENTIAL & UTILISABLE WATER RESOURCES OF MAJOR RIVER SYSTEMS IN HIMALAYAN REGION*

River Basins

S.No.	Item	Indus	Ganga	Brahmaputra	Meghna
1.	Water Resource Potential (Km3)	73.3	525	537.2	48.4
2.	Utilizable Surface Water (Km3)	46.0	250	24.0	
3.	Groundwater Potential (Km3)	25.5	171.7	27.9	1.8
4.	Per Capita Annual Availability of Water (m3)	1757	1473	18417	7646
5.	Per Hectare of Culturable Area Annual Availability (m3)	7600	8727	44232	43447

*Source: Reassessment of Water Resources-CWC Publication March 93, Bahadur, J.

Section.2 GENERAL SITUATION IN THE COUNTRY

Discourse

In his address to the newly formed Parliament on June 06, 2004, the President of India said that, " The Government is concerned that a significant portion of our population does not have access to safe drinking water. My government will work with the State Governments to draw up innovative schemes including harvesting rainwater and de-silting existing ponds. Effective measures will be taken to put an end to the acute shortage of drinking water in drought prone areas and in cities like Chennai, including through setting up desalination plants wherever found viable. Special problems of habitations in hilly terrains will be addressed immediately. Watershed development projects will be promoted on a large-scale, and the wasteland development programme lying dormant these past few years will be revived."
[Hindi]

The Financial Budget (2004-2005) for country was announced by the Finance Minister of the newly formed government on July08, 2004. The Budget has indicated schemes for repairing, renovating and restoring all water bodies that are directly linked to agriculture. Pilot projects addressing the same will be launched in five districts. The Finance Minister also announced the formation of a National Water Resources Development Project. There will also be a nationwide water-harvesting scheme to cover 100,000 irrigation units throughout the country at an average cost of Rs. 20,000 (US $ 432) per unit.

(http:indiabudget.nic.in)

The Planning Commission constituted a Committee on Vision 2020 for India in June 2000. 30 experts from different fields were involved in this initiative. The exercise extended over a period of more than two years, and has helped to focus on some critical issues. The report recommends the efficient use of water, including appropriate water pricing and more effective institutional mechanisms for water management. It urges the government and private bodies to deliberate future action.
http://planningcommission.nic.in/plans/planrel/pl_vsn2020.pdf

Water management has been the focus of the past governments also and there has been an attempt at looking at integrated water management over the past several years. The phrase `Integrated Water Resource Management' or IWRM has come into extensive use in recent years, particularly in the Global Water Partnership (GWP) and World Water Council (WWC) circles and at the World Water Forums. Even earlier, a consultative process undertaken in the country, in preparation of the World Summit on Sustainable Development, 2002 indicated that there was a demand for, "sustainable integrated water resource management and this should optimise water security and human benefit per unit of water, while protecting the integrity of ecosystems"(CEE 2002).

As part of the Ministerial Conference held during the 3rd World Water Forum in Kyoto, India's Minister for Water Resources endorsed the aim of developing integrated water resources management and water efficiency plans by 2005 (World Water Council 2004).

More recently, India's Report to the 12th Review Session of the United Nations Commission on Sustainable Development indicates the need for integrated water resources management (MoEF 2004).

Iyer (2004) analyses the concept. According to him, there is integration of water resources at different levels. There are also different uses of water ranging from irrigation, industrial, municipal, domestic to navigational etc. There are different sources of water ranging from precipitation, rivers, other surface water bodies, groundwater to soil and atmospheric moisture. There is also an integration of the demand and supply side of water. Then there is land and water use, water availability and water supply and sanitation. Consider with this the interests of different land users, ranging from rural to urban, upper riparian to lower riparian etc. There are different aspects of large water resource development projects such as irrigation, power generation, flood control etc. as also different disciplines in these projects. All this results in diverse concerns in planning. Some planners look at efficiency and economy, while others look at environmental/ecological and human concerns and still others at maximisation of benefits. The scale of projects also varies. He feels that the word 'integrated' is used but doubts if all these aspects are considered while doing so.

In his words, "A truly integrated, holistic planning would mean inter-disciplinary planning, with a consciousness of the hydrological cycle, guided by earth science, marrying land-use and water-use, harmonizing diverse water uses on the demand side and

integrating all `development' from local rainwater-harvesting and micro watershed development to `mega' projects (and surface water and groundwater) on the supply side, while at the same time fully integrating environmental, ecological, human, inter-generational, social, and water-quality concerns, and fully associating the people concerned (`stakeholders') at all stages. This kind of integration is rarely seen. Local. community-led planning and management and the inclusion of traditional knowledge are almost always overlooked. What is really needed is a change in ways of thinking and understanding" (Iyer 2004).

In reality, there is very little integrated water resources management that is happening in a truly 'integrated' manner. There components of it being implemented in various regions. There are thousands of watershed management projects being implemented across the country, but few integrate all components of water management into them. The ecosystem approach to IWRM, per se does not exist in India.

External donors support a bulk of the watershed development projects in India. Of the donor agencies, the World Bank and the Department for International Development (DFID), UK are some of the key ones working in the water sector. The World Bank has been a key partner in the water development sector in India for many years. It has played a significant role in the negotiation of the historic Indus Water Treaty with Pakistan. The Bank in its recent Water Resource Sector Strategy (2004) has stated that while important opportunities remain in the sector of development of water resources (e.g. hydropower in the mountainous regions), water development and management priorities have changed in India. The Bank is focusing more on managing scarce water resources in an efficient and accountable manner. Brisco (pers com.) was quite skeptical about IWRM and was of the opinion that it is rarely implemented in India.

DFID's overall strategy in water includes, "efforts in improving the management and allocation of water resources and access to water and sanitation on achieving improved health and sustainable livelihoods for the poor as a means to eliminate poverty". 8% of DFID's expenditure on water-related projects (1999-2000) was allocated to integrated water resources management and climate change (DFID 2001). DFID however, focuses its work on the four Indian states of Andhra Pradesh, Madhya Pradesh, Orissa and West Bengal, which are not part of the Himal region.

There are other donors such as the Danish Development Assistance (DANIDA) and the German Agency for Technical Cooperation (GTZ) who have for several years supported watershed programmes in India. A lot of these have focused on issues of IWRM. GTZ works closely with the Ministry of Agriculture and has supported some extremely successful projects in the Himal states of Uttaranchal and Himachal Pradesh.

The Government of India made a significant decision in 2003, which is going to impact many of the relatively small donors working in the country. In June 2003 the Government of India (GoI) announced a new policy for bilateral development assistance. The policy essentially puts an end to grant as well as credit assistance from small bilateral donors to the GoI and State Governments. It indicates that small donor agencies can provide

support to the Indian civil society and channel funds through multilateral organisations. Specific guidelines issued on the 12th September 2003 define the mechanism for such support. This will apply to all bilaterals, except Japan, UK, Germany, USA, EC and the Russian Federation (Saxena 2003). The new government however has yet to comment on this.

Governance

The key Ministry that is responsible for the management of water resources in the country is the Ministry of Water Resources. But other ministries play a key role in IWRM through its schemes and guidelines. If only the aspect of watersheds is considered,
Box. 1. provides an interesting perspective on who actually looks after watershed programmes in the country.

Box. 1.

Ministries Fight over Watershed Plans

NEW DELHI: Whose baby is watershed development? With too many ministries claiming to be parents, the Cabinet has the unenviable task of deciding who should take charge. The different watershed development programmes are currently scattered through the agriculture, rural development and environment ministries. "Every department has its own views," says Shanta Kumar, rural development minister. A Cabinet note has been prepared by this ministry.

The aim of putting all the different watershed schemes and programmes under one roof is to streamline funds, avoid duplication and ensure better execution and monitoring. Once integration has been achieved at the Central level, the government would be keen to see this replicated in states where, again, departments as varied as environment, agriculture, rural development and soil conservation have a finger in the pie.

This integration plan was first mentioned in the President's address to Parliament in 2000.

To give an example of some of the diversity on offer, the agriculture ministry has a decade-old national watershed development project for rain fed areas, an integrated watershed development project for hilly areas and a watershed development fund in Nabard. The fund has a US$ 43 million corpus for integrated watershed development in 100 districts in 14 states. This ministry also monitors externally-aided state projects such as the Karnataka watershed development project or Tamil Nadu's comprehensive watershed development project.

The rural development ministry has three projects: The desert development programme, the drought-prone areas programme and the integrated wasteland development programme, all using watershed development as the base. The environment ministry's

National Afforestation and Ecodevelopment Board focuses on improving degraded forest areas.

No department wants to give up an inch of its territory. The environment ministry, maintaining it is focusing on forest land, would like this to remain with it. The agriculture ministry, it is learnt, has agreed in principle to the concept of one roof -- but it would like to provide that roof.

The rural development ministry, tasked with framing the proposal, is believed to be of the view that it has the infrastructure and technical expertise to do the job. It is, after all, armed with a land resources department with an annual budget of US$ 218 million.

Source:http://timesofindia.indiatimes.com/cms.dll/html/uncomp/articleshow?artid=35995249
Jan.31, 2003

This is quite the reality because programmes focusing on watershed development operate through three different Ministries at the central level. Moreover, the aim of watershed or IWRM programmes within each Ministry is quite different.

The Ministry of Agriculture, Department of Agriculture and Cooperation, under its Rainfed Farming System Programme, has a scheme called the Watershed Development Council (WDC), which was initiated during 1983-84 to service World Bank and other foreign aided, and national projects. The Council has now been designated as one of the executing agencies to provide technical assistance to Integrated Watershed Development Project (Hills-II) and other World Bank aided Projects operational in various States of the Country. The role of WDC is visualized as that of coordinating and convening of the Government of India's overall watershed related policies. The Ministry through the National Bank for Agriculture and Rural Development (NABARD) also has a Watershed Development Fund, which is used to promote people's participation and also enable water users' associations to implement, operate and maintain irrigation schemes. *All watershed programmes executed under the Ministry of Agriculture are primarily meant for enhancing the agriculture potential of the area in question.*
http://agricoop.nic.in/progs.htm

Watershed programmes under the Ministry of Rural Development are aimed at poverty alleviation, employment generation, infrastructure development and social security. Watersheds are promoted by the Department of Land Resources through three major programmes. These are: Drought Prone Area Programme (DPAP) The Desert Development Programme (DDP) the Integrated Wasteland Development Programme (IWDP) and Land Reforms (LR). These aim at increasing the soil and moisture conservation and productivity of the wasteland of the degraded lands thereby increase the income of the people.
http://rural.nic.in/i1.htm

Watershed management through the Ministry of Environment and Forests is initiated with a focus on the afforestation and regeneration of degraded areas. Several watershed programmes are initiated through the Ministry's National Afforestation and Eco-Development Board (NAEB). The Board is responsible for carrying out activities related to afforestation, tree planting, ecological restoration and eco-development with special attention to the degraded forest areas and lands adjoining the forest areas, national parks, sanctuaries and other protected areas as well as the ecologically fragile areas like the Western Himalayas, Aravallis and the Western Ghats.
(http://envfor.nic.in/).

Table. 1. gives an overview of all relevant activities in this area of work.

Box. 2. indicates some relevant schemes of the Government of India.

BOX. 2.

