

PREPARING FOR THE NEXT GENERATION OF
WATERSHED MANAGEMENT
PROGRAMMES AND PROJECTS

ASIA

Proceedings of the Asian Regional Workshop

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PREFACE

On the occasion of the International Year of Mountains, and in response to the clear consensus reached by the international community regarding the need to ensure harmonious and sustainable development of mountainous areas and watersheds, the Food and Agriculture Organization of the United Nations (FAO) and its partners in the subject, undertook a large-scale assessment and global review of the current status and future trends of regarding knowledge about and techniques for integrated watershed management.

The objectives were to promote the exchange and dissemination of experiences of integrated watershed management techniques, identify constraints to the implementation and development of those techniques during the decade from 1990 to 2000 and capture relevant new paradigms and approaches. The lessons learned from diverse experiences are being used to define a new generation of integrated watershed management projects.

Experts from four continents contributed to the assessment, which yielded four main outputs: 1) a review of experiences in watershed management, based on questionnaires that were sent to active partners in the field; 2) substantive reports from four regional workshops held in Nairobi (Kenya), Kathmandu (Nepal), Arequipa (Peru) and Megève (France); 3) four case studies from the Mediterranean basin, Nepal, Bolivia and Burundi; and 4) an international conference in Porto Cervo, Sassari Province, Sardinia, Italy.

Watershed management concepts and approaches were reviewed, and different experiences assessed. The results of this exercise are presented in several documents, including the proceedings of workshops and reports on the four case studies.

The conservation, use and sustainable management of watershed resources in order to meet the demands of growing populations have been a high priority for many countries over the past several decades. In this respect, integrated watershed management through people's participation has become widely accepted as the approach that ensures sound sustainable natural resources management and a better economy for upland inhabitants, as well as people living in downstream areas.

Within Asia there has been a noticeable divergence in approach to watershed management. The watershed development projects in India, which have a strong rural development component and make use of the "ridge-to-valley" treatment, are in marked contrast to the hydrological and land cover approaches adopted in other parts of Asia. The more recent interest in the ecosystem

services that catchments provide has helped clarify the objectives of watershed management, particularly in the water towers of the Himalayas. While great advances have been made in the last 20 years, there is still great opportunity to develop further understanding of these upstream–downstream interactions and linkages. Equally important is the need to develop and sustain synergy and partnership among different communities of practice involved in watershed management, within Asia and beyond.

This volume contains the proceedings of the workshop held in Kathmandu in September 2003.



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All those presenters who were able to provide outlines of their papers within one month of this workshop are very much appreciated. This made it possible for a draft CD-ROM to be made available at the Sassari Workshop held in October 2003.

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ACRONYMS

AsDB	Asian Development Bank
CBS	Central Bureau of Statistics of the Government of Nepal
CDCC	community Development Conservation Committee
CDG	Community Development Group
CVP	Chakriya Vikas Pranali (India)
DANIDA	Danish International Development Agency
DDC	District Development Committee
DFID	Department for International Development (UK)
DLR	Department of Land Resources (India)
DSCWM	Department of Soil Conservation and Watershed Management
FAO	Food and Agriculture Organization of the United Nations
FY	Financial Year
GDP	Gross Domestic Product
GIS	Geographic Information System
GTZ	German Agency for Technical Cooperation
HRD	Human Resource Development
HRU	Hydrologic Response Units
ICIMOD	International Centre for Integrated Mountain Development
IFAD	International Fund for Agricultural Development
IUCN	World Conservation Union (formerly International Union for Conservation of Nature and Natural Resources)
IWDP	Integrated Watershed Development Project (Haryana, India)
IWM	Integrated Watershed Management
IWMI	International Water Management Institute
JICA	Japanese International Cooperation Agency
LSFP	Lao Swedish Forestry Program
M&E	Monitoring and Evaluation
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MoF	Ministry of Forests/Forestry
MoRD	Ministry of Rural Development
MoWR	Ministry of Water Resources
MW	Megawatt
NARMSAP	Natural Resource Management Sector Assistance Programme (Nepal)
NDWMP	Nepal-Denmark Watershed Management Project
NGO	Non-governmental Organization
NPC	National Planning Commission
NR	Nepalese Rupee (US\$1 = NR 78, July 2004)
NTFP	Non-timber Forest Product
NWDPRA	National Watershed Development Project for Rainfed Areas (India)
ODA	Overseas Development Administration (UK)
PARDYP	People and Resource Dynamics in Mountain Watersheds of the Hindu Kush Himalayas Project

PDR	People's Democratic Republic
PRI	Panchayati Raj Institution
RCUP	Resource Conservation and Utilisation Project
REDLACH	Latin American Network for Technical Cooperation in Watershed Management
RELMA	Regional Land Management Unit (East Africa)
SALT	Sloping Agricultural Land Technology
SCWMC	Soil Conservation and Watershed Management Component (NARMSAP)
SDC	Swiss Agency for Development and Cooperation
SEED	Service, Economy, Environment and Democratic (norms)
Sida	Swedish International Development Cooperation Agency
SWAT	Soil and Water Assessment Tool
SWC	Soil and Water Conservation
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UWMP	Upper Watershed Management Project (Sri Lanka)
VDC	Village Development Committee
WOCAT	World Overview of Conservation Approaches and Technologies
WM	Watershed Management

INTRODUCTION

This volume presents proceedings of the Asian Regional Workshop on Preparing the Next Generation of Watershed Management Programmes, which was held in Kathmandu from 11 to 13 September 2003. The workshop formed part of an FAO global initiative to review existing watershed management programmes and produce guidelines for future strategies, approaches and projects. This review, the first of its kind for more than 15 years, was to comprise a stocktaking exercise, analysis of case studies, a series of regional workshops – in Africa, Asia, Europe, and Latin America – and the dissemination of results.

