Developing markets for watershed services and improved livelihoods

Fair deals for watershed services in India

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WINROCK INTERNATIONAL INDIA

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with

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First published by the International Institute for Environment and Development (UK) in 2007

ISBN: 978-1-84369-649-0 ISSN: 1605-1017

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A catalogue record for this book is available from the British Library

Citation: Agarwal *et al.* 2007. *Fair deals for watershed services in India.* Natural Resource Issues No. 10. International Institute for Environment and Development. London, UK.

Design by: Eileen Higgins, email: eileen@eh-design.co.uk
Printed by: Russell Press, UK on 80% recycled paper

Contents

Acronyms and abbreviations

AFPC	Asia-Pacific Forestry Commission
BHEL	Bharat Heavy Electricals Limited
BIS	Bureau of Indian Standards
BMC	Bhopal Municipal Corporation
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CAT	Catchment area treatment
CES	Compensating for ecosystem services
DSK	Dam Suraksha Kosh (i.e. Dam Protection Fund)
EIA	Environmental impact assessment
ELDF	Enviro-Legal Defence Firm
EPA	Environmental Protection Act
EPCO	Environmental Planning and Coordination Organisation
FAO	Food and Agriculture Organization of the United Nations
FD	Forest Department
FYM	Farmyard manure
GC	General Category
GONGO	Government-owned non-governmental organisation
GTZ	German Agency for Technical Cooperation
HEP	Hydroelectric project
HP	Himachal Pradesh
HPEDS	Himachal Pradesh Eco-Development Society
IBM	Incentive-based mechanism
IEG	Institute of Economic Growth
IGCEDP	Indo-German Changar Eco Development Project
IIED	International Institute for Environment and Development
IIFM	Indian Institute of Forest Management
ISEC	Institute for Social and Economic Change
JBIC	Japan Bank for International Cooperation
JFM	Joint forest management
LCA	Lake Conservation Authority
LEAD	Livestock, environment and development
LIS	Lift irrigation system
Lps	litres per second
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MMWS	Mini-micro-watersheds
MP	Madhya Pradesh
NGO	Non-governmental organisation
NPV	Net present value
NRSA	National Remote Sensing Agency
NVS	Natural vegetative strips
OBC	Other Backward caste
PES	Payments for environmental services
PSI	Peoples Science Institute
PWS	Payment for watershed services
SC	Scheduled caste
SHG	Self-help groups
ST	Scheduled tribe
VDC	Village development committee
WII	Winrock International India
WWF	World Wide Fund for Nature

Glossary

baowdi	Spring
Bhu-NADEP	Unlike NADEP, this does not require the construction of the brick tank
Changar	Signifies a remote and rugged terrain prone to water scarcity in Himachal Pradesh
ghoora khad	A local form of traditional farmyard manure
gulch	Local term in Kangri dialect for closed area
hayland	Terraced or sloping land that is managed for the production of hay
Himalayan Niti	Recent civil society effort to promote mountain-friendly policies in the Himalayas, starting with Himachal Pradesh
IBM	Incentive-based mechanism
Jheel ki kahani	Story of the lake/lake matters
kanal	Local land unit: approximately, 10 kanals = 1 acre
kharif	Monsoon crop (from July to October)
Langha Kharetar	Local term in Kangri dialect for closed area
Matka khad	Pot compost
Mirge de naal	Local term in Kangri dialect for closed area
NADEP	A method of composting, developed by Shri N.D. Pandhari Pande from Maharashtra, which requires preparation of a brick structure measuring 10 feet × 6 feet × 3 feet with holes in the side walls to ensure adequate supply of air during composting
Nala	Drainage line
Napier bajra	Elephant grass
Panchayats	Constitutionally approved decentralised governance units in India
Pula	Sheaf
Rabi	Winter crop (October–November)
Ramsar	A Ramsar site is a wetland that has been designated as internationally important according to a set of criteria under the terms of the (Ramsar) Convention on Wetlands, 1971
sammelan	Hindi word for a gathering or event for a specific purpose
Swajal Dhara	A community-based rural water supply scheme, based on articulated demand from user communities and the payment of usage charges
tali	*Dalbergia sissoo*, an indigenous tropical timber tree species

Acknowledgements

This action research project has benefited greatly from a variety of stakeholders, from the village level to the policy level, who have participated in learning group meetings, and have engaged in the project process, especially at the state level in Himachal Pradesh and Madhya Pradesh.

In Himachal Pradesh, in the Kuhan catchment, the village development committees and eco-clubs of Kuhan Khas and Oach Kalan engaged patiently with the project process and evolved their own agreement for catchment protection. Feedback from Vinay Tandon, Ashok Thakur, Rajwant Sandhu, R.K. Sood, Farhad Vania, Vinod Tiwari and Ajit Baghla among others helped in evolving the process. Pradeep Kumar, Vijay Kumar, Vijay Guleria, Sanjeev Minhas and other staff of the Himachal Pradesh Eco-Development Society carried the facilitation process forward admirably.

In Madhya Pradesh, the process has benefited from interactions with a variety of stakeholders. These include the successive heads of the Lake Conservation Authority, Aniruddhe Mukherjee, J.S. Mathur, Hari Ranjan Rao and Alka Upadhaya; and Bhopal Municipal Council commissioners, Gulshan Bamra, Manish Singh and Manish Singh.[1] Dr Pradeep Nandi, Sanjeev Sachdev, S.M. Mishra, Alok Nayak and others from the Lake Conservation Authority facilitated the process, despite considerable odds, in the rural catchment of the Bhoj Upper Lake. Girija Godbole and Suresh Motwani, consultants, supported the implementation process in the rural and urban catchment respectively. Satyaprakash and B.M.S. Rathore deserve a special mention for engaging with this idea and making it their own.

Madhu Verma, C.V.R.S. Vijay Kumar and Alind Shrivastava from the Indian Institute of Forest Management, Debashish Sen from Peoples Science Institute (PSI), and Rohini Chaturvedi, S.M. Misra, Pradeep Joshi, and Rakesh Sharma undertook site-level research. Rajesh Thadani, Sanjay Upadhyay and Apoorva Mishra undertook thematic research. In Delhi, we thank Sanjay Kumar, Rekha Pai, G. Balachander and Virender Sharma.

Sandeep Sengupta anchored the scoping study that preceded this project. Sushil Saigal, Radhika Gupta and Alok Dhuria at Winrock International India (WII) were instrumental in shaping the early stages of the current project. The project support unit at WII played a critical role in supporting the process. Sanyogita Rawat anchored the administration.

We are grateful to Bhaskar Vira and Peter Frost for comments and improvements in the text. A special thanks to Ivan Bond for helping to guide the process to fruition, and to the International Institute for Environment and Development for coordination and to the Department for International Development for financial support.

1. Two successive BMC Commissioners had the same name: Manish Singh.

Executive summary

India is facing an acute scarcity of irrigation and drinking water both in villages and cities, particularly in summer months when springs, streams and rivers have reduced flows or dry up. In addition, when water is available, its quality is often suspect. The emerging threats of variation in precipitation induced by climate change will likely only exacerbate the scarcity in many parts of the country. Watershed protection services, which include regulation of water flows, improved water quality and control of soil erosion, can play an important role in adapting to these conditions. Watershed protection services are perhaps the most valuable of forest environmental services in India.

Central and state governments have traditionally expended a significant amount of public investment and regulatory effort (for example, watershed treatment projects and formation of national parks, respectively) to realise the benefits of watershed protection. Recognition of the limitations of these approaches has led to an interest in assessing how incentive-based mechanisms (IBMs), a broader form of market-based approaches, might play a complementary role in the management of land and natural resources.

Incentive-based mechanisms (IBMs) for environmental services try to value the services provided by land and resource managers and the opportunity cost of providing them. By creating a resource flow from watershed service recipients to providers, appropriate forms of incentive (such as compensation) can encourage upstream providers to sustain watershed services by modifying land- and resource-management activities that influence the quantity (both overall and seasonally) and quality of water downstream.

This report shares field experience and lessons in developing IBMs for watershed protection services and improved livelihoods at micro- and macro-scales, derived from an action-learning project in India.[2] IBMs were tested at three locations in the two states of Himachal Pradesh (HP) and Madhya Pradesh (MP). An inter-village transaction was facilitated at one site (the Kuhan micro-catchment in HP), while at

2. Winrock International India (WII), in collaboration with the International Institute for Environment and Development (IIED) and field partners, undertook this action-learning research project. A copy of the synthesis report and further details are available at the project websites: http://www.environmental-incentives.org and www.iied.org/NR/forestry/projects/water.html. The primary field partners are the Himachal Pradesh Eco-Development Society (HPEDS), supported by the German Agency for Technical Cooperation (GTZ) and the Government of Himachal Pradesh, for the Kuhan and Bhodi sites, and the Lake Conservation Authority (LCA), supported by the Government of Madhya Pradesh for the Bhoj Wetlands site.

the second site (Suan micro-catchment) a transaction failed to materialise despite initial interest. At the third site in MP, there is interest in undertaking a transaction between the city of Bhopal and the catchment of its lake, the Bhoj Wetlands. A tabular summary of the three sites is provided below, followed by a brief summary of the process in each site, overall lessons and brief recommendations.

This report introduces the concept of IBMs (Section 1), provides an outline of the project methodology and sites (Section 2), the process, progress and problems in the three sites (Section 3), and the initial findings (Section 4). Finally, in the concluding Section 5, key lessons are discussed, followed by some specific recommendations.

Summary of the three sites and incentive-based mechanisms

Watershed	Watershed service	Proposed change in land-use practice	Incentive-based mechanism (realised/potential)	Watershed service receiver	Watershed service provider
Kuhan (HP) 210 hectares (ha)	Silt load reduction in stream	Grazing control to reduce erosion Brushwood checkdams to trap silt in stream	Realised: eight-year agreement to halt grazing in return for: • Cash for purchasing and transporting saplings • Labour and material sharing for checkdams	Downstream village: Kuhan	Upstream village: Oach Kalan
Suan (HP) 406 ha	Increased infiltration for improved water quantity downstream; fire control	Fire lines, timely harvesting to control fire	Potential: agreement to harvest for fire control in return for access to grass	Downstream village	Upstream village
Bhoj (MP) 361 km^2	Reduced nutrient runoff for improved water quality downstream	Multiple options: organic farming, riparian buffers, composting	Potential: technical advice, market access and input cost reduction	Bhopal Municipal Corporation	Catchment farmers

Activities

Kuhan micro-catchment

In Kuhan, the high silt load in its main stream was choking up the reservoir that serves as the water source for the local lift irrigation system (LIS). In just two years, at least half the reservoir capacity had silted up. The initial facilitation process had two objectives. The first objective was to make the local institutions more robust and expand irrigation downstream. This broadened the water user base from eight to over 50, creating a larger constituency of beneficiaries and greater surplus funds for catchment protection. The second objective was to help the farmers realise the relevance of changes in the land uses upstream and their role in promoting it. A geo-hydrological assessment helped identify erosion-prone zones and build consensus towards a transaction. Eventually an agreement was signed whereby the upper village closed a small patch of sloping land adjacent to the stream, identified as a high erosion potential zone, to grazing for eight years, to allow re-growth and reduce erosion. In return the lower village provided tree saplings which were also planted in the closed area, creating a further interest of the upstream village in the closure. Subsequently, the villagers, along with children from newly formed eco-clubs, made at least seven brushwood checkdams in tributaries to the main nala to prevent silt from flowing downstream.

Suan micro-catchment

The Suan micro-catchment has a decade-old history of upstream–downstream collaboration.[3] Here, there is a need to maintain and enhance summer flows in the main stream, to make viable a planned investment in a small irrigation scheme. While downstream users showed initial interest in financially supporting the protection of additional areas upstream, a variety of factors contributed to their eventual reluctance, despite considerable facilitation by the project team. These factors included: a need to first fence the cropped area to reduce losses from crop-raiding wild animals, a lack of initial success in securing government funds for the irrigation project, conflict in the lower village, and a geo-hydrological assessment which indicated that the impacts of land use change might be limited.

Bhoj catchment

Bhopal city, which has developed around the Upper Lake of the Bhoj Wetlands, is interested in reducing agricultural runoff from the lake catchment into the wetlands, hence improving the water quality of the lake itself. A change in agricultural practices in upstream farms, from chemical to organic wetland-friendly

3. The lower Suan village diverted a project investment for planting tree saplings from their village to the upstream Bhodi area, and contributed labour. Bhodi subsequently protected the planted area against considerable odds. This background of collaboration was an important criterion in selecting the village as a field site for action learning.

practices, was identified as a cost-effective and sustainable solution. The focus in this site was therefore on orienting the upstream and downstream stakeholders to appreciate their respective roles in the management of lake water quality, especially in relation to the rural catchment. Although no IBM has been started yet, a foundation for setting up contributions to catchment protection in the near future has been established.

Studies and learning groups

Studies were also undertaken on the legal and policy environment and on the scope for including IBMs in the process of catchment area treatment in hydroelectric power (HEP) projects. In addition, action-research at each field site was supported by baseline studies on hydrology, livelihoods and land use. Learning group meetings with researchers and policy makers at the state and national levels helped guide the process and share lessons.

Lessons

In this section we briefly discuss key lessons from the project based on transactions attempted and achieved.

Characteristic and impact of IBMs

The first lesson is not new. Simply put, local money that is generated among the stakeholders conveys the concern of the watershed service receiver and therefore carries a higher 'moral value' than externally sourced funds. Second, IBMs can lead to a greater voice for the marginalised, as they demand negotiation and dialogue. There is a higher chance that marginal users are consulted to choose options for land-use change and implement them through an agreement. Transactions can lead to broadening the watershed protection service user base downstream as well – driven by the need to generate contributions for that service.

Impact on poverty and environment

IBMs can typically complement incomes of stakeholders receiving payments rather than raise them significantly. Downstream beneficiaries could have larger benefits eventually, when watershed service benefits are received, though there may well be a time lag. Poor people, especially graziers, run the risk of exclusion if consultations are not undertaken carefully. The lack of clear community rights on common lands makes implementing IBMs on a larger scale a risky exercise both for upstream and downstream stakeholders.

Attributes affecting decision making

A match between the spatial and temporal scale of decision making and biophysical processes can play an important role in facilitating agreements; conversely, a mismatch complicates them.

Land-use practices and hydrology linkages

The linkages between land-use practice and watershed protection services are important for any agreement, but difficult to ascertain in practice. Both expert views as well as local hydrological monitoring can help build awareness of watershed services among stakeholders.

Nature of land use change

Experimenting and adapting to local conditions can generate land-use options that have greater ownership and chance of success. Win-win land-use practice options that create direct benefits for the upstream community, and provide watershed service benefits to downstream stakeholders, are therefore more likely to be accepted.

Local institutions

Functional local-level institutions representing watershed service suppliers and receivers play a key role in developing and sustaining an agreement and reducing transaction costs. For voluntary transactions to work, transparency in the transaction process is necessary. This transparency can feed back to the working of the local institutions and make them more transparent in other spheres as well.

The negotiation process

Downstream buyers need to be convinced by clear benefits. If there is no single overwhelming financial benefit, the case for securing a broader bundle of values may have to be explored. For the process itself, facilitators need to work closely with key individual stakeholders through one-to-one interactions to enhance positive support and minimise concerns. That process should throw up one or more local champions to own and drive the process, without which significant progress is unlikely. The specific tactics for engaging stakeholders would vary by stakeholder group. Exchange visits and field trips are valuable in increasing understanding and motivating action among stakeholders.

Nature of mechanism

Transactions can take a range of forms within one site, including cash and in kind. Typically both upstream and downstream parties have contributed, often because benefits are shared to some extent. In certain conditions, payments are one-time, or for a short finite period, with a specific purpose of aiding a transition from a current

land use that is hard to change, to a more optimal land use and land management state (for example, from openly grazed lands to closed patches).

To summarise, an IBM process that respects and adapts to the needs of various stakeholders upstream is more likely to be sustained.

Recommendations

1. *IBMs should complement mainstream approaches of regulation and public investment.* There is a whole host of useful approaches available – such as regulation, public investment, zoning, tenure, community ownership and participation – to manage and improve watershed services. IBMs work best as a complement to these other approaches, rather than as a substitute for them.

2. *Invest in watershed hydrology, in linking land uses to hydrological impacts and in exposure and skills in developing IBMs to promote an effective multi-disciplinary approach.* Developing multi-disciplinary skills is particularly important to address the crisis in water quality and quantity, especially in light of impacts of climate change on water supply.

3. *Apply IBM processes in micro-watersheds to enhance the sustainability of benefits of watershed development and micro-irrigation expenditures.* Downstream beneficiaries of watershed treatment projects, and of small-scale gravity and LISs, can further enhance the quality and quantity of water by investing in catchment protection in upstream areas by using IBMs.

4. *Apply IBM processes to invest in critical catchments that supply drinking water to rural and urban areas to enhance water quality and quantity.* These bodies can use IBMs to encourage upstream communities to adopt those practices that improve water quality and quantity, thus complementing and ultimately reducing investment required for water treatment and distribution.

5. *Use IBMs to enhance the effectiveness of catchment area treatment (CAT) for hydroelectric power projects.* Clean water, with low sediment loads, is critical for keeping the operation and maintenance costs of HEP plants low. IBMs can channel funds for CAT to upstream communities, to facilitate land management practices that enhance and maintain water quality.

Watershed protection services are critical for livelihood security in the Indian subcontinent. IBMs for watershed services, a broader application of the concept of markets for watershed protection services, can play an important complementary role in helping to secure watershed services and to support livelihoods in the face of increasing stress on the availability of clean and adequate quantities of water in a timely fashion.

1 Introduction

1.1 What this report is about

This report aims to critically analyse and share field experience in developing incentive-based mechanisms (IBMs) for watershed services and improved livelihoods at micro- and macro-scales in India (see Box 1 for definitions). This experience has been gained through action-learning research by Winrock International India (WII) and their field partners, in collaboration with the International Institute for Environment and Development (IIED). The report outlines the processes adopted, the challenges and issues faced, and the measures taken to try to address them. It concludes by distilling the lessons learnt, identifying contexts where IBMs add value and provides some policy options. A copy of the report and further details are available at the project websites: http://www.environmental-incentives.org and http://www.iied.org/NR/forestry/projects/water.html.

This action-learning project is based on the growing recognition of the importance of forest environmental services and watershed services in particular, in sustaining human livelihoods and well-being as well as ecosystem functions.[4] It builds on an earlier diagnostic study undertaken by WII and IIED, which considered the potential use of, and current interest in, market-based approaches for enhanced watershed services and improved livelihoods in India.[5]

Globally, trading of carbon sequestration offsets is perhaps the most well-known and developed of the environmental service markets. Watershed service benefits, which are less fungible and primarily local, generate considerable value as well. Experiments with market approaches for maintaining and enhancing watershed services have focused on linking upstream and downstream stakeholders and generating a resource flow from watershed service beneficiaries to service providers. The payment may be in cash or in kind, and aimed at providing an input cost or at offsetting an opportunity cost.

In India, public expenditure, regulation and peoples' participation have been the primary instruments of choice to maintain watershed services, though with notable exceptions.[6] Therefore the concept of developing IBMs for watershed services has

4. Typically, environmental services provided by forests include carbon sequestration services, biodiversity services, watershed services and landscape values (Landell-Mills & Porras 2002).
5. Sengupta *et al.* 2003.
6. These include market-like initiatives such as Sukhomajari and Pani Panchayats, which involve local cooperation, broad sharing of rights to water and the option of trading those rights. For details see the diagnostic study preceding this project: Sengupta *et al.* (2003).

evoked a variety of reactions ranging from curiosity and appreciation to cautious doubts about its applicability.

Over the past two years WII, its local partners and IIED have experimented with promoting IBMs for watershed services and have attempted to ground this concept in three sites in India. Two sites in the western Himalayan state of Himachal Pradesh (HP) represent rural–rural interactions between villages at the micro-level, within a mini-micro-watershed.[7] The third site around the Bhoj Wetlands, Bhopal, in the central Indian state of Madhya Pradesh (MP) is a macro-level experiment aimed at securing the rural drinking water catchment of the city of Bhopal. The interaction here is between numerous urban stakeholders and peri-urban farmers in the catchment areas.

Box 1

Definitions of watershed services and incentive-based mechanisms

What are watershed services?

Watershed services are environmental services provided by a watershed or catchment area that produce benefits downstream, usually in the form of water quality or water quantity. These may include regulation of water flow (increased dry season flows, reduced flooding), reduced siltation, improved water quality, and so on. These services are directly influenced by upstream land use and practices – so it follows that changes in upstream land use and practices have a direct impact on watershed services. Care must be taken in making correlations between types of upstream land use and downstream impacts.

What are incentive-based mechanisms?

Put simply, market-based mechanisms involve a willing buyer and a willing seller of a commodity. In this case the commodity is the watershed service (for example, reduced sedimentation or water purification). As is it difficult to directly ascertain the watershed service, the transaction usually revolves around a proxy indicator. Payments may be in cash or in kind, including labour and other inputs. Examples of transaction mechanisms include watershed protection contracts, watershed leases, water use rights, stream flow reduction licences and water quality credits.

In the international project these are referred to as market-based mechanisms; however, in the context of the India country study we have a somewhat broader definition of incentive-based mechanisms (IBMs). This is because 'market-based' may be negatively misconstrued as wholesale privatisation. Also, IBMs focus on building a relationship between the stakeholders and the transfer of resources from the service provider to the service recipient, in a local cooperation framework, rather than with a market orientation.

7. A minimicro-watershed is a watershed covering an area less than 500 hectares (ha). In hilly areas, sub-catchments can be quite small, even under 100 ha, covering a hamlet/village or group of villages, but still draining from a single source. This term was used in the German Agency for Technical Cooperation (GTZ)-supported Changar Project.

IBMs for watershed services attempt to sustain the environmental and livelihood outcomes from investments, both public and private, made towards watershed protection. They do this by channelling local investment, and, just as importantly, local interest and attention upstream. Locally generated payments (in cash or in kind) carry with them the perception of a higher opportunity cost or sacrifice by the givers, as the payments could have been put to other purposes, compared with funds sourced from government, which are perceived to be free and often wasted. Locally generated payments also signal that the contributors feel the purpose is important to them, and thus carry an expectation of accountability. In sum, the moral value of a rupee contributed locally is significantly higher than a rupee from a government or non-governmental organisation (NGO) scheme.

Based on the diagnostic study, the scoping exercise undertaken to select field sites and actual implementation, it is clear that there are several challenges to address while promoting IBMs. These include:

- How to identify relevant land management options and to establish their link with the watershed service(s) within a particular local context.
- How to ensure that the options chosen are socially acceptable.
- How to encourage interest and a sense of responsibility in the upstream communities, in terms of their impacts downstream; as well as downstream, for supporting changes upstream. This is all in a setting where such responsibilities (and certainly investments) are currently mostly perceived to be in the domain of the state.
- How to design the intervention appropriate to the scale of the problem: as the scale increases so do the number of influencing factors, making it more complex, both bio-physically and institutionally, to develop an appropriate IBM.
- How to create interest within the policy environment, such that IBMs are expanded beyond pilot studies.
- How to recognise the broader set of environmental benefits derived from watershed protection (for example, improved habitats for flora and fauna) such that they are bundled within the IBM framework.
- Conversely, how to assess the signals provided by policy, regulation and public investment so as improve the 'investment climate' for securing the provision of watershed and other environmental services.