Relevant ongoing GOI Schemes/Programmes

- The National Watershed Development Project for Rainfed Areas, (ii) Watershed Development Fund, and (iii) Externally Aided Projects under Rainfed Farming System Programme of the Ministry of Agriculture.
- The Centrally Sponsored Scheme of Soil Conservation for Enhancing Productivity of Degraded Lands in the Catchments of River Valley Projects and Flood Prone Rivers (RVP & FPR)—Subsumed under Macro management Scheme, (ii) Scheme of Watershed Development Project in Shifting Cultivation Areas Scheme, and (iii) Externally Aided projects under Natural Resource Management Programme of the Ministry of Rural Development
- The International Co-operation Programme, Ministry of Rural Development.
- The Hill Areas Development Programme/Western Ghats Development Programme, Planning Commission.
- The (i) Sampoorna Grameen Rozgar Yojana, (ii) Integrated Wastelands Development Programme, (iii) Drought Prone Areas Programme, (iv) Desert Development Programme, (v) International Co-operation Programme (vi) Other Schemes of Wasteland Development, (vii) Rural Water Supply And Sanitation Programme, Ministry of Rural Development.
- The Watershed Development Programme, CAPART

- The Accelerated Urban water Supply Programme, Ministry of Urban Development and Poverty Alleviation

Source: Kamath and Shresth 2002

Table.1 An Overview

	Ministry of Agriculture	***Ministry of Rural Development***	***Ministry of Water Resources***	***Ministry of Environment and Forests***	***Planning Commission***
Institutions	-Water and Land Management Institutes - Watershed Development Council		-National Water Development Council -National Water Development Agency (Himalayan Rivers Devpt. Component	-Central Groundwater Authority -National Afforestation and Ecodevelopment Board	-North Eastern Council -Dept. of Devpt. of North Eastern Region
Commissions			-Central Water Commission -National Commission on Water Resource Development		
Programmes	Integrated Watershed Projects supported by Donors	-Drought Prone Area Prog. (DPAP) -Desert Devpt. Prog. (DPP) -Integrated Wastelands Dept. Prog. (IWDP)			-Special Area Programmes
Legal Provisions/Guidelines/Other Provisions		HARIYALI Guidelines 2003 for watersheds	-NationalWater Policy 1987 -National Water Policy 2002		Xth Five Year Plan (2002-2007)
Financial Support General -State allocations -Programme allocations -Donor Agencies	National Bank for Agriculture and Rural Development (NABARD)				

Some Key Government Institutions

The National Water Resources Council (NWRC)

This is the key body with constitutional backing and which is responsible for the formulation of the National Water Policy of 1987 and 2002. The NWRC is a prestigious body with Chief Minister's of the states and Lieutenant Governors of the Union Territories as well as a number of Central Ministers as members, the Prime Minister as the chairperson, and the Secretary, Water Resources, the Secretary of the NWRC. This is an important institution, particularly for making federalism functional with regard water issues. However, although constituted by a Government Resolution in 1983, it has hardly ever met (Iyer 2003).

The Central Water Commission

Central Water Commission was set up in 1945 as a premier 'Technical Organization' specifically in the field of Water Resources since 1945. At present it functions as an attached office of the Ministry of Water Resources. The Commission is responsible for initiating, coordinating and furthering (in consultation with state governments) schemes for control, conservation and utilization of water resources throughout the country, for purpose of Flood Control, Irrigation, Navigation, Drinking Water Supply and Water Power Development. CWC has thirteen regional offices. These offices closely interact with the States and are responsible for monitoring of medium and major projects, appraisal of medium projects, flood forecasting and hydrological observations. More and more activities like initiating, coordinating and furthering.
http://cwc.nic.in/

National Water Development Agency

The Ministry of Water Resources established the National Development Agency (NWDA) 1982 to promote, "scientific development for optimum utilization of water resources in the country and for preparing feasibility reports for interbasin transfer of water from surplus to deficit areas as envisaged in the National Perspective for Water Resources Development".

Himalayan Rivers Development Component

The Himalayan Rivers Development Component of the Agency, is focused on construction of storage reservoirs on the principal tributaries of the Ganga and the Brahmaputra in India, Nepal and Bhutan, along with interlinking canal systems to transfer surplus flows of the eastern tributaries of the Ganga to the west, apart from linking of the main Brahmaputra and its tributaries with the Ganga and Ganga with Mahanadi.

http://wrmin.nic.in/publication/ar2003/ar2002-03.pdf

Central Groundwater Authority

The Central Groundwater Authority was set up by the Ministry of Environment and Forests (MoEF) under the Environment (Protection) Act, 1986. This has yet to be effective and operational.

Legal Provisions

The National Water Policy 1987

Having recognized the importance of water and the need for a national consensus on a policy framework, the seed for the National Water Policy 1987 was sown. There was also recognition to move away from discrete projects more towards issues of resource policy. Some of the key aspects of the Policy were: the emphasis that the basis of planning should have a hydrological unit, such as a basin or a sub-basin; project planning should be for multiple benefits and based on an integrated and multidisciplinary approach, with special focus on human, environmental and ecological aspects; groundwater should be regulated with reference to recharge possibilities and there should be consideration of social equity (Iyer 2003).

The National Water Policy 2002

In April 2002, a new National Water Policy was announced in India. The amended policy focused on aspects such as: non-conventional methods for utilisation of water such as through inter-basin transfers; artificial recharge of ground water and desalination of brackish or sea water and promotion of traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting. It also indicated that water resources development and management will have to be planned for a hydrological unit such as drainage basin as a whole or for a sub-basin, multi-sectorally, taking into account surface and ground water for sustainable use incorporating quantity and quality aspects as well as environmental considerations. The Policy stressed that all individual developmental projects and proposals should be formulated and considered within the framework of such an overall plan. The Policy promoted watershed management and encouraged the construction of check-dams. Mechanisms for carrying out suggested activities are also described in the Policy.

http://wrmin.nic.in/policy/nwp2002.pdf

Criticisms to the National Water Policy 2002

This policy has come under a lot of criticism. Former Secretary Ministry of Water Resources, Ramaswamy Iyer feels that, “The NWP 1987 may have been inadequate, incomplete and sketchy, but it at least had a structure and flow. The ‘revision’ exercise played havoc with that structure and flow, without achieving any significant purposes. A valuable opportunity for fresh, careful and fundamental thinking has been lost. It took 15 years to revise the NWP 1987, and it may be another decade at least before the NWP 2002 is replaced by a new document. Meanwhile we have in place a policy document that can be only described as a ‘non event’ (Iyer 2003).

Several non-governmental organizations (NGOs) have spearheaded a campaign to take a fresh look at the existing National Water Policy 2002. Tarun Bharat Sangh, which has been working in state of Rajasthan on traditional water harvesting systems for several years, was involved in the drafting of this Policy but feels that not many of its inputs have been considered. Taking that into consideration and the fact that there is a need for a water policy that empowers communities and provides them with a sense of ownership

over their water management systems, Tarun Bharat Sangh has established a *Rashtriya Jal Biradari* (National Water Community). This is a coalition of individuals and organizations concerned about water conservation. The *Jal Biradri* has begun a nationwide campaign to raise awareness, challenge the water policy and provide an alternate policy. (Tarun Bharat Sangh and *Jal Biradari*)
http://www.righttowater.org.uk/code/advocacy_4.asp

Says Sunita Narain, Director of the Center for Science and Environment (CSE), "Successive droughts and the growing water scarcity are creations of government policy and this new policy will only perpetuate the disastrous policy framework of the past," Narain also feels that the new policy overlooks the potential of rainwater harvesting and the importance of involving communities in these programmes. CSE has been involved in a long standing campaign for community control over water resources.
http://www.indiatogether.org/environment/water/nwp.htm

Other Legal Provisions

Although, not directly related, there are many wetlands (part of a larger watershed) that are being managed under the Convention on Wetlands, commonly known as the Ramsar Convention. It was signed in Ramsar, Iran in 1971. It is an intergovernmental treaty, which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (http://www.ramsar.org/). India became a member of this Convention in 1982. As of November 2002, 19 wetlands have been designated as Ramsar Sites.

Many of these have the potential of sites for looking at an ecosystem approach to IWRM.

Towards an Integrated Water Resource Management

The Planning Commission
The Planning Commission set up an Expert Group in 1992, to formulate a policy for the integrated development of the Himalayan region. The Expert Group addressed several major issues. These were: agriculture; horticulture; other agricultural activities; forests; irrigation and water management; energy development; roads and communications, industrialization; tourism; tribals and education; health, nutrition and family welfare and environmental education. This group also considered suggestions/ recommendations of Committees and Task Forces that had earlier been set up as also issues relating to the development of the region that emerged from previous Plans. The Report of the Expert Group published in 1983, stressed the need for an administrative mechanism for conservation and the subsequent monitoring of specific activities. It recommended the setting up of a Himalayan Development Authority and the creation of a Himalayan Environment and Development Fund to support activities based on the recommendations of the Expert Group (Planning Commission 1983). However, neither of these has been established to date.

Xth FiveYear Plan (2002-2007)
The Xth Five Year Plan formulated by the Planning Commission for the Government of India, stresses the need for Participatory Irrigation Management (PIM). It urges that planners take a look at the autonomy for the Water Users' Association, multifunctional nature of these associations, assess and improve various indicators like efficiency, financial viability, environmental sustainability, productivity etc. It also recommends a major reformulation of priorities and programmes and restructuring of institutions and operational means are required for integrated local watershed development. The Planning Commission visualizes the integration of rural area programmes into an umbrella programme and the inclusion of watershed development as an integral component

Special Area Programmes
Under the Planning Commission are Special Area Programmes. By and large planning and development of an area within the state is the responsibility of respective state governments. However, the Central Government supplements these efforts through special central assistance for special area programmes such as Hill Area Development Programme (HADP) and Western Ghats Development Programme (WGDP), Border Area Development Programme (BADP), etc. As part of the Himal region two hill areas: a) Two hill districts of Assam – North Cachar and Karbi Anglong and b) Major part of Darjeeling District of West Bengal) qualify for support under this programme.

The thrust for the Xth Plan in these areas will be: (a) Watershed Development (b) Participatory Approaches (c) Innovative Schemes for Technologies suited to Hill Areas (d) Schemes for Biodiversity Conservation (e) Schemes for Income Generation (f) Gap-filling Infrastructure (g) Maintenance.
http://planningcommission.nic.in/plans/planrel/fiveyr/10th/volume3/v3_ch4.pdf
http://planningcommission.nic.in/plans/planrel/fiveyr/welcome.html

National Commission for Integrated Water Resources Development
The Government of India, Ministry of Water Resources, set up a National Commission for Integrated Water Resources Development Plan with the following objectives in mind:

- "To prepare an integrated water plan for development of water resources for drinking, irrigation, industrial, flood control and other uses
- To suggest modalities for transfer of surplus water to water deficit basins by inter-linking of rivers for achieving the above objectives
- To identify important ongoing projects as well as new projects which should be completed on priority basis in a phased manner
- To identify a technological and inter disciplinary research plan for the water sector with a view to maximizing the benefits

- To suggest the strategies for generation of physical and financial resources for the water sector"

The National Commission for Integrated Water Resources Development Plan has submitted its partial report to the Government of India on 1.12.99.

http://wrmin.nic.in/interbasin/commission.htm

BOX. 3.

Vision for Integrated Water Resources Development and Management

The 12th National Conference of Water Resources and Irrigation Ministers was held on 5th February 2003 at New Delhi. The then Prime Minister released the Document on "Vision for Integrated Water Resources Development and Management" at an event prior to the Conference. The important decisions/recommendations of the Conference were:

"(i) Adoption of Action Plan for Implementation of the National Water Policy-2002.
(ii) Each State to formulate their State Water Policy backed with an operational action plan within two years in line with the National Water Policy - 2002.
(iii) All out efforts to be made by all concerned to meet the targets set for the Water Resources Sector in the Tenth Plan document adopted by National Development Council.
(iv)Reforms required in the water sector are key to sustainable development and the stability of the irrigation systems. Initiatives towards sector reforms as discussed in the conference and those detailed in the Tenth Plan document will be taken up in the right earnest. Reform measures viz. rationalization of water rates are also important aspects of Accelerated Irrigation Benefits Programme through incentives provided for such measures for funding of schemes.
(v) The Restructured Programme of the Command Area Development will be pursued further. The States will make all out efforts in the implementation of the restructured programme. Participatory Irrigation Management is central to the sustainable management of irrigation systems as also for improving their efficiency. Recognizing this, the implementation of the Command Area Development Programme is closely linked with Participatory Irrigation Management, wherein beneficiaries are required to bear a small part of the overall costs."
http://wrmin.nic.in/publication/ar2003/ar2002-03.pdf

Guidelines for Watershed Development

The Ministry of Rural Development for the purpose of involving village communities in the implementation of watershed projects under all the area development programmes namely, Integrated Wastelands Development Programme (IWDP), Drought Prone Areas Programme (DPAP) and Desert Development Programme (DDP) issued Guidelines for Watershed Development, which were adopted w.e.f.1.4.1995, and subsequently revised in August 2001. New guidelines called **Guidelines for Hariyali** were issued in 2003 to

simplify procedures and involve the *Panchayat Raj* Institutions (PRIs) more meaningfully in planning, implementation and management of economic development activities in rural areas.