The Asian workshop was co-hosted by FAO and the International Centre for Integrated Mountain Development (ICIMOD), with funding from the Government of the Netherlands¹.

The objectives of the workshop were:

- to assess watershed management programmes and projects throughout Asia by identifying and quantifying their achievements and gaps;
- to identify lessons learned and major issues emerging from past watershed management experiences in the region, especially during the decade 1990 to 2000;
- to identify guidelines for formulating and implementing the next generation of watershed management programmes and projects in Asia.

After the opening address and welcome, Moujahed Achouri of FAO presented an overview of the FAO initiative². Papers on various topics related to watershed management in Asia were then presented. On the second day of the workshop, three working groups were convened to discuss major themes in watershed management. The group themes are given in the following sections, along with a summary of each group's findings and conclusions³. The working group presented their conclusions at a plenary meeting on the third and final morning of the workshop.

WORKING GROUP 1: WATER CONSERVATION AND USE

This group explored innovative approaches and methodologies for effective watershed management, with a special focus on the conservation and sustainable use of water resources.

Watershed management has evolved and passed through several stages of development. In the initial stages, it concentrated on forestry and forestry-related hydrology, and the involvement of people was not an issue. Watershed management was solely the business of government forest departments, and activities were directed mainly towards symptoms. During the second stage – the integrated watershed management stage – it turned to land resources management, including finding activities that would bring economic benefits. At this stage, the focus was on

1. The workshop programme, including titles of the papers presented and the names of their authors, is presented in Annex A. Names and contact addresses for all the participants are given in Annex B.

2. This presentation is given in Chapter 2 of these proceedings.

3. The list of working group participants is presented in Annex D.

beneficiaries. It is now at the participatory, integrated watershed management stage, which includes the involvement and contribution of local people. Participatory integrated watershed management looks at symptoms, as well as causes. Hence, watershed management has moved from treating the symptoms to treating the causes.

Today, most decisions on watershed management activities/projects are driven by political and other major national objectives, and even areas for treatment are chosen on these grounds rather than on the basis of studies and surveys.

In watershed management, “approach” is defined as a way of tackling issues, or as the concept of planning watershed management with objectives and implementation strategies. “Technology” includes all the methods, tools and techniques available to achieve objectives. Among new technologies, Geographic Information Systems (GIS) have become particularly important in watershed management. GIS is a useful tool for identifying and justifying areas of intervention, particularly for larger areas where problem assessment can be difficult.

Lessons learned

From its assessment of recent watershed management approaches and methodologies, the group concluded that watershed management and decision-making are becoming increasingly decentralized and now involve more groups, including government ones. Alongside this decentralization, new watershed management organizations are emerging, and the capacity of community-based groups is improving.

Watershed management is now taking a more bottom-up approach. As part of this, participatory research is a good way of developing appropriate technologies, including those based on indigenous knowledge. Human resources need to be developed through capacity building at all levels.

Upstream–downstream linkages continue to be an issue, and involvement tends to be limited to local upstream participants. It is important that different stakeholders, including people in downstream areas, are involved in watershed management. There is also need to identify upstream–downstream issues more clearly and to look for ways of cross-linking with other sectors.

It is clear that treating causes is as important as treating symptoms, however many programmes and projects do not pay sufficient attention to causes.

Gaps

Among the gaps identified was a lack of policies to guide integration and varying degrees of inconsistency among the government departments, donors and other agencies involved in watershed management programmes. For example, different agencies have different management boundaries. Related to this, appropriate legislation is often lacking, resulting in legal issues remaining unsettled.

There are weaknesses in communications, including inadequate documentation, dissemination and networking (vertical/lateral), and there is a failure to mainstream key lessons learned into practice. Even frontline workers are often not fully aware of new technologies and policies.

Regarding the environment, environmental feasibility assessments often pay insufficient attention to human well-being, and some environmental issues – such as biodiversity and climate change – are not addressed at all. At the same time, financial commitments are often too short-term, making it difficult to sustain and replicate beneficial interventions after projects have finished.

Participation still needs to be increased. At present, participation is often restricted to local communities, and there is only very limited inclusion of resource-poor people in watershed management programmes.

Technologies

Among useful technologies identified by the working group were water budgeting as a monitoring tool, appropriate technologies that make use of indigenous knowledge, GIS tools, and cost-effective tools, including 3D modelling.

Improved approaches

In order to promote greater and more committed participation of local people, innovative approaches are needed to promote local value addition, to address the needs of resource-poor and marginalized groups, and to ensure short-term economic gains. Improved dissemination and communications would help in this area, especially better learning frameworks, more effective feedback channels (both bottom-up and top-down), and tools/mechanisms for documenting best practices and lessons learned.

Planning needs to be improved, and adequate institutional, organizational and coordination arrangements put in place. Upstream–downstream linkages are still not sufficiently understood and would benefit from the development of appropriate mechanisms. Two other major needs are innovative monitoring and evaluation methodologies for impact assessment of watershed management, and ways of addressing rangeland management issues.

Regarding the environment, improved approaches could include using water budgeting as a monitoring tool (focusing more on water to avoid complications), and incorporating clean development and management principles into watershed management. A better balance between human well-being and protecting the environment is also required.

Technology gaps in that require research

Watershed management research should be practical, applied and appropriate for local inhabitants, and should include cultural and socio-economic research. Its outputs should be targeted to different levels of education and income. Research results are often specific to a particular agro-ecology, ecoregion or ethnic group, and may not be easily replicable.