1.2 The study team's vision

The study team's vision guiding the implementation of this project comprised the following elements:

1. Develop an India-specific understanding of the feasibility and applicability of IBMs for watershed services and sustainable livelihoods, based on facilitation of IBMs at three field sites.

2. Assess the preliminary impacts of IBMs on watershed services as well as on livelihoods, particularly those of the poor.
3. Undertake strategic studies to enhance understanding of the efficacy of the current regulatory framework in maintaining watershed protection services and conditions under which IBMs may emerge; and to learn from relevant experience in the implementation of catchment area treatment plans.
4. Create a national-level learning group and state-level learning groups in HP and MP, as a means to start a policy dialogue on IBMs.
5. Document and communicate findings from all the above activities.

1.3 Methodology

A brief introduction to the methodology adopted for this project is provided here, with further details given in Section 2.2. Initial feasibility for the action-learning approach was ascertained through an extensive diagnostic exercise.[8] This work facilitated the preparatory phase, at the end of which a comprehensive work plan outlined the nature of the problem, potential steps at three sites in two states, the role of partners, and the state and national context. In the implementation phase, facilitation teams interacted extensively with the local communities at the three sites and other stakeholders to sensitise them to the concept of IBMs and to explore opportunities for establishing such mechanisms. Further, baseline studies that assessed land use and management practices, watershed protection services, and livelihoods were commissioned to document pre-project conditions and to support facilitation.

Learning group meetings at state and national levels brought together policy makers, practitioners and researchers. The purpose was to share concepts and progress at the sites, obtain feedback and involve them in the project process to facilitate policy learning. The project team also undertook two strategic studies to analyse larger influencing factors and opportunities. One of these examined the legal and policy environment, whereas the other drew from the experience of catchment area treatment plans to look at the scope for IBMs in the hydroelectric sector. For wider dissemination of the project concept, a pamphlet and policy brief were published and a project website developed: http://www.environmental-incentives.org. Finally, preliminary impact studies were conducted in the project sites.

1.4 National context

With a population of over one billion,[9] India is the world's second most populous country after China. Poverty and degradation of land and other natural resources are among the biggest challenges facing the country. Although the percentage of

8. Sengupta *et al.* 2003.
9. The total population of India on 1 March 2001 stood at 1,027,015,247 (Census of India, 2001): http://www.censusindia.net/results/resultsmain.html.

population living below the poverty line has declined considerably in the past decade (from 36% in 1993–94 to 22% in 2004–05),[10] apparently because of the economic growth that India has witnessed since the 1990s, attempts to arrest natural resource degradation have not been as successful. As stated in a Planning Commission report, satellite data confirm that although total forest cover has increased marginally by 0.65% between 2000 and 2002, dense forest cover has declined by 6.3%, indicating degradation.[11] An earlier assessment of wastelands, by the National Remote Sensing Agency (NRSA), again with satellite data, suggested widespread degradation in all lands including forests.[12]

Such degradation is visible in the form of increased soil erosion, declining groundwater tables, decrease in the availability of drinking water, and desertification in different parts across the country.[13] Many critical watersheds are also becoming degraded, with the consequent loss of watershed services. Water stress is becoming acute both in urban and rural situations. Both quality and quantity of water supplied or available is under question. For example, per capita availability of water fell from 6,008 m^3 in 1947 to 2,266 m^3 in 1997.[14] Furthermore, frequent floods or droughts are thought to be at least partial evidence of improper land use in the catchments, and of the inadequate conservation of forests (MoA 2002).

Conventional approaches in India for maintaining watershed and other environmental services have been command-and-control regulation and public expenditure. Most forests have been nationalised by the government and several laws have been enacted to protect environmental services, the main ones being: the Indian Forest Act, 1927; Wildlife Protection Act, 1972; Forest Conservation Act, 1980 and the Environment Protection Act, 1986. In addition, large-scale watershed protection projects are implemented by state agencies.

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10. The percentage of people living below the poverty line has reduced from 36% in 1993–94 to 26% in 1999–2000 and to 22% in 2004–05. The latest estimates of National Sample Survey (NSS) 2004–05 imply that the number of people living below the poverty line has dropped by an average of 0.74% per year between 1993–94 and 2004–05. In net terms, this translates to around 80 million people. However, there are still about 225 million people below the poverty line: http://www.thehindubusinessline.com/2006/06/15/stories/2006061504670100.htm.
11. http://planningcommission.nic.in/plans/planrel/app11th_24.pdf.
12. A National Remote Sensing Agency (NRSA) study estimated 63.85 million ha of wastelands. Of these, 31 million ha of the total forest area suffer from some form of degradation; the 14.06 million ha of forests that suffer from extreme degradation form part of the 63.85 million ha of wastelands reported by the NRSA. In addition to the wastelands identified by the NRSA, other areas such as deserts, drought-prone land, flood-prone land and tribal areas have been subjected to severe forms of degradation (Planning Commission: 2002: 581–582): http://planningcommission.nic.in/plans/planrel/fiveyr/10th/volume2/v2_ch5_3.pdf.
13. Ninan and Lakshmikanthamma, 1994.
14. http://www.infochangeindia.org/EnvironmentIb32pprint.jsp.

Regulation has had some success in curbing large-scale change in land use and habitat loss. For example, diversion of forest lands for non-forest purposes has declined considerably since enactment of the Forest Conservation Act (1980). Similarly, the ban on hunting since the Wildlife Protection Act (1973) did stabilise populations of threatened species, such as tigers, for a while. However, in recent years there has been increased degradation and loss of such species, and this is linked to regulatory breakdown and a lack of incentives for local people to participate in conservation.

More generally, the economic and regulatory climate has been changing from a command-and-control approach based on licence controls and public enterprises to one where the government is more of a regulator and enabler. The reforms programme initiated in response to a balance of payments crisis in 1991 started de-regulating the economy to accelerate investment, growth, employment, and reduce poverty. Sectors such as hydro-power and electricity generation and distribution have been opened up to the private sector. In recent years annual economic growth has been between 6% and 9%.

Realising the critical link between environmental degradation and poverty, the government has also launched several programmes to encourage the active involvement of local communities in natural resource management. The major programmes include Joint Forest Management, Watershed Development and Participatory Irrigation Management. Innovative institutional mechanisms can make large investments productive, and reduce or reverse the degradation of watersheds and consequent loss of watershed services.

In addition to regulation and investment, there is also scope for demand-side measures. These can reduce water use and waste, reduce peak water requirements and thereby help reduce the scale of supply-side investments. Situations where these would have particular relevance include Shimla, the state capital of HP, which faces a spike in water demand in the peak summer tourist season when supply is at its lowest. In general, demand-side management would benefit most of the country, as demand is mostly greater than supply.

Many upstream communities, who are stewards of watersheds, are poor and receive limited benefits from the watershed services they provide.[15] Quite often upstream communities are dependent on the same resource for their livelihood, for example livestock grazing. On the other hand, people in downstream areas who benefit from these services may contribute nothing towards better management of upstream areas. Thus, there is a need to explore alternative approaches through which receivers of

15. http://www.worldagroforestry.org/SEA/Networks/RUPES/about.htm.

the service can compensate the suppliers for changes in land use and management practices upstream to secure watershed services. Incentive-based approaches offer a solution that can be tried in conjunction with the other existing approaches.

1.5 An introduction to incentives and incentive-based mechanisms in India

Incentives and IBMs can be of several types, financial, or in kind, for inputs or for outputs. Usually, they generate a flow of resources between two parties. The legal and policy review (see Section 1.6) suggests that although there is no specific mandate for incentives or payments for watershed services in law, neither is there anything that bars it. In sum, there is scope for developing incentive mechanisms and supporting guidelines or regulation for payments for watershed services (PWS) if required in the future. At the same time, the Ministry of Environment and Forests has concerns about the idea of payments for environmental services in general, in the Indian context. On the other hand, state-level policies such as the forest policy in HP mention the need for experimenting with market-based instruments for forest conservation.

In this context, we provide a quick summary of a range of incentives and IBMs to introduce this idea. This also highlights that although the term may be new, there are several precursors to this concept in practice that have been attempted in India by the government, communities and civil society.

Taxes and levies. HP has pioneered an ecological tax on diversion of forest land for non-forestry uses. The purpose of the tax is to dis-incentivise diversion of forest lands. The amount of tax has been based on the value of forests, of which watershed services form a significant part. At the national level the Supreme Court appointed an expert committee to value forests.[16] The committee has undertaken experimental valuation of the forests of HP. Of the indicative values of forests that it suggests, watershed service values of forests have the highest value of all seven forest uses that they consider (see Annex 4). Payments for diversion of forest lands are likely to be guided by these values.

Payments to line departments. The payments for implementing catchment area treatment (CAT) plans are provided for in regulation. HEP projects make payments to state governments which in turn release the money to the state Forest Departments for CAT plan implementation. The study on the scope for IBMs in the hydro sector (Thadani 2006) clearly points to the need for working within the scope of the

16. Popularly known as the NPV committee, its full report can be seen at http://iegindia.org/npvreport.pdf.

existing regulation to ensure that mandated payments can be creatively used by providing a sense of contingency, so that the element of payment on performance is enhanced.

Tenure as incentive. At different points in the past century, the government allocated rights in local forests back to communities so as to provide local incentives to them to protect the vegetation. The logic was that while biomass benefits could largely go to communities, the environmental service benefits – such as watershed service benefits of reduced erosion – would have both local and wider benefits. Examples include the Van Panchayats in (what is now) Uttarakhand since the 1930s and the Kangra Forest Cooperatives in (what is now) Himachal Pradesh since the 1940s. The numerous state-level joint forest management (JFM) programmes, started after 1990 and aimed at restoring degraded forest lands for providing goods and services, provide weak tenure with an element of conditionality – the Forest Department can disband the local forest protection committees.

Direct payments from watershed protection beneficiaries to service providers. In the Shanan hydroelectric project in the 1920s–1930s, in the Chota Banghal region of Kangra district of HP (erstwhile Punjab), the state government bought the grazing rights of residents on an annual basis, and made an annual payment. The transactions may not have been entirely voluntary, as was evident in the struggle that local residents had to undertake to re-establish their grazing rights in the 1970s. However, as the rights were bought annually, and had not been bought in perpetuity, or were extinguished, as happens in the formation of national parks, the local communities were able to get back their grazing rights from the government.

1.6 National status of payments for watershed services

In India, the concept of incentives or payments for watershed services per se is not mentioned in most policy documents and legislation. However, certain policies and legislation mandate approaches that are similar to the IBM approach, or have language that can be supportive to IBMs.[17] This section highlights the national status of IBMs/PWS, the policy and legal space to facilitate them and efforts within the government, academia and civil society that relate to promoting IBMs for environmental and particularly watershed services.[18]

17. For example, the new Forest Sector Policy and Strategy (2005) in Himachal Pradesh states that 'the state will explore the potential of market-based instruments for facilitating protection and development of catchments...' (Himachal Pradesh Forest Department 2005).
18. Details on the policy and legal space to facilitate IBMs may be obtained from the legal and policy review study commissioned by the project. A summary is available in the annexe, and the full study may be seen at the project website.

1.6.1 Policies and guidelines

Watershed treatment (termed 'watershed development' in India) programmes have been implemented in India for over four decades. As practice has evolved, the Government of India moved towards a community-based (participatory) approach proposed in the form of Watershed Development Guidelines (1994).[19] A key change has been the stress on local communities contributing towards the costs of watershed treatment activities, to demonstrate their interest in the activities and to create local ownership. Later, contributions have also been generated for maintenance charges, to enhance the sustainability of the investments. In practice, these were often deducted at source from wages and were perceived more as a tax for contribution and maintenance of engineering structures. Nonetheless, this approach has highlighted the underlying principle of enhancing local stakes in the preservation and provision of watershed services, an aspect critical for the development of PWS mechanisms.

Participatory approaches that aim to involve communities in decision-making and implementation processes and include contributions and user charges have now become an integral part of most rural development programmes and policies, and provide a useful foundation on which to develop IBMs for watershed services. For example:

- *Swajaldhara*, a community-based rural water supply scheme, is based on articulated demand from user communities and the payment of usage charges.[20]
- The National Water Policy of 2002 (as well as state water policies that have imbibed the spirit of the national policy) reflects participatory principles and suggests roles for user groups/beneficiaries.
- The idea of local people contributing a portion of the cost of local investments was also included in the India Ecodevelopment Project, to foster local ownership, but after some debate, as the investments were perceived as compensation for forgoing the use of biomass resources from protected areas (Singh and Sharma 2004).

The new *Forest Sector Policy* for HP (Government of Himachal Pradesh 2006) specifically calls for experimenting with market-based instruments to secure environmental services from forests. This concept was included in the policy document as a possible solution to resource degradation problems in HP. Some of those charged with developing the policy were associated with the learning group established by this project and attended learning group meetings; one of them prepared the legal and policy review under this project. Such exchange of ideas and experience between this action-learning initiative and the policy development process helped to facilitate incorporation of the concept of PWS in the policy.

19. Under the Ministry for Rural Development's Common Guidelines for Watershed Development. These guidelines were further revised in 2001 and most recently in 2003 (Hariyali Guidelines).
20. Guidelines on Swajaldhara by the Ministry of Rural Development in 2002.

1.6.2 Legislation

Within the legal environment, two major safeguards for watershed areas with large forest cover are the Environmental Protection Act (EPA) of 1986 and the Environmental Impact Assessment (EIA) Notification of 1994. Since 1994, EIA has been required for projects with likely significant environmental impacts, such as HEP projects. In addition, the EIA process mandates a public hearing, and environmental management plans designed to mitigate environmental damage and impacts of displacement. One of these plans is the CAT plan, which aims to improve the quality of watershed services from the catchment. For large hydro projects, CAT plan allocations are typically 0.5–1% of the total project cost.

Although CAT plan payments are aimed at maintaining watershed services that would ultimately benefit those making the payments, the hydro-power projects, there is an important lesson to be learnt. IBM/PWS schemes need to be in the form of a transaction. Ideally, the payment should be contingent upon performance by the watershed service provider. Payments made by hydro-power projects (whether private or in the public sector) for CAT plans, however, are not contingent as the payments are mandated by law. In fact, they are viewed more as a tax than transaction, and as a cost of doing business for the hydro-power projects. The state governments receive the money, but then, as the seller of the watershed service, have little incentive to ensure good quality inputs in terms of actual treatment of catchments or outputs in the form of watershed services. Often, payments are received regardless of benefit accruing to the buyer. This situation reflects the lack of contingency inherent in many current schemes in India, where there is scope for introducing performance-based payment measures.[21]

A recent effort to secure forest values is the Compensatory Afforestation Fund Management and Planning Authority (CAMPA). Set up by the national-level Ministry of Environment and Forests on orders from the Supreme Court, CAMPA will (when operational) consolidate financial resources for compensatory afforestation realised primarily from payments for diverting forest lands for non-forestry uses. The payments are for the net present value (NPV) of the forest land diverted for non-forestry purposes.[22]

Further, within the federal governance framework, constitutional provisions for panchayats[23] and urban bodies potentially create space for devising IBMs, should the states want to do so.

21. A study on CAT plans was undertaken by the project. A summary is available in the Annex; the full report is posted on the project websites.
22. CAMPA Notification, Ministry of Environment and Forests (Forest Conservation Division), ORDER, New Delhi, 23 April, 2004.
23. Panchayats are elected bodies, a constitutional tier of local government.

1.6.3 Watershed services and incentive-based mechanisms in the news

Of late, the concept of payments for environmental services is reflected in the rhetoric as a possible market-based equitable solution for natural resource management. For example:

- The Supreme Court of India has asked the Institute of Economic Growth (IEG) to value forest types for each biogeographical zone of India. This is expected to help determine amounts of payments for the costs of restoration and/or compensation for destruction of forest.[24]
- The HP State Government has demanded compensation from the Central Government for the opportunity costs of maintaining land under forest cover.[25] In its memo to the 12th Finance Commission, the HP Government makes a case for compensation based on the opportunity costs of reduced revenue from not logging, and the benefits of forest cover to the nation (supply of water for irrigation to the bread baskets of Punjab and Haryana, reduced silt loads, etc.).
- As stated above, market-based approaches are also mentioned in the new Forest Policy in HP. Further, the Himalayan Niti, a civil society effort to promote mountain-friendly policies in HP and the Himalayas, endorses the idea of payment for the provision of environmental services by HP (in terms of water, hydro-power and landscape values) both locally and to downstream states.
- The Institute for Social and Economic Change (ISEC) in Bangalore organised a workshop on 'Compensating for Ecosystems Services' in May 2006. This aimed to synthesise the South Asian experience in developing and implementing compensating for ecosystems services (CES) as an instrument for environmental management and poverty reduction.
- The Asia-Pacific Forestry Commission (AFPC) organised a special session on Payment for Environmental Services (PES) at its biannual meeting in Dehradun, India, in April 2006.
- The Tiger Task Force Report (2006) has made a clear recommendation to assess and implement payments for environmental services.
- WWF India and the IEG are undertaking a scoping exercise on the role of economic instruments such as payments for environmental services and economic valuation to support the provision of ecosystem services.

1.6.4 Role of the national-level Ministry of Environment and Forests

Athough at state level in MP and HP several policy makers have evinced interest and supported the process of developing IBMs at the local level (for example,

24. Supreme Court of India *vide* judgment dated 26 September 2005 in IA No. 826 in IA No. 566 of 2000 in Writ Petition (Civil) 202 of 1995. The full report may be accessed at http://iegindia.org/npvreport.pdf.
25. Memo from HP Government to the 12th Finance Commission: http://fincomindia.nic.in/pubsugg/memo%20hp.pdf.

between villages, or between towns and villages, typically within the state), the national-level Ministry of Environment and Forests (MoEF) has a different take on this. Current rhetoric from the MoEF suggests opposition to the idea of payments for environmental services, especially watershed services, at the global or transboundary level. This is primarily due to the limited knowledge of the specific linkages between forest patches and their hydrological benefits, as well as the perceived risks of further disputes rather than solutions.[26] Given the limited application of the idea within India, the MoEF has not taken any formal stance with regard to small-scale payments for environmental services domestically. In such a scenario, presenting a nuanced approach that promotes the broader concept of IBMs is likely to be better accepted at the national level. Further, given the MoEF's mandate as a national agency, to consider the international context, it may be simpler to promote this with the states directly, and promote the idea with the MoEF rather than expect the MoEF to lead, in the near future.

In addition, the National Forestry Commission, appointed by the MoEF, submitted its report in 2006 and made several recommendations for incentives that enhance the provision of ecosystem services. These include incentives for enhancing trees on lands not in the control of state forest departments (recommendation no. 49), sacred groves (recommendation no. 200), forest-rich states (recommendation no. 337) and forest-poor states (recommendation no. 338). In addition, the report makes two specific recommendations: linking annual grants to states to conservation performance and not just forest area alone (recommendation no. 346) and enhancing the current 2% CESs on water paid by industry, and providing a portion to state forest departments as rivers primarily arise from forested upper catchments (recommendation no. 358). Thus it may be concluded that, at the domestic level at least, there is considerable debate on the role of incentives in maintaining forest ecosystem services, including watershed services (Government of India 2006).

Therefore, at a national level in India, there are ongoing dialogues, debates and studies around the concept of PWS. There also exists scope in policies, legislation and approaches adopted so far for new approaches such as PWS. There is an opportunity to capitalise on this interest, allay some fears and demonstrate the benefits of such an approach in enhancing environmental and livelihood security, and complementing existing regulatory and participatory approaches. It may be prudent and realistic to promote a broader IBM approach that tries to explicitly address poverty and livelihoods as well as watershed services, rather than a pure PWS approach.

26. A similar, if not stronger, view was voiced during the Asia-Pacific Forestry Conference in 2006.

2 Outline of the project

2.1 Development of the project

The goal of the project was to maintain and enhance the flow of direct and indirect services provided by watersheds, with particular emphasis on the livelihoods of the poor. This was part of an international project, coordinated by IIED, which included action-learning activities in four countries/regions (India, the Caribbean, Indonesia, South Africa), diagnostic studies in two further countries (Bolivia and China), and a range of other activities.[27] The Indian component was developed in two phases over a period of four years (2002–2006). Each of these phases is briefly discussed below:

Diagnostic study.[28] The study identified the potential use of, and current interest in, market/incentive-based approaches for enhanced watershed services and improved livelihoods in India. It showed that markets for environmental services can promote equity and improved livelihoods by complementing existing regulatory and participatory approaches at the micro-level. Further, the study reported potential at the macro-level for making more effective, regulation induced payments in the hydro-sector as well as securing urban drinking water supply. Overall, there was general validation of the need for such an approach from stakeholders at different levels.

Preparatory phase. In this phase the hill state of HP and the central Indian state of MP were chosen. State policies were reviewed to assess the policy environment, and potential partners approached.

Site selection. Through extensive field visits and consultations, ten potential sites in HP and 12 in MP were reviewed through a lens of 16 *essential* and *desirable* criteria (see Annex 1). The criteria were developed internally and refined through state and national-level workshops. Finally two mini-micro-watersheds in the Changar[29] region of HP, namely the Bhodi-Suan and Oach-Kuhan catchments, and the Bhoj Wetlands at Bhopal, MP, were identified for the implementation phase. State-level partners were also identified.

27.Details of the international project are given on the website: http://www.iied.org/NR/forestry/projects/water.html.
28. Sengupta *et al.* 2003.
29. In the local dialect, *Changar* signifies a remote and rugged terrain prone to water scarcity. The area receives an average annual rainfall of about 1860 mm of which approximately 65% is lost to runoff because of steep slopes, which causes severe soil erosion.

Map 1

Project sites in India

Workplan. The preparatory phase culminated in the preparation of a comprehensive workplan that utilised learning from the earlier phases. The workplan described the three selected sites, the nature of the problem and the associated scope for developing IBMs for watershed services in each site. It also included a detailed methodology, site-specific work schedules and budgets.

2.2 The overall project methodology

The project adopted an adaptive management approach. Key activities were identified in site-level workplans, and further refined as the project progressed. The steps and processes involved in implementing this action-learning project are given below. Baseline and strategic studies and other reports may be accessed at the project website: http://www.environmental-incentives.org.

Field facilitation. Winrock staff or long-term consultants were posted in each state for day-to-day facilitation with local partners and were supported by staff from Delhi. Meetings with key individuals as well as intra- and inter-village meetings played a key role in sensitising people to the concept. Specific activities helped build both awareness and the capacities of the communities involved. Exposure visits proved critical in all three sites to motivate communities to try out activities

in their own catchments. Need-based training programmes – on hydrological monitoring and record keeping in HP and organic farming techniques in MP – improved capacity.