These guidelines focused on issues such as creating regular sources of income from village bodies from rainwater harvesting; employment generation, community empowerment and poverty alleviation through IWRM; mitigating the adverse effects of extreme climatic conditions such as droughts and desertification; supporting use of simple, easy and affordable technological solutions and institutional arrangements that make use of, and build upon, local technical knowledge and available materials. The *Gram Panchayats* (Village Councils) were considered the institutional mechanism to take these forward.

(dolr.nic.in/HariyaliGuidelines.htm)

Criticism of HARIYALI Guidelines

There has been severe criticism to these guidelines. One view is that these guidelines will remain ineffective because watershed programmes today, are still being carried out by different Ministries with different approaches and differing institutional mechanisms. Each Ministry believes that its approach is the best and therefore an agreement on common guidelines for Watershed Development remains elusive. Recent reports indicated that the Centre proposes to consolidate all watershed programmes under a single ministry. However there is no action on this front. Also, the watershed programme still remains a 'government driven' and not a 'people's programme'. Despite this, user groups and informal village associations carrying out watershed management at the local level have proliferated. Typically, these have been informal associations not formed under any of the formal laws of the state concerned. There is a fear that these guidelines might undermine informal arrangements and attempt to standardize institutions. This may happen due to the fact that the guidelines indicate that *Gram Panchayats* (Village Councils) should be involved in water management programmes. *Gram Panchayats* themselves can become highly politicized bodies (Upadhyay 2003).

Institutional Mechanisms

Few institutional mechanisms such as river basin organizations do exist. Some of these in the Himal region are the Bhakra Beas Management Board, the Brahmaputra Board, the Ganga Flood Control Commission and the most recent Upper Yamuna Board. On the international side, the Indus Commission, the Joint Rivers Commission, the Kosi and Gandka Projects Agreement and the follow up Coordination and Monitoring Committees and the Mahakali Commission also exist (Char 2003). However, it is not clear of effectively these, function. Under the recently formulated Biodiversity Act (2002), each state will have Biodiversity Boards through which a coordinating mechanism could be thought of.

North Eastern Council (NEC)

The North Eastern Council (NEC) was set up in August 1972 under the NEC Act, 1971 (with its Secretariat at Shillong) for regional planning and development. The Council acts

as an advisory body empowered to discuss matters of common interest to the Union and the North-Eastern States. It can make recommendations of any matter of concern in the fields of economic and social planning, inter-State transport and communications, power and flood control, etc. This may be a good institutional mechanism to take forward the EA approach to IWRM in North-East India.

Department of Development Of North Eastern Region (DONER)
The Department of Development of North Eastern Region (DONER) is a newly created body under the Planning Commission. DONER is now the lead department in the Government of India for coordinating all Central initiatives and programmes in the North East The role of this body would be to create synergy and ensure convergence of programmes by coordinating the efforts of both Central agencies and the State Governments. The department would help on increasing opportunities for productive employment, strengthening infrastructure, particularly connectivity and communication,

http://planningcommission.nic.in/plans/planrel/fiveyr/10th/volume3/v3_ch4.pdf

Water and Land Management Institutes (WALMIS)
During the 80s, a number of Water and Land Management Institutes (WALMIS/ IMTI etc.) were established in various States with the technical and financial support from USAID. These institutes were envisioned to help irrigation departments to train Irrigation System Managers and to improve the efficiency of water use in irrigated commands but canal commands in particular. The Ministry of Water Resources has now in collaboration with the Ministry of Agriculture involved the Water and Land Management Institutes in the National Watershed Development Project for Rainfed Areas (NWDPRA). (http://wrmin.nic.in/publication/ar2003/ar2002-03.pdf)

Practice

There are several programmes of the central government, state government, multilateral agencies and several bilateral agencies along with a number of NGOs, which support IWRM projects in the country. Most of these have been watershed programmes. Watersheds projects in India were initiated in the 1980s and 1990s, primarily to develop semi-arid areas that had been bypassed by the Green Revolution. (Government of India 1990). By the late 1990s watershed development seemed to have become a focal point for rural development in India, with an annual budget of over $450 million from all sources (Farrington et al 1999). However, it is difficult to ascertain whether these have addressed a really integrated approach to water resource management. Despite the fact that integrated watershed development was accepted as official policy nearly 25 years ago, programmes continue to operate on a fragmented basis of concepts such as soil conservation on agricultural land, soil conservation of river catchments, wasteland development schemes etc. In reality planning, management and integration are confined only in the title (Vaidyanathan 1991).

Out of the many IWRM projects in the country, two, which are most relevant to the Himal region are described here:

The People and Resource Dynamics Project (PARDYP)

The People and Resource Dynamics Project (PARDYP) is a three-year watershed management research and development project of ICIMOD. The many activities within this project include: co-operative rural participation, hydrology and meteorology research, soil erosion and fertility studies, conservation activities, rehabilitation of degraded areas, and agronomic and horticultural initiatives PARDYP is funded by the Swiss Agency for Development and Co-operation (SDC), the International Development Research Centre (IDRC - Canada), and ICIMOD

PARDYP operates in five watersheds in four of ICIMOD's partner countries - Pakistan, India, Nepal, and China.

In India, the project operates in the Bheta Gad Garur Ganga Watershed in the state of Uttaranchal. The Bheta Gad-Garur Ganga watershed covers a total area of 8,481ha. Studies have initially concentrated on the smaller Bheta Gad watershed (2,230 ha). The watershed is near Kausani and is characterized by several areas of degraded land, different land-use patterns and forest types, several major different soil types, favorable hydrological and meteorological sites, and several possibilities for twin catchment arrangements.

Many lessons were derived from the earlier phase of this project. It was realized that water was a key factor for the sustainability of mountain farming systems and is as important as soil conservation and fertility. Also, the difficulty of generalizing about processes like erosion and sedimentation without long-term mechanisms for data collection and analysis in place was understood. Further, the need for a common framework for monitoring various different parameters was felt.
("http://www.icimod.org/projects/images/pardypsit)

The Doon Watershed Management Programme

The European Union and the Uttaranchal state government agreed to finance a nine-year integrated watershed management project starting from 1993 in the Doon Valley with special emphasis on community participation.

The project encompassed an area of 185 000 ha with 250 villages. Project activities were carried out in select micro watersheds and were focused on Social Forestry, Horticulture, Livestock, Minor Irrigation, Agriculture, Soil Conservation, Community Participation and Energy Conservation. Taking into account the fact that women are crucial to natural resource management in the region, female village motivators were recruited to facilitate community motivation and communication with other village women. This approach has generated many employment opportunities for the village community. A case study of ten of the project villages shows that the villages have been able to break out of the 'dependency syndrome', which is prevalent in many hill states of the country where dependency on government subsidies is becoming a cause for concern.

(http://www.fao.org/montes/foda/wforcong/PUBLI/V2/T9E/3-1.HTM#TOPof forests and natural resources)

Both these address several issues of IWRM. It is hard to judge if they demonstrate IWRM with an ecosystem approach. Site visits and analysis of these programmes would be required for this to be determined.

The following, are more ecosystem and species conservation programmes and although they do not look at water and other land use issues, per se, they do use the landscape/ecosystem approach and the wetlands/landscapes described could be a potential sites for looking at the IWRM approach.

WWF-India's High Altitude Wetland Programme

The Himal region of India has several thousand wetlands of greater ecological importance. Since the last decade, WWF-India has made concerted efforts in conserving some of these, particularly in the Western Himalaya. In this endeavor, WWF-India has developed a strategy and action plan for the conservation of three wetlands, i.e. Tsomoriri, Tsokar and Pangong Tso (Chatterjee et al 2002). In another initiative, the organization is now attempting to consolidate the status of knowledge on the other Himalayan high altitude wetlands for conservation prioritization. A recent consultation (May 25-27, 2004) was held in Sikkim for this purpose (WWF-India 2004).

WWF-India's Asian Rhino and Elephant Action Strategy

The Asian Rhino and Elephant Action Strategy (AREAS) is a WWF initiative for the conservation of the mega-herbivores Indian Rhino and Asian Elephants. The AREAS Programme is a response to the recognition that long-term conservation for large animals such the elephant and rhino requires a landscape-based approach that goes beyond isolated protected areas and includes the surrounding landscapes and related land use practices. The largest and the most contiguous population of the Asian elephants is found along the North Banks of the river Brahmaputra covering parts of Assam, Arunachal Pradesh, North Bengal and Bhutan. Under the AREAS programme in India, WWF is looking at the management of this area as a larger landscape. The North Bank Landscape (NBL) is the area between the northern bank of the river Brahmaputra in the south to the foothills of the eastern Himalaya in the north and the river Manas in the west to the river Dibang in the east and covers about 3000 sq.km. of Protected Areas.
(http://www.wwfindia.org/programs/tigers-wild/areas.jsp?prm=66)

Section.3. CONTRIBUTION TO LIVELIHOODS

Discourse

Water is linked to the food supply and livelihoods of India's rural and urban poor in many ways. The quality and availability of water have direct impacts on the quality of life as well as livelihoods of people. This is very clear in the context of irrigation. Access to water for irrigation enhances the agricultural productivity of people's land and thus has a positive effect on their livelihoods. Shah (1998) feels that irrigation provides the crucial link between water resource development and food security. Farmers, who have the ability to irrigate their fields as opposed to being dependent on rainwater, have a greater chance of improving their livelihoods. These farmers can use new technology and do intensive cultivation resulting in significantly higher crop yields per acre. India has been able to increase its food production by 3.5 times, largely through irrigation development.

Turton and Farrington (1998) in their paper have reviewed the experience of how the 1994 Watershed Guidelines have been put into practice in the states of Andhra Pradesh, Madhya Pradesh and Orissa. They found that there was clear evidence that the rehabilitation phase of the watershed projects has created employment for the poor and as a result reduced seasonal out-migration. In some older, well-managed watershed development projects, increased natural resource productivity has also created employment, but it was still too early to tell whether this will happen under newer projects

Srigiri et al (2003) in their case study of watersheds in Maharashtra, point out that participatory watershed development projects have been seen as a solution for the problem of rural resource degradation and poverty alleviation in the past decade. Studies based on biophysical indicator as well as new institutions built during the project period show substantial improvement. However, there is still no convincing evidence if there has been equity in the distribution of benefits and if they have been successful in alleviating poverty of the most vulnerable sections.

Kerr (2002) raises an interesting point about the issue of who benefits from watershed management. He states that watersheds being complex landscapes have multiple users. Upper watersheds often have uncultivated common land that would require revegetating to protect against erosion. This would mean placing limits on fuel wood collection and grazing. This would directly impose costs on the poor who are often landless and rely most on this land. Women, in particular who use this land for various purposes, are most affected. Sloping upper watershed areas harboring rainfed croplands, are also treated with soil conservation measures. Ironically, benefits from water harvesting accrue quite disproportionately down stream to the wealthier farmers. These farmers typically own most of the irrigable land anyway. It is then the poor people using the upper watersheds who are asked to provide environmental services to the people in the lower watersheds. Looking at this situation, Kerr (2002) suggests that successful watershed programmes require either (i) the development of appropriate institutional mechanisms that ensure

equitable use or (ii) ensuring that upstream area users restrict resource use and agree to provide environmental services without compensation.

However it is not that the landless and poor have not benefited from these programmes at all. In many cases the benefits have been indirect. There have been increased labour opportunities, which has subsequently led to less out migration. Apart from employment benefits there has been a general improvement (such as increased drinking water, higher economic activity, micro-enterprise development etc.) at the village, from which everyone has benefited. In some cases, the participation of the landless in watershed activities has improved their social standing in the village, a definite intangible, but important benefit. (Kerr et al 1998)

There are few studies of this kind available from the Himal region.

Governance

The 1994 Watershed Guidelines were revolutionary for supporting the devolution of power, promoting indigenous technology and allowing for NGO participation. The guidelines were significant in supporting the strengthening of local institutions. These also, provided financial support for activities not completely related to watershed development, but of high priority for villagers. What the guidelines did not ensure was that the poorest people would not be adversely affected by watershed development. Many case studies have shown that benefits from watersheds were skewed towards wealthier households (Kerr 2002).