Among the areas requiring more research are site-specific land husbandry; new approaches and technologies; water budgets and household water use for demand management; improved solar energy for pumping water and for greenhouses; nutrient input loss management, particularly leachate; the impact of land use on hydrology, sediment transport and water availability; and

bioengineering, particularly root systems and their usefulness – including suitable vegetation for rehabilitation and production – and weeds.

Technologies need to be demonstrated – so that people can see for themselves – and simplified for easier adoption. They also need to be affordable (low-cost).

In the area of information collection and dissemination, the group recommended that databases be amalgamated to form decision support systems. Climate change baselines should be set up, and rainfall information from watersheds collected, taking into account the great variability in mountain areas and the introduction of new crops.

Appropriate procedures and information would also make it easier to prioritize critical watersheds, identify appropriate technologies at the farmer level, and value upper watershed services for downstream areas.

Watershed management global network

It is necessary to establish a forum for dialogue, which would act as a focal point for watershed management. Practitioners could use this as a source of information. For example, an on-line library would be an effective way of storing information, including research results, case studies and links to other Web sites, watershed workers and projects.

Best elements of watershed management

The best watershed management has the following features: decentralized operations with sensible controls that are executed by communities; the contribution of beneficiaries; participatory design, including local consultations and empowerment; a focus on water, with improved water management at its core; regional networking; education; conservation of environments and biodiversity; and a good philosophy of watershed management.

Scope of the next generation of programmes

Watershed management develops entry points, and so has been hijacked as it provides opportunities for others. For example, poverty alleviation is high on donors' agendas, and the World Bank now emphasizes natural resource conservation projects.

Watershed management programmes of the future need to identify primary and secondary activities in watershed management. Interventions should be watershed-specific (needs-based) and needs should be reflected in project design. Funding and planning must be decentralized if integrated resource development projects are to succeed.

Specific to Asia is the issue of focus, which appears to be a problem in that region, but not in the Americas or Europe.

WORKING GROUP 2: RESEARCH NEEDS

This group investigated appropriate strategies for meaningful research and linkages between research and implementers; and strategies and approaches for technology transfer and dissemination. It also identified technology gaps in watershed management that need more research.

The two main conclusions the group drew were: 1) research should be applied; and 2) social and cultural research on watersheds should be incorporated into all the other research needs.

More specifically, the group identified the following gaps in the current state of watershed management research and technology transfer: hydrometrological and sediment data at the watershed level; tools for land managers to assess the impacts of catchment management interventions; farm-based technologies; bioengineering for stabilization and rehabilitation; assessment of downstream costs/benefits of upstream interventions; adaptive research on indigenous technologies; tools for modelling “what if” scenarios; effective weed control (e.g. Lantana); effective biodiversity management (including agrobiodiversity); and an efficient framework for water assessment through multi-linked catchment landscape.

Possible solutions to these gaps include: well-designed extension packages and approaches; farmer-led demonstrations; improved networking at all levels (from farm to policy); appropriate technologies adaptable to the farm level; researcher-to-researcher and -policy-maker links; awareness raising on watershed approaches; and appropriate curricula for watershed concepts (from school to university).

Institutional issues for watershed management research include a lack of coordination and dialogue, which would be resolved by appointing a coordinating body as a focal point. Institutions’ weak commitment (low priority, low investment) would be strengthened if the economic benefits were understood and communicated better. There is also a need for institutions to allocate sufficient time to projects and programmes.

Regarding watershed management programmes and projects that are driven by donors and/or researchers, a national research framework for watershed management needs to be in place, research should reflect local priorities, and research programmes should be taken forward collectively by all stakeholders (communities, scientists and donors).

WORKING GROUP 3: ECONOMIC AND SOCIAL ISSUES

This group concentrated on innovative approaches and methodologies for effective watershed management, with special reference to economic and social considerations. It did this by discussing four specific themes and posing questions for each of these.

Topic 1: Watershed management policy and legal environment

In answer to the question “What are the fundamental policy and legislative weaknesses associated with the contemporary watershed management programmes, with special focus on economic and

social considerations?”, the group concluded that policy lacks focus in terms of classifying projects with regard to site-specificities and that it pays insufficient attention to monitoring and evaluation mechanisms. In order to improve policy, there is need for a master plan-type mechanism to identify hot spots, and for frequent reviews of policy that has been promulgated.

Legislation is often absent or inadequate with respect to interdepartmental collaboration, funding allocation, sharing of resources and decentralization of authority. Another common problem is lack of enforcement, owing to legislation being out of date or for other reasons.

The group recommended reviewing existing legislation and formulating new legislation to address policy issues such as interagency collaboration, decentralization of authority and sustainability of resources.

Topic 2: Watershed management planning

In answer to the question “What are the major issues associated with contemporary watershed planning methods, with special focus on economic and social consideration at the national, watershed and local levels?”, the group identified several significant gaps.

A lack of information makes it impossible to prioritize watersheds for treatment, or to decide what to focus on. As a result, insufficient attention is paid to either biophysical or socio-economic issues. There is also a lack of national master plans and holistic approaches. In addition, planning methodology is weak at all levels, there is no assessment mechanism to define watershed-specific requirements, and interdisciplinary collaboration is insufficient.

In response to these gaps, the group recommended bottom-up preparation of watershed plans, with top-down screening to ensure their technical feasibility and policy consistency with master plans. Best practices should be documented, field tested for local adaptability and included in implementation plans, which should also consider upstream–downstream linkages and benefit sharing. There should be coordination among ministries, among stakeholders and among disciplines, including in planning.