Baseline studies. Baseline studies at the sites assessed land use and management practices, watershed protection services (including hydrology studies), and livelihood patterns. The studies covered evaluation of incomes, assets and expenditure patterns to assess well-being, appropriate hydrological monitoring for assessing watershed services (silt reduction in Oach-Kuhan, water flows in Bhodi-Suan, and water quality in the Bhoj Wetlands catchment), and assessment of land use and management practices to identify changes required to secure the watershed services in question. This facilitated a comparable approach across all the sites. The list of studies is provided in Annex 2.

Supporting activities. Tangential activities helped prepare for a transaction. For example, in the Oach-Kuhan catchment in HP, the local Kuhan Village Development Committee was reconstituted, a children's eco-club established, and irrigation was made accessible by creating four different levels of users such that those who had not contributed capital for the lift irrigation system (LIS) could also access water as temporary members and non-members. Sliding water charges meant that members paid lower rates, and non-members higher rates. Earlier non-members did not have the option to buy water. This recasting of the LIS working in terms of a 'water business' helped to increase users from about eight to 52. In Bhopal, a communications campaign on issues afflicting the Bhoj Wetlands was organised to enhance awareness among all sections of watershed service receivers (see Section 3.4.3.1). These activities also helped the project team to understand different stakeholders' perceptions of the issues related to the Upper Lake and thus to build rapport.

Learning group meetings. Learning group meetings with policy makers, practitioners and researchers at the state and national levels helped generate policy interest and support for the IBM concept. The purpose of learning groups was to sensitise stakeholders and involve them in the project process by providing them with updates, and to incorporate their feedback with the intention to facilitate policy uptake at the end of the project. The meetings were organised at the beginning of the project and again as learnings emerged from the field. Over the course of the project, two learning group meetings were held in HP at local level, and two at state level; in MP, there were two meetings at local level, two at state level, and six stakeholder-specific meetings; and two national-level learning group meetings were also held. In addition, a final round of state and national learning group meetings is planned to share findings.

Strategic studies. These were undertaken to examine key national-level issues and to analyse larger influences and opportunities. The first study reviewed state and national policies and legislation and examined whether these were conducive for scaling up the IBM concept (ELDF 2006). The second study critically examined the scope for IBMs in the hydroelectric sector, specifically reviewing financing, planning and implementing processes of the CAT plans, a regulatory requirement under the Environmental Protection Act, 1994 (Thadani 2006).

Dissemination activities. Published and audio-visual media were used to facilitate concept sharing and promotion. Pamphlets and a policy brief were widely disseminated. A film on the application of the IBM concept in the Bhoj Wetlands entitled 'Lake Matters' was prepared and screened for a range of stakeholders.[30] The Bhoj Wetlands case was also included in a documentary entitled 'Shed Loads: paying to protect watersheds', which was screened on BBC World in September 2005.[31] In HP eco-walks for schoolchildren, and catchment-level seminars to discuss and debate the issue of IBMs for watershed services, were organised in the two sites. Further, to disseminate project results, a website was created[32] where project reports and updates are posted: http://www.environmental-incentives.org.

Impact studies. Towards the end of the facilitation process, studies were undertaken at the sites to assess preliminary changes in land management practice and livelihoods (Chaturvedi 2006; Verma *et al.* 2006. See Annex 2.).

2.3 Brief description of the project sites

This section briefly describes each of three sites and the nature of the problem that the project intervention attempts to address.

2.3.1 Himachal Pradesh

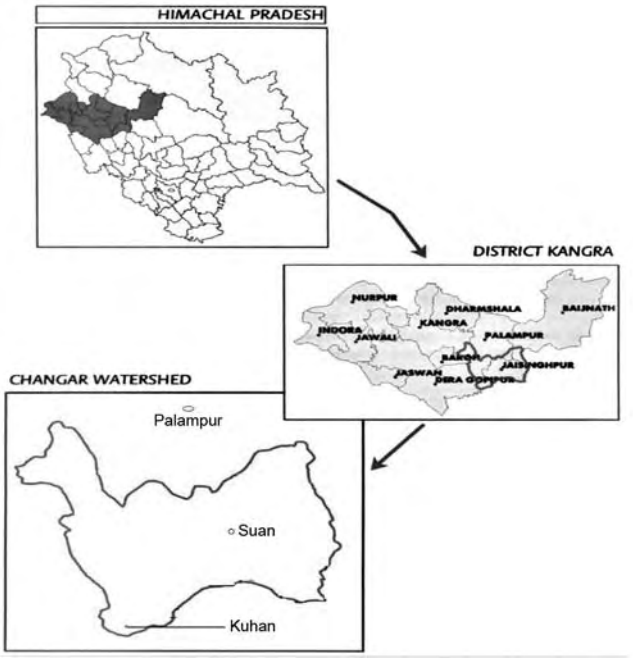
Located in the Shiwalik hills in the southeastern part of Kangra district of HP, the Changar region is characterised by scarcity of drinking water and little irrigation (see Map 2). In the summer, springs (*baowdis*) used for drinking water often go dry and people are mostly dependent on lift-based drinking water supply. The region has been the focus of the GTZ-supported bilateral Indo-German Changar Eco Development Project (IGCEDP), popularly referred to as the Changar Project, since the early 1990s. The project focused on watershed treatment and livelihood enhancement in 37 micro-watersheds that were further sub-divided into mini-

30. A DVD of the film (English: Lake Matters; Hindi: Jheel ki kahani) may be obtained from WII by emailing somon@winrockindia.org. To view on the web, see http://www.iied.org/NR/forestry/projects/water_mm2/water_mm1.html.
31. Shed Loads may also be viewed on the IIED website.
32. www.environmental-incentives.com.

micro-watersheds (MMWS). The Bhodi-Suan and Oach-Kuhan MMWSs covered under the IGCEDP programme were selected as action-learning sites.

Map 2

Project sites and Changar region in Himachal Pradesh



Oach-Kuhan or 'Kuhan' catchment. About 58 km south of Palampur, the Kuhan catchment covers about 210 ha and includes lands of five revenue villages: *Oach Kalan, Oach Khurd, Uparla Kuhan, Kuhan Khas* and *Gulana*. All are part of the Kuhan Panchayat.[33] Oach Kalan and Oach Khurd are upstream villages, and Kuhan Khas and Gulana downstream villages. Uparla Kuhan lies somewhat midway, as can be seen in Map 3. Villages and catchment boundaries are not co-terminus: only parts of these villages fall within the catchment. Agriculture and forestry are the major land uses.

Table 1

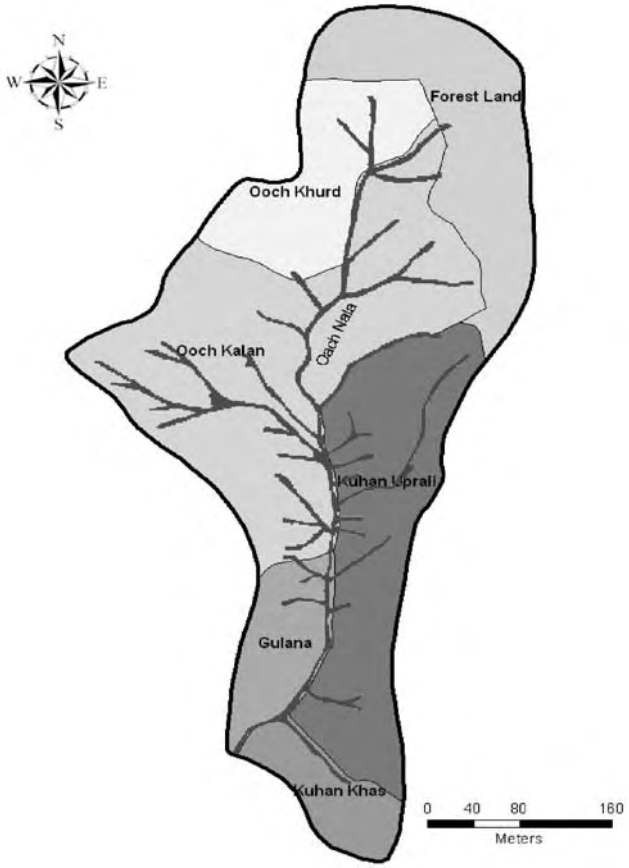
Kuhan catchment land use

Land use	Area (ha)
Agriculture	67.1
Forests	81.2
Grazing land	1.0
Hayland	24.4

33. A small area in the northernmost part of the catchment belongs to Lahdu village of the Lahdu Panchayat.

Map 3

Oach-Kuhan catchment



The Kuhan catchment is characterised by rugged hills with altitudes between 540 and 750 m. The area is largely rain-fed with an average precipitation of 1800 mm. However, the runoff is high with almost 65% of the precipitation lost due to the steep slopes.[34] The primary drainage channel is the Oach nala, also known as the Gulana khad. As can be seen in Map 3, several perennial and seasonal nalas or streams feed into this primary channel.

The nature of the problem. Under the second phase of the Changar Project, a dam was built across the main drainage line – Gulana Khad in 2003 at the downstream village of Kuhan Khas and an LIS was installed. When the current WII project was initiated, about eight farmers were using this system to irrigate about 0.4 ha, mostly for vegetable cultivation, with substantial gains from this changed cropping pattern, albeit from a small area.

34. Source: IGCEDP.

The principal watershed service problem in Kuhan was the high silt load in the Gulana Khad, which was resulting in the rapid silting up of the reservoir that serves as the water source for the LIS. In just two years, at least half the dam capacity had silted up (Kartar Chand, personal communication 2005). The baseline hydrology study provided a conservative estimate for silt loss of 20 tons/ha/year for the Kuhan catchment, which was on the higher side of the range for the Changar area, of 3.6–22 tons/ha/year (PSI 2006). After just two monsoons, it was clear to the farmers that they needed to take quick and serious action if they wanted to preserve their dam. The initial facilitation process had two objectives. The first was to make the local institutions more robust and expand irrigation downstream: this would broaden the user base and create a larger constituency for catchment protection. The second objective was to help the farmers realise the relevance of changes in the land uses upstream and their role in promoting it.

Bhodi-Suan or 'Suan' catchment. The Bhodi-Suan catchment, also referred to as the Suan catchment, is located about 30 km southeast of the town of Palampur. Defined by clear ridgelines in the northern, eastern and western sides, the catchment covers an area of about 406 ha. Its altitude is between 730 and 1100 m, with steep slopes that are covered by grass.[35]

This project focused on the lands of three villages: *Bhodi, Kharjar* and *Suan*. The villages of *Jarerh, Maharaj Nagar* and *Ropadi* also have lands in the catchment, but Maharaj Nagar is virtually uninhabitated and mostly comprises fairly dense forest; Ropadi is further downstream, and Jarerh has only a small area in the catchment. The *Suan Khad* is the primary drainage channel in the catchment. It is a perennial stream that originates in the northeastern section of the catchment and flows in a southwesterly direction. Several perennial and seasonal *nalas* or streams feed into this primary channel (see Map 4). Bhodi (12 households) is the upstream village, Kharjar (15 households) lies somewhat mid-stream and Suan (57 households) is the downstream village. The catchment has considerable areas under agriculture, grazing, hayland and forests (Table 2).

The nature of the problem. Water scarcity was a key problem in the Suan catchment in the 1990s. Natural springs had started to dry up in the village in the summer and the upper forest and hayland area experienced fire almost on an annual basis. During the first phase of the Changar Project (1995 – 2000) the villagers traced the cause of the declining water problem to the degradation of land in the upper catchment. Accordingly, sections of the upper catchment were protected for regeneration and planted. These have reportedly resulted in increased sub-surface flows as observed in the recharge of *baowdis* (springs). However, even

35. WII (2005). Site profile of the Bhodi-Suan MMWS.

Table 2 **Suan catchment land use**

Land use	Area (ha)
Agriculture	221.6
Forests	55.2
Grazing land	187.9
Hayland	177.2
River	33.4
Waste land	24.1
	699.4

now, the water flow in the nala during the summer months is very low. In fact, in summer, the stream is intermittent in sections and the water ceases to flow and remains stagnated in small, natural pools in the streambed. Villagers in Suan want to install an LIS on the Suan Nala to irrigate their agricultural fields – for protecting their wheat crop and experimenting with vegetable farming and thus improving livelihoods. However, for a LIS to be effective, the volume of surface water in the stream, especially in the summer, needs to be increased. On the basis of their experience with the Changar Project, about half of the members of the Suan Village Development Committee felt that changes in upstream land use might increase the summer flows in the nala.

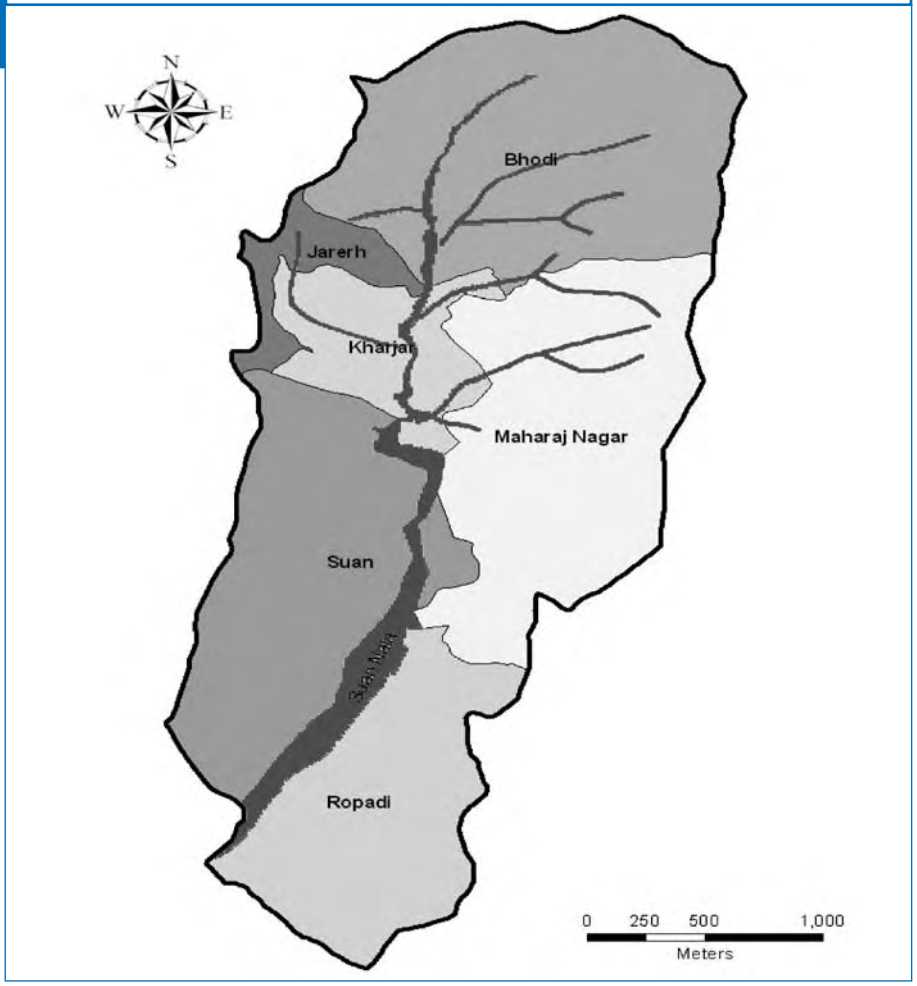
Although the problem was initially seen as one of water quantity, after some time the focus of discussions shifted to fire control. Forest and grassland fires leave hard-baked soil with poor infiltration, which leads to greater wet season runoff and reduced dry season flows. Thus, in addition to the direct benefits in terms of saving grass and protecting houses and other property, controlling fires in the upper watershed also impacts directly on downstream watershed services.

Socioeconomic profiles of the two catchments. Both catchments have similar socioeconomic profiles. In both catchments the dominant ethnic group belongs to the General Category,[36] forming 75–80% of the population. Most of the agricultural lands are rain-fed and subsistence agriculture is widely practised. Livestock keeping is also a secondary or tertiary occupation and there is a general trend to reduce the livestock holding in the region (for example, the entire Suan village has only one pair of bulls). Most households depend on income from relatives working far away in the plains, and migration is high. As a result, increasing areas of agricultural lands are being converted to haylands. Most of the households across the two catchments

36. General Category refers to Forward castes or Upper castes or Non-reserved castes, a group of castes that are classified neither as Backward castes nor Scheduled castes and tribes in lists published by the Government of India or by various state governments of India.

Map 4

Bhodi-Suan catchment



fall within the 'poor' (annual income between Rs18,000 and Rs40,000[37]) and 'medium' (annual income between Rs40,000 and Rs60,000[38]) income groups.[39]

37. US$400 to US$889 at a conversion rate of Rs45:$1.
38. US$889 to US$1,333.
39. The poverty line as per the Planning Commission estimate at 1999–2000 prices was Rs328 per person per month or approximately Rs19,680 per year for a family of five. The guidelines of the panchayat, which includes Suan, take Rs18,000 per household per year as the poverty line; the panchayat is advised of this threshold by the local government. The figure of Rs19,680 has been rounded down to this. Another estimate used is Rs10 per person per day, which also works out to roughly Rs18,000 for a family of five per year. For the purposes of this project, Rs18,000 was taken as the poverty line for a household of five people; the project team then made their own categories to show poor, medium and rich farmer classes, as given in the footnotes above (Madhu Verma, personal communication, 2006).

Partner organisation. The partner organisation in HP is the Himachal Pradesh Eco-Development Society (HPEDS), which is the implementing agency for IGCEDP and is a semi-governmental organisation supported by GTZ and the government of HP. The autonomous status of HPEDS helped IGCEDP to promote innovative multi-stakeholder approaches in decentralised natural resource management, which formed the core of its work. They also set up village development committees at the village level. This approach, and the extensive information gathered on the villages covered under the IGCEDP, made HPEDS a valuable partner for intensive fieldwork at the local level.

2.3.2 Madhya Pradesh

The Bhoj Wetlands, Bhopal. The Bhoj Wetlands around Bhopal city in MP are recognised as wetlands of international importance and are a *Ramsar Site*.[40] They consist of two man-made reservoirs, the Upper Lake and the Lower Lake. Constructed in the 11th century by King Bhoj of Dhar, the Upper Lake was created by building an earthen dam across the Kolans River. It has a catchment area of 361 km^2 and water spread of 31 km^2. Although it includes parts of the city, the catchment is predominantly rural. Created in 1794, the smaller Lower Lake has a catchment area of 9.6 km^2 and water spread of 1.29 km^2. It receives water from the Upper Lake through seepage as well as from its mainly urban catchment area. The wetlands support a wide variety of flora and fauna. Over 160 species of birds and 14 rare macrophytes have been reported in the area (personal communication, Nandi 2005).

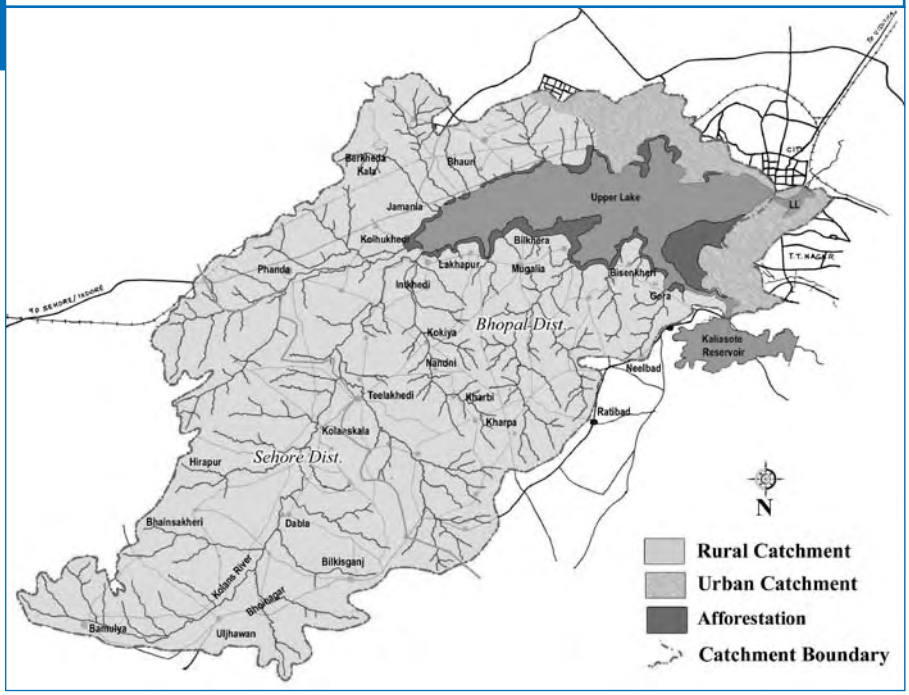
The Bhoj Wetlands are an important source of drinking water and recreation for the 1.8 million[41] residents of Bhopal. The Upper Lake provides about 40% of the city's drinking water, about 29 million gallons per day. There are boating and water sports facilities on both lakes. Further, livelihoods of many people are directly linked to the wetlands. A fishermen's cooperative of about 250 fishermen holds fishing rights on long lease. Some people grow water-chestnuts in the wetlands, for sale locally. Local washermen who washed on the banks were recently shifted to another site to reduce pollution from detergent.

The nature of the problem. The Bhoj Wetlands are facing twin problems of poor water quality and reduction in storage capacity due to siltation. The water quality is being affected by several factors such as inflow of sewage and solid waste from the urban areas and runoff from agriculture fields in the peri-urban/rural catchment. In recent years, several steps have been taken to control pollution from sewage

40. A *Ramsar Site* is a wetland that has been designated as internationally important according to a set of criteria under the terms of the (Ramsar) Convention on Wetlands, by the Administrative Authority of the Contracting Party State (www.wetlands.org/RSDB/default.htm).
41. Census of India 2001.

Map 5

Catchment area of the Upper Lake and Lower Lake – Bhoj Wetlands



and solid waste generated mainly in the urban areas.[42] The problems related to agriculture runoff, on the other hand, have not been addressed substantially so far, although they have been acknowledged as problems in official documents.[43] There are 55 complete villages and lands of 87 villages in the catchment of the Upper Lake in the Bhopal and Sehore districts; the major part of the catchment is under agriculture. Use of chemical fertilisers for wheat and soyabean and inadequate soil management lead to nutrient runoff (mainly nitrate and phosphate). This affects the Upper Lake by increasing its productivity, leading to increased production of algae, which ends up affecting the filters in the water treatment plants. Although comprehensive monitoring of the nutrient load according to (rural or urban) source is not available, desk estimates suggest that the rural catchment is a significant source of nitrates (Misra 2006).

42. Under the Japan Bank for International Cooperation (JBIC)-funded 'Lakes Bhopal Conservation and Management Project', popularly called Bhoj Wetland Project and implemented between April 1995 and June 2004. The Environmental Planning and Coordination Organisation (EPCO) implemented this project, on behalf of the Housing and Environment Department of Madhya Pradesh. The total project cost was Rs2,470.20 million (GB£30.88 million), out of which Rs370.5 million (GB£4.63 million) was provided by the Government of Madhya Pradesh.
43. The Bhoj Wetland Project focused on the urban pollution into the lake. For the rural catchment, treatment included construction of 75 checkdams and two silt traps. Later the LCA also experimented with promoting composting techniques in villages near the lake.