The newly issued HARIYALI guidelines for watershed development clearly state that, "Employment generation, poverty alleviation, community empowerment and development of human and other economic resources of the rural areas" will be given priority. However, how much of this is actually taken into consideration while implementing these programmes is not clear.

The Water Policy 2002 does not clearly state the need for IWRM to contribute to livelihoods.

Practice

Described here are some traditional water management systems in the Himal region which having accepted an alternate approach are attempting to ensure equity in water management decisions.

Jardhar's *Pani Panchayat* (Western Himalaya)

Jardhar is a village in the Tehri region of the Western Himalaya. Jardhar's *Pani Panchayat* (Village Water Council) has been a traditional and time-honored system of irrigation to regulate water during periods of need and for equitable distribution amongst local farmers. This system has not changed over the years. The term *Pani Panchayat*

came about because it is a part of the *Gram Sabha* (Village Council) responsibilities. Both the *Panchayat* and the villagers keep an eye on its smooth functioning.

The local *Pani Panchayat* system covers the irrigated portion of Jardhar's agricultural lands along with the other villages. The total area covered under this system is approximately 28 hectares.

The method of irrigation is by the diversion of natural drainage streams, which are perennial or seasonal and diverted by simple methods through the system of *kuls* or *guls.* This term refers to the diversion structure or also the diversion channel. There are six main sources (*srot*) (springs/streams) of water for the Jardhar/Nagni area.

The temporary *kuls* constructed in earlier days needed a lot of effort for maintenance due to their weak construction. Now concrete *kuls* have been made by the *Laghu Sinchai Vibhag* (Department for Minor Irrigation) and repaired at Block level through funds obtained under JRY (*Jawahar Rojgar Yojana*). The Department of Minor Irrigation has no subsequent role in maintaining the *kuls.* For new new *kuls* to be constructed the G*ram Sabha* sends a proposal to the Block Development Committee who in turn send the proposal to the Department for Minor Irrigation. The Gram Sabha appoints a headman for the supervision of the *Kuls.* He has under him a team of 10-12 men (*Kulwale*) who are appointment for the duration of one year. Men who work as *kulwale* normally belong to the weaker sections of the village, those with small farm holdings or small pensioners. The *kulwale* also perform other functions such as guarding forest/grass areas and preventing animals from entering the fields for a specific period of time. Many villages in the region follow this or a variation of this system. However, with changing times, there is a fear that this system will erode (Suryanarayan et al unpublished).

Many areas in the state of Himachal Pradesh (Western Himalaya) also follow similar systems.

Water Management in Ladakh (Trans Himalaya)

Located at the edge of the Tibetan Plateau, Ladakh receives an annual rainfall of only 140 mm. Intelligent use of water is the key to civilization in Ladakh. Of the total land in Ladakh, nearly 68% lies above 5,000 m above sea level, and is quite unsuitable for vegetation and human life. The Ladakhis have developed an effective irrigation system. During the day, guiding channels are used to divert water from the streams. In the evening, it is taken to a small tank called *zing*. The following day, this stored glacier water is then used in the fields. A large network of canals and *zings* exist in each village. At the start of each agricultural season, the villagers elect a water official known as *churpan* whose task is to ensure equity in the distribution of this scarce resource. The *churpan* does this by making sure that each farmer gets adequate water in proportion to the area of the land he owns. The water official (*Churpan*) also ensures that no field is left unirrigated. As a result, disputes over water are rare. Repairing of the canals is also a community effort. Almost the entire irrigated area in the district is based on the traditional system of canals, which are constructed and repaired by the community.

Recently, the Desert Development Programme (DDP) has undertaken the maintenance and repair of traditional canals and also some minor irrigation works. However, the focus of DDP's work is on the two medium sized canals, the Kharbathang canal in Kargil district and the Igo-Phey canal in Ladakh (Agarwal and Narain 1997).

The Apatanis of Arunachal Pradesh (Eastern Himalaya)

The Apatanis are a community residing in the state of Arunchal Pradesh in the eastern Himalaya. They have a unique system of agriculture and subsequently an interesting system to irrigate their fields. These people harvest stream water from the surrounding hills for wet rice cultivation cum pisciculture. Most of their agricultural land is irrigated. About 10 % of the agricultural land consists of rainfed millet cultivation and home gardens. Wet cultivation of rice takes place in irrigated valleys and on slightly terraced land around the valley. Dry cultivation of millets is done on rolling, dry hilltops. The Apatanis tap the several small streams and springs found in the hills by making temporary walls, which act as barriers and subsequently divert the water towards the terraced slopes and valley lands. Traditionally these walls were made of stones and wooden logs. Groundwater that oozes is also collected in small ponds and channelised towards the valley and slope lands. Wet rice cultivation is a cooperative effort of many farmers. The village chief is responsible for the overall supervision and also raises funds for the maintenance of this system. Each beneficiary is expected to devote a few days for cleaning and repairing the channel (Agarwal and Narain 1997).

Reviving Traditional Systems

In the past few years there have been efforts by organizations to document and help revive many such traditional systems of water conservation and management. The Centre for Science and Environment (CSE) has compiled such practices from all over the country (Agarwal and Narain 1997). Specifically in the Himal region, The People's Science Institute based in Deharadun has carried out an extensive study on the water management system in the Garhwal Himalaya of the state of Uttaranchal (Kumar et al 1991). Winrock International India, an organization based in Delhi documented four irrigation systems in the district of Leh in collaboration with a local NGO (Tiwari et al 2002). Among the projects supported by the UNDP GEF/CCF Small Grants programme-India, one supports the revival of the *Pani Panchayat* system (Water Councils) in the area surrounding the Tendong Nature Reserve in the state of Sikkim (CEE 2004).

Section 4. ECONOMICS & FINANCE

Discourse

The concept of payment for environmental services has been gaining ground in the recent years. The role of forests in providing these services has been particularly recognized. Watershed protection services have received comparatively less attention. However, there is a growing realization that hydrological functions of land use are of importance and that improved access to clean water and reduced vulnerability to disasters

such as floods, landslides and water pollution etc can actually improve livelihoods of local communities.

A report by Bishop (1999) looks at the nature of non-market values and the need for valuation, as well as the different techniques used to estimate non-market forest benefits. It considers the use of valuation results in cost-benefit analysis and in forest policy and management. The report includes an extensive review of recent empirical studies of the economics of forestland use options in the developing world.

Water markets in the rural sector, primarily for agriculture, are widely prevalent and well established in many parts of the country. It is estimated that at the national level, the area irrigated through water markets, in the form of lift irrigation schemes, is around 50% of the total gross irrigated area (Shah 1989). At the national level, there are approximately 5-7 million rural families who own wells and play the role of water sellers, while there are over 15-25 million who are water buyers. The value of water is rapidly being realized even in urban areas. Many studies have indicated that the urban and rural (rich and poor) communities are willing to pay more for water for better and reliable services. However, the government has rarely taken this into account (Sengupta et al 2003).

In case of watersheds, many studies have shown that watershed and forest protection has been much more effective where communities had an incentive to protect the area and where beneficiaries themselves contributed to the project costs. But, in the wider context, for people living upstream and downstream, the concept of receiving and making payment for environmental services is still new.

It is only recently that the idea of beneficiaries contributing to the costs of watershed protection has entered the policy arena. Here again, beneficiaries are defined in a very constricted sense and are seen as communities living on-site, rather than the larger beneficiary community located downstream. Some larger beneficiaries do make compulsory payments for protection of the upstream catchments, but rarely do these payments ever go towards actually improving the livelihoods of poor upstream communities (Sengupta et al 2003).

Governance

With regard payment for watershed protection, the new Watershed Guidelines direct local communities to mandatory contributions towards the cost of watershed treatment activities. This was quite a change from the previous programmes where watershed activities were funded through government schemes. But these payments were made by local on-site beneficiaries, and not by distant beneficiaries from the programme. As per the guidelines communities are to compulsorily contribute at the rate of a minimum of 10% from direct beneficiaries (5% for poorer sections) for work on individual land and 5% from village community/users for work on community land (Sengupta et al 2003). The proceeds from these contributions are put into a Watershed Development Fund

(WDF). This fund is to be used for the future maintenance of the watershed once the project is over. The government contributes an equal amount as the funds collected into the WDF. The guidelines also recommend that user fees be charged for the use of assets that are generated from the watershed projects. These are: as water for irrigation, fuel wood, fodder etc. (dolr.nic.in/HariyaliGuidelines.htm). However, there has been very little implementation of this in the field.

The National Water Policies of 1987 and 2002 issued by the Ministry of Water Resources both acknowledge that fact that forests play an important role in providing protection services to watersheds. Interestingly, the National Water Policy of 2002, for the first time affirms the 'polluter pays' principle to manage polluted waters. The policy also encourages the participation of the private sector in the planning, development and management of water resources. The policy is an attempt to bring in elements of user-contributions/payments to a very 'subsidy driven' approach.

In the recently concluded National Biodiversity Strategy Action Plan (Ministry of Environment and Forests and Kalpavriksh 2004 unpublished), one suggested strategy is, "To conduct research to assess the precise nature and quantum of ecosystem services provided by different kinds of natural ecosystems and elements of biodiversity, including micro-organisms. For this, use available methods and develop new methods. In particular, focus on the **hydrological** benefits, stressing on the contribution of such ecosystems to the water security of downstream settlements including villages and cities, and the nation as a whole". The plan also urges that agreements be forged amongst states (and regions within states) to pay appropriate compensation to each other for ecosystem services and for ecological damage caused. Many Himalayan states in their plans have requested that a mechanism to do this be thought of.

Practice

Perhaps the most recent and most relevant exercise conducted has been that within the formulation of the National Biodiversity Strategy Action Plan. Of the 74 different plans formulated under this, was one for the Western Himalayan ecoregion. The group formulating this plan, realizing the tremendous environmental services the Western Himalaya provide to the rest of the country, carried out an in-depth study of this aspect for this ecoregion. The following is what the group highlighted:

Box.4.

Ecosystem Service from Western Himalaya

Mountains are regarded as the water towers of the world. The extraordinarily massive Himalayan Mountains have shaped the climate of the Indian subcontinent apart from providing water and soil to the Gangetic plains. Among the contribution of Himalaya are the monsoon pattern of rain, high round the year humidity, mild winters and slow lapse rate of temperature with increasing altitude. These influences are reflected in high biodiversity, forest cover up to considerable altitude, dominance of evergreen forest, rapid soil formation, and agriculture round the year.

The ecosystem services of the Western Himalayan forests to the people in the Gangetic plains are listed as following:
-Rapid soil formation, particularly in oak forests, thus nursing crop-fields both in hills and plains by providing soil and nutrients.
-Controlling erosion and flood peaks in plains.
-Maintaining water flow in rivers, which contributes to pollution control and help maintain aquatic diversity and soil water storage.
-Maintaining native crop diversity through human efforts, thus allowing evolution to take place (global importance).
-Organically produced food (through human efforts, utilising forest services).
-Carbon sequestration and climate stabilization (global importance).
-Stabilization of climate (regional and global importance)

Forest services of local use are:

-Formation of fertile soil utilized in crop-fields.
-Retention of water as spring water, which is the only water source in most areas.
-Water filtration that serves to keep the spring and lake water clean.
-Organically produced food.
-Restoration of landslide sites through the process of succession in which N_2 fixer woody species like alder (*Alnus nepalensis*) and *Coriaria* (a bush) play important facilitating role. In fact, succession is a composite ecosystem service package, generating soil, nutrients and control over all destabilizing physical forces of nature.
Much of them are due to oak forests, which are not valued commercially. There is a need to value these services in policy decisions.

(Source: Western Himalya Ecoregional Working Group Report.2003)

The group urged that the biodiversity and ecosystem services of this region be recognized and incorporated into the national accounting to enable the people to conserve natural forests and other ecosystems. To this effect a Memorandum has been submitted to the XII Finance Commission of India (Singh 2004).

There are several important on-going initiatives in Himachal Pradesh to value and/or capture forest values. There is the Central Statistical Office project to develop a system of green national income accounting. This is led by the Indian Institute of Forest Management. There is also a World Bank study of institutional management of watershed externalities (URS Corporation Limited 2003).