Investment should be made in information collection, national database infrastructure and easy data access (such as through the Internet), and modern technologies such as GIS should be used to analyse problems. Cost-effective technologies should be emphasized, and proper attention paid to indigenous knowledge.

Topic 3: Watershed management field implementation

Next, the group turned its attention to the question “What are the major issues associated with implementing watershed programmes/projects, with special focus on cost-effectiveness, synergy, sustainability and equity at the national, watershed and local levels?”

Many of these issues were related to the institutional and legislative set-up. For example, the group identified a lack of implementation authority at the local level, poor inter-agency coordination, contradictory legislation and a lack of clear rules and guidelines for implementing legislation, and cases of political interventions working against the prescriptions of management plans.

In addition, the use of inappropriate approaches is an issue. This is often the result of donors' involvement in programme planning. There is a proliferation of development paradigms, with each donor pushing others to join its "bandwagon". Some programmes pay lip-service to donor priorities and fashionable terms, indiscriminately replicating best-bet options approved by research and using high-tech solutions, without investigating lower-cost, indigenous technologies.

Achieving adequate resources is often a problem. Funding is inadequate and erratic, and there is no clear cost sharing for policy and enforcement. In addition, extension workers and local leaders often lack the capacity for implementation – in terms of both technology and number.

Among the recommendations for resolving these issues, the group mentioned the need for adaptive research, testing, demonstration, replication and dissemination of best practices. Training in implementation capacity at all levels should be strengthened.

There is need for greater harmonization between donors and recipients. Governments and donors should consider making longer-term commitments, and donors should be more flexible. Governments should create mechanisms in which revenue from watershed resources is used at the local level for community activities, and coordination capacity should be enhanced through legislation and regulatory measures. Governments also need to establish greater clarity in cost-sharing and incentive policies.

Topic 4: Monitoring and evaluation (M&E)

In response to the question "What are the major issues in M&E that are associated with successes and failures of watershed management projects/programmes in the context of participation, sustainability, cost-effectiveness and equity?", the group pointed out that inadequate M&E has led to mismanagement, wasted resources and mismatched interventions

At present, there seems to be no will to carry out M&E, and capacity for monitoring at the field level is inadequate. There are no effective and transparent M&E systems, and projects often fail to include M&E plans. Post-project evaluations are often lacking, and best practices are not included in the preparation of follow-up phases. Where M&E plans do exist, they are usually too top-down, use inappropriate indicators, with target monitoring predominating over impact monitoring, and lack baseline information for determining economic feasibility and input/output analysis.

The group's recommendations regarding M&E included creating data sets and increasing access to information; carrying out M&E from the beginning of a project and on an ongoing basis; involving all stakeholders in M&E; ensuring post-project evaluations; and including both external and internal M&E.

M&E must look at both the biophysical and the socio-economic aspects; it must be flexible; and guidelines for M&E must ensure effectiveness and transparency.

PART 1

FAO WATERSHED MANAGEMENT REVIEW

CHAPTER 1

PREPARING THE NEXT GENERATION OF WATERSHED MANAGEMENT PROGRAMMES

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It is clear that much progress has been achieved in watershed management, especially during the 1990 to 2000 period when new approaches and methodologies were developed to promote participatory integrated watershed management. However, no clear picture has been drawn as to what has really been working and what can be done to improve future watershed management programmes. In fact, there has been no systematic effort to review and assess watershed management strategies and approaches at a global scale since FAO did so at the expert meeting held in Kathmandu, Nepal from 25 February to 1 March 1985. Hence, in-depth analysis of watershed management achievements and existing gaps, with particular emphasis on the experiences of 1990 to 2002, is a prerequisite to further development of watershed management programmes.

This paper has been prepared in response to the raising of key issues of major concern to the development of watershed management. It reviews and assesses watershed management activities and provides reliable information on lessons learned and existing gaps. Such information is needed to justify investment in watershed management activities and to focus such activities on the areas where they are most needed. The assessment concept and approaches were designed to respond to the needs and characteristics of different audiences involved in watershed management.

BACKGROUND

Interest in and awareness of the multiple environmental, economic and social benefits provided by watershed management and development have greatly increased in recent decades. This may be particularly true in developing countries where the economy depends predominately on agriculture, but there are also fast-growing urban populations that depend on water and food supplies on an unprecedented scale.

Degradation of natural resources is considered to be the greatest constraint to sustainable agricultural development in most developing countries. It is generally accepted that sustainable use and management of land resources will only be achieved by adopting a system of improved land, water and vegetation management and use based on an integrated approach to land resources development with the direct involvement and participation of the different actors.

Given that watershed management is the implementation of management systems that ensure the preservation, conservation and sustainable use of all land resources, the development of watershed management is recognized as a prerequisite for the sustainable management of land resources and the improvement of upland inhabitants' living conditions. In fact, watershed management integrates various aspects of forestry, agriculture, hydrology, ecology, soils, physical climatology and other sciences to provide guidelines for choosing acceptable management alternatives within the specific social and economic context.

Integrated watershed management through people's participation has become widely accepted as the approach that ensures sound sustainable natural resources management and a better agriculture economy for upland inhabitants as well as the people living in downstream areas.

As a consequence of the attention paid to and the important investments secured for the development of watershed management, much progress has been achieved in this field. However, several issues of major concern, which were raised many years ago, still require in-depth analysis and consultation among all concerned parties for better understanding and implementation of effective watershed management.