Photo credit: Amitangshu Acharya/WII

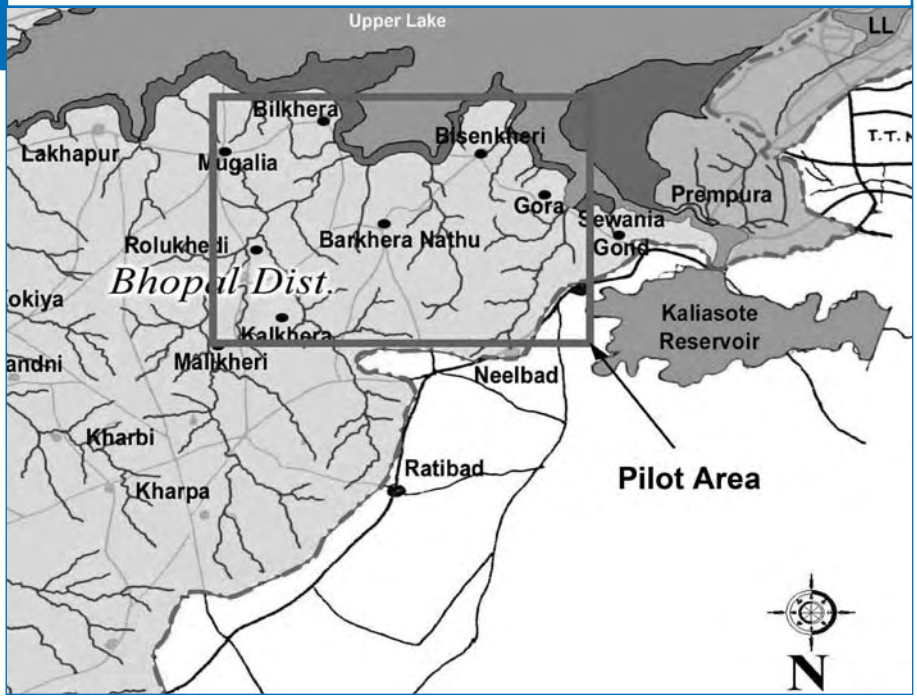
Bhopal Upper Lake

On the urban side, this project focused on sensitising and mobilising organisations and communities that benefit from the lake. In the rural catchment, eight villages along two drainage channels that flow into the lake were selected on a pilot basis. These were: the villages of *Gora* and *Sewania Gaur* along the *Gora Nala* and *Mungaliachhap, Bhilkheda, Bishenkhedi, Barkhedanathu, Rolukhedi* and *Malikhedi* villages along *Neeljhi Nadi*. The villages are shown in Map 6.

All eight villages are well connected to the city of Bhopal through pucca or semi-pucca roads. The villages have access to electricity and telephone connections. Most of the catchment's population belongs to the Scheduled castes and General Category. Average literacy rate in these villages is 67.45%, marginally higher than the MP state average of 63.7%. Though household asset ownership was reported to be quite high in villages with a higher population belonging to the General Category, at the other end of the spectrum were villages comprising mostly religious and socioeconomic minorities which had fewer movable assets, smaller landholdings and poorer housing conditions.

Map 6

Selected villages of the Bhoj Upper Lake catchment, Bhopal



Agriculture is the major livelihood activity in the area, with almost 75% of the population sampled during the baseline study accessing irrigation facilities for agriculture. Agriculture was the primary income source in all sampled villages except for Sewania. Given the proximity of these to Bhopal, migration to the city for labour and 'service' was also prevalent.

The baseline study revealed a skewed pattern of ownership of cultivable land. Those people belonging to Scheduled castes and tribes had a negligible share of land ownership (6.7% and 0.6% respectively), whereas those belonging to Other Backward castes[44] had a share of total land ownership (43.7%) that was almost the same as for those from the General Category (48.9%) – and that too concentrated within a few households. Most (64%) of the sampled population were marginal farmers. Soil quality was reported to be average; and agriculture is chemical intensive in nature. High expenditure on agriculture inputs, mainly fertiliser and pesticides, was reported across the sample population. A summary table on the selected villages in the Bhoj catchment is given in Annex 3 (Verma *et al.* 2006a).

44. Backward castes or Scheduled castes and tribes are classified as such on the basis of a range of socioeconomic criteria and given in lists published by the Government of India or by various state governments of India. The rest of the population is referred to as the General Category, which includes mostly Forward castes or Upper castes, or Non-reserved castes.

Partner organisation. WII's partner for the Bhoj Wetlands study is the Lake Conservation Authority (LCA). The LCA was created in 2004 by the Government of MP to sustain the Japanese-supported Bhoj Wetlands Project efforts and to initiate holistic conservation and management of other lakes in the state. The LCA develops conservation projects for other lakes, monitors the Bhoj Wetlands, provides advice on impacts on lakes and water bodies on demand and engages in awareness raising. It does not have regulatory powers, which rest mostly with the owner of the lake, the Bhopal Municipal Corporation, as well as with the State Pollution Control Board.

2.4 Summary of sites

The primary watershed service that this study addresses in Kuhan and Bhoj is water quality. In Suan, it was initially water quantity, but then the focus shifted to fire control. A summary of the sites is provided in Table 3.

In addition, a new site, earlier shortlisted in the scoping exercise, was explored towards the end of the project – the catchment of the spring that supplied the water to Palampur city, in Kangra district, in HP. Progress at this site is reported in Box 7 in section 4.1.

Table 3 **Summary of the three sites**

Watershed	Area	Land use and land management	Watershed service
Kuhan (HP)	210 ha	Forest, hayland, grazing land, rainfed agriculture	Silt load reduction in stream to prevent silting of small reservoir
Suan (HP)	406 ha	Forest, hayland, grazing land, rainfed agriculture	Increased infiltration to improve water quantity downstream
Bhoj (MP)	361 km^2	Mostly agriculture, and creeping urbanisation	Reduced nutrient runoff to improve water quality in the Bhoj Upper Lake

3 Process, progress and problems

3.1 Introduction

Developing IBMs is, fundamentally, an exercise in adaptive management. Although care was taken in choosing sites that had existing institutions, considerable effort has been made to strengthen institutional processes so as to facilitate positive interactions between upstream and downstream stakeholders.

Key elements of the facilitation process were to:

- develop baselines on land use, livelihoods and hydrology in each site;
- help stakeholders understand the environmental problem, the nature of the potential watershed service, and possible land use and management changes that can help maintain or enhance watershed services;
- perform preliminary assessments of emerging impacts of the institutional strengthening and IBMs, developed in the course of the project.

In this section, we describe the process of developing IBMs, the progress made and the problems encountered for each site.

3.2 Review of process in the Kuhan catchment

In the two HP sites, Kuhan and Suan catchments, the selection process showed that there were issues about watershed services of both water quality (sediment load) and quantity. The key villages in these catchments had functional Village Development Committees (VDCs) formed by HPEDS under the Changar project. The VDCs were, in principle, agreeable to negotiating some sort of transaction arrangement that would improve watershed services.

Once the facilitation process started in earnest in January 2005, the project team took a range of steps to 'set the stage' before the start of any negotiation on the potential land use changes and the payment required to support those changes. These steps aimed to streamline and strengthen the institutions and to clarify the land management options.

In Kuhan, for example, facilitative steps were undertaken to strengthen the process and to identify other steps to reduce sediment load in the dam; the latter step took place following the signing of a land protection agreement (described below). Key steps are listed in Box 2.

3.2.1 Warm-up

In the actual run-up to the negotiation meeting in August 2005, several pre-meetings were held with the VDC of both the upstream and downstream villages to help them clarify the limits to which they were willing to negotiate. In addition, two steps stand out. First, a cross-visit was arranged for people from the Kuhan catchment to the Suan catchment, where women had been involved in protecting their forest. This had a positive impact in motivating people in Oach-Kalan village. Second, a process of exploring options for protecting the dam in Kuhan Khas village was adopted. In the early days several people in Kuhan thought that manually de-silting the dam could be a direct solution. Accordingly, a half-day dam de-silting festival was held. About 25 people participated and removed an estimated 10 m^3 of silt. This, however, was less than 10% of the silt accumulated over just two years. This led to the realisation that tackling the silt problem would require multiple steps and catchment protection would be a key element. In the subsequent hydrology study, a local hydrologist identified zones of high erosion potential. The combination of this study and the abortive dam cleanup effort suggested to the Kuhan VDC that preventing erosion and catching sediment upstream was an important element of dam protection.

Photo credit: Kirsten Henninger

Discussion with members of the eco-club on the working of min-max thermometers

Box 2

Facilitative steps before and after the agreement in Kuhan

Early facilitation steps, January to August 2005

The project team:

- took an early conscious decision not to contribute project funds to the facilitation process, so as to keep the process self-reliant from the start, and thus increase the chances of it being sustainable. This extended to simple steps like not funding any snacks for village meetings, to encouraging volunteers to collect primary rainfall and stream flow data;
- organised hamlet level meetings in the Kuhan Khas village (downstream) to ascertain interest in the irrigation system when village level meetings were not showing results;
- facilitated many independent and joint meetings of the two key villages and other villages in the catchment, to facilitate the IBM;
- facilitated a meeting of the Kuhan Khas VDC, during which accounts were discussed, the irrigation sub-group was dissolved and the Kuhan Khas VDC was reconstituted with new membership;
- suggested combining the three bank accounts of Kuhan Khas VDC to simplify accounting and reduce chances of accounting gaps, which had happened earlier. Developed a micro-credit scheme and a provision for cash-back to members from their monthly subscription after each year, to incentivise those villagers who were not accessing irrigation water, to participate in the VDC;
- surveyed the irrigation system to assess options for expansion.

Post-agreement steps, August 2005 onwards

The project team:

- developed a sliding scale of water user charges (according to whether people had contributed capital to the LIS) to broad-base irrigation water use. The number of users increased from eight to 52;
- organised a catchment-level eco-walk for school students, followed by a catchment-level camp where VDC members and students played a key part. The eco-walk and camp helped to announce the agreement across the four catchment villages, increased use of irrigation water in Kuhan, engaged several families through their children and started the process of engaging the panchayat;
- assisted in the formation of an eco-club that has engaged students in environmental issues in their catchment;
- provided training on water record keeping, self-audit, micro-credit record keeping and actual set-up of registers, to increase transparency of accounts and processes in the Kuhan Khas VDC;
- took the volunteer environmental data collectors on an exposure trip to the neighbouring state of Uttaranchal to visit the laboratory where the samples are processed and to visit other instrumented catchments;
- organised a meeting with the panchayat to explore options for a catchment-level body.

3.2.2 Financing the protection

To finance protection of the dam through silt control activities, the Kuhan VDC set up a dam protection fund (the Dam Suraksha Kosh, DSK) in April 2005. The hourly pumping charge was increased from Rs10 to Rs15. Of the extra Rs5, Rs2 was kept for the Dam Suraksha Fund, Rs2 for pump maintenance and Rs1 for pipe maintenance. However, by August 2005, when negotiations were on in earnest, only about Rs150 had been collected. Subsequently, an additional flat contribution of Rs50 per permanent member per year was also agreed. To meet the cost of about 330 saplings, an advance of Rs1,000 was taken from the general VDC account (returnable as money accrued in the DSK). The expansion in water users and irrigated land has increased pump use and bolstered the DSK. Initiating the DSK and expanding irrigation downstream has provided a small but sustainable source of funds for the LIS infrastructure and catchment security upstream.

Subsequently, Kuhan VDC nominated three people to negotiate a settlement on their behalf with the Oach Kalan VDC. They also set an upper limit of Rs1,000 to their upstream cash contribution. By then, some Oach Kalan VDC members had also seen the protection efforts in Bhodi-Suan.

3.2.3 Getting to yes

On the day of the negotiation, three members from the Kuhan VDC attended a general body meeting of the Oach Kalan VDC. The meeting started with a simplified presentation by the hydrologist of the nature of the catchment and the relation between geology, slope, land use, etc. in assessing zones of high erosion potential in the catchment. This was a critical input into the process and provided an objective assessment of the erosion problem based on a comprehensive field study. The impact of open grazing on erosion was mentioned. Discussion then moved to options for closing sections of the catchment to grazing. The final area chosen for closure comprised eight to ten hectares of private land. Twenty-eight people owned this land, including some absentee owners. It was used as a grazing route, with light grazing and some sporadic agriculture. Kuhan VDC offered to pay for saplings, the cost of transporting them, and also contributed some labour for planting.

The landowners present had several concerns:

- What could they plant? (any species of their choice: they finally chose mostly commercial ones such as *Acacia catcheu* and *Dalbergia sissoo* (tali)).
- Would Kuhan or the government get a claim on the land? (No).
- How could they (the women) decide in the absence of menfolk? (In some households where men worked and lived elsewhere, the women were making all the decisions anyway, so why not on this issue, which would benefit both them and the environment).

- What would be the impacts on local graziers? (The area was mostly used for transit and both local people and migratory herders (gaddis) would find alternate routes. The issue of paying them did not arise.)
- What should be the duration of the agreement? (Kuhan initially suggested 20 years, Oach said three or four; they finally settled on eight.)

The final agreement between Oach-Kalan VDC and the Kuhan VDC includes several provisions on the area for closure, duration, what is allowed or not, the support from Kuhan Khas village and the responsibilities of Oach Kalan VDC. The key provisions of the agreement are given in Box 3. The actual scanned copy of the agreement (in Hindi) is provided in Box 4.

Box 3

Key elements of the protection agreement between Village Development Committees of Oach Kalan and Kuhan Khas villages

Kuhan VDC will provide the landowners with 330 saplings for planting in this area. Oach Kalan VDC will provide Rs50 towards transportation, and the rest of the costs of purchase and transport will be borne by the Kuhan VDC (point 1). The agreement calls for the closure to grazing of the protected area (locally referred to as Gurchu, Mirge de nal and Langha Kharetar) for eight years (point 6).

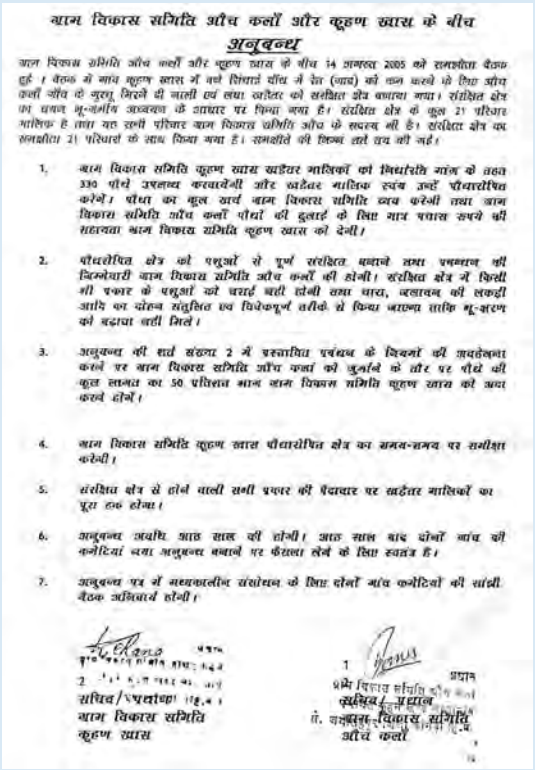
Oach Kalan VDC will enforce the agreement to restrict grazing and allow judicious harvesting of fuelwood (point 2). If the agreement is broken, then Oach Kalan VDC will have to pay 50% of the cost of saplings as a fine (point 3). The agreement may only be revised through a joint meeting of both VDCs (point 7). The Kuhan Khas VDC can visit the closed area (point 4). After eight years both VDCs are free to consider a new agreement (point 6). The produce of the area will belong to the landowners (point 5).

It is notable that although the agreement mentions that 21 families are involved who have agreed to it and they are members of the Kuhan Khas VDC, which is the signatory, it does not actually specify them by name. Similarly, it does not specify the actual area that is under protection. This is perhaps because there is common understanding on the area under protection and perhaps because Oach Kalan VDC does not want to get bound legally.

Based on the agreement, the Oach Kalan VDC developed management rules for the area. These rules ban grazing and state the fines to be paid by villagers and migrant graziers if grazing occurs. An exception is made for those bullocks that are used for ploughing the few agricultural fields in the area. The primary agreement for closure has continued to hold as per the management rules framed above. In a review with the upstream community in the summer of 2006, the Kuhan VDC was satisfied that protection was indeed underway and the agreement terms were being met.

Box 4

Agreement for catchment protection in the Kuhan catchment (in Hindi)



गाम विकास समिति औच कलाँ और कूहण खास के बीच

अनुबन्ध

गाम विकास समिति औच कलाँ और कूहण खास के बीच 14 अगस्त 2005 को सम्पन्न बैठक हुई। बैठक में गांव कूहण खास में बने सिंचाई चॉच में पेत (जाब) को बन्द करने के लिए औच कलाँ चॉच से जुरनू मिटने की जाली एवं खदेर को संरक्षित क्षेत्र बनाया गया। संरक्षित क्षेत्र का चयन भू-जलीय अध्ययन के आधार पर किया गया है। संरक्षित क्षेत्र के कुल 21 परिवार मालिक है तथा यह सभी परिवार गाम विकास समिति औच के सदस्य भी है। संरक्षित क्षेत्र का समझौता 21 परिवारों के साथ किया गया है। समझौते की निम्न शर्तें तय की गई।

1. गाम विकास समिति कूहण खास खदेर मालिकों को निर्धारित शर्तों के तहत 330 पौधे उपलब्ध करवायेगी और खदेर मालिक स्वंय उन्हें पौधारोपित करेगें। पौधा का कुल खर्च गाम विकास समिति व्यय करेगी तथा गाम विकास समिति औच कलाँ पौधों की सुरक्षा के लिए मात्र पचास रुपये की सहायता गाम विकास समिति कूहण खास को देगी।

2. पौधरोपित क्षेत्र को पशुओं से पूर्ण संरक्षित बनाने तथा प्रबन्धन की जिम्मेदारी गाम विकास समिति औच कलाँ की होगी। संरक्षित क्षेत्र में किसी भी प्रकार के पशुओं को चराई वर्जित होगी तथा चारा, जलावन की लकड़ी आदि का दोहन संतुलित एवं विवेकपूर्ण तरीके से किया जाएगा ताकि भू-क्षरण को बढ़ावा नहीं मिले।

3. अनुबन्ध की शर्त संख्या 2 में प्रस्तावित प्रबंधन के नियमों की समदेखरेख करने पर गाम विकास समिति औच कलाँ को चुनाँव के तौर पर पौधे की कुल लागत का 50 प्रतिशत गाम गाम विकास समिति कूहण खास को अदा करने होगें।

4. गाम विकास समिति कूहण खास पौधारोपित क्षेत्र का समय-समय पर समीक्षा करेगी।

5. संरक्षित क्षेत्र से होने वाली सभी प्रकार की पैदावार पर खदेर मालिकों का पूरा हक होगा।

6. अनुबन्ध अवधि आठ साल की होगी। आठ साल बाद दोनों चांच की कमेटियां चाहे अनुबन्ध बनाने पर फैसला लेने के लिए स्वतंत्र है।

7. अनुबन्ध पत्र में मध्यकालीन संशोधन के लिए दोनों चांच कमेटियों की संयुक्त बैठक अनिवार्य होगी।

सचिव/प्रधान
गाम विकास समिति
कूहण खास

प्रधान
गाम विकास समिति
औच कलाँ

3.2.4 Other incentive-based mechanism land management activities

In addition to the closure, additional land management activities were discussed or undertaken in 2005 and followed up in 2006 to control erosion and reduce silt loads. These were: (a) constructing brushwood checkdams on sub-streams to hold silt; (b) planting live bamboo rhizomes in the stream to hold silt; (c) planting Elephant grass (*Napier bajra*) on agricultural field bunds in the closed area; (d) leaving a narrow strip of natural vegetation along the contour in hayland areas; and (e) closure elsewhere. The experience was as follows:

- After the catchment level *sammelan*[45] in November 2005, village people were motivated to try silt control activities. They built three 'brushwood checkdams' – vegetative structures of stone, live cuttings and other woody material that eventually create a dense vegetative barrier in the stream and entrap silt. The first (experimental) one in Chir nala was prepared with the technical support of

45. A *sammelan* means a gathering or event for a specific purpose. Here the event was organised in the local school, and involved debates on environment, IBMs, songs and dances; and some speeches and snacks.

the facilitation team, while the villagers supplied some labour and all materials. An earlier offer to fund materials and labour was later turned down by the villagers; the technical support was considered sufficient. The second dam on the Sai nala was made with material supplied by the upper village and labour from the lower one, with the field team present as support. For the third dam at Bai de Nal, the field team was not present at all. The checkdam in Sai hamlet was broken in the dry summer months to access water for animals; this led to a reassessment of the social process of selecting sites for the dams. The broken checkdam has now been re-built at a more appropriate location after another meeting with the nearby households. In January 2007, after an eco-walk, children who were members of eco-clubs of both villages got together and made two new brushwood checkdams in the upper catchment.

- Another option identified was to create a live hedge in the stream, to establish live stands to hold silt. This idea was shared during the catchment level *sammelan* in November 2005 by a catchment farmer from Oach Kalan who had tried it earlier. The Kuhan VDC has planted this in two places in the main stream, and around brushwood dams, in the 2006 monsoon, with labour coming from the students' eco-club. The stems have been donated by individual members.
- It was suggested that Elephant grass be planted on the agricultural field bunds in the closed area in Oach Kalan in order to reduce erosion and provide year-round

Photo credit: Vijay Guleria/WII

Kuhan VDC members and HPEDS staff preparing the first brushwood checkdam

fodder. The grass provides green fodder in winter and controls erosion. Kuhan VDC offered the planting stock to Oach. Oach VDC instead considered obtaining material from their private fields, but in the end did not plant in the 2005 monsoon. The following year the Kuhan VDC raised the issue before the 2006 monsoon and five families from Oach Kalan planted tufts of *Napier bajra* on their own. However, this has remained a small-scale activity.

- The idea of leaving natural vegetative strips (NVS) has emerged from the Philippines as an easily implementable erosion control measure. This was discussed with farmers in the catchment: a few showed interest but this could not be followed up in this phase of the project.
- In a small patch of about 5 ha in Sai hamlet of Uprela Kuhan village, villagers have agreed to a Forest Department proposal to close the area to grazing and not harvest grass from there. This is thought to be an influence of the project as earlier the villages had grazed a plantation in that small patch.

Recent developments. During the 2006 monsoons, a faulty road construction process upstream of the reservoir in Kuhan Khas village inundated the reservoir with silt. Various cleaning strategies were tried out by the Kuhan Khas VDC. However, faced with endless problems, the community has decided on a multi-pronged approach. While considering legal recourse (not ultimately followed), and installing a de-silting sluice gate (underway by the community), they still planned to continue with protection and silt management activities upstream. This event (as illustrated in Box 5) shows how macro-external factors such as 'business as usual' road building that is associated with high levels of erosion can impede the provision of micro-level watershed services.