In the year 2000 the Himachal Pradesh Forest Department sponsored a study, which was funded by DFID and undertaken by Indian Institute of Forest Management. This study estimated the gross economic value of forests in Himachal Pradesh to be a sum of Indian US$ 2,306 per annum. The revenue, as reported by the Himachal Pradesh Planning Board, on the other hand was only US $ 106 million per annum. The annual budget for Himachal forests is only US $ 23 million. In August 2002, the Himachal government

notified imposition of an environmental levy for compensating for the loss of environmental value on user agencies against forestlands diverted for non-forest use. This is to rectify the distortions that have crept into the forest accounting system. The one time levy has been fixed as US $ 17,000- per hectare where forest density is above 10 per cent and US $ 10,000 per hectare for other forest areas. This levy is in addition to the compensatory afforestation and cost of catchments and responsibilities for information production.
(http://www.iifm.ac.in/sfmindia/pdf/FRA%20NL.PDF)

The Table below provides a snapshot view of current payment mechanisms in Himachal Pradesh.

Payment type	**Nature of payment**	**Reason for payment**	**Amount of payment**
Compensatory Afforestation	One time payment as per FCA 1980 for all projects diverting forest land	To compensate for diversion of forest land to an alternative use	Cost of plantation on equal area if within forest area, or double the forest area, if outside the forest area
Catchment Area Treatment (CAT)	One time payment as per EPA 1986 for all hydel power projects	To protect the catchment area of the dam	10% of project cost for private sector projects, 1-5% for other projects
Environmental Value Tax	One time payment for all projects diverting forest land	To generate revenue for forest protection	US$ 17,450 / ha where forest density is >10% and US$ 10,905/ ha for other forest areas
Royalty	Mandatory for all non-state projects	Partly for CAT	12.5% of power generated
Water cess	Mandatory for 29 industries under Water Cess Act, 1977	Partly for CAT	US$0.000865/ kl

(TERI. 2004. Draft Forest Resource Valuation and Policy in Himachal Pradesh: Synthesis paper based on workgroup meeting on 12 May 2004 and literature

Winrock International India undertook a scoping exercise on, 'Developing Markets for Watershed Protection Services and Improved Livelihoods in India'. This was part of a larger international study being carried out by the International Institute for Environment and Development (IIED), London in several parts of the world. The two states of Himachal Pradesh and Madhya Pradesh were the focus of this study. The primary focus of this study was to look at the potential and desirability of using market-based approaches to provide watershed protection services in these two states. This was with

the view of making benefit-sharing more equitable and improving livelihoods. The study intended to explore the potential and limits of a market-based approach in the context of their approaches and to identify areas where such an approach could be applied, particularly to benefit the poor (Sengupta et al 2003).

A number of organisations including the National Environmental Engineering Research Institute (NEERI), Center for Interdisciplinary Studies of Mountain and Hill Environments (CISMHE), Institute of Economic Growth (IEG), Tata Energy Research Institute (TERI), Centre for Atmospheric Sciences, Indian Institute of Public Administration (IIPA), Kalpavriksh, Operations Research Group (ORG) and WWF-India carried out a study of the value of natural resources in the Yamuna River Basin. The study was based on a combination of randomly sampled field studies, primary and secondary literature sources and the analysis of remotely sensed data. CISMHE has also carried out a study on the loss of carbon sequestration from destruction of forest areas of the National Capital Region of Delhi since the 1940s. This has helped to ascertain the value of a terrestrial ecosystem in the event of its loss (NAP) (Ministry of Environment and Forests and Kalpavriksh 2004).

Towards Institutionalizing Payment to Environmental Services

The Traditional *Kuhl* System in Himachal Pradesh

The traditional community irrigation system of Kuhls is over 150 years old. This consists of earthen or cemented channels running along a drainage line. This is used to channelise water from upstream to downstream. This is an intricate system worked out over centuries where upstream-down stream rules, rights and responsibilities have been worked out and negotiated. There is a well-established system in place that determines how much water is to be released, when to villages downstream. The system also determines how much free labor has to be provided by different downstream villages for the maintenance of the *Kuhls* upstream. This is a good model of how upstream and downstream transactions are negotiated by a community-managed system. This model can be extended to negotiating other watershed service transactions.
(IIED, Winrock International India: A Policy Brief)

Section 5. RESOURCE SITUATION

Adaptation to Climate Change

The effect of climate change is and continues to be serious, especially in the Himalayan region. Looking particularly at the effect on water resources, climate change and variability are likely to further limit water availability. The combined effect of lower rainfall and more evaporation as a result of a changed climatic regime would have dire consequences. The availability of freshwater in the watersheds would substantially

change due to less run off. There will also be a dramatic impact on the soil moisture and aridity level of hydrological zones due to potential changes in temperature and precipitation. Water available for usage will further decrease with changes in the flows, annual runoff, and ground water recharge.

Scenarios developed from Hadley Centre Model Simulations to assess the implications of climate change for hydrological regimes and water resources indicate that by the year 2050, the average annual runoff in the river Brahmaputra will decline by 14 %. Studies show that the impact of snow melting in the high Himalayas will lead to flood disasters in Himalayan catchments. The Western Himalaya will be impacted more as the contribution of snow to the runoff of major rivers on the western side is about 60 % compared to 10 % on the eastern side
IPCC. 2001.

The glaciers in the Himal region provide a repository of renewable fresh water benefiting thousands of people in this region. These glaciers are however are retreating as a result of global warming. This in turn results in rapid accumulation of water forming lakes. The sudden breaching of unstable dams discharges of huge amounts of water and debris from lakes are known as Glacial Lake Outburst Floods (GLOFs). GLOFs often have catastrophic effects. ICIMOD with support from the United Nations Environment Programme (UNEP) is working on the GLOF phenomenon in Nepal and Bhutan. The project aims at developing the capacity of national institutions to assess and monitor the GLOF phenomenon. Unfortunately, very little work on this has been done in India. Views of scientists on this aspect are discussed in the following paragraphs.

"Glaciers in the Himalaya are receding faster than in any other part of the world and, if the present rate continues, the likelihood of them disappearing by the year 2035 is very high," says the International Commission for Snow and Ice (ICSI) in its recent study on Asian glaciers. "But if the Earth keeps getting warmer at the current rate, it might happen much sooner" says Syed Iqbal Hasnain of the School of Environmental Sciences, Jawaharlal Nehru University, New Delhi. Hasnain is also the chairperson of the Working Group on Himalayan Glaciology (WGHG), constituted in 1995 by the ICSI.

With the end of the Little Ice Age (1430 to 1850), glaciers have been retreating with the rise in atmospheric temperatures. "In the last 100 years alone, the global mean temperature has increased by about 0.5 to 1°C and the rapid receding of glaciers, to a major extent, is a consequence of global warming," says Jagdish Bahadur, a leading glaciologist and former joint advisor at the Department of Science and Technology, New Delhi. "But, in the long run, the melting of glaciers also means the drying up of rivers," says Hasnain. "Most of the rivers in northern India originate from glaciers. About 70 to 80 per cent of the water in these rivers comes from snow and glacial melts, and the rest from monsoonal rains."

"With only the summer precipitation to depend on, the glaciers in the eastern and central Himalaya have the dual problem of receding snowline and decreased precipitation due to global warming," says Hasnain. "Besides, accumulation and melting of snow takes place

at the same time in these glaciers." Hasnain has another dimension to add, "The recession is also the highest in the central and eastern Himalayan glaciers because, compared to the rest of the world, the population density near these glaciers is very high." Most of the people living in this area are economically backward and the consequent deforestation has adversely affected the glaciers, adds Bahadur. The WGHG, submitted its final report to ICSI in July 1999. "Ironically, we have very little information on India because, apart from the possible causes of recession, we do not have many weather monitoring stations near glaciers to collect information and create a database," says Hasnain. "The glaciers in Nepal are better monitored. Our government is totally blind to the urgency of the problem. Just one glacier monitoring station has been set up and that stopped functioning within two months," he says.
Hhttp://www.mountain-portal.co.uk/text/himalglacierx.htmlimalayan

"Glaciers are studied by the government only for defence purposes. The results of such studies are kept confidential" says Sarfaraz Ahmed, a glaciologist with JNU's Glacier Research group. Many feel that the government has been pretty lax towards assessing the impact of recession. (Gupta 2002). Climate change remains a low priority issue for the Indian government. There is lack of domestic debate on climate change and India is left to respond to agendas of climate change of politicians and foreign interests (Jayan 2003).

What the Indian Government could do is: i) Develop a systematic and continuous monitoring system for monitoring mountain environments ii) Raise awareness and provide early warning information with respect to changes in mountain environments and their consequences (Iyngararasan et al 2002).

The United Nations Framework Convention on Climate Change (UNFCCC) came into being in 1992 primarily to address issues of rapid climate change. India signed this multilateral treaty on June 10,1992.

The Ministry of Environment and Forests has constituted a 'Working Group on the FCCC' to deliberate upon measures and positions that should be taken regarding the various issues emerging out of the climate change negotiations. A separate group on the Kyoto mechanisms has also been constituted. India acceded to the Kyoto Protocol on 26 August 2002

The Government of India has currently undertaken the task of preparing its first national communication to the UNFCCC. The project which has come to be known, as NATCOM will provide a comprehensive estimation of emissions of greenhouse gases from five major sectors in the country: Energy, Industrial Processes, Agriculture, Land use, land use change and forestry and Waste (www.natcomindia.org). Besides this, activities under the project would also include uncertainty reduction in GHG estimations, vulnerability assessments and adaptation strategies, setting up of a data centre, and targeted research and capacity building initiatives. The Ministry of Environment and Forests (MoEF) is the project's implementing and executing agency and has allotted different components of the project to different national institutions. eighth Conference of Parties to the UNFCCC (COP-8) Preliminary findings of this report indicate that dramatic increases of minimum

temperatures by 4 degrees Celsius across the country will result in the drying of key river basins by 2024. The report admits that at present India has no policy related to adaptation and mitigation and urges that this be given priority (Down to Earth 2004).

India has often been in the lead of G77 demands that an international agreement on climate change should differentiate between the industrialized North and the developing South. India's delegations have had a crucial part in the insertion of statements in the UNFCCC that the largest share of historical and current emissions originates in developed countries and that the emissions of developing countries will have to grow, while those of developed countries will have to be reduced

Four striking features prevail from the investigation of policy-making on climate change in India. First, that domestic experts and activists have had a significant influence in shaping the contours of the national position. Second, that energy concerns remain the main driving force. Third, that the Indian government has been reactive rather than proactive in its policy-making. Fourth, that the Indian research agenda on climate change appears considerably directed by foreign rather than domestic priorities (Jacobson 1998).

There is no specific policy, which addresses the water agenda within climate change in terms of water management adaptations to deal with the phenomenon.

Despite the relative apathy on climate change, there are some initiatives in the country.

The MoEF supports a number of programmes and projects at the regional and the national level, which would have a mitigating impact on GHG emissions. These include the ALGAS project. Table 1 lists potential mitigation options that have been identified for various sectors in India, along with their costs. GEF (Global Environment Facility) acts as the interim financing mechanism of the FCCC and helps fund the additional or incremental cost of efforts to address global environmental objectives, which are beyond those required for national sustainable development.

One relevant GEF project is the one on, "Optimizing Development of Small Hydel Resources in Hilly Areas". The project will facilitate the Government of India in the optimum utilization of small hydel resources in the Himalayan and sub-Himalyan regions. 20 demonstration projects will be set up. The project is aimed towards potentially reducing deforestation and also reducing GHG gas emissions.
India acceded to the Kyoto Protocol on 26 August 2002.

WWF-India has also recently embarked on initiating a process for assessing the impact of Climate Change in India on its ecosystems as also looking at the country's mitigation policies. A series of meetings and workshops were held in the year 2003 to better understand key climate impacts in India. A publication (Dash and Rao 2003) is a compilation of various stakeholder views.

WWF-India has also prepared a project proposal for the "Assessment of Impacts of Climate Change on Himalayan Glaciers and Fresh Water System". The overall goal of

the project is to validate existing scientific research on the relation between climate change, glacial retreat and changes in the freshwater regime in the region; and based on this develop climate change scenarios for selected river basins. The project will focus on three sites representing the Himal region: Uttarkashi District, Uttaranchal; Lahaul-Spiti District, H.P and the Sikkim Himalaya. (WWF-India-Concept Note).