The expert meeting on strategies, approaches and systems for integrated watershed management held in Kathmandu, Nepal in 1985 highlighted the threats that represent for the livelihood of millions of people, and the related constraints to the development of a healthy agricultural and natural resources base. This meeting, which was organized jointly by FAO, the International Centre for Integrated Mountain Development (ICIMOD) and the East-West Centre, Environment and Policy Institute (EAPI), also identified and recommended relevant action for urgent implementation.

The main actions it recommended can be summarized as follows:

- develop significant policy and programme responses;
- develop national conservation strategies and frameworks to achieve appropriate and comprehensive management of mountain watersheds;
- develop relevant training, efficient applied research and demonstration projects required to achieve effective watershed management.

In spite of the progress achieved in developing watershed management approaches and application, most of the actions identified 17 years ago are still in urgent need of implementation, even though some of them were proposed with time deadlines; for example, the development of relevant policies and programme responses was projected to be achieved by 2000.

In addition, issues such as people's participation, in which watershed management scientists and practitioners feel that major progress has been achieved, are now being raised by many as requiring further analysis and clarification. Questions that still require satisfactory responses include: What kind of participation are we using? Are we achieving what was expected? and What is missing for the institutionalization of participatory approaches?

Another important issue that many consider to be a major gap in the evolving watershed management concept is the still very limited dissemination and exchange of information on achievements and lessons learned. Owing to various reasons – mainly a lack of adequate

institutional and organizational arrangements – project experiences and lessons learned are sometimes not even shared among concerned institutions of the same country.

In this connection, the World Bank carried out a review of its own watershed management projects in May 2000. The findings of this review of 42 projects, which had a total budget of US\$2.37 billion and were implemented between 1990 and 1999, also call for in-depth analysis to identify what has been achieved and what can be done to improve future watershed management programmes.

In view of these issues, an assessment and review of results and lessons learned in watershed management are considered prerequisites not only for providing answers and clarifications of the issues raised but also, and mainly, as an important preparatory stage for the next generation of watershed management projects and development programmes.

ACHIEVEMENTS AND EXISTING GAPS

During the last few decades, watershed degradation has been seen as a serious threat to environmental conditions and to the well-being and survival of millions of people living in watershed and downstream areas. Many countries recognize the importance of upper catchment conditions, and have made reversing watershed degradation a priority.

However, many watershed management programmes have failed to achieve their objectives, mainly owing to the following reasons:

- They focused too much on natural resources conservation.
- They were designed with little attention to human activities and the priorities and needs of people.
- They neglected beneficiaries' involvement and contribution to the planning and implementation of watershed management interventions.
- They were frequently limited in span and scope, and lacked the long-term commitments needed to address underlying causes and long-term management issues in a satisfactory way.

Consequently, new concepts and approaches were developed to reverse watershed degradation and establish an improved agricultural and rural economy. In order to achieve such objectives, social and economic aspects were given particular attention in watershed management programme/project formulation and implementation. In addition, *people's participation* was recognized as being key to the success of watershed management programmes.

Recognizing that the management and conservation of land resources through physical structures, reforestation and other conservation measures would not be sustainable and replicable unless people's concerns were taken into account, the *integrated concept* was developed as a process in which community problems and needs can be considered as an important component of development programmes. People's participation was also recognized as a principal component in all phases of the development of watershed management programmes.

The *participatory integrated watershed management* approach introduced and developed over the last decade includes, in addition to the technical aspects, the economic, social, political and cultural dimensions of natural resources conservation and management. Watershed management has become a multi-disciplinary activity in which appropriate institutional and organizational mechanisms are required for the coordination/implementation of watershed management activities.

The development of concepts and approaches, and the watershed management experiences from many parts of the world now call for further investigation, analysis and consultation among watershed management stakeholders for greater consensus on what has been achieved and on how things could be done better. Stakeholders are stressing the need for a clearer overview of several key issues of major concern to watershed management development.

Although it is generally agreed that integrated watershed management can play an important role in natural resources conservation and improvement of the conditions of upland people, conflicting views on the approaches and methods of watershed management continue to be the subject of concern and controversy.

A quick overview of the last decade's findings and recommendations on watershed management activities outlines a number of key questions.

Are we sharing experiences and lessons learned? It is recognized that significant progress on watershed management approaches and methodologies has been achieved in different parts of the world. However, sharing these results and identifying appropriate mechanisms for disseminating such information are important issues that require urgent action in order to benefit watershed management users/new projects from experiences learned and to avoid the duplication of efforts.

Are we using the appropriate participatory processes? The experience of participatory approaches during the last decade has raised several issues: What kind of participation is taking place? To what extent can participatory approaches be used? Are we overestimating what can be achieved through participatory approaches?

Participatory processes are recognized as primordial in watershed management at all stages, from project identification to the appraisal and implementation of activities. Experiences have shown that one-sided bottom-up or top-down approaches do not work. This leads to the conclusion that no single approach or method can be considered as the most appropriate one, but rather a variety of approaches and methods should be pragmatically used and adjusted according to specific circumstances.

Are the technologies developed producing the desired results? Greater emphasis is being put on the services and benefits that watershed management can provide. Watershed management is increasingly seen as an appropriate vehicle not only for environmental conservation but also for the improvement of rural livelihoods. In this regard, there is demand for the development of appropriate technologies that can ensure sustainable development and natural resources management. Specific issues are also raised regarding watershed management scale problems, upstream–downstream relationships and the technologies and methodologies needed.

Are project activities sustainable and replicable? There is uncertainty about the sustainability and replicability of the technologies that projects implement. The World Bank (2000) review of watershed management projects raised this concern, stating that “many Bank projects, while able to achieve considerable gains in the short term as a result of an intensive injection of funds and expertise, are neither replicable nor sustainable following project completion”.