3.3 Process, progress and problems in the Suan catchment

The second site in HP, Suan micro-catchment in Kangra district, has a decade-old history of upstream – downstream collaboration.[46] The watershed service issue here is the need to maintain and enhance summer flows in the main Suan nala, to make viable a planned future investment in a small irrigation scheme. In the scoping phase, people from Suan were interested in protecting additional areas upstream in Bhodi and were also willing to support it financially. However, as discussed below, a variety of factors contributed to their eventual reluctance to invest in catchment protection upstream, despite considerable facilitation by the project team.

46. The lower Suan village diverted a project investment for planting tree saplings from their village to the upstream Bhodi area, and also contributed labour. Bhodi had since protected the planted area, against considerable odds. This background of collaboration was an important criterion in selecting the village.

Box 5

Roads, dams and silt: a macro-lesson from a micro-story in Kuhan?

Among the western Himalayan hill states of India, HP is well known for establishing road connections to remote villages to improve their quality of life. However, the environmental costs, in the form of siltation of waterways and landslides, can be significant. A key reason is haphazard road cutting and dumping of silt in water channels and valleys, rather than disposal at designated dumping sites. Roads also act as major channels for overland flows of water. Part of Kuhan catchment, which is 'benefiting' from the new road, is currently bearing these environmental costs.

In the summer of 2006, a road was built a few hundred yards upstream of the dam and reservoir in Kuhan Khas village. Typically, tenders account for the cost for dumping the soil and other material removed in such operations in specified dumping sites. However, this is apparently rarely done in practice. Kuhan was one such case, and the excess soil was thrown on the slopes overlooking the dam. With a few heavy monsoon showers, the reservoir silted up completely, to the level of the surrounding land. There was no longer enough water depth to lift water; the pumps were silent and the pipes went dry. About 50 households that had experienced the benefits of irrigation the previous year were literally left 'high and dry'.

Petitions and visits to the Public Works Department (PWD) to pay for the cleanup did not bear fruit. The PWD said that they could not sanction additional money for the cleanup for faulty dumping when they had already accounted for it in the road-building contract: instead they would try to convince the contractor to bear the cost – something that has not happened so far. The contractor is also politically connected, which adds to the problem. Opposing the road was not felt to be a socially sound idea, as some families in the catchment would benefit from it.

Desperate, the Kuhan VDC organised a three-day dam cleanup effort in early November 2006, after the monsoon. Men, women and children contributed, and after more than 100 person–days of effort, the dam was partly de-silted. However, after a few winter rains, more silt was washed down the slope and the dam filled up again.

Realising the futility of manual cleanup, the Kuhan VDC is now pursuing a multi-pronged approach. They plan to continue investing in repairing and building brushwood checkdams in tributaries upstream. They actively considered going to court to force the PWD and contractor to dump silt in an environmentally friendly manner, but decided that the process would be too long drawn-out. Instead, they have started to break a section of the dam to install a de-silting sluice gate (the two pipes currently in place are insufficient), and then rebuild the dam. Now they will not be held hostage to silt load overwhelming their dam, and over which they have little control. The silt from the catchment will now spill into the Beas river, and contribute to the silt in the Pong reservoir downstream.

Subsequently, a separate transaction was attempted between the upstream Bhodi and the Kharjar village (downstream of Bhodi, but above Suan), around the issue of common land management to reduce the threat of fire, with downstream Kharjar providing labour and nominal cash inputs, and receiving direct grass benefits. The environmental service benefits were the reduction in fire risk and the secondary benefits of improving infiltration and reducing erosion. This process has also run into a few obstacles in both villages.

As regards engagement of the communities in Bhodi-Suan catchment, in initial meetings it was clear that investment in catchment protection upstream would largely be motivated by irrigation benefits to Suan. The facilitation team supported this through a series of technical feasibility surveys. The first ruled out a gravity irrigation scheme (as Suan's land was at a higher level than the point of offtake the second survey assessed an LIS only for Suan as it was not feasible to include Kharjar. When some people from Suan objected to the idea of pipes passing through their lands, the survey team modified the plan. It was proposed in a VDC meeting that each family in Suan would contribute Rs1,500 for the irrigation scheme, and the VDC would apply for government development grants for the balance.[47]

At the same time, Suan VDC members pointed out a more pressing threat to agricultural productivity: the loss of a third to a half of their crop to wild and stray animal depredation. They felt, rightly, that investing in irrigation (and catchment protection) had little meaning if the crops were still raided by animals. The facilitation team helped conduct a survey and assessed that the 2,040 m fence required to protect the cultivated area would cost at least Rs30,000 (assuming some labour contribution from the village).

While this process was underway, differences were arising within the Suan VDC over the mining of sand from the streambed in Suan by an influential VDC member. Subsequently, some Suan residents were also divided over their perception of impacts on water flow of the previous protection efforts in Bhodi a decade ago, and the idea to protect the upstream catchment lost favour. Unfortunately there were no records available of stream flows to validate the competing views. The findings of the hydrology survey were also mixed – that there were a few small zones that were conducive to infiltration, but most of the catchment comprised conglomerates with low infiltration potential. The hydrology study recommended specific measures in a few identified locations around stream banks to retain water over a longer period after the monsoon.

The need for fencing the cropped area, and the lack of initial success in securing government funds for irrigation, meant that the Suan VDC needed to make a concerted push to generate external and internal funds. However, the conflict within the village together with the mixed views about impact of protection on summer flows and the findings of the hydrology report led to a situation where the idea of financial support upstream was dropped, but elements within the Suan VDC decided to provide moral support upstream.

47. The final estimate was for Rs2,69,435 for a 10-horsepower LIS. As mentioned earlier, the family contributions were not collected, neither did the families apply for a grant.

Photo credit: Satyaprasanna/WII

Meeting in Suan village with the VIllage Development Committee

This moral support was provided by Suan VDC members who participated in meetings between the upstream Bhodi and Kharjar VDCs, where a separate transaction was attempted (but did not finally succeed). People from Kharjar informally access the common lands in Bhodi for grass harvesting. The land management change proposed was that Kharjar VDC members would re-organise the harvesting such that they cut from outwards in, create a fireline, and ensure biomass is removed before the fire season in April, as well as maintaining some fencing so as to create an effective fireline by early summer. It was thought they would also pay a nominal amount (about Rs10), and in return they would get legitimate access to grass. The first hitch was reluctance among three (out of 13) families in Bhodi to shift their goats to an alternate grazing site, which was a bit further away. They finally agreed, and a draft agreement was prepared, but then the lower village of Kharjar could not agree on how to coordinate their labour input for grass harvesting and fence maintenance. This was because different households collected varying quantities of grass from Bhodi, and they could not agree how labour should be contributed fairly, to reflect this variation. Thus the transaction based on the draft agreement did not take place – there was no contribution from the downstream and the proposed changes in harvesting practices did not take place. This is where the situation stands at the time of writing.

3.4 Process, progress and problems in the Bhoj Wetlands, Bhopal

At the Bhoj Wetlands, the watershed protection service comprises a reduction in agricultural runoff and hence improvement in the water quality of the Upper Lake. A change in agricultural practices in farms upstream, from chemical to organic wetland-friendly practices, was identified as a cost-effective and sustainable solution to the problem of agricultural runoff into the wetlands. The focus in this site was therefore on orienting the upstream and downstream stakeholders to appreciate their respective roles in lake water-quality management, especially in relation to the rural catchment. This was a relatively complex site requiring interactions between multiple rural and urban stakeholders. Key stakeholders in the city of Bhopal, the downstream beneficiaries of watershed services, were sensitised to the uses of the lake. They were asked about the possibility of supporting the suppliers of the watershed service of improved water quality, initially farmers in eight selected villages around the lake, to make the change in land management practices. Although no payment has been made at the time of writing, a very good basis has been established for setting up contributions to catchment protection in the near future.

The facilitation process for identifying an IBM around the Bhoj Wetlands involved the following key steps:

3.4.1 Identifying suppliers and receivers

Eight riparian villages along two streams (*Gora Nala* and *Neelji Nadi*) feeding into the lake were selected as representative watershed service suppliers, based on the twin criteria of (i) proximity of the farms to the stream bank or lake shore and (ii) existing contacts of LCA in the village and the potential for promoting wetland-friendly practices. In these villages about 150 riparian farmers with farms adjacent to the streams or to the lakeshore were identified as the primary watershed service providers. Other farmers were treated as secondary providers.

On the urban side, the stakeholders who stood to benefit from improved water quality and storage capacity of the Bhoj Wetlands were identified.[48] Table 4 lists the key stakeholders and their interests in the lake.

3.4.2 Clarifying the science

The next steps were to establish the contribution of the rural catchment to the pollution load of the lake, and to identify land management activities that improve water quality.

48. Note by Dr Nandi, Lake Conservation Authority.

Table 4

Stakeholders in the Upper Lake, Bhopal

Stakeholder	Benefits from the lake
Residents of Bhopal (individuals and their associations – Resident Welfare Associations, Lions Club, Rotary Club, etc.)	• Water for domestic consumption (40% of the city of Bhopal: mainly residents of Old Bhopal) • Idol immersion • Recreation: morning walks, bird watching, boating, etc. • Micro-habitat
Bhopal Municipal Corporation	Owns the lake and is responsible for upkeep. As operator of water treatment plants, and water supply, has a direct financial stake in water quality, as it affects treatment cost
Fishermen's cooperative	About 250 fishermen's households dependent on the lake for livelihoods
Water-chestnut cultivators	Activity banned, but still practised sporadically: provides income
Industrial, institutional and commercial users (Bharat Heavy Engineering Limited (BHEL) and Indian Railways)	BHEL and Railways buy raw water for institutional use and treat it themselves
Boatmen	Use the recreation value of the lake: source of income
Providers of water sports	Use the lake to host water-sport events
Hotels along the lake	Uses the aesthetic value of the lake to attract tourists Lake view rooms have higher tariffs in some cases
Forest Department	Manage the Van Vihar, a sanctuary adjacent to the lake and a key bird habitat. Interest in preserving bird habitat beyond forest lands

Contribution of the rural agricultural catchment to the pollution load of the lake

The quality of water in lakes, streams, rivers, etc. is directly dependent on land management practices prevalent in their catchments. In the USA, nutrients (i.e. phosphorus and nitrogen) are the top pollutants that impair water quality in lakes and reservoirs: they enter such water bodies through non-point source runoff from urban areas and agriculture. Nutrient levels in most lakes in Missouri are determined by non-point source impacts within the watershed.[49] The type of land cover within a watershed also plays a major role in water quality. In Missouri and elsewhere, more agriculture in a watershed leads to more nutrient inputs into the lake.[50] In contrast, a forested watershed generally equates to less human impact and therefore lower nutrient inputs. In India, in the relative absence of sewage treatment, point sources like sewage are still perhaps the dominant contaminants

49. This information is excerpted from the Lakes of Missouri Volunteer Program 2004 Data Report, available at www.lmvp.org.
50. Ibid.

in lakes and rivers; however as treatment increases, the relative impact of non-point sources will increase.

In the context of the Bhoj Upper Lake, identifying the impact of chemical agricultural practices in the catchment on lake water quality could be assessed in broad qualitative terms only. Quantification is difficult as, although lake water quality is monitored regularly (key parameters are monitored monthly and other parameters, quarterly), assessing the relative pollution load contributed from the rural and urban zones of the catchment would require monitoring the quality and quantity of inflows from all streams and drains on a regular basis. This is a resource-intensive exercise, and not currently undertaken by the Lake Conservation Authority. Thus the relative pollution load contributed from the rural and urban zones of the catchment cannot be assessed empirically at present. To address this problem, a desk assessment was conducted as part of the water and soil monitoring study (Misra 2006). The study made a qualitative assessment of the contribution of the rural agricultural catchment to pollution in the lake, based on the regular water quality monitoring data.

The methodology used had the following steps:

1. The lake was divided into different regions – rural- and urban-influenced – based on the predominant source of pollution and nutrients.
2. The biophysical potential for mixing of water and of nutrient loads between these lake regions was assessed.
3. Several water quality monitoring stations representative of each region was identified.
4. Key parameters for lake water quality (both surface and bottom) for rural- and urban-influenced regions of the lake were tabulated on a seasonal basis.
5. Finally, these parameters were interpreted in the context of lake ecology in order to make tentative conclusions on the scale of contribution of the rural catchment to the pollution/nutrient load of the lake.

This analytical process is given in Box 6.

Box 6

Qualitative water quality analysis in the Upper Lake

Total parameters: 120
Parameters selected: nitrate, phosphate, potassium, biological oxygen demand (BOD), chemical oxygen demand (COD), MPN, faecal coliforms
Identified sampling points: two in urban areas, five in rural areas

Comparisons made between (average values):

- **surface and bottom of the lake**
- **seasonal fluctuations**
- **identified parameters**

Seasonal averaging: winter, summer, monsoon and post-monsoon.

The results are summarised below. This qualitative approach revealed three factors that, when considered in combination, suggest that the rural area contributes significantly to the nutrient load. These factors (illustrated in Map 7) are:

- The rural agricultural catchment lies predominantly to the west and the urban area predominantly to the eastern section of the lake catchment.
- The direction of water flow of water in the lake is west to east.
- The depth gradient is also west to east; the lake is deeper in the east.

These three factors strongly suggest that the pollution load in the western end of the lake is mostly influenced by the water flowing in from the rural catchment, and is unlikely to be influenced by the urban sewage-impacted water that predominates in the eastern end of the lake. If anything, water from the western catchment is more likely to influence the eastern section. Based on the analytical method summarised in Box 6, the relative pollution loads in the rural and urban catchment-influenced points were compared for the selected parameters. The results are summarised in Table 5.

We can conclude that the pollution load at the rural-influenced sampling points was similar to that at the urban-influenced points for nitrates, phosphates, potassium and COD. The load was somewhat higher at the rural points for transparency and coliform count, and it was somewhat lower at the rural points for BOD and turbidity. The study also suggests that the in the rural catchment areas, the nutrient loading remained high even after consumption of nutrients by macrophytes (water plants), which can moderate nutrient levels. The study therefore concluded that because the rural-influenced points had mostly similar or higher loading (for six out of eight parameters) compared with the urban-influenced points, the rural catchment does contribute significantly to the pollution load of the lake (LCA 2006).

Once it had been established that the rural catchment was a relatively significant source of nutrient pollution, the study looked at the absolute water quality levels in the lake. Water quality data indicated that the deeper part of the lake showed mesotrophic status but the shoreline and shallow part was in eutrophic condition.

Poor water quality in the lake affects the degree and cost of treatment necessary for meeting drinking water standards. Although nitrates and phosphates are well within the permissible limit specified by the Bureau of Indian Standards (BIS) and are within drinking water standards (which set a limit of 45 mg/l for nitrates, for example), their concentrations of 1.5 to 2.5 mg/l and above support luxuriant growth of macrophytes and algal blooms. The algae clog the sand filters that are used to filter raw water, such that frequent backwashing of the sand filter beds (an energy intensive task) is required and the filter medium has a shorter life. The high levels of turbidity, partly contributed by algae, require more flocculants such as alum to

coagulate suspended and dissolved solids, thereby increasing treatment cost. The high coliform counts suggest bacterial contamination of water: this increases the use of chlorine as disinfectant for drinking water supply.

Thus, to reduce treatment costs of potable water, it is essential to control the productivity of the lake by controlling and checking inflowing organic and inorganic matter through point and non-point sources of pollution. Reducing the inflow of nitrates and phosphates from agricultural areas is a key element in this process.

Table 5

Summary of water quality parameters at sampling points in the Upper Lake

Water quality parameter	Significance	Approximate value in the Upper Lake (2000–2005)	Impact of rural catchment
Biological oxygen demand (BOD)	The rate of oxygen uptake by micro-organisms reflects the level of organic matter in the water. BOD over 10 mg/l reflects poor water quality in surface water. Pristine rivers would have BOD below 1mg/l	Varies from 2 to 36 mg/l	Somewhat higher in lake bottom where weeds settle and decompose, than at the surface. Higher in urban-influenced points as compared with rural-influenced points
Chemical oxygen demand (COD)	Determines the amount of organic pollutants found in surface water (for example lakes and rivers)	Varies from 50 to 200 mg/l	Similar across both urban and rural sampling points, suggesting intensity of load is similar
Potassium	One of the major plant nutrients. Potassium is required in large quantities by plants for somatic growth	around 5 mg/l (3–6 mg/l).	Similar for both urban and rural points. Suggests that both sewage at the urban points and agricultural runoff at the rural points impact the potassium loads
Nitrate	Promotes algae and plant growth in water bodies	Overall both the surface and bottom values of nitrates vary between 0.5 and 1.5 mg/l	No clear difference is discernable between urban and rural values. While drinking water limits are 45 mg/l, from a lake quality point of view, even 1.5 mg/l can be considered high, as it leads to algal and plant growth, which eventually increase turbidity and water treatment costs
Phosphates	Can be a limiting factor to weed growth. The presence of additional phosphorus compounds stimulate algal productivity and eutrophication	Varies between 0.3 and 2 mg/l	Urban and rural point values fluctuate around each other. Marginal increasing trend over time

Turbidity	Reflects suspended matter	Varies between 20 and 300, with few spikes	Highest for urban bottom points, during monsoon. Declines in other seasons
Transparency secchi disk[51]	Secchi disk transparency depth is reduced by suspended algae and sediment particles in the water	Varies between 20 cm and 130 cm	Lowest clarity in monsoon, highest in winter. Overall, rural points are less transparent, suggesting more algal/sediment load
Total and faecal coliforms	Reflects level of bacterial contamination	Overall declining trend – from an average of 1500 to about 1000	Somewhat higher in rural points (bottom and surface). Current levels mean water is unfit for human consumption without treatment

Identifying land management activities to improve water quality

Having assessed the contribution of the rural catchment to lake pollution, the next challenge was to identify wetland-friendly practices that might reduce the impact of agricultural runoff. Increasingly, it has been established that conventional farming practices, such as intensive row cropping with heavy fertilisation, can greatly increase the potential hazard of environmental pollution from plant nutrients in water runoff or in leachate going to groundwater. Pollution is substantially minimised when a portion of the crop's nutrient requirement is supplied by animal manure, composted organic waste, inorganic nutrient sources of limited solubility and with implementation of best management practices that control runoff and soil erosion (Parr *et al.* 1982).

Although there is much literature promoting organic farming practices, there are relatively few studies on the impacts of organic farming practices on water quantity and quality. In a review of good management practices to control agricultural non-point source pollution, Cestti *et al.* (2003) refer to several studies and conclude that organic farming has less negative environmental impacts on the quality and quantity of water. In a report entitled 'Protecting water quality on organic farms', Bellows (2002) emphasises that 'Organic farming involves many practices that protect against nutrient leaching, water runoff, and soil erosion'. However, Bellows cautions that 'water quality protection is greatest when organic practices are implemented using a "systems approach" rather than simply following a general list of approved practices'. Long-term trials performed at the Rodale Institute since

51. A Secchi disk is a white disc about 20 cm in diameter, which is used to measure transparency of water on the basis of visibility. Secchi disk transparency is the depth to which the disk can be seen. The depth of Secchi disk transparency is reduced by suspended algae, soil and sediment particles in the water.

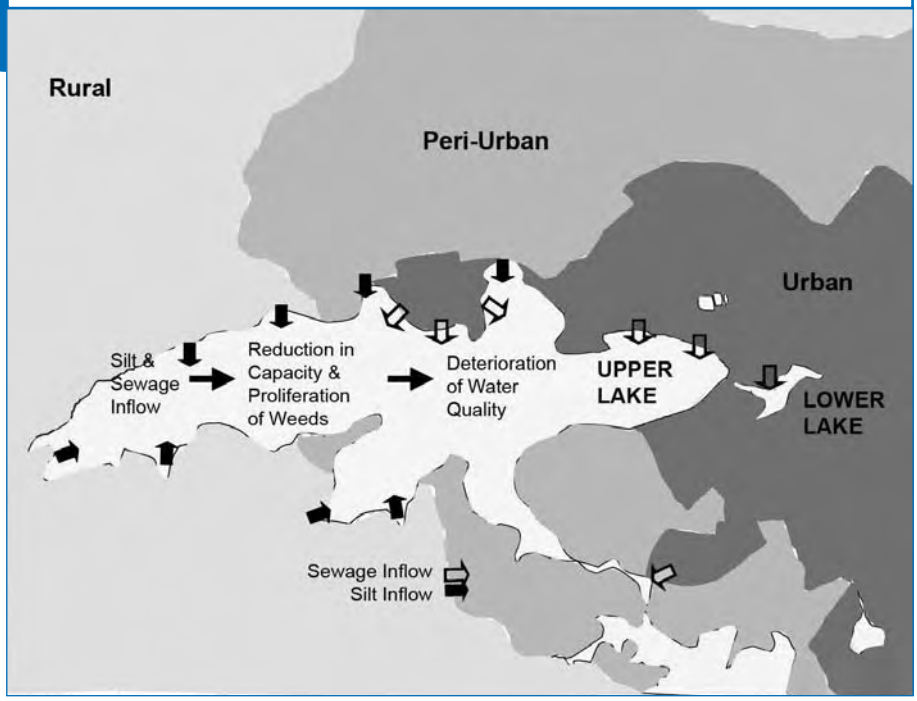
1981 on corn and wheat have shown water quality benefits from use of compost as opposed to manure or fertilisers (Hepperly *et al.* 2006).[52]

Examples of the application of this idea – whereby nutrient management and chemical agricultural practices have been restricted to protect urban water supply and lake catchments – were also identified. These include Lake Biwa in Japan,[53] and proposed measures to reduce contamination in Lake Constance in Germany.[54]

Another practice reported was that riparian buffers can filter silt and nutrients before runoff reaches water bodies (North Carolina State University 2002). The effect of a 6 m buffer strip in reducing runoff, suspended solids and nutrients from a field growing maize, winter wheat and soybean was assessed in a field experiment conducted in northeast Italy during 1998–2001 (Borin *et al.* 2005). The results indicated that the buffer strip was an efficient and economical way to reduce agricultural non-point source pollution.

Map 7

Rural and urban inlets into the Upper Lake



52. Increased levels of soil carbon is an important side benefit as well.
53. http://www.livinglakes.org/biwa/pollution.htm, March 15, 2006.
54. http://www.livinglakes.org/bodensee/agriculture.htm#Solutions. March 15, 2006.

3.4.3 Engaging the rural and urban ends of the catchment

Once the contribution of rural areas to the water quality problem was confirmed, and wetland-friendly practices beneficial to water quality identified, the focus shifted to engaging both urban and rural stakeholders, and to designing and monitoring the mechanism to promote wetland-friendly practices.

Interactions with farmers, both informally and in a structured way through surveys, revealed the need for incentives to facilitate the shift towards organic farming to offset several transition costs and constraints that were identified. These included the need for sustained knowledge inputs on organic techniques such as composting and bio-pesticides, reducing uncertainty of yields, offsetting the likely initial dip in outputs, and the starting costs of certification/verification. Further, demand for organic produce was still nascent. Besides, chemical farming benefited from national and state level subsidies; government effort and focus has been overwhelmingly on chemical farming whether in agricultural research, extension, or policy and programmes. To cap it all, agricultural subsidies mostly support chemical inputs.[55] The subsidies are also tied to the production (i.e. they go to the fertiliser producer) and supply of chemical inputs; there is a case for untying the subsidy and giving it directly to the farmer, and letting the farmer choose the type of crop nutrients – chemical or organic – to invest in.