UNDP, New Delhi is developing a project proposal to demonstrate the application of an integrated climate risk management (ICRM) approach in specific locations that face climate related risks on a range of temporal and spatial scales. Pilot projects will be started in selected locations representing a range of typologies – drought prone areas, coastal environments, small island developing states, mountainous environment – to pilot the application of ICRM approach. These projects will be chosen also on the basis of their current development context, and opportunities for convergence of other disaster risk management and environmental issues (UNDP 2003).

There are also documented experiences of 'on-the –ground' adaptations to climate change.

The Centre for Science and Environment (CSE) in India in 1999 prepared a paper on Policies, Programmes and Institutions on Water Harvesting in the Himalayan region of India for ICIMOD, Nepal. (Agarwal et al 2001).

Ladakh's Unique Water Harvesting System

Ladakh is a high altitude cold desert. The approximate annual rainfall here is 50 millimeters between May and July. It is essentially the waters from melted snow, which provide sustenance for the inhabitants. With the melting of snows in April, commences the agricultural season. However, if there is a delay in the melting, there is no water for irrigation, thus delaying the sowing season. There is a traditional water storage system but this does not solve the problem of water for the timely sowing. For centuries farmers have attempted to create 'artificial glaciers' or ice blocks by diverting water from streams located at the base of mountains. These blocks would melt earlier than the water from the glaciers and provide water for irrigation at the appropriate time. The Department of Rural Development in Ladakh has taken this idea forward and created 'artifical glaciers' with better technology and these have proved to be successful and cost effective. (Norphel 2001 and Athawale 2003).

Perceptions and Responses to Droughts and Floods

Floods and droughts in India are neither a paradox nor an irony. The topography of the land and the pattern of rainfall are such that they result in the incidence of floods in some places and droughts in other areas, and sometimes they can occur (in different areas of course) at the same time. These are merely facts of geography. Area-specific ways of

coping with these features of nature have to be made. This is the big challenge (Iyer 2004).

It is increasingly recognized that what must be done is not so much to `control' floods as to cope with them when they occur and minimize damage, partly through `flood-plain zoning' (i.e., regulation of settlement and activity in the natural flood plains of rivers) and partly through `disaster-preparedness'. However, the notion of `flood control' continues to hold some sway over people's minds (Iyer 2004).

The Himalaya is the youngest mountain range in the world and also the most erosion-prone. The rainstorms that lash out at these mountain ranges, along with some of the world's worst earthquakes, make this mountain range extremely vulnerable to natural disasters and floods. Some of the most flood-affected valleys are the Alaknanda and the Bhagirathi valleys of the Garhwal Himalaya and the Teesta valley in the eastern Himalaya (CSE 1991).

The hydrology of the Himalayan slopes is relatively unknown. One study shows that less than one-fiftieth of rainfall in the lesser Himalaya gets converted into surface flows. What contributes significantly to Himalayan streams are sub-surface flows. However, these also make the area prone to landslides. Landslides are responsible for more soil loss in the Himalaya as compared to surface erosion. Deforestation is often stated as the cause for landslides but that is only true for shallow landslides and not for the deep ones. In fact, it is felt that natural erosion processes in the Himalaya are so intense that the changes caused by deforestation seem insignificant in their place (CSE 1991).

However, studies on individual watersheds in the Himalayan region indicate that land cover changes and deforestation do result in high and low flows. Mitigation of catastrophic floods is best done through on going monitoring of glaciers and slope failures throughout the Himalayan range utilising ground water inventories and remote sensing (Gardner and Singh 2003).

In 1975, then Ministry Energy and Irrigation's Committee on Floods and Flood Relief recommended that a draft bill be prepared which focussed on rigorous mapping and zoning of flood plains for regulating growth of settlements. In 1976, a *Rashtriya Barh Ayog* (National Flood Commission) was set up. This Commission seconded this proposal. The draft/model bill addressed the preparation of flood control schemes, land use regulations, prohibition of obstructions to rivers and drains and disaster preparedness. Manipur was the only state that adopted this bill. To date, there is there is no real move to adopt recommendations of the *Rashtriya Barh Ayog*. The recommendations included watershed management, flood forecasting and regulation of settlements (CSE 1991).

An interesting initiative is the Adaptive Strategies Project, a collaboration between local grassroots organisations, non governmental organisations, academic institutions and international organisations working across South Asia. The project has attempted to develop an understanding of the impacts of floods, droughts and long–term water problems have on livelihoods of people living in this region. The study has focussed on

flood-affected areas of Nepal, Uttar Pradesh and Bihar. The project also attempts to improve understanding of the incentives offered to people in the region, the opportunities they perceive, and the constraints they face while they respond to the immediate impacts of floods and droughts as well as the long term water-related problems such as depletion of groundwater (Moench and Dixit 2004).

Inter-linking of Rivers

The Supreme Court of India, in response to a public interest writ petition, in 2003 urged the then government that the project for linking of rivers of India be accelerated and implemented by 2016. A Task Force was subsequently set up to consider the modalities of the project. The idea of linking rivers, which had been dormant for a long time, acquired new prominence. It was presented by the government as a major initiative towards meeting the future water problems of the country. The project is estimated to cost approximately, US $ 112 Billion and envisages 30 links across Himalayan and peninsular rivers. Interlinking is based on the fact if the enormous amount of water that flows from the seas is transferred to water deficit areas, this will meet the water needs of the entire country. There are supporters to this concept but also people who raised a lot of questions. There is the issue of resources. The estimated cost is about 50 times the total allocation for the ongoing water resource development projects in the Tenth Plan. The project has huge environmental and human costs, which have to be addressed. There is also the question of political feasibility with concurrence from all state governments (). At a larger level, the neighboring country of Bangladesh has expressed concern about this project and the impact it will have (Saha 2004) on its ecosystems.

The project has since come under a lot of criticism. It has been extensively written about (Samya 2003; Iyer 2003; Gujja and Shaik; Pahuja 2003; D'Souza 2003; Pelkey 2003; Sharma 2003; Alam 2003).

There have been several meetings to dialogue this issue (ENVIS 2004). Several websites and egroups are facilitating virtual dialogues on the subject. Very recently a National Civil Society Committee on Interlinking of Rivers has been set up. This Committee hopes to generate more public debate on the issue, facilitate the exchange of ideas between civil society and the government, collate available information, and finally attempt to use the knowledge to build an appropriate policy framework. The Committee consists of thirteen members who are all in their own right deeply involved in issues related to water and policy (NCSC on Interlinking of Rivers in India 2004).

With the change of government at the center, however there is a chance that this project will be reviewed (Sharma and Awasthi 2004). The government is considering winding up of the Task Force as it continues to review the feasibility of this project (Parsai 2004). Ironically, the President of India in his speech to the parliament said, "The Government will accelerate the development and use of the country's irrigation potential. Starting with peninsular rivers, the environmental, ecological and techno-economic feasibility of linking the rivers of the country will be carefully examined."[Hindi]

Large Dams in India

India has over centuries had a wide variety of water conservation and harvesting structures and systems. The British rule ushered in the era of large dams and this trend continued even post-independence where as quoted by the then Prime Minister large infrastructure projects such as large dams were to be considered, "temples of modern India'.

The International Commission on Dams states that India has four thousand 'large dams'. Roughly half of these came up between the years 1970 to 1989. These dams were built primarily because there was wide variability in the availability of water in the country. These structures provided the possibility of storing water from rivers in reservoirs. They also had the option of transferring water during periods of scarcity. There was also the thought these would moderate floods. Lastly, large dams also provided hydropower (Iyer 2003).

It is said that the large dams in the country have contributed to increasing food grain from 51 million tones in 1950-51 to almost 200 million tones by 1996-97. However, it debatable as to how much can really be attributed exclusively to dams. About two-thirds of the installed hydropower can be attributed to dams. Dams have not really contributed much to flood control but have contributed to water for domestic, municipal and industrial uses (Iyer 2003). The Water Resources Sector Strategy of the World Bank (2004) states that, "In the Himalayan region only a tiny portion of the vast hydroelectric potential has been tapped".

However in the past two decades along with a growing awareness about the negative social, environmental economic impacts has come disenchantment. The India Country Study (commissioned by the World Commission on Dams) which looked at the impacts from large dams was rejected by the Government of India (Central Water Commission) and the Ministry of Water Resources along with the larger WCD report. The findings from the study indicated that the social and environmental impacts from large dams were poorly understood in the Indian context. Financial and economic calculations were ignored and prevention and mitigation of adverse impacts by and large neglected (Singh and Banerji 2002). There is a move to address these issues but the large anti-dam movement is also growing. The Silent Valley project in Kerala and the Rathong Chu in Sikkim were abandoned but the Narmada (Saradar Sarovar) in Gujarat and the Tehri Dam in the Himalayan region heralded by strong anti-dam movements, have still lost the battle to dam builders (Bandopadhyay et al 2002).

The Tehri Dam, Garhwal Himalaya

The movement against the Tehri dam states that:

"*The dam is being built in a highly earthquake-prone zone, which the International Commission of Large Dams has declared to be one of the most hazardous sites. The dam's design is technically outdated since it was conceived in the 1940s and designed in the 50s and 60s when the available seismic information was limited. The Himalaya are a very young and fragile mountain range. Scientists have expressed doubts about the Himalayan mountainside's ability to hold such a mammoth structure -- believed to be the fifth highest dam with a water reservoir that is 260 meters deep and spread over an area of 45 sq. km.

*The building of this dam will kill Ganga, the most sacred river of India.

*The Tehri dam planners have made no provision to provide water and electricity to surrounding Himalayan villages, who need them most to meet their daily needs. All of the electricity generated is meant for Delhi and cities of western UP.

*The claimed irrigation potential (270,000 hectares) as well as the expected electricity-producing capacity (350 MW) of the dam is too small to make it economically viable.
Due to Ganga's heavy siltation rate, the life span of the dam is expected to be no more than 30-40 years against the claimed 100 years.

*There are serious allegations of corruption resulting in the use of substandard materials, making the dam even more unsafe.

*The resettlement package offered is not only ridiculously inadequate but being carried out in the most ham-handed fashion, allowing large scale corruption and misuse of funds."
Extracted from:
http://free.freespeech.org/manushi/94/tehri_updt.html

The North-East India is now being presented as 'India's future powerhouse'. A ranking study carried out by the Department of the North Eastern Region (DONER), states that there are 168 schemes in the region with a hydroelectric potential of 63.328 MW and 149 of these were highly viable (Menon et al 2003). Agencies such as the National Hydro Power Corporation (NHPC), North Eastern Power Corporation (NEEPCO), the Brahmaputra Board and State Electricity Boards will develop these projects. Ironically, a majority of the power will go to other parts of the country. However, many groups from the region have raised questions of the openness of the process of planning; the need for a comprehensive options, assessment for water and energy resources; whether the social and environmental factors have been studies adequately; have the relevance of these rivers and people's dependence of the same been looked at? Two regional consultations on 'Dams and Development' have been held in the region. The Ecologist Asia also brought out a special issue entitled, " Large Dams in Northeast India: Rivers, Forests, People and Power" (Menon et al 2003). This issue of the magazine looks at some depth into issues relating to large dams in the region.

The question still remains whether local rainwater harvesting and watershed development schemes will remain secondary to large projects or whether they need to be given the appropriate and policy impetus to be considered more in the forefront of water conservation and management issues.

Environment Impact Assessment

The Environment Impact Assessment (EIA) Notification of 1994 issued under Environment Protection Act 1986 makes it mandatory for large hydel projects to get an assessment done before any project is sanctioned. Both the Central Water Commission and the MoEF have laid down guidelines on scope, coverage and methodologies. A clearance by the Environmental Appraisal Committee under the MoEF is a pre-requisite for final investment approval for all big projects. However, the quality of these EIA reports, which form the basis of environmental decision-making most often, is quite questionable. There remain a number of inadequacies in the notification, and in its implementation. **Box. 5**. illustrates some of these as complied in the recently concluded National Biodiversity Strategy Action Plan (MoEF unpublished).

BOX.5.