To what extent have the institutional/organizational and legislative arrangements been developed? Institution building for watershed management has been mentioned as one of the most neglected parts of watershed projects. It is recognized that there is a need for improved understanding and identification of the institutional and organizational arrangements required for effective watershed management. An appropriate legislative framework to support watershed management policies is an important tool that needs particular attention.

Are the expected policies/strategies in place? Recent assessments have shown that although broad environmental policies are in place in many countries, generally no attention has been given to the development of watershed management policies. Lacking or inadequate national policies, strategies and action plans are recognized as principal constraints to implementing sustainable watershed management programmes.

These are some of the relevant controversies and watershed management issues that have emerged from watershed management experiences all over the world, especially those carried out during the 1990 to 2000 period.

In order to achieve effective watershed management, it is necessary to examine state-of-the-art watershed management programmes and concepts. In this context, the review and assessment intends to address the key watershed management issues raised, in preparation for future watershed management projects/programmes.

ASSESSMENT: LESSONS LEARNED AND FUTURE PROGRAMME DEVELOPMENT

The assessment and review of watershed management activities is being conducted with the broad objective of promoting, disseminating and exchanging information on watershed management achievements and existing gaps and providing support for the development of effective watershed management through relevant projects and programmes. It aims to provide an adequate opportunity for all concerned parties to share information and contribute to a better understanding of the current status of watershed management, and to provide awareness raising and the required advocacy and support for the implementation of effective watershed management at the local, national and regional levels.

Based on the in-depth analysis of watershed management activities carried out over the last few decades, with emphasis on the last decade (1990 to 2000), and in view of important events such as the International Year of Mountains (IYM), the assessment/review initiative was developed with the main objectives of:

- assessing and identifying the nature and extent of achievements and existing gaps in state-of-the-art watershed management programmes and concepts;
- identifying lessons learned and principal issues emerging from the experiences of FAO and other relevant organizations, with particular focus on the 1990 to 2000 period;

- identifying guidelines for the formulation and implementation of the next generation of watershed management projects/programmes;
- contributing to implementation of Agenda 21, Chapter 13 (Sustainable Mountain Development) and to the outcome and follow-up of the IYM and the International Year of Freshwater.

The assessment's approach was carefully developed in order to respond to several needs while considering the characteristics of the different audiences involved in watershed management at the global, regional and national levels. It includes:

- stakeholder identification, participation and contribution;
- steps in the assessment development process that allow relevant parties to contribute;
- output that responds to the issues raised by stakeholders.

The following steps were identified as necessary for the proposed watershed management review and assessment.

Consultation: The review/assessment concepts and approaches were discussed in-house. Comments and suggestions were sought from technical divisions involved in watershed management activities.

Investigation: In-depth investigation was conducted to identify whether FAO and/or others had conducted other reviews and assessments on issues related to watershed management activities.

Stocktaking: FAO experiences of watershed management were emphasized, with particular attention on the period 1990 to 2000. Project formulation documents, evaluations and findings, recommendation reports and the outcomes of watershed management events such as seminars, conferences and workshops represent a principal source of information for the assessment. To be in line with the assessment objectives, experiences and information from other relevant organizations were taken into account during this phase of the assessment.

Case studies: Selected case studies treating watershed management issues were identified for in-depth analysis to provide reliable information on state-of-the-art watershed management. By highlighting what does or does not work, the case study analysis can also orient the formulation and implementation of the next generation of watershed management projects. Ongoing work on sustainable mountain development case studies could be a good source of information for the watershed management activities assessment.

Workshops: In order to learn from regional experiences, regional workshops were conducted. Watershed management experts who had been involved in watershed management shared experiences and lessons learned. Workshop participants commented on the outcome of the assessment steps, and contributed to the exercise's findings and recommendations.

International conference: An international conference was planned where key partners in watershed management could discuss the findings/recommendations of the review and guidelines for the next generation of watershed management programmes for dissemination at the global scale.

Dissemination of results: The review and assessment results will be disseminated through reports and relevant Web sites. An FAO Conservation Guide on future watershed management programmes is an outcome of this exercise.

The potential users of the watershed management activities review and assessment include FAO and other relevant international organizations, national institutions/decision-makers dealing with watershed management activities, and watershed management specialists, including researchers involved in watershed management development activities.

Potential uses include: sharing/promoting lessons learned from past experiences; greater streamlining and consensus on the issues raised; raised awareness on the role of watershed management in rural development/poverty alleviation programmes; development of future watershed management plans and strategies; guidance for policy development and formulation of relevant projects/programmes; and orienting research action to identified key issues for the development of watershed management programmes.

The findings and recommendations of the watershed management activities review and assessment will be presented in an FAO Conservation Guide. The results are also available through relevant Web sites.

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CHAPTER 2

REVIEW AND ASSESSMENT OF WATERSHED MANAGEMENT STRATEGIES AND APPROACHES

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The importance of multiple economic, social and environmental benefits derived from land-based resources has increased in recent years. Sound management of these resources is therefore prerequisite to sustainable resource-based production systems. Watershed management, which in essence is the application of land resource management systems, is considered by many to be the most appropriate approach to ensuring the preservation, conservation and sustainability of all land-based resources and improving the living conditions of people in the uplands and lowlands. Integrated watershed management with participation of all the relevant key actors has become widely accepted as the approach best suited for sustainable management of renewable and non-renewable natural resources in upland areas.