Removing such barriers to adoption would complement an incentive-based approach to promote wetland-friendly practices. For example, if farmers can opt for the types of input they prefer – organic or chemical – and subsidies are made available for either approach, this would help 'level the playing field' for organic farming.[56]

Another key challenge on the rural side was the absence of farmer institutions in these villages, such as self-help groups, farmer clubs and VDCs. Farmer groups can help enhance intra-group learning and reduce the transaction costs of individual interactions. The local facilitation team interacted intensively with individual farmers in the sub-catchment and prepared the ground for such groups to form in future.

On the urban side, the direct stakeholder is the Bhopal Municipal Corporation (BMC), which is responsible for the quality (and quantity) of water supply to the city. Other stakeholders such as local industry, hotels, financial institutions and residents of

55. Current levels of subsidy are around 25% and are paid directly to companies after a verification process.

56. A banker providing agricultural credit gave the example of a step he took: he included expenses incurred in vermicomposting as an eligible activity for crop loans, on a par with expenses for seed, fertilisers, etc., as opposed to the earlier practice of treating them as a capital loans requiring greater paperwork and oversight.

Bhopal benefit from the lake and are therefore indirect watershed service receivers. Where they impact the lake, they are accountable for their actions, as per pollution prevention rules. However, they do not really view the catchment as their responsibility.

Therefore, concerted efforts were made to develop a two-pronged strategy that aimed to:

- Support upstream farmers to experiment with organic farming. The experiments helped identify the factors and inputs that were important in facilitating the shift.
- Engage downstream stakeholders in appreciating the overall value of the lake and the relevance of improving the raw water quality. The BMC has expressed interest in experimenting with investing in the catchment.

The urban question

Urban downstream stakeholders were engaged through (a) a communications campaign in the early stages of the project, (b) one-to-one meetings and (c) stakeholder consultations organised around screenings of the film prepared on the Bhoj Wetlands – *Lake Matters/Jheel Ki Kahani*.

A concerted communication campaign (WII 2005) was implemented early on from January to August 2005 to sensitise the receivers to the urgent need to address issues of pollution and siltation. This included:

- Production and dissemination of calendars and pamphlets.
- A media workshop focusing on environmental reporting.
- A corporate workshop focusing on corporate social responsibility.
- A painting competition with schoolchildren.
- A street play focusing on the role of citizens in maintaining the lake.

Subsequently, one-to-one meetings were held with some corporate groups and other stakeholders to assess their interest in supporting an investment in the rural catchment of the Upper Lake. Meetings were also held with the primary stakeholder, the BMC. Although there was some interest, the BMC, however, was found to operate under several constraints which are discussed below.

Interacting with the head of the BMC has been a slow process, partly because of transfers which require re-establishing contact with each new incumbent,[57] and staff changes within the project and partner teams as well. The lessons learnt from numerous interactions may be summarised as follows. The primary constraint of the BMC is financial – revenues from water charges are less than half the operational costs of supplying water. Despite two attempts in as many years, the BMC's efforts to raise water rates have been unsuccessful owing to local political unwillingness.

57. The project team interacted with three BMC commissioners in a year and a half.

The gap in water revenues leaves little financial leeway to the BMC to consider investing in the perceived long-term threat of agricultural runoff. Instead, the BMC gives priority to operational issues of fixing water leaks, managing the water treatment plants, and, when it can obtain the resources, infrastructural investments in expanding the distribution network and the sewage system. Recently, it has agreed to consider the idea of catchment protection, as it views it as an important, albeit secondary, focus.

Stakeholder consultations

A 20 minute film that highlighted the IBM concept in the context of the Bhoj Wetlands was produced in Hindi (*Jheel Ki Kahani*) and English (Lake Matters). Stakeholder discussions around the film were organised with separate groups from the media, NGOs, local citizen groups like the Citizen Forum, a chapter of the Rotary Club, the lake fishermen's association, water supply staff from BMC, and water supply staff from the Bharat Heavy Electricals Limited (BHEL), the largest bulk water user. Meetings were also held with lake-front hotels and boatmen. The shows were followed by discussion on the concept of IBMs and an exploration of the ways through which stakeholders can support wetland friendly practices upstream.

Many showed willingness to consider engaging in the process of developing IBMs for the Upper Lake of the Bhoj Wetland. For example:

- Hotel Noor Urs Sabbah, a heritage hotel overlooking the lake, showed willingness to buy produce from organic farmers and mention it on the menu card.
- Fishermen were interested in visiting organic farmers and also raised the idea that perhaps aquatic weeds from the lake could be gainfully composted by farmers.
- The Rotary Club appreciated the idea and showed willingness to help in organising a press conference and also engaging with the political leadership.
- The Citizens' Forum, a pressure group of mostly retired government officers and also some researchers, supported the concept and agreed to lobby for it, and support any awareness programme.
- Local NGOs shared their experience with promoting farmer organisations, self-help groups (SHGs), and organic farming, and highlighted the need for LCA to share data on lake water quality publicly.

Working with farmers: do wetland-friendly practices sell?

The Lake Conservation Authority (LCA) had previously worked with farmers in the catchment to promote the Bhu-NADEP form of composting, as an alternative to traditional farmyard manure (FYM).[58] At the start of this project, improved composting techniques and associated fertility management techniques were the

58. The Bhu-NADEP process decomposed raw manure into compost in about two months as opposed to six to nine months for farmyard manure (FYM), also known as *ghura khad* locally. Bhu-NADEP has partly displaced the use of chemical fertilisers.

primary wetland-friendly practice identified. Accordingly, farmers were offered training programmes, and exposure visits to a local government farm, and to the local jail which had experimented with organic practices. The Agriculture Department played an important role in facilitating these activities with the LCA. These activities took place in April–May 2005, and helped farmers to adopt composting techniques for the 2005 kharif crop (the monsoon crop from July to October).

A review of the literature (see above) and interactions with farmers led the team to consider full-scale organic farming as a conceptually elegant land-use practice that was both wetland-friendly, eschewing both chemical fertilisers as well as pesticides, and possibly self-sustaining: once they turned organic, farmers could supply to the emerging organic market in India and outside and would then have an independent incentive to stay organic. The problem would then be how to support farmers through the transitional phase of converting from chemical to organic farming.

A package of activities was undertaken to orient farmers to try fully organic practices on at least a part of their farm in the winter rabi season in October–November 2005. This included (a) training by an organic farming and certification expert, (b) practical training on organic techniques and supply of starter organic inputs by the LCA and the state Agriculture Department, and (c) awareness meetings by an organic input supplier of bio-cultures – for example, the state-level MP Agro-Industries Corporation. Farmers were given a list of practices to follow through the cropping cycle. About 90 farmers from the eight villages agreed to try organic farming on one acre of their land. The outcomes of this experiment in the 2005–06 rabi cropping cycle were mixed. Except for a few organic enthusiasts, most farmers reverted to using chemical inputs. There were several reasons for this:

- Wheat is the primary cash crop of the year for most farmers and provides most of the cash income (except for some vegetable growers). Farmers were less willing to take the risk of changing to organic inputs for their main source of income than, for example, they were concerning the kharif soybean crop. Current practices for wheat involve several doses of chemical fertilisers. The replacement suggested, *matka khad* (or pot compost), requires cattle urine to prepare, and collecting/obtaining emerged as a bottleneck for most farmers and a cause of reversal.
- The key organic inputs are not readily available in the market, unlike chemical inputs, which are supplied by the government and also peddled by private firms and their ubiquitous salesmen; for example, most farmers have limited supply of dung, at least half of which is used as fuel for cooking (as dung cakes), and the amount available for sale is limited as well.

59. While no formal demand survey could be located there were several instances reported of increasing demand from organic farmer practitioners (Ravi Kelkar, personal communication, April 2006).

Photo credit: LCA

Field discussion on the use of microbial cultures

- Controlling weeds requires a combination of organic strategies that are somewhat labour intensive, and farmers did not get practical experience with these techniques.
- A key constraint expressed was that no organic expert was available to advise the farmers on a sustained basis. This becomes critical in the initial transition stages, as organic farming is a systems approach rather than merely a package of practices. Farmers need holistic advice and practical instruction on techniques and swift feedback for troubleshooting.

This was a considerable learning experience for the implementation team and led to a reassessment of the options for IBMs that might be proposed to upstream and downstream stakeholders.

3.4.4 Identifying incentives

Based on extensive interactions of the facilitation team with the farmers, the baseline studies in the eight project villages, and a broader socioeconomic study in the catchment, a combination of technical and demand and supply-side options and associated incentives were identified to facilitate this shift. These options are summarised in Table 6:

Table 6

Options and incentives to facilitate change to organic farming

Options to facilitate shift	Identified incentives
Technical options to promote wetland-friendly eco-agriculture and organic farming	• Financing regular/on-call technical support for organic farming practices • Training and exposure visits
Supply-side options for reducing costs and associated risks during the transitional phase (2 years)	• Access to organic inputs at wholesale prices • Assured and timely supply of organic inputs • Access to credit facilities: micro-finance options • Access to innovative risk management options like crop insurance, organic farming insurance, rain insurance, etc.
Demand-side options to increase income	• Linkages to local and distant organic markets, especially discerning markets with premium prices • Certification of organic products
Additional activities to reduce impact on birds and protect bird habitat, including bird-friendly farming practices,[60] that can give additional income to farmers trying organic farming	• Promote eco-tours that include bird watching[60] and visits to organic farms • Train local villagers as eco-guides • Link up with hotels, corporates, tour companies, schools

It was also realised that an intermediary was required. This could be a group of facilitators who would act as an intermediary body, engage with experts and practitioners, and who would coordinate the collection and transfer of the incentives to the suppliers upstream. This body would create an environment conducive to developing an agreement acceptable to both the watershed service providers and service receivers. This intermediary body is expected to help resolve potential conflict situations and other differences that may hamper the transaction process. It would facilitate the smooth functioning of the transaction system and the provision of technical inputs to the farmers.[62] Accordingly two meetings were held in the third quarter of 2006 which included representatives from media, various government departments (including the BMC) and civil society. The first was a discussion meeting whereas the second included a bird watching walk in the local reserve, Van Vihar, adjacent to the lake.[63]

60. The Bhoj Wetland attracts migratory water birds including the endangered Saras crane. These birds can be poisoned by feeding on chemically treated seeds from the fields. So bird-friendly practices such as organic agriculture can reduce such impacts.
61. The area is a potential bird habitat zone.
62. Tiwari and Amezaga. 2006.
63. Based on discussions at these meetings a proposal has been submitted to the BMC for financing catchment protection on a pilot basis.

3.5 Palampur: the start of a new process?

Towards the end of the action-learning study, a feasibility study was conducted for an additional site, the town of Palampur in HP. Palampur derives part of its water supply from a spring located in an upstream village, and that supply is declining. Although there is interest in developing an IBM in Palampur, this is still at the proposal stage. Details of IBM options to secure Palampur's water supply are summarised in Box 7.

Box 7

Spring water for Palampur town: scope for an incentive-based mechanism?

Palampur is located on the Neugal khad in the foothills of the snow-capped Dhauladhar range, in Kangra district of HP. The Palampur Municipal Council (PMC) obtains its water from three main sources: (a) gravity supply of spring water from a spring in Bohal village upstream of the city; (b) gravity supply of water diverted from the Neugal stream; and (c) groundwater pumped at different locations in the city. The PMC is considering investing in an IBM in the upstream Bohal village from where it derives high-quality spring water for drinking water.

While the Neugal water is the major source, quick 'back-of–envelope' calculations suggest that both the Neugal and groundwater sources have significant costs associated with them due to treatment, taxes and pumping costs. Although the Bohal spring supplies a smaller proportion of Palampur's water, it is significant to the PMC for three reasons. First, having bought the land on which the spring emerges in 1952, it does not need to pay a royalty for the supply. Second, water quality at the source is high as it is naturally filtered into the ground. And third, gravity supply implies zero pumping costs.

However, total water supply has come down from 7–8 litres per second (lps) to about 3–4 lps over the past few decades. Although part of this decline in quantity is likely due to changes resulting from broader climate-related issues, unsustainable land-use practices upstream – such as intensive grazing and lopping – have likely played a major role.

Key reasons behind water quality deterioration were hypothesised in a preliminary assessment during site visits: accumulation of debris in the primary collection chamber; the flow of a newly developed second spring (below the main one) overland through a nala (which may be contaminated with wastewater); and nitrates reaching spring aquifers and polluting them due to use of chemical fertilisers upstream. Scientific testing below the spring has revealed discernible levels of contamination with Escherichia coli: this is very likely due to the nala being used as an open toilet.

Located upstream, Bohal village is the primary stakeholder for ensuring the water supply, and residents of Palampur and the PMC are the downstream beneficiaries. The comparative cost and high potential quality of water sourced from the Bohal spring is a strong incentive to the PMC to maintain and augment its supply.

Hence, an incentive-based mechanism supported by PMC can help Bohal village residents to identify, adopt and maintain spring-friendly practices in the upper catchment. This offers an opportunity to strengthen urban–rural linkages to maintain and efficiently manage watershed services.

Existence of institutions both up- and downstream should facilitate such processes. The PMC needs to support the Bohal community to treat wastewater entering the lower spring, to shift open toilets away from the stream vicinity and to support the community to undertake long-term protection and closure of the forest upstream.

The presence of functional and strong local institutions in Bohal (for example, an active Mahila Mandal) would play a key role in facilitating such a transaction. Hence a win-win situation between watershed services suppliers and recipients is possible through institutional strengthening and facilitating agreements between stakeholders.

Schoolchildren's entries to the 'Save Bhopal Lakes' painting competition


कहां गया जीवन
जल ही जीवन है


इसे सभी नागरिक को बचाये रखिये


Save Bhopal's Lake


LAKE CITY
GREEN CITY


जल के बगैर
प्रकृति की सुन्दरता
अधूरी है!


SAVE

4 Findings

4.1 Incentives and incentive-based mechanisms

The legal and policy review suggests that although there is no specific mandate for incentives or payments for watershed services in Indian law, there is nothing that bars it either. Thus there is scope for developing incentive mechanisms and supporting legislation for PWS if required in the future. State-level policies such as the new forest policy in HP mention the need for experimenting with market-based mechanisms for forest conservation. However, at the same time, the MoEF has concerns about the idea of payments for environmental services in general.

Incentives and IBMs can be of several types. As highlighted in section 1.5, the taxes such as the HP ecological tax may dis-incentivise diversion of forest lands. Regulatory payments to line departments, for example to the Forest Department for catchment area treatment, need to enhance conditionality to be effective. The provision of tenure itself can be an incentive: local communities have some incentive to protect the vegetation, such that biomass benefits largely go to those communities, and the environmental service benefits (for example, reduced erosion) are enjoyed both locally and more widely. JFM would be one such example, with weak benefits and weaker conditionality. Payments may also be direct.

In our action research work, payment mechanisms that involve direct payments from watershed protection beneficiaries to service providers have been attempted in three sites. Of these, payments have taken place in Kuhan, may potentially take place in the Bhoj site and have not taken place in Suan.

In Kuhan there is now an eight-year agreement between the VDCs of two villages to protect a patch of privately owned erosion-prone riparian land. The families who own land in the patch are members of the VDC, but have not individually signed it. As the agreement pertains to private land, there is no need for any government intervention. In more formal societies, the agreement may have taken the form of a short-term conservation easement.

As described earlier, the payment has been generated downstream by increased hourly water user charges and through a cropwise lump-sum fee from water users. This finances a dam suraksha (protection) fund.

The payment offered to the upstream community was in cash, but was given in kind on request. Upstream Oach Kalan requested saplings that would be planted in the area to be protected; downstream Kuhan paid for the saplings and transport.

Table 7 A summary of the transactions, attempted and achieved

Watershed	Watershed service	Proposed land-use practice change	Payment	Buyer	Sellers
Kuhan (HP)	Silt load reduction in stream	Grazing control to reduce erosion	Saplings Grass slips (achieved)	Downstream village – Kuhan	Upstream village
Suan (HP)	Increased infiltration and fire control	Firelines, timely harvesting to control fire	Access to grass (attempted)	Downstream village	Upstream village
Bhoj (MP)	Reduced nutrient runoff	Composting Multiple options – organic farming Riparian buffers	Technical advice, market access, and input cost reduction (attempted)	City of Bhopal (BMC)	Catchment farmers
Palampur (HP)	Protect quality, and enhance quantity	Divert local washing, reduce agro-chemical inputs, and infiltration measures	To be decided – perhaps forest guard payment	Municipal Council Palampur	Mahila Dal in Bohal village

4.2 Environmental impacts

4.2.1 Hydrological and environmental impacts in Kuhan catchment

The primary environmental impact that the Kuhan VDC hopes to see is a decline in the suspended silt load in the stream flow and hence a reduction in the silt reaching the Kuhan Khas LIS dam. This would be achieved through a reduction in erosion levels in protected areas upstream and the trapping of silt in the sub-streams (or *nalas*) where brushwood checkdams were built. However, the VDC is clear that the current area under protection is too small to make a major impact on the erosion levels, which is why they are also building brushwood checkdams in the sub-streams. They also expect that it will take several years before silt loads stabilise in the stream. They view the efforts taken for protection and silt control in 2005 through the agreement with Oach Kalan VDC as the first step in a process of controlling silt loads in the Gulana khad. The estimated annual suspended silt yield in the Kuhan catchment is 20 tons/ha/year (PSI 2007). As a point of reference, the comparable figure for the Suan catchment, in the same Changar belt, is 11 tons/ha/year.[64]

64. Other research suggests a range of 3.6 to 22 tons/ha/year for the Changar area. Treated areas can go down to 2 tons/ha/year (PSI 2006). The permissible limit of soil loss ranges from 4.5 to 11.2 tons/ha/year (Mannnering 1981, in PSI 2006). As mentioned in Section 3.2, road building above the dam has increased the silt load substantially in the catchment.

One of the positive impacts of the agreement between Oach Kalan and Kuhan Khas VDCs has been felt elsewhere in the catchment. A new area in Sai hamlet of Upper Kuhan village has also been closed to grazing, this time by the Forest Department, working in cooperation with local farmers. This is noteworthy as the Forest Department had tried to close the area for planting in previous years, but at that time, farmers had not agreed.

4.2.2 Environmental impacts in Suan catchment

Water flow and silt load monitoring has been undertaken since August 2005 in the main stream, the Suan Nala, and provides a good baseline estimate. The estimated annual suspended silt yield in the Suan catchment is around 7 tons/ha/year. This data will facilitate the assessment of environmental impacts of any payment mechanism that may be introduced in the future.

4.2.3 Environmental impacts at Bhoj

Since the pilot interventions are very recent, it is too early to observe any environmental impacts. The LCA is preparing a baseline of stream level water, sediment quality and farm soil quality in the riparian zone where wetland-friendly practices have been tried, to assess the impact of agro-chemical and organic compost-based farming practices in the Upper Lake catchment.

4.3 Impact on poverty and livelihoods

4.3.1 Impact on poverty and livelihoods in Kuhan

Upstream impacts. In the upper village of Oach Kalan, the landowners benefited directly from the 330 saplings provided by the Kuhan VDC. In addition, Oach Kalan VDC members invested their own labour in planting the saplings on their land. They can look forward to longer-term benefits, as the trees can be felled after 20 or more years. Also, after just one month of closure, the landowners harvested about 40 pulas[65] of grass in October 2005. By October 2006, the area had been closed for a year and, as expected, the increase in grass production was reported in a community meeting at around 30–40%, because of some thicker growth and also because of the benefit of being able to harvest twice, as opposed to once, formerly.

There are a few negative impacts. Some of the families who grazed animals on the land before closure have shifted to other grazing lands locally and have to invest a little more time for grazing. In the longer run, other currently open grazing areas in the rest of the catchment could be also managed. Migrant graziers were asked to bypass the area as well. One migrant grazier who camped in the vicinity was

65. Pulas are sheafs, each of about 2.5 kg.

warned that the fine would be Rs500 if goats entered the protected patch. However, as the area closed is quite small, graziers have bypassed it and taken adjacent routes.

Downstream impacts. The initial input has been that Kuhan VDC spent about Rs1,150 on purchase and transport of saplings to Oach Kalan (Oach Kalan VDC provided Rs50 for the latter). In addition, the Kuhan VDC contributed labour for constructing the brushwood checkdams in three locations. A secondary benefit of the institutional strengthening and the differential tariffs for irrigation water has been the phenomenal increase in irrigation in Kuhan. From about eight users and about ten kanals, there are now around 52 users irrigating about 50 kanals (covering 2 ha).[66] The winter wheat crop has been irrigated for the first time in 2005, with an increase in yield ranging from 0 to 200%,[67] and several farmers have also started growing and selling vegetables in 2005–06. The increase in irrigation has also improved contributions to the Dam Suraksha Kosh. The silt from road building has, however, filled the dam, stalled irrigation in the 2006 winter season, and again reduced yields in the area.

4.3.2 Livelihood impacts in Suan catchment

A baseline livelihood assessment has been made in Suan catchment and has shown the dependence on jobs and subsistence agriculture. Impacts of any payment mechanism introduced can be assessed in the future.

4.3.3 Impact on poverty and livelihoods in the Bhoj site

In the Bhoj site, because no payment mechanism has yet been initiated, it is premature to assess the impact of payments for watershed services on poverty and livelihoods. Given that agriculture is the primary occupation and the main source of income for most of the population in the eight villages, any IBM that involves a change in agricultural practice is important for livelihoods. Therefore the incentives should be designed to significantly influence the returns. In the long term, net profit per acre of cropped area can remain the same or even increase in some cases if farmers shift to organic farming, because input costs are likely to reduce. A preliminary impact study (Verma *et al.* 2006b) suggested that net profit per acre of soyabean increases with the shift from inorganic to transitional to organic farming.[68]

66. Kanal is a local unit of land; 25 kanals = 1 ha.
67. Variation in yield was attributed largely to unfamiliarity with irrigation. For example, farmers reported that the few people who watered their fields before sowing got the best results.
68. For example, in the case of soyabean, net loss incurred per quintal of soyabean grown in case of inorganic farming ranges from about Rs400–800, increases to Rs475–875 for transitional farming practices, and leads to net profit of Rs100–500 per acre in the case of organic farming. In the case of wheat, net gain in the case of inorganic farming practices is Rs2,000–2,600 per acre, while under transitional agriculture it is Rs2,410–3,010 per acre, and Rs2,950–3,550 per acre in the case of organic cultivation (IIFM, 2006).

However, transaction costs[69] associated with the shift are not valued in the study. The study concluded that the willingness among farmers to shift to organic/wetland-friendly farming practices is greater if incentives like certification and market support through differential pricing systems are arranged. Additionally, the benefits received in terms of technical assistance further help to compensate for the transitional costs of shifting from inorganic to organic farming.