Inadequacies in the EIA Notification

-Absence of several kinds and sizes of development/industrial projects and activities from the list of projects requiring EIAs;

-Lack of impact assessment of the combined or cumulative effects of projects, as every project is assessed independently;

-Lack of impact assessment of policies and sector-wise programmes (as distinct from EIAs of individual projects);

-Weak integration of biodiversity (especially 'lesser' species and agro-biodiversity) and of long-term and indirect impacts into the guidelines and EIA reports;

-Inadequate or no exploration of alternatives to the proposed project;

-Absence of participation of affected people in the EIA process;

-Inadequacies in the public hearing process including the lack of any guarantee that affected people will have a say in them and that the results of the hearing will influence the decision on the project;

-Lack of expertise and human power amongst concerned authorities;

-Frequently biased, incomplete or unsubstantiated EIA reports;

-Lack of integration of decentralized decision-making and local self-governance principles into the process.
Source: Ministry of Environment and Forests (MoEF) and Kalpavriksh. National Biodiversity Strategy Action Plan. Final Technical Report of the UNDP-GEF Sponsored Project, MoEF, GOI, New Delhi. unpublished.

Trans Boundary Water Conflicts

In the context of large projects arise inter and intra country water conflicts. The Farraka Barrage projects were instrumental in the India-Bangladesh dispute over the Ganaga waters. The projects on the Kosi and Gandak rivers and further the Tankapur Barrage Project have resulted in a prolonged history of misunderstanding and mistrust between India and Nepal. The Mahakali Treaty of 1996 did help resolve some of the disputes, but there are still some pending issues relating to the Pancheshwar Project. Despite the fact that planning needs to be done from a hydrological perspective, taking into consideration the hydrological unit of the basin or sub-basin, political boundaries cannot be ignored and the reality remains that it is the political boundaries that will continue to prevail in planning. More mechanisms that address the issue of trans boundary river basins need to be thought of (Iyer 2003).

Groundwater

The National Commission for Integrated Water Resources Development Plan puts the national groundwater resources at 432 billion cubic meters (BCM), and the utilization component at 396 BCM. It is estimated that approximately 50 per cent of irrigated agriculture is dependent on groundwater, and 85 per cent of rural drinking water is derived from ground water (Iyer 2003).

Groundwater irrigates nearly 40 million hectares net. However, this burgeoning groundwater irrigation economy is destined to collapse if tube wells continue to grow at 0.8-1 million/year as they have since 1990. There is already cause for alarm as water levels fall and there is evidence of arsenic in the eastern Ganga basin (Shah 2004). Water markets have tended to emerge particularly in the context of groundwater extraction through tubewells and borewells. Though serving a useful purpose, there are dangers of unsustainable extraction as also of inequitable relationships between sellers and buyers (Iyer 2003).

In relation to groundwater, `governance' seems non-existent. By law, the water under a piece of land belongs to the owner of that land. The 'owner' (which could include businesses and corporate entities) can exploit it at will. This could lead to inequity between the seller and the buyer of water, the depletion or contamination of the aquifer, and the drying up of wells and other water-sources in nearby areas.

There does exist a Central Groundwater Authority, which was set up by the Ministry of Environment and Forests (MoEF) under the Environment (Protection) Act, 1986. This

has yet to be effective and operational. Despite some attempts at legislation at the State level, there is no real regulation of groundwater use.

There are ideas on how governance of groundwater should be handled. One suggestion is that the existing legal position of ownership of the resource with the landowner should change and the state could hold the resource in trust for use by present and future generations. However, there are apprehensions as to how the word 'Trust' is interpreted and also the fear that the dominant role of the state might not be advisable. Another possibility is to treat groundwater as a common entity and placed under community management. This seems to be the most viable. But the mechanisms to do so would need to be worked out (Iyer 2003).

The water resources potential of the North-Eastern Himalaya is the largest in the entire country. It has abundant groundwater resources due to its heavy rainfall. However, only a small part of the region has been studied to estimate the groundwater potential. Although it is known that the maximum scope for development of groundwater exists in Assam, Tripura and Arunachal Pradesh. Ironically, the available surface water resources have hardly been tapped because of the rugged nature of the terrain. Agriculture in the region still remains largely rainfed and *jhum* cultivation (shifting cultivation) is widely practiced.

Despite this there are documented instances of some indigenous rainwater harvesting systems used for agriculture. In some parts of Nagaland and Meghalaya, settled agriculture is practised in the form of irrigated terrace cultivation. The fields are irrigated through dug channels. In other parts of Meghalaya, people use an intricate network of bamboo pipelines to deliver water to betel leaf plantations in rocky areas. No channels exist here. The system works like a modern drip irrigation one, where the appropriate amount of water is delivered directly to the roots of the plants (Agarwal et al 2001).

There are also innovative structures such as recharge tubewells, sub-surface dykes, individual well recharge, percolation ponds and check dams that are being promoted (Raju 2001).

Environmental Flows

There is very little mention of environmental flows in the water related laws and policies. Scientists such as Gosain (pers.com.) feel that, " This is a very important component of the regime of the drainage system and must be preserved. All along there has been no denial about the desirability but we have not been very firm on its implementation and have been lapsing. There are no proper guidelines yet available in this regard. We must have them as soon as possible". Iyer (pers.com) feels that people do pay lip service to the idea but he doubts whether it goes beyond that. Iyer (2004) is also of the opinion that one cannot make an allocation of water for ecology. It has to be the other way round. Ecological considerations need to be considered before water is used in various ways. Ecological imperatives must guide our water-use.

There has been some work on select Himalayan rivers to study the environmental flow. Goswami (http://www.cig.ensmp.fr/~iahs/maastricht/w4/w4601.htm) in his paper describes the Himalayan catchment and the hydrologic regime of Brahmaputra river.

Winrock International India in collaboration with the Indian Institute of Technology, Delhi and the Centre for Landuse and Water Resources Research (CLUWRR), University of New Castle Upon Tyne, UK is carrying out a project entitled, "Low Base Flows and Livelihoods in India". The project is looking at improving scientific understanding of forest-water flows interactions in an arid zone context; developing decision making tools such as GIS models and linking this improved understanding to policy with the aid of these tools and through direct interactions with institutions and policy makers. Watersheds within the states of Madhya Pradesh and Himachal Pradesh have been selected for study. Baseline information from three villages in Himachal Pradesh has already been collected (Winrock International India, pers com.).

Section 6. LOCAL EMPOWERMENT

Discourse

'Participation' could actually vary in its meaning from the full involvement of the local communities from the earliest stages of planning to the mere formality of seeking feedback on a plan, programme or project prepared entirely within the governmental machinery, with no serious intentions of making any significant changes (Iyer 2004). It is important to see where IWRM stands in this debate.

The 73rd Constitutional Amendment which empowers *Panchayati Raj* Institutions (PRIs is very significant for natural resource management also. However, this should mean that the state completely withdraws from all activities, particularly, when it is does have an important role to play. The aim really should be for the state to facilitate the empowerment of people to enable them to carry out programmes, on their own through *Panchayati Raj* Institutions. IWRM still has a long way before it reaches that stage (Shah 2001).

A problem facing watershed development in India is that of equity. Case studies have shown that most of the positive benefits from participatory watershed development projects have gone primarily to medium and large landowning farmers. Small and marginal farmers and landless have benefited far less. Benefits include increased availability of water, decreased soil erosion, higher crop yields and increased household income (Sengupta et al 2003).

Gender Issues

"More than one billion people are deprived of access to water of sufficient quantity and quality to meet even minimal levels of health, income and freedom from drudgery. Poor

women are particularly affected. It is primarily women who bear the daily burden of hauling heavy buckets long distances to meet the domestic water needs of their families. …water has never been a 'free good' for poor women. Meeting the multi-faceted water needs of poor men and women should be a priority in water policy at the international, national, basin and community levels," (Koppen, 2000 at www.cgiar.org/iwmi).

Women have generally been marginalised in watershed development projects. This is because of the focus on land development, and control of land in many parts of India, is male-focused. However, it is important for women to play a more active role particularly in watershed management because of the migration of men from hill areas. It is significant that in women do play an active role in management in the matriarchal system prevalent in lot of the North East region and the Lahual Spiti area in the Himalaya (Samra 2003).

According to a recent review of the Report of the First National Commission on Water (1999) by one of its members, women have "little voice in water-resource planning in this country" yet they are always depicted as the providers and managers of water at the household level (Iyer 2001). A recent poverty profile study in Himachal Pradesh (PRAXIS, 2000) shows that while the upper castes are able to identify closely with the *Panchayats*, this is not so with the Scheduled Castes, and among the Scheduled Caste groups the women know the least about the process. The findings showed that women feel distant from official institutions in general, including the *Panchayats*.

Kerr (2002) in his study on watersheds finds that women particularly from lower income groups were negatively impacted by watershed programmes. This was because most of these programmes resulted in restricted access to common lands where these women collected fulewood. The women indicated that it also resulted in loss of their income that they got from various other forest products they collected from these lands. There was very little effort in trying to find alternative sources of income for these women, although some programmes did try to train women in other activities.

Governance

The IXth Five Year Plan (1997-2002) re-emphasised the shift from perceiving water as a social good to be provided free by the government, to acknowledging that water is a scarce economic resource which should be provided according to the standard of service that users are willing to maintain, operate and finance. Rural users were expected to provide 10 percent of capital costs, and were fully responsible for the management through *panchayats* and/or *pani samitis*. For the first time people's participation was called for at all stages of project implementation right from the selection of technological options to implementation and maintenance (Ahmed unpublished).

The Xth Five Year Plan (2002-2007) states that, "The central and state governments need to promote Participatory Irrigation Managment (PIM) more vigorously, as currently only 15.25 per cent of the net irrigated area is partially covered. There is merit in linking the Command Area Development Programme (CADP) to PIM so that projects receiving

assistance under the former have to promote PIM in at least a part of the command area. The sustainability and success of PIM depends on mutual accountability between the Water Users' Association and the Irrigation Department, attitudinal change in the bureaucracy, autonomy for the Water Users' Association, multifunctional nature of the Water Users' assess and improve various indicators like efficiency, financial viability, environmental sustainability, productivity etc.
(http://planningcommission.nic.in/plans/planrel/fiveyr/10th/volume3/v3_ch4.pdf
http://planningcommission.nic.in/plans/planrel/fiveyr/welcome.html

The National Water Policy (2002) states that, "Management of the water resources for diverse uses should incorporate a participatory approach; by involving not only the various governmental agencies but also the users and other stakeholders, in an effective and decisive manner, in various aspects of planning, design, development and management of the water resources schemes. Necessary legal and institutional changes should be made at various levels for the purpose, duly ensuring appropriate role for women. Water Users' Associations and the local bodies such as municipalities and *gram panchayats* should particularly be involved in the operation, maintenance and management of water infrastructures / facilities at appropriate levels progressively, with a view to eventually transfer the management of such facilities to the user groups / local bodies."

http://wrmin.nic.in/policy/nwp2002.pdf

The Watershed Guidelines issued by the Government of India in 1994 state that, "special emphasis to improve the economic and social condition of the resource-poor and the disadvantaged sections of the watershed community such as the asset less and women".

However, women are often not recognized as members of the watershed community in their own right, but are there to fill the quota, which the Guidelines outlines. The Guidelines do not specify any mechanism or institutional arrangement for ensuring and sustaining the true involvement of the poor and women. (Sarin et al 2000).

The watershed guidelines of 2002 state that, " The involvement and participation of beneficiaries and other stakeholders should be encouraged right from the project planning stage itself. (Iyer 2003) feels that the terms 'stakeholder' and 'beneficiary' have been very loosely used and could have several interpretations. It is not necessary that this would ensure the participation of the disempowered including women. Also, 'participation' here is referred to in the context of 'projects'. This may have nothing to do with local community management.

In pursuance of the watershed guidelines, many State Governments have amended their Irrigation Acts or have come out with specific Acts on the Participatory Programme in Irrigation. Some of the States have gone further and have made specific provisions for women.
(http://wrmin.nic.in/publication/ar2003/ar2002-03.pdf)

Practice

A study (Chakraborty 1998) conducted in 10 villages within Chandrabhaga watershed located in Garwhal region of the western Himalaya, indicates how community management of the river system as well as the watershed has succeeded in resolving conflict and also benefited the community.