WATERSHED MANAGEMENT – A HISTORIC VIEW

Large-scale removal of forest lands by humans in the nineteenth and early part of the twentieth centuries created significant changes in the hydrologic function of watersheds. Downstream flooding occurred more frequently, with subsequent increases in loss of life and damage to infrastructure. Accelerated erosion, produced by changes in the biotic and hydrologic components of natural drainages (watersheds), created unprecedented large-scale siltation of developed lowlands. At the time, the general consensus was that the removal of forest was causing these undesirable impacts. However, the mechanisms for reversing the process through sound scientific management had not been developed.

During the second quarter of the twentieth century, the discipline of forest hydrology evolved from the need for scientific management of the soil and water resources of headwater catchments in order to minimize the flooding and siltation of productive lands and infrastructure in the valleys and plains inhabited by humans. As the importance of rangelands and cultivated lands in the hydrologic cycle and the erosion–sedimentation processes of catchments became known, forest hydrology gave way to the more comprehensive, present-day watershed management.

Over time and in response to changing needs, the scope of watershed management has broadened from the initial concept of technical management of the water resource to an integrated discipline that applies biological, technical, social and economic principles to maintain the productivity of headwater and lowland areas through the scientific management of soil, plant and water resources.

Watershed management in its truest form is the conservation management of the soil, plant and water resources of a catchment to benefit humanity. It involves managing the land and human resources of the drainage in a manner that sustains adequate levels of water, soil, food and fibre production. This form of management requires a participatory integrated approach that includes the various physical, vegetative and human components of areas that range from a few hectares to large river basins.

The watershed part of watershed management implies management of these resources, to the extent possible, within a defined physiographic boundary. From a conceptual perspective, when the boundaries of a management system are defined it is easier to identify and monitor the components (e.g. inputs, storage and outflows) of that system – e.g. the hydrologic cycle. However, from a land management perspective, these physical boundaries are considered to be simply topographic demarcations within political and administrative boundaries that usually overlay a series of watersheds.

The theoretical concept of participatory integrated management of natural resources is difficult to apply. The myriad uses, ownerships, political and social constraints and biophysical systems in large watersheds limit application of the idealistic integrated approach. In practice, large catchments are usually managed according to economic, social and political considerations.

Management of the natural resources in headwater watersheds has the greatest potential for application of the participatory integrated concept. Agricultural, forest and rangelands often represent a potentially significant production resource for local inhabitants. However, the natural physical and biological constraints of uplands often limit productivity compared with lower elevations where major production and population centres are located.

WATERSHED MANAGEMENT REVIEW AND ASSESSMENT OF STRATEGIES AND APPROACHES

Degradation of the natural resources of upland areas has been occurring on the global scale for several decades. In an attempt to reverse this trend, concerned governments and development assistance organizations have been employing watershed management principles since the 1960s. Through these years of development, strategies and approaches for implementing watershed management interventions have changed as the discipline moves forward along the learning curve. By responding to research results, lessons learned, failures and successes, periodic reviews and evaluations, the discipline continues to be dynamic, with adjustment and modification as required to meet changing needs.

During the past decade, the social and economic aspects of watershed management have been given high priority. In addition, people's participation has been recognized as one of the keys to successful management of natural resources (Bendtsen and Sthapit, 1999; Petersen, 1999). The integrated concept has expanded to include community needs and problems as part of a holistic watershed management development scheme.

The last review and assessment of watershed management development strategies and approaches by FAO was held in 1985–1986 (FAO, 1986b). In view of the development changes that have occurred during the past decade, and the period of 17 years since this review, it was

decided to conduct a stocktaking exercise to determine the present status of watershed management development, identify any gaps and formulate guidelines for future development projects/programmes.

Objectives

The overall aim of the assessment was to promote, on the global scale, the dissemination and exchange of information regarding achievements and gaps in watershed management, and to provide future support for effective watershed management projects and programmes. Specific objectives include:

- to conduct a study, on the global scale, of the nature and extent of accomplishments in watershed management;
- to identify major gaps in watershed management strategies and approaches, with focus on the 1990 to 2000 period;
- to formulate guidelines for the next generation of watershed management development projects and programmes.

Procedures

A five-pronged approach was followed to collect information. The first step was to identify key actors) involved in watershed management development during the study period. A set of questions designed to provide information relevant to the study was prepared and sent to the key actors. The responses were reviewed and summarized.

The second step was to conduct stocktaking of FAO experience of watershed management development projects/programmes during the 1990 to 2000 period. This process included reviewing project terminal and evaluation reports, proceedings of seminars, conferences and workshops, personal and group consultations, and other information sources.

The third step was selection and review of case studies on completed watershed management projects or programmes. The selected case studies are summarized in this paper.

The fourth step was to convene a series of regional workshops to provide a forum for regional, national and local actors in watershed management.

The fifth and final step was to prepare a summary of the results of the first four steps and to formulate guidelines and strategies for future watershed management development programmes, with subsequent distribution on the global scale.

RESULTS

Initial findings of the watershed management review are presented in the following sections.

Key actors survey

The survey questionnaire was sent to 30 key actors (organizations, agencies and institutions). A total of 18 responses were received: 14 of these provided answers to the questions, and four provided information on contacts and publications (see Table 1).