Photo credit: Amitangshu Acharya/WII

Onion sorting

4.4 Governance context, impacts and transaction costs

4.4.1 Himachal Pradesh

The high levels of education and low levels of poverty in HP reflect a relatively positive governance. On the environmental front, HP was among the first states to introduce a unilateral ban on green felling of trees in forests in the 1980s, as well as the first to introduce an ecological tax on diverting forest lands. It has prepared state-level water and forest policies. Panchayat elections are held periodically. The relatively micro-scale of the transactions attempted – inter-village – has meant that there is personal interaction between stakeholders.

69. For example, the costs of arranging organic inputs, securing technical support, etc.

Impacts on governance are harder to tease out. At a local level the IBM process requires a considerable amount of consultation and negotiation between upstream and downstream stakeholders. An interesting effect of this has been the voice provided to more marginal players in the two HP sites. In the negotiations, local graziers were consulted and played a role in the final decision, for example in the negotiations between Bhodi and Kharjar villages in the Suan catchment, the interests of grass harvesters and graziers, and the variations in the levels of use, have so far blocked an agreement. They have not been able to come up with a mechanism that satisfactorily compensates upstream users and distributes the costs equitably among downstream beneficiaries.

In the Kuhan catchment, when the interests of all nearby stakeholders were not adequately taken into account in siting the brushwood checkdam in Sai hamlet of Oach Kalan, adjacent households broke the dam when it hindered access to water in summer and it had to be rebuilt at a more appropriate location after a comprehensive consultative process. Thus the process of getting formal assent makes it more inclusive and also precludes non-workable investments or payments. An external facilitator can guide this process by promoting dialogues between the stakeholders, but cannot force an agreement if the intervention is to be sustainable.

Institutional capacity building in the Kuhan VDC has improved governance within the VDC. Reconstituting the VDC, training office bearers in record keeping, social audits and implementing differential tariff rates have served to increase the membership, improve transparency and streamline access to water.

Panchayat involvement has been significant, if peripheral. Panchayat members in HP have been kept informed of the negotiation process. The panchayat pradhan helped convene a meeting in one of the Kuhan catchment villages early in the process. Further, a copy of the agreement between the upstream and downstream villages has been deposited with the panchayat to give it greater local sanctity. Panchayat members also participated in the catchment level *sammelan* and spoke in support of the concept. More recently, a meeting was held in the Kuhan catchment on the pros and cons of setting up a natural resource management committee, as a sub-committee of the panchayat as per the provisions of the HP Panchayati Raj Act, to sustain and expand the process at the catchment level. However, opinion was divided: some people did not want to inject panchayat politics into what they thought was a collaborative process of catchment protection.

The primary transaction cost has been the time spent by the communities in the upstream and downstream villages in a variety of meetings and activities. These include:

- dam de-siltation;
- VDC meetings;
- negotiation meetings;
- exposure visits;
- voluntary rainfall, flow and silt monitoring on a daily basis;
- brushwood checkdam construction;
- catchment level meetings;
- answering questions as survey respondents.

The extent of this may be gauged by the fact that a somewhat disgruntled resident of the downstream Kuhan village put a news item in a local paper highlighting that the HPEDS–WII project requires many meetings and that local villagers should be paid wages for attending them. This was viewed as an indication of success by the project team, as most of these meetings had been initiated by the Kuhan VDC, and many were not even attended by the field staff.

4.4.2 Madhya Pradesh

The governance issues around developing an IBM for the Bhoj Wetlands are complex for several reasons. These include:

- *Scale.* The catchment of the Upper Lake includes land from 87 villages, of which eight were selected for the study. The downstream city of Bhopal has about 1.8 million residents, with multiple service receivers who have to be motivated individually as well as collectively.
- *Rural – urban gap.* Unlike the inter-village transactions, which are between communities that often know each other in a rural – rural context, the interaction between urban and rural involves bridging cultures and mindsets.
- *Large number of small-scale independent farmers but a lack of upstream institutions.* The upstream watershed service providers are a large number of independent farmers. The lack of institutions in the form of farmer groups adds to the complexity of interacting with farmers in the eight selected villages. Farmers had to be mostly individually motivated, making this a resource-intensive exercise for the external facilitator. The outcome therefore depends mostly on the interest and decision of each individual without any internal peer support (for example through farmer groups) to push collectively for the desired results.
- *Scale of organic farming.* Facilitating a shift to organic farming presents a collective action problem from the point of view of developing a successful IBM. It is more feasible for a block of farms to shift collectively, rather than to have isolated farms convert to organic practices, in a sea of chemical-based farming.
- *State support to chemical agriculture.* Although the state Agriculture Department does have some programmes for promoting organic agriculture, its predominant push is to support chemical agriculture – both in the state and in the catchment.

Thus inputs and technical advice are mostly chemical in nature. Subsidies reflect the chemical domination as well.

- *Mismatch in spatial and temporal decision making.* Most of the watershed service receivers are institutions whose role and functions do not allow for or encourage direct interaction with the rural catchment of the Upper Lake. Adding an investment towards the rural catchment to their portfolio of activities has therefore presented a significant challenge to the external facilitators. For example, in the case of the BMC, which is one of the primary service receivers in this case and which is responsible for maintaining the Upper Lake and the city's water supply, the frequent transfers of key BMC officials, leads to a short-term focus, whereas investment in the catchment requires a timeframe of decades.
- *Municipal budget deficit.* On a practical front, the BMC has to have the funds to be able to contribute towards the rural catchment. However, its financial revenues are currently less than half the operational costs of supplying water and its attempts to raise water rates, twice in the past few years, have been thwarted by local political considerations.
- *Preference for engineering solutions.* To provide for the shortfall in current and projected water demand (given expansion of the city of Bhopal), the state is planning to lift and pump water from the Narmada river, over 80 km away. Although operational costs will be several times higher than those of existing sources, the project seems to command political interest. In general, engineering solutions require less interaction with farmers (once land is available). In this scenario, the Upper Lake may not command attention as a major source of drinking water for the city. Given the interest in the Narmada project, mobilising political will for investment in the catchment in order to improve water quality (and quantity) in the Upper Lake is a challenge.
- *Paucity of hydrological data.* The LCA undertakes monthly monitoring of lake water quality as a post-project activity of the JBIC-supported Bhoj Wetlands Project. However, to analyse the relative contribution of different sources requires monitoring those sources, both point and non-point. This is an extensive exercise that is not undertaken. Further, the water quality data that are collected are not shared publicly, even in summary form. They are made available on request at the LCA's discretion. For example, such data were made available for the purposes of this action-learning project, and also analysed to determine longer-term trends of key variables. Finally, there is little concerted public demand to release the data, and little incentive for the LCA to do so.

Preliminary impacts

Despite this relatively challenging environment, the project team was able to make some headway with the governance in the area, namely:

- A few senior policy makers are interested in experimenting with the implementation of the IBM concept in the Bhoj Wetlands. Beyond participating in the learning group and other meetings, they are supporting the initiative by trying to mobilise the BMC and other departments to take part in the process as well. They are therefore potential 'champions' for the concept in the state.
- Through consultations, one-on-one interactions and a comprehensive communications strategy, significant awareness has been generated in the value and benefits of the lake and the IBM concept among a variety of stakeholders – from schoolchildren to the Citizens' Forum and industry.
- The BMC is now willing to consider a proposal for investment in the rural catchment on a pilot basis as they view it as an important issue, but secondary to the treatment and distribution of water.
- In the eight selected villages of the rural catchment, farmers have attempted organic farming on a pilot basis with preliminary beneficial results.

Facilitating a change in the governance scenario is a slow process. Given the challenges facing the external facilitator, the preliminary impacts mentioned above are a definite step towards developing IBMs for watershed services and improved livelihoods in the Bhoj Wetlands.

Transaction costs

The primary transaction cost has been the time spent by farmers and other various stakeholders in the upstream and downstream areas as well as from supporting agencies (for example, the Department of Agriculture) in a variety of activities. These include:

- village meetings;
- one-on-one interactions;
- training and exposure visits;
- stakeholder consultations;
- answering questions as survey respondents.

These have, however, yielded results, albeit preliminary, as mentioned above. In addition, a proportion of the facilitation costs of the project team can also be viewed as transaction costs.

4.5 Role of government

Given the strong presence of government in India, in the form of public employment, investment, regulation and ownership of land (especially forest land), a nuanced government role is critical. In fact, the local partners for this action-research project in both states were government-owned NGOs (GONGOs). Field experience indicates that different arms of the government can play different roles in enabling and facilitating

IBMs and in demanding and supplying watershed services in different contexts.

- *Government role at the local level.* Constitutional bodies like panchayats, and resource user groups (government promoted or traditional), can play a role in implementing and supporting the land-use practice changes in question. In HP, the local VDCs have kept the panchayat informed of the agreement and taken their support while dealing with external graziers. Different tiers of government can support these local self-governance bodies.
- *Government as provider of watershed services.* As the largest land manager in the country, the Forest Department facilitates the provision of watershed services across the country. Any serious effort to promote PWS, whether singly or bundled with other services, will have to involve them and, importantly, the resource user communities. Although this is generally true across the board, there are specific instances where downstream receivers would like to demand the supply of watershed services, for example hydro projects and rural (and urban) water supply departments. The state Forest Departments need to invest in planning, managing, monitoring and valuing forests for their hydrological benefits, and also experiment with IBMs that promote the provision of watershed services.
- *Government bodies as receivers of watershed services.* Local urban municipal bodies that source water from rural catchments benefit from clean secure supply and are key stakeholders in demanding and paying for watershed services, as are public sector hydro projects.[70]
- *Government-led PWS.* There are several existing national and state-level schemes for watershed treatment (development) and tree planting that are implemented with the implicit or explicit objective of improving watershed services. An incremental approach can be taken to refine the schemes to improve their impact on watershed and other environmental services, as well as to explore options for including elements of IBMs for watershed services for improving their effectiveness.
- *Government as policy maker.* Policy makers in state governments in both HP and MP have shown interest in the concept and practice of PWS. Given the fluid policy environment, policy makers can support individual PWS schemes, which in turn may lead to a broader policy for supporting PWS. At the national level, the decision to oppose potential international, inter-country demands for PWS has led to a cooling of the support for PWS.

70. Note that even private projects are often to be handed over to government after a specified period, usually 35 years. They are thus future government property, and the government has a long-term stake in the ecological health of its catchments.

5 Conclusion: lessons learnt and policy recommendations

5.1 Introduction

The collaborative action research between WII, IIED and site-level partners has yielded insights into the role of hydrological information, types of incentive mechanisms, the importance of institutions and the implementation of IBMs. In the following sections we assess the action-learning approach, highlight the key lessons learnt and make some policy recommendations both to state and national policy makers.

5.2 An assessment of the action-learning approach

The implementation phase of this project has been based on an 'action-learning' approach, central to which is 'learning by doing' in order to develop real-life and real-time experience. Action learning is not complete without regular reflection and questioning to inform current and future activities and to distil lessons for application elsewhere. The key methodological lessons that emerged from project experience are:

- Action learning is based on partnerships between multiple organisations, with different sets of skills and operating at different scales. Projects that build on existing partnerships are quicker off the ground and are more likely to be successful over the (short) project cycle.
- A considerable proportion of the total effort is required at community level to mobilise and motivate the communities involved. Because there is little provision for investments in physical infrastructure, greater efforts are necessary in the facilitation process to motivate and mobilise the communities involved.
- Most action-learning methodologies need to include an element of capacity building and training, especially where new approaches and concepts are being developed.
- Effective communication strategies and tools are important throughout the life of the project in order to build and maintain support for the concept.
- There is an inherent tension between stakeholders as advocates of a new idea or concept and the critical evaluation of the results of the action learning.
- The project teams need to be flexible and responsive to the needs of the stakeholders within the sites. As limited experience and guidelines exist, and contexts in south Asia vary considerably from other developing countries, the project team had to learn as the project progressed and adapt quickly to emerging situations.
- Greater emphasis should be placed on the process adopted than on the end result in order to capture key lessons for future replication.

5.3 Lessons learnt

The process of field facilitation, combined with research and interaction with researchers, managers and other policy makers, both individually and via the learning groups, has generated a variety of lessons. These lessons – shared below – relate to the characteristics and impacts of IBMs, decision-making attributes, land use changes, the role of local institutions, the negotiation process and the nature of mechanisms.

5.3.1 Characteristics and impact of incentive-based mechanisms

Impact on livelihoods. In the Indian context, IBMs for watershed services are a relatively new tool that is being advocated to meet environmental challenges as well as to address livelihood issues. The results from the limited number of Indian sites suggest that these types of payment are unlikely to substantially address poverty. At best IBMs will, depending on the nature of the incentive, provide some complementary sources of income. The evidence from Kuhan is that the benefits from increased biomass production in the upper catchment (grass in the short term, and trees in the longer term) were the sweetener that tipped the balance such that the residents were in favour of the agreement. Also, as the area closed was small, the opportunity cost was not high. Similarly, the benefit to the downstream farmers will be from reduced silt loads that will slow the rate of siltation in the dam from which irrigation water is drawn. The additional capacity building of the downstream institution led to a changed perception that the supply of water was really a 'water business' that had to sustain its costs. This led to a 50% increase in tariffs and four categories of water charges, which in turn led to an expansion of water users from eight to more than 50. This expansion was indirectly driven by the need to generate a surplus to pay to the upstream community. Thus the need to do a transaction led to expansion and equity in water use downstream. Although these livelihood impacts are drawn from a single site, and each site will be different, stakeholder groups are likely to be similar, for example concerns about impacts on graziers' livelihoods would probably occur across many watersheds.

There may be a risk of negative impacts on livelihoods, however. For example, in the case of Suan, concerns of upstream graziers were a significant factor in scuttling the potential agreement, and in Kuhan one upstream family that was not seriously consulted broke a vegetative checkdam built by downstream people, as it had been constructed at the site where their cattle drank water. This risk of negative impacts is minimised if agreements are carefully negotiated, fully involving all stakeholders, and if they are truly voluntary.

Moral authority of local-level payments. This lesson is not new and is supported not only from the results of this project but by a range of other community-based projects across India (for example, community contributions for Swajaldhara and watershed treatment projects). Simply put, the lesson is that the source of the payment matters. Cash or in kind payments that are generated locally carry with them the perception that the payers have diverted their own money, which they could have used gainfully for other purposes. In comparison, funds sourced from government are often perceived to be free and are used less effectively. Locally generated payments also signal that the contributors feel the purpose is important to them, and thus carry an expectation of accountability. In sum, the moral value of a rupee contributed locally is significantly higher than a rupee from a government or NGO scheme. The implication is that these agreements with local payments are treated seriously and there is a collective will to ensure that agreements are, wherever possible, adhered to and maintained.

The process of developing an incentive-based mechanism can lead to a greater voice for the marginalised. This is true among receivers and suppliers of watershed services, whether an agreement for a mechanism is reached or not. By definition, a transaction or an IBM involves two parties that interact and negotiate with each other. Given this, there is a higher chance that marginal users upstream are consulted to choose land-use change options and implement them via an agreement. For example, addressing the numerous concerns of women-headed households in the Kuhan catchment led to an agreement there; conversely, inadequate consultation led to breakage of the brushwood checkdam in Chir hamlet in Kuhan; and unwillingness of upstream stakeholders to shift grazing led to the collapse of negotiations in Bhodi-Suan.

5.3.2 Attributes affecting decision making

A match between the spatial scale of biophysical processes and administrative areas can play an important role in facilitating agreements. In Kuhan, the catchment overlaps with the panchayat boundary and includes the two VDCs representing suppliers and users of watershed services, making interaction and decision making simpler. Conversely, in Bhoj, the suppliers and users of watershed services are represented by different administrative bodies: rural panchayats/district government and the Bhopal Municipal Council. These have little overlap in mandate and geographical areas of responsibility.

A match between the temporal scale of biophysical processes and decision making processes can play an important role in facilitating agreements. Agreements need to reflect the time required for effective land-use change. In Kuhan, the eight-year agreement to stop grazing is adequate to improve the

watershed service by reducing erosion. Similarly in Bhoj, although individual farms can change to organic practices in a few years, any agreement would need to cover a longer timeframe to reflect the impacts on the lake water.

Short tenures of politicians, city representatives and executives are likely to create short-term planning horizons and are at variance with the longer gestation period of mechanisms, as in Bhoj. This is less likely to be an issue in inter-village interactions as the actors have longer-term stakes in their local environment.

5.3.3 Land use changes

Linking land-use practices to watershed services is important for any agreement, but difficult to make in practice. The hydrological linkage is not usually apparent and is often assumed. It may require expert opinion to verify it: this was true for all sites, with varying success. Hydrological information helps to assess the problem, identify intervention options and their likely impacts and can build support for interventions. Expert views as well as local hydrological monitoring can help build awareness of watershed services among stakeholders, as in the sites in HP. All sites demonstrated that for voluntary IBMs, credible hydrological information is a critical input in convincing stakeholders to make payments and change land use.

Locally generated and win–win options for land-use change are more likely to work. Experimenting and adapting to local conditions can generate options for land-use that have greater ownership and chance of success – an example from Kuhan is the bamboo planting in streams and brushwood checkdams in sub-streams. Win–win options for land-use practice create direct benefits for the upstream community and provide watershed service benefits to downstream stakeholders, and are therefore more likely to be accepted. Protection in Kuhan has increased grass yields, while maintaining grass cover during the monsoon, the high erosion period.

5.3.4 Role of local institutions

Functional local institutions reduce transaction costs. Functional local-level institutions representing watershed service suppliers and receivers play a key role in developing and sustaining an agreement and reducing transaction costs. The presence of institutions in Kuhan has helped overcome hurdles, while the combination of the lack of institutions in Bhopal at the farmer level, and multiple stakeholders downstream, has increased the costs of interaction.

Transparency is both required and created by IBMs. For voluntary transactions to work, transparency in the transaction process is essential. This transparency can feed back to the working of the local institutions and make them more transparent

in other spheres as well. In Kuhan, the transaction discussions prompted the election of a new VDC executive body and encouraged more transparent accounting, which in turn boosted confidence in the VDC.

5.3.5 The negotiation process

Downstream buyers need to be convinced by clear benefits. If there is no single overwhelming financial benefit, the case for securing a broader bundle of values may have to be explored. In Bhoj, interactions with the BMC and other stakeholders suggest that a mechanism is more likely to work when based on the multiple use and non-use values of the lake (water quality as well as recreation, bird habitat, fish catch, microclimate, etc.).

Tactics for engaging stakeholders vary by stakeholder group. A range of methods for communication, knowledge sharing and motivation may be applied to different stakeholder groups, as in the communication effort and stakeholder consultation in Bhoj, and transect walks and presentations by the hydrologist in Kuhan. All sites demonstrated that exchange visits and field trips are valuable in increasing understanding and motivating action among stakeholders.

Endogenous champions are critical to drive the process. Facilitators need to work closely with key individual stakeholders through one-to-one interactions to enhance positive support and minimise concerns. This process should identify one or more local champions to own and drive the process, without which significant progress is unlikely. For example, the VDC president in Kuhan and a key policy maker in MP have played this role.

5.3.6 Nature of the mechanism

The nature of payments, role of stakeholders, duration of payments and contingency varies. Transactions can take a range of forms including cash and in kind. Sometimes both upstream and downstream have contributed to the land-use change, especially when both stakeholders benefit directly or indirectly. In certain conditions, payments are one-time, or for a short finite period (transition payments), with a specific purpose of aiding a transition from a current land use that is hard to change, to a more optimal land use and land management state, for example from openly grazed lands to closed patches. Finally and as in Kuhan, even if payments are made upfront, contingency can be built into the contract through performance clauses.

An IBM process that respects and adapts to the needs of various stakeholders upstream is more likely to sustain. In Kuhan, payments were offered in cash, but given in kind, as requested upstream. Conversely, in Chir hamlet, a household

adjacent to a brushwood checkdam that was inconvenient to it, broke it. However, after consultation, the checkdam was re-built in a different place and is still standing at the time of writing.

5.4 Recommendations for policy actions

In this section we make recommendations for policy action, based on project lessons and feedback from individual interactions and learning group meetings.

The first two recommendations (5.4.1 and 5.4.2) are concerned with the facilitation of knowledge production and decision making that is sensitive to the provision of watershed services and that harnesses tools like incentive-based approaches.

The further three recommendations (5.4.3 – 5.4.5) are aimed at specific contexts where IBMs for watershed services seem to be particularly relevant, namely:

- micro-level watershed treatment projects;
- urban drinking-water supply catchments; and
- catchments of hydroelectric power projects.

All three contexts involve downstream actors who could have significant economic and financial interest in maintaining and enhancing watershed services of water quantity and quality. The choice of field sites and strategic studies reflected this learning. The two micro-sites of Kuhan and Suan were good examples of micro-level watershed treatment projects, whereas the Bhoj Wetlands site was an urban–rural macro-site around an urban drinking-water supply catchment. One of the strategic studies looked at the financing and implementation of CAT plans of hydroelectric power projects and options for IBMs (Thadani 2006). The Kuhan site also provided, from the perspective of a micro-scale hydro project, a small dam downstream affected by siltation.

5.4.1 Incentive-based mechanisms should complement mainstream approaches of regulation and public investment

There is a whole host of useful approaches available to manage and improve watershed services such as regulation, public investment, zoning, tenure, community ownership and participation. IBMs work best as a complement to these other approaches, rather than as a substitute for them.

India's predominantly mixed landscapes provide a range of environmental goods and services. Often a single good or service is not valuable enough to justify the opportunity costs of changing land uses and practices. Inputs – whether financial or in kind – generated from multiple stakeholders through IBMs can reduce such

upstream opportunity costs by helping to meet the costs of watershed protection and treatment and also contribute to providing incentives for the provision of other environmental services. They also play an important role in creating local ownership and buy-in to watershed management, as in Kuhan. In this way IBMs complement regulation and public investment, and can guide such approaches so that they are suitably adapted to local conditions.

However, IBMs are a relatively new concept compared with some other approaches. To fully develop and benefit from their potential as a complementary approach in policy making and implementation in the longer term requires several actions including:

- Build capacity in government organisations, research bodies, and NGOs to incorporate watershed and other environmental service values and IBMs into decision making, planning and implementation.
- The Forest Department and other agencies to pilot IBMs for watershed, biodiversity and other environmental services, both singly and bundled together, to generate experience with payments from diverse stakeholders.
- Forest Departments to strengthen local tenure in Joint Forest Management and move towards community forestry, as an IBM that provides local incentives for managing forests for the provision of both products and environmental services.
- Forest and Tribal Welfare Departments to use the concept of IBMs to secure environmental services and develop synergies between JFM – which focuses on collective management of forest lands – and the Forest Dwellers Rights Bill, which provides for recognising private use on designated public lands.

5.4.2 Invest in watershed hydrology expertise, in linking land uses to hydrological impacts and in exposure and skills in developing incentive-based mechanisms to promote an effective multi-disciplinary approach

Developing good hydrological and multi-disciplinary skills is particularly important to address the crisis in water quality and quantity, especially in light of the impacts of climate change on water supply.

- Researchers, policy makers and implementers synthesise existing knowledge and generate new insights on land–water relations: identifying impacts of pristine, degraded and restored landscapes on watershed services.
- Departments such as Forest, Agriculture, Water Resources and Rural Development appoint nodal persons and collaborate with research agencies to promote an IBM perspective as well as a watershed and other environmental services perspective in research, policy formulation, decision making, implementing and monitoring.