Chandrabhaga is a small stream draining into the Bhagirathi river and is the major source of water for both drinking and irrigation water in the area. Continued environmental degradation, demographic changes and breakdown of traditional social arrangements resulted in conflict in the area. There was tension between villages upstream dominated by high caste small landowners and the down stream villages inhabited by low castes. In the past, the upstream villages were dependent on labor from downstream to work on their perennial crops. In turn, the upstream villages allowed cattle grazing and collection of fodder and fuelwood from their land to the downstream working communities. However, new economic opportunities appeared with the opening of the road network. There was seasonal migration to the plains by the laboring class. The higher castes now opted for laborsaving, cash-giving apple and other fruit orchards instead of perennial crops. Thus their dependence on downstream labor was reduced. The downstream villages reacted and started grazing their cattle in upstream farms and collecting fodder and fuel. The upstream villages retaliated by blocking the entry paths of the downstream villages, wherever possible. The stream was polluted with fecal matter by people upstream and the down stream inhabitants suffered.

A local NGO called the Sri Bhuvaneshwari Mahila Ashram (SBMA) intervened at this stage and initiated a self-help project. A Chandrabhaga Coordination Committee was formed. The down stream and upstream inhabitants came to an agreement. SBMA then facilitated the realignment of irrigation channels and check-dams in such a way that water wastage were reduced and crop application efficiency improved. Additional storage tanks and irrigation channels were constructed, with material and labor contribution from the beneficiary households. Funding for this came from Central Government agency CAPART as well the German donor, GTZ.

This example acted as an impetus for the Government of Uttaranchal (then part of Uttar Pradesh) and the World Bank to launch in 1995 a watershed programme called SWAJAL for 350 villages in the Tehri district, which would advance community involvement, institutional development and introduce technological renovations in water management. SBMA is acting as the bridge between the SWAJAL and local communities.
Many other initiatives discussed in **Section 3**, also present examples of local empowerment that, foster IWRM.

Section 7. INFORMATION SYSTEMS TO SUPPORT EA IN IWRM

Discourse

It is important to understand that integrated watershed management should not merely imply the maintenance of an inventory of different activities to be undertaken within a hydrological unit. It also requires the collation of relevant information needed to evaluate the cause and effect of all the proposed actions within the watershed

(Gosain et al unpublished) feel that the implementation of the watershed management programmes in India at present has many weaknesses. Some of these are: (i) not considering the hydrological boundaries of the watersheds, (ii) treating each watershed as an individual unit and not looking at connectivity where impacts downstream are not considered (iii) not looking at the hydrological characteristics of the watershed for possible interventions, (iv) non-existent evaluation procedures, and (v) undermining the environmental sustainability aspects. These shortcomings are primarily because of non-availability of the required tools and a unified framework within which the issues can be addressed. Such a framework will entail regular maintenance and updating of accurate ground truthed data. Such a framework, once available, could be used by all the line departments and updated by the relevant departments.

The second major problem encountered in watershed management programmes is that all the information required for integrated planning and management is not readily available at the desired scale of the watershed. This is more true with respect to the quantities of water, both surface and ground. Although the information on local water availability as well as its variability in time is essential for proper planning and management, measurement of these quantities in terms of flows is not financially viable at such scales. Hydrological simulation modeling is a very effective tool, which can allow estimation of these quantities at the watershed scale. This is being used in some places.

Several papers have been written on this subject, particularly in the Himalayan context. Jagadeesha http://www.gisdevelopment.net/application/nrm/water/overview/wato0001.htm writes about the "Advantage of using remote sensing data for hydrological modelling and monitoring is its ability to generate information in spatial and temporal domain".
Rawat http://www.gisdevelopment.net/application/nrm/water/watershed/watws0014.htm has written about, "Water Resource Assessment and Management in Himalayan Catchments through Remote Sensing and GIS Technology".

Kumar and Singhal Next Ihave written about "Hydro power assessment for small ungauged catchments in Himalayan region using GIS techniques".

It is difficult to gauge the range of information systems in demand. This would be very site specific. Information systems being promoted at the national and regional level are discussed. There is no documentation specifically on the information systems to support EA in the region or in the country.

Governance

The Xth Five year Plan states that, "Organisations under the Ministry of Water Resources like the CWC, Central Water and Power Research Station (CWPRS) and the National Institute of Hydrology (NIH) have developed in-house capability to interpret satellite imageries in some of the facets of water resources planning like reservoir sedimentation and river behavior. The capability needs to be expanded to cover other areas in water resources planning like land use, irrigated area assessment, water logging and salinity, crop condition, river morphology studies using long-term data to assist states in planning of flood protection works etc."
(http://planningcommission.nic.in/plans/planrel/fiveyr/welcome.html

The National Water Policy (2002) says: "A well developed information system, for water related data in its entirety, at the national / state level, is a prime requisite for resource planning. A standardized national information system should be established with a network of data banks and data bases, integrating and strengthening the existing Central and State level agencies and improving the quality of data and the processing capabilities. Standards for coding, classification, processing of data and methods / procedures for its collection should be adopted. Advances in information technology must be introduced to create a modern information system promoting free exchange of data among various agencies. Special efforts should be made to develop and continuously upgrade technological capability to collect, process and disseminate reliable data in the desired time frame. Apart from the data regarding water availability and actual water use, the system should also include comprehensive and reliable projections of future demands of water for diverse purposes."

(http://wrmin.nic.in/policy/nwp2002.pdf)

Practice

Indian Institute of Remote Sensing

The Indian Institute of Remote Sensing (National Remote Sensing Agency), is involved in the training of scientific and technical personnel in the application of remote sensing & GIS techniques for various disciplines i.e. Urban and Regional Planning; Environment Geology & Natural Hazard Surveys; GIS applications; Eco-development; Watershed Management; Water Resources; Forestry & Ecology; Agriculture and Soils, and Geology, Geomorphology & Hydrogeology. Other activities of the Institute include: Education, Research and Consultancy in remote sensing and GIS applications in the above fields.

The National Remote Sensing Agency (NRSA), Department of Space, Government of India is the parent body for this Institute.
http://www.isro.org/iirs-training.htm

The National Natural Resources Management System

The Government of India has set-up the National Natural Resources Management System (NNRMS), which **i**s an integrated approach for management of natural resources, optimally utilizing the advantages of conventional systems and the information derived through remote sensing. The nodal department for the evolution, establishment of

NNRMS and all remote sensing related activities is the Department of Science (DOS), Government of India. DOS has also established five Regional Remote Sensing Service Centres (RRSSCs) in the country. RRSSCs facilitate the use of remote sensing technology at a reasonable cost. These centres are located at Jodhpur (Western Region), Dehradun (Northern Region), Kharagpur (Eastern Region), Nagpur (Central Region) and Bangalore (Southern Region) and function under RRSSC, Central Management Office, ISRO Headquarters, Antariksh Bhawan, Bangalore.

The Centres provide facilities for digital image analysis techniques and GIS to the users as also guide and assist users; develop and demonstrate techniques in new areas of application; train scientists in these technologies and provide support to execute national projects.
http://www.isro.org/rrssc/abtus.htm

Natural Resources Data Management System (NRDMS)
The Department of Science & Technology, Government of India has set up a Natural Resources Data Management System (NRDMS). This is a multidisciplinary programme to help developing decision support systems (DSS) for decentralized planning using GIS technology. It is targeted at district-level planners and professional staff of line departments engaged in rural development activities. The attempt, is to develop a spatial decision support system (SDSS) by drawing together the natural resources data of sectoral agencies, convert the data to a computer compatible format and establish a database for watershed planning in an integral manner. NRDMS centers are being set up in various districts in 10 Indian states.
(www.tucson.ars.ag.gov/icrw/Proceedings/Adinarayana.pdf).

The Indira Gandhi Conservation Monitoring Centre (IGCMC)
The Indira Gandhi Conservation Monitoring Centre (IGCMC was established by WWF-India in 1994 as a facility to provide information support to government and non government programmes for environmental conservation. One of the functions of IGCMC is application of remote sensing, GIS and GPS in mapping, ecological modeling, landuse/land cover mapping, landscape analysis etc. The project has developed a database for the North Bank Landscape (**See Section 2**) in Assam and Arunachal Pradesh using GIS. Complete mapping of different thematic layers has been carried out for the landscape (IGCMC-Profile).

UNDP has also sponsored project "GIS based technologies for local level development planning", implemented by the Department of Science and Technology, Government of India (Gosain et al unpublished).
The People's Science Institute, an NGO based in Dehradun, has developed digitized maps for almost all (16,000) villages of Uttaranchal (giving details on demography, land use, occupational groups etc.) based on census data from 1981-91, through GIS mapping technique (Debashish Sen pers.com).

RECOMMENDATIONS

This report is an overview of IWRM and its components in the Himal region. To locate specific sites, as also develop a strategy for the region, more intense discussions with key resource persons and institutions and field visits would be required. The following recommendations may be useful for future strategizing:

Regional Selection

Many of the Himal region states are a victim of political strife and insurgency. The most conducive states for future work may be Himachal Pradesh and the Ladakh region in the state of Jammu and Kashmir in the Western Himalaya and Sikkim in the North-East region. All three suggested areas have active NGOs and supportive state governments. A lot of significant work on water issues has already been done in these regions. Ideally it would be good to select a site each in all the three regions, which represent the Trans Himalaya (Ladakh), Western Himalaya (Himachal Pradesh) and North-East (Sikkim).

Strategy

IUCN could take different approaches in its attempt to operationalize IWRM at select sites. It could work with existing institutions in the area or it could support one or more NGOs to implement the programme. There are instances of both. For example, ICIMOD/SDC/IDRC support the G.B.Pant Institute for Himalayan Environment and Development to implement the PARDYP project in the state of Uttaranchal. The Indo-German Changar Eco-Development Project (IGCEDP) in Himachal Pradesh is being implemented jointly by Himachal Pradesh Eco-Development Society and the German Agency for Technical Cooperation (GTZ). Funding is provided by both the Government of Himachal Pradesh and the Government of Federal Republic of Germany. Either of these models could be followed. The third possibility could be that IUCN itself implement the projects by hiring people to do so. However, given that IUCN at this point of time does not have a presence in India, this may be a complex process.

Capacity Building

This report clearly indicates that there is a great need for capacity building on various aspects of IWRM. IUCN through its extensive network could facilitate the exchange/dissemination of information as also appropriate training. For example, to particularly address the issue of climate change and more specifically Glacial Lake Outburst Floods GLOFs), IUCN could provide support in developing a monitoring and an early warning system. There is very little information and very little debate on environmental flows. This also needs to be supported and information on this disseminated.

Inter-regional Collaboration

Given that IUCN will be working in all the Himal countries, it could perform an important function of facilitating collaboration and exchange of information/expertise across these countries. This would be extremely useful in the case of GLOFs, where there is substantially more work carried out in Nepal and Bhutan and India has much to learn from these countries.

Extend the Ecosytem/Landscape Approach used by Conservation NGOs

This report has pointed out some programmes such as the Wetlands one and the AREAS programme of WWF. There maybe value for IUCN to collaborate with these agencies to extend the scope of their programme and integrate IWRM. At present the focus of these programmes is more conservation oriented. There is scope however for expansion of mandate.

Support to Indigenous/Traditional Water Resource Management Systems

This report indicates that many indigenous/traditional water resource management systems do actually support elements of the EA approach to IWRM. They are also far more successful because they have the support of the community and attempt to share the benefits equitably. There is a need for these systems to be revived and supported. IUCN could consider supporting these in the Himal region. A comprehensive study of all such systems in each of the Himal States would make an invaluable contribution to this field. The Centre for Science and Environment has attempted to do this for the whole country. A more in depth study for the region would still be useful.

Towards a More Integrated and Inter-sectoral Approach

As mentioned earlier, an EA approach to IWRM needs a truly integrated/inter-sectoral approach. This indeed is a big challenge in a country like India, where two Ministries do not even talk to each other. Further, the process of widespread consultation of diverse stakeholders and right holders rarely happens. Institutions which will continue to implement this process, monitor it and ensure its sustainability are often not built, facilitated or supported Even one model where these components are in place would help support future such projects. IUCN could consider initiating one such model programme.

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