TABLE 1

Key actor survey: organizations and names of respondents to FAO review questionnaire

<p>CGIAR, Consultative Group on International Agricultural Research. Ruth Meinzen-Dick, Senior Research Fellow, International Food Policy Research Institute.</p>
<p>CIAT, International Center for Tropical Agriculture. Joachim Voss, Director-General.</p>
<p>CIFOR, Center for International Forestry Research. Mike Spilsbury.</p>
<p>CONDESAN, Consortium for the Sustainable Development of the Andean Ecoregion. Roberto Quiroz.</p>
<p>DANIDA, Danish International Development Agency. Poul Richardt Jensen, TSA.</p>
<p>DFID, Department for International Development, United Kingdom. Professor Ian R. Calder, Director, Centre for Land Use and Water Resources Research.</p>
<p>EU, European Union. Helmut Bloch, M.Sc., Ph.D., Director-General Environment.</p>
<p>FAO, Food and Agriculture Organization of the United Nations. Kumar Upadhyay, CTA, and Prem N. Sharma, Consultant.</p>
<p>IADB, Inter-American Development Bank. Roberto E. Quiroga, Senior Economist.</p>
<p>ICIMOD, International Centre for Integrated Mountain Development. Roger White.</p>
<p>IWMI, International Water Management Institute. Frits Penning de Vries.</p>
<p>NUS, National University Singapore. Professor Roy E. Sidle, Department of Geography.</p>
<p>PROMIC, Programa Manejo Integral de Cuencas. Roberto Mendez and Ana V. Heredia.</p>
<p>TMI, The Mountain Institute. D. Jane Pratt, President.</p>
<p>UNESCO, United Nations Educational, Scientific and Cultural Organization. Dr Mike Bonell, Chief of Section, Division of Water Sciences.</p>
<p>UNU, United Nations University. Libor Jansky, Ph.D., Senior Academic Programme Officer, Environment and Sustainable Development.</p>
<p>World Bank. Norman B. Piccioni, Sr. Agric. Economist LCSES.</p>

The results of the survey were summarized according to three main topics: 1) major issues that require further investigation and in-depth analysis; 2) major constraints – past and future; and 3) challenges, needs and opportunities for future effective watershed management. A summary of the responses is presented in the following.

Major issues that require further investigation and in-depth analysis include: pathways of water, sediment and nutrients in response to land management; appropriate sustainable natural resources management options; cross-scale biophysical and socio-economic issues; the dynamics of natural resource use intensification; multi-institutional approaches to acting together in watershed management projects.

The above suggests that there is a need to establish linkages among central governments, local governments and civil organizations, together with a more coordinated and effective international aid effort. It is also necessary to find ways of: appraising the ecosystem services of catchments and the damage to on- and off-site environments from the viewpoints of farmers and society; creating options for catchment development in which all stakeholders gain (including through intersectoral or downstream–upstream transfers); and dealing with trade-offs and conflict. Staff require careful on-the-job training, particularly in dealing with people, and the role of youth in watershed management should be investigated in greater depth.

In its response, the World Bank stresses that “...finding the right way to address the policy framework and the sets of incentives that affect natural resources in watersheds (water, land, forests, etc.) is key. Also, issues of governance (local vs. central; upstream users vs. downstream users; community organization; mechanisms for water allocation and property rights) are central themes. The challenge is not a conceptual investigation of these issues, but rather the political will to move in the right direction.”

Major constraints for the present include reconciling the needs of resource-based planning with “people-first” objectives, the weak national research systems in developing countries, and the need to develop central and/or local government/community commitment and the political will to allocate appropriate staff. Watershed management is about managing conflicts. Thus, lack of governance is a major constraint.

In addition, process-based concepts and models are lacking across many spatial scales. There is insufficient understanding of the reasons why some major catchment development programmes are working well while others are not – in other words there is an inability to replicate successes. Lack of sustainable financial and institutional mechanisms was identified as an additional “Achilles heel” of watershed management projects.

Major constraints for the future include the present-day constraints continuing. Additional constraints for the future are related to limited access to freshwater, with worsening of the environmental situation as water quality and flooding become more important in highly settled areas; upstream–downstream issues are most important where water supply limits productive land use.

There is also a need to improve project design and management in order to increase the participation and commitment of key actors. A major constraint for catchment development is often the willingness/capacity of national governments to act, e.g. with respect to land tenure and payments for ecological services of catchments, including that of water supply.

Challenges include adapting decision support tools for different biophysical and socio-economic conditions, and documenting experiences and lessons learned in order to become the leading organization in this field.

Needs include a specific focus on water and sustainability as they apply to protection of human health and the environment, capacity building of youth through training and rural school curricula appropriate to their environments, and demonstrations of the usefulness of methodologies for science-based project design and monitoring and evaluation.

Opportunities include recognition of watershed management's important role as one of the most important mechanisms to address global climate change and the high negative impact of desertification in a sustainable way. There is also increasing public understanding of the importance of managing watersheds. Information collected during the 1990s will make it possible to assess performance more effectively and compare methodologies and approaches based on actual results.

FAO experiences

The second step of the study was to conduct stocktaking of FAO experiences with watershed management development projects/programmes during the 1990 to 2000 period. The process included review of project terminal and evaluation reports, proceedings of seminars, conferences and workshops, personal and group consultations, and other information sources. The results of the stocktaking exercise are presented in the following according to major topics.

Evolution of watershed management methodologies/approaches over the past decade, 1990 to 2000

The top-down approach, which was prevalent during the 1970s and 1980s, has given way to the grassroots, bottom-up approach. However, it appears that neither of the extremes is the recipe for success. The correct, sustainable approach is somewhere in between. The proper mix would include factors such as biophysical, social, cultural, financial and political considerations for all concerned stakeholders.

The emphasis of watershed management has changed from development of upland water and soil resources to all-encompassing management of upland natural resources, communities and associated infrastructure, with diffusion of the focus and prioritization of objectives. Community development has become a part of many integrated watershed management projects, with subsequent lower priority being set for management of soil and water resources. Technology for soil and water conservation on sloping lands has changed from mostly physical methods to emphasis on biological and biophysical treatments.

To some extent, the transfer