The next three recommendations concern specific contexts where IBM processes may be gainfully applied.

5.4.3 Apply incentive-based mechanism processes in micro-watersheds to enhance the sustainability of benefits of watershed development and micro-irrigation expenditure

Downstream beneficiaries of watershed treatment projects, and of small-scale gravity and LISs can further enhance the quality and quantity of water by investing in catchment protection in upstream areas by using IBMs.

Inclusion of IBM approaches in the guidelines and operational manuals of agencies (whether local, state, national or international) charged with financing or implementing watershed and micro-irrigation projects will enable the application of IBM approaches. Linking downstream and upstream communities and institutions through a flow of information and resources will serve to create additional ownership within the catchment among the natural beneficiaries. This, in turn, will help to sustain public investments beyond the project cycle.

5.4.4 Apply incentive-based mechanism processes to invest in critical catchments that supply drinking water to rural and urban areas to enhance water quality and quantity

Public services bodies such as municipal councils and panchayats should use a strategic mix of IBMs, zoning, local protection institutions, land purchases, etc. to promote land management practices – which may include silviculture – to enhance watershed services from which they typically benefit. These bodies can utilise IBMs to encourage upstream communities to adopt those practices that improve water quality and quantity, thus complementing and ultimately reducing investment required for water treatment and distribution.

In the past, protection of forest areas (sometimes with the exclusion of people) has been used successfully to secure drinking water, for example the Shimla municipal forest in HP and the Almora forest catchment in Uttaranchal. Currently, such models of protection may not be practical given the large number of settlements in most watersheds. Application of IBMs will involve people in those watershed settlements by offering incentives for the protection of infiltration or runoff zones for the supply of domestic water (whether from springs, streams or groundwater). This can lead to improved water quality and/or quantity for the domestic supply. Use of IBMs to improve drinking water supplies is currently being attempted in the Bhoj catchment and with the Palampur Municipal Council.

In addition, demand-side measures that reduce water use and waste can reduce peak water requirements and thereby help reduce supply-side investments, for example, Shimla in the summer tourist season, and Bhopal in the peak summer demand season.

5.4.5 Use incentive-based mechanisms to enhance the effectiveness catchment area treatment for hydroelectric projects

CAT plan payments are a good example of an existing regulatory payment system. Water with low sediment loads is critical for hydroelectric plant operations and capital and maintenance costs. Therefore they have a vested interest in the long-term health of their catchments. Current regulation-induced payments from hydroelectric projects to state governments for implementing CAT plans are viewed as tax-like and are largely ineffective: current treatment focuses primarily on public land and engineering inputs. Accordingly, suggested policy actions are:

- Forest Departments that are implementing CAT plans should develop IBMs as a means of channelling CAT funds to upstream communities, to facilitate land management practices that enhance and maintain water quality on both private and public lands.
- Facilitation should be provided to upstream community/participatory management institutions (like JFM groups), where communities are present and/or have rights.

Application of IBMs on a long-term basis will provide the motivation for catchment protection throughout the operational phase of a dam, as opposed to CAT plan payments which apply only during the construction phase. IBMs will also help to maintain and enhance the provision of environmental services.

Watershed services are critical for livelihood security in the Indian subcontinent. This importance will only increase as impacts of climate change are felt across the region. These impacts will be felt at the local, regional and broader levels. IBMs for watershed services, which are a broader application of the concept of payments for watershed services, can play an important complementary role in helping to secure watershed services and to support livelihoods in the face of increasing stresses on the availability of clean and adequate quantities of water in a timely fashion.

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Annex 1

Criteria for site selection

Essential

1. A watershed service related to land use (especially forests) is clearly discernible (water quantity, quality, wetland conservation, stream flow regulation, prevention of floods, soil erosion, etc.)
2. Clearly identified watershed service suppliers (preferably an upland community/ village) and receivers are present.
3. Receivers (downstream) are facing (or are likely to face) major problems due to poor quality of service (water quality, quantity, soil erosion, etc.), which have a strong economic impact on the receivers.
4. The solution to the problem should lie in the upstream area. That is, the management activities of the suppliers directly affect the quality of watershed service of receivers.
5. Suppliers and receivers are located in reasonably close proximity (so that they can engage in transactions).
6. There should be willingness and enthusiasm among both upstream and downstream communities to participate in a transaction related to a watershed service along with favourable political climate.
7. There should be a willingness to pay (manifest or latent) by the watershed service receiver (downstream) to improve the service.
8. There should be no conflicts between the upstream and downstream stakeholders that could affect the process.

Desirable

1. Improving management of the watershed results in a 'win–win' situation for suppliers and receivers.
2. There is a possibility of cooperation with line departments and other key organisations in the area.
3. Watershed service can be 'bundled' with other services.
4. Presence of a facilitative organisation.
5. Suppliers and receivers are organised. This would include the organisation of people in the upstream and downstream areas through village-level institutions.
6. Transactions are already taking place between suppliers and receivers (preferably related to a watershed service but other transactions are also fine – transactions could be in cash or kind).
7. Presence of traditional social linkages and mechanisms for maintaining watershed-related services.
8. Existence of baseline hydrological data.

Annex 2

List and summary of studies undertaken under the project

Site-specific studies: baselines and preliminary impacts

Livelihoods in the Bhoj Wetland catchment, March 2006 (Madhu Verma, CVRS Vijay Kumar and Alind Shrivastava).

Land use and agricultural practices in catchment of the Bhoj Wetlands, January 2007 (Rohini Chaturvedi).

Livelihoods in the Bhodi-Suan and Oach-Kuhan catchments of Kangra district, Himachal Pradesh, March 2006 (Madhu Verma, CVRS Vijay Kumar and Alind Shrivastava).

Land use and land management practices in the Oach-Kuhan catchment, Kangra District, Himachal Pradesh, March 2006 (Rohini Chaturvedi).

Land use and land management practices in the Bhodi-Suan catchment, Kangra District, Himachal Pradesh, March 2006 (Rohini Chaturvedi).

Geohydrology study of the Kuhan catchment in Kangra District of Himachal Pradesh, March 2006 (Rakesh Sharma).

Geohydrology study of the Bhodi-Suan catchment in Kangra District of Himachal Pradesh, March 2006 (Rakesh Sharma).

Hydrological study in Bhodi-Suan and Kuhan catchments of District Kangra, Himachal Pradesh: a report, December 2006 (Peoples Science Institute).

Impact of the rural catchment on the Bhoj Wetland and options for mitigation, December 2006 (S.M. Mishra, Lake Conservation Authority).

Land use and livelihood impact assessment, Oach-Kuhan and Bhodi-Suan catchments, Kangra District, Himachal Pradesh, December 2006 (Rohini Chaturvedi).

Impact of incentive-based interventions on land use and livelihoods: Bhoj Wetland catchment, June 2006 (Madhu Verma, CVRS Vijay Kumar and Alind Shrivastava, IIFM).

Strategic studies

Incentives for watershed protection services and improved livelihoods in India: review of legal and policy framework with focus on states of Madhya Pradesh and Himachal Pradesh, March 2006 (Mishra, A. and Upadhyay, S. ELDF).

Incentive-based mechanisms in the hydro sector: CAT plans and beyond, March 2006. (Rajesh Thadani).

Summary of studies

Baseline reports

Livelihoods in the Bhoj Wetland catchment

This study developed a baseline assessment of the socioeconomic background, income and asset levels and livelihood options in eight riparian villages in the rural catchment of the Bhoj Wetlands by sampling 20% of the population. About 80% of the sampled population belonged to the Scheduled castes and General Category. Asset ownership, including landholding and income levels, was skewed in the favour of households belonging to the General Category. Agriculture was the major livelihood option, and the primary source of income. However, significant expenditure on agricultural inputs, mainly fertilisers and pesticides, was also reported. A majority (64%) of the sample were reported to be marginal farmers. Migrating to Bhopal city for labour and 'service' was noted to be prevalent. Promoting organic farming as a means of reducing farmers' input costs was found to be a plausible incentive for the area, if it could also help realise better returns.

Land use and agricultural practices in catchment of the Bhoj Wetlands

The study documented land use and agriculture management practices in eight riparian villages in the rural catchment of the Bhoj Wetlands. Most land in this catchment is privately owned. Agriculture is the dominant land use, and is mainly irrigated. Fields close to the lake and major drainage channels are vulnerable to submergence and flooding. Soyabean, rice, pulses and maize are the major monsoon crops. Wheat and chickpea are cultivated in winter. Use of chemical fertilisers along with partially treated manure is the most prevalent farming practice in the catchment. Reportedly, use of chemical pesticides is low. 85% of the farmers surveyed were willing to try organic farming if resources were conveniently available and supply of organic compost assured. Drop in yields, non-availability of adequate organic matter and lack of resources to bear the relatively high input costs were the main reasons for unwillingness to shift to organic farming.

Livelihoods in the Bhodi-Suan and Oach-Kuhan catchments of Kangra District, Himachal Pradesh

The study provides an assessment of the current socioeconomic background, income, asset levels and prevailing livelihood options within the two catchments. The dominant primary occupation in both the catchments was found to be 'service', mostly with the armed forces. Dependence on agriculture (mainly rain-fed) is low, except for a few downstream households with access to irrigation. High dependence on 'other sources of income' for food security was reported. The majority of households fall either into 'poor' or 'medium' income categories. High levels of migration were reported in both catchments. There was a general trend of reducing livestock holdings. The study found that broad-basing the users of the lift-irrigation

scheme downstream could create opportunities for facilitating land-use changes upstream (if supported by effective institutional mechanisms). In the upstream, bringing haylands under plantations can provide short-term (green fodder) and long-term (timber) benefits under an IBM for watershed services.

Land use and land management practices in the Oach-Kuhan catchment, Kangra District, Himachal Pradesh

The study provides an understanding of land use and management practices in the five revenue villages in the catchment. Private lands, common lands and forests are the main land-use types in the catchment. Agriculture is subsistence, with limited use of fertiliser. Maize and wheat are the two major crops. However, increasingly, cultivable lands are being converted to haylands owing to poor agricultural returns. Haylands are closed in the monsoon for collection of grass, and open for grazing for the rest of the year. There are seasonal variations in the biotic pressure on the haylands, forests and agricultural lands. Further, transfer of grazing pressure among these lands is common. For successful implementation of an IBM in the catchment, it has to be centred on constructing physical structures for arresting erosion as well as adopting socially acceptable mechanisms for controlling open grazing in the upstream.

Land use and land management practices in the Bhodi-Suan catchment, Kangra District, Himachal Pradesh

The study provides an understanding of land use and management practices in the three revenue villages in the catchment. There is a history of cooperation between the villages regarding use of common land and managing forest fires. Private lands, common lands and forests are the main land use types in the catchment. Agriculture is subsistence, with limited use of fertiliser. Maize and wheat are the two major crops, with comparatively low yield in the upstream and midstream villages as compared with the downstream village. Haylands are closed in the monsoon for collection of grass, and open for grazing for the rest of the year. For successful implementation of an IBM in the catchment, it has to be centred on reducing crop losses, increasing crop protection and diversification in downstream villages, increasing availability of fodder in the midstream village, and facilitating cooperation for management of common lands in the upstream village.

Geohydrology study of the Kuhan catchment in Kangra District of Himachal Pradesh

This study presents geohydrological data bearing on problems of erosion in the Oach-Kuhan catchment, both specifically and qualitatively. Its objective was to gather a scientific understanding of the geohydrological functions in the catchment that could be shared with the local inhabitants in order to facilitate decision making. The rate of erosion in the catchment was approximated at about 2.5 tons/ha/year.

Most of the streams/sub-streams were found to flow in a steep gradient with high runoff. Nude sandstone in the northeast, conglomerate in the southwest of the watershed, crush zones at a few places and nude clay and conglomerate exposed along the road up to Oach Kalan were found to be highly erosion prone areas. Further, the study identified suitable sites for the remedial measures to be adopted along with recharge zones to meet the projected requirement for irrigation. The study concluded by proposing immediate, short-term and long-term measures for reducing erosion and promoting recharge in the catchment.

Geohydrology study of the Bhodi-Suan catchment in Kangra District of Himachal Pradesh

This study assessed the geohydrology of the Bhodi-Suan catchment to identify erosion prone areas. This study facilitated the identification of suitable treatments for preventing soil erosion and increasing the water availability in the catchment. The study found that because of geological conditions in the catchment, potential recharge areas (mostly in the northeast and southeast) and infiltration zones were limited. Further, the discharge area was also minimal. There were few recharge areas along the right bank of the main stream except near Kharjar village. The limited infiltration zones were found in areas where there were weathered/ fractured rocks and small channel deposits. Discharge from sub-streams was found to vary between from 1 lps to 6 lps across the catchment. High rates of runoff during the monsoon months were also noted. The study concluded by suggesting water conservation structures and vegetative measures to be adopted in specific locations in the catchment in order to maximise water retention.

Hydrological study in Bhodi-Suan and Kuhan catchments of District Kangra, Himachal Pradesh

The Peoples' Science Institute (PSI), Dehra Doon, undertook participatory hydrological monitoring of Bhodi-Suan and Kuhan micro-catchments in Kangra district of Himachal Pradesh over a period of 15 months (August 2005 to October 2006). The objectives of the study were to install monitoring systems and train village communities to collect relevant data, and further analyse the collected data to create a hydrological database including total rainfall, number of rainy days, rainfall intensity, stream discharge, sediment yield and water quality. The estimated values of annual suspended silt yield for Bhodi-Suan and Kuhan catchment exceed the tolerable limits of soil erosion. However, the stream water quality parameters in both the catchments were found to be within the standards prescribed by the Central Pollution Control Board and the Bureau of Indian Standards. The study gives insights into the status of the catchment areas and can help in initiating discussions for watershed services among the concerned communities.

Impact of the rural catchment on the Bhoj Wetland and options for mitigation. December 2006. (S.M. Mishra, Lake Conservation Authority)

The study attempted to review the contribution of the rural catchment to the pollution load in Upper Lake, Bhopal, and to identify options for reducing the impact of the rural catchment on the lake, especially in terms of water quality. Although long-term monitoring data by pollution source was not available, the study, based on qualitative assessments, concluded that existing pollution in the Upper Lake was substantially contributed by the rural catchment and that the lake was partly eutrophic and partly mesotrophic. The impact of agricultural runoff constituents such as nitrate levels, and the importance of reducing them, to reduce treatment costs of potable water, was highlighted. In terms of options, the study recommended that substitution of chemical fertilisers by crop residues, dung and other rural bio-waste, and organic compost can be an effective option for sustaining the lake water quality.

Land use and livelihood impact assessment, Oach-Kuhan and Bhodi-Suan catchments, Kangra District, Himachal Pradesh

This study assessed the impacts of developing IBMs for watershed services in the Oach-Kuhan and Bhodi-Suan catchments. In Oach-Kuhan, an IBM based on mutual cooperation was developed between upstream grazing landowners and downstream water users, each group represented by the respective VDCs. The payment was in kind and involved saplings for reforestation, and labour inputs. The impacts of the project included: restriction of open access to the grazing land and consequent transfer of grazing pressure from private to common lands; an increase in irrigated area; an increase in the confidence of members of VDC Kuhan Khas and their ability to negotiate with their upstream neighbours and government departments; and finally, functional training such as record keeping, and self-audit. The long-term benefits are yet to be assessed. In the Bhodi–Suan catchment, negotiations for the IBM were continuing at the time of the study.

Impact of incentive-based interventions on land use and livelihoods: Bhoj Wetland catchment

The study assessed the impact of facilitating a trial shift from inorganic to organic farming practices in the eight riparian project villages that were the potential suppliers of watershed services to the Bhoj Upper Lake and Bhopal city. Two distinct farming practices were prevalent – organic inputs in combination with pesticides (on a need basis), and a 'transitional phase' where organic compost along with chemical fertilisers and pesticides were applied. Beyond these, around 11% of farmers were found to be practising organic farming. The average yield of wheat using organic inputs reported an increase of 35.38% compared with wheat using transitional farming methods. Also reported was a net saving in agricultural inputs of Rs950 per

acre in the case of wheat, Rs900 per acre in the case of soyabean and Rs50 per acre in the case of gram, owing to shifting to organic farming methods. Lack of suitable market linkages and inaccessibility to improved techniques of organic farming were reported as the constraining factors to adoption of organic farming.

Strategic studies

Incentives for watershed protection services and improved livelihoods in India: review of legal and policy framework with focus on states of Madhya Pradesh and Himachal Pradesh

This report assesses whether current policy and legislation in India supports or impedes the development and application of IBMs as a complement to existing regulatory, customary and participatory approaches. National policies and legislation were considered, as well as those from the project states of Himachal Pradesh and Madhya Pradesh. The study found that in several cases IBMs or market-like instruments are not mentioned as such, but there is legal and policy space for them to be developed. The review at the national level and in the two study states established that while there is broad agreement at the policy level, legal instruments have been oblivious to mechanisms such as IBMs in watershed management. In fact, the legal regime has not treated watersheds as a concept in the statutory provisions. That said, the legal and policy framework does not appear to present significant impediments to the introduction of IBMs.

Incentive-based mechanisms in the hydro sector: catchment area treatment plans and beyond

CAT plans are implemented in hydroelectric projects to improve environmental services. This study assesses the efficacy of CAT plans in the Himalayas, and evaluates the scope for IBMs for watershed services and livelihood enhancement. Although the potential importance of CAT is undeniable, impacts have been limited. Lack of clear guidelines, weak institutional mechanisms and the perception of CAT as a regulatory mechanism hinder implementation. Poor coordination, and financial problems such as late release and diversion of funds, were observed. CAT funds often replaced existing programmes rather than working as an additionality. Although CAT can be seen as a payment for environmental service schemes, it should be in the form of a transaction where the 'seller' has incentives to ensure quality outputs. Here, payments were received regardless of benefits accrued. Among other suggestions, the study advocates enhanced involvement of local communities in CAT, improving management of existing land-use types, and an ecosystem service-centric approach for greater impact.

Annex 3

Summary statistics on the eight selected villages of Bhoj Wetlands catchment, Bhopal

	Rolukhedi	Gora	Mugalia chhap	Barkheda Nathu	Malikhedi	Sewania	Bilkheda	Bishan Khedi
Total area	67 hectares	158 hectares	880 hectares	480 hectares	600 hectares	232 hectares	230 hectares	160 hectares
Caste	Majority General followed by SC, ST and OBCs	Majority General followed by SC, ST and OBCs	Majority General followed by SC, ST and OBCs	Majority General followed by SC, ST and OBCs	Majority General followed by SC, ST and OBCs	Majority General followed by SC, ST and OBCs	Majority General followed by SC, ST and OBCs	Majority General followed by SC, ST and OBCs
Religion	Hindu and Muslim	Hindu and Muslim	Hindu and Muslim	Hindu and Muslim	Hindu and Muslim	Hindu and Muslim	Hindu and Muslim	Hindu and Muslim
Literacy rate	87.5%	64.34%	64.04%	61.85%	54%	80%	74.69%	72.15%
Main occupation	Agriculture	Agriculture followed by labour, service and business	Agriculture, labour and business class	Agriculture, labour, service class	Agriculture and labour	Business followed by labour and agriculture	Agriculture followed by labour	Agriculture followed by labour
Major food crops	Wheat, maize, soyabean, chana	Wheat, maize, soyabean, chana	Maize, wheat, gram	Maize, wheat, gram	Soyabean, maize, wheat, gram, floriculture	Maize, wheat, gram	Maize, wheat, gram	Soyabean, maize, wheat, gram
Infrastructure	Electricity, telephone, semi-pucca road	Electricity, telephone, pucca road	Electricity, telephone, pucca road, high school, post office	Electricity, telephone, pucca road, high school, post office	Electricity, telephone, narrow pucca road	Electricity, telephone pucca road, high school, post office	Electricity, telephones, semi-pucca road, primary school and post office	Electricity telephones, pucca road, primary school
Household size	8	Maximum 18 Minimum 2	Maximum 14 Minimum 2	Maximum 14 Minimum 2	Maximum 9 Minimum 5	Maximum 10 Minimum 1	Maximum 16 Minimum 3	Maximum 13 Minimum 6
Connectivity of the village	Cut off from other villages due to its interior location	Connected by road and very near to Bhopal city	The biggest village in the catchment, well connected through road and public transport	Well connected to the nearest town with road and public transport	Interior village which has a very narrow road. No transportation facilities available	Well connected to the nearest town through road and public transport	Interior village with bad road connectivity	Connected with a road but there is no public transport

Source: Baseline report: Livelihoods in Bhoj Wetland catchment, March 2006 (Madhu Verma, CVRS Vijay Kumar and Alind Shrivastava).

Annex 4

Net present value per hectare of forest services

Figures calculated at a 5% rate of discount for 20 years (Rs)

Forest circle	Timber	Carbon	Fuel wood	Fodder	NTFP	Eco-tourism	Watershed service
Bilaspur	25,842	141,661	51,720	51,659	121,998	181,220	276,748
Chamba	18,686	229,697	4,010	3,981	12,746	20,664	276,748
Dharamshala	37,812	99,037	25,270	25,241	94,148	96,771	276,748
Mandi	11,488	246,112	10,420	10,408	42,692	4,223	276,748
Nahan	9,529	83,806	6,423	6,415	21,149	10,228	276,748
Shimla	19,134	187,916	3,793	3,789	13,508	159,408	335,881

Note: watershed services have the highest value of all forest goods and services across all regions across the state.

Natural Resource Issues

If poverty is to be reduced and livelihoods improved, significant shifts in policies, institutions and markets will be required to encourage sustainable natural resource management. How to go about this is a major challenge facing governments and civil society groups. Much guidance is available for farming, forestry and fisheries, but in reality livelihoods depend upon many forms of natural capital and are not amenable to sectoral interventions. This series of reports aims to present material on key cross-cutting themes of significance to many natural resource sectors, including water, soil, biodiversity, carbon and climate.

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India is facing a scarcity of irrigation and drinking water in villages and cities, particularly in summer months when springs, streams and rivers have reduced flows or dry up. In addition, when water is available, its quality is often suspect. The emerging threats of variation in precipitation induced by climate change will only exacerbate the scarcity in many parts of the country. Watershed protection services, which include regulation of water flows, improved water quality and control of soil erosion, can play an important role in adapting to these conditions.

This report shares field experience and lessons in developing incentive-based mechanisms for watershed protection services and improved livelihoods at micro- and macro-scales at three locations in Himachal Pradesh and Madhya Pradesh. The process, progress and problems in the three sites, and the initial findings, are presented. Key lessons are discussed and specific recommendations made.

This study was funded by the UK Department for International Development (DFID) as part of a multi-country project coordinated by the International Institute for Environment and Development (IIED) on Developing Markets for Watershed Services and Improved Livelihoods. The views expressed in this study do not necessarily represent those of the institutions involved, nor do they necessarily represent official UK Government and/or DFID policies.

DFID Department for International Development

IIED Natural Resource Issues No. 10

ISBN: 978-1-84369-649-0
ISSN: 1605-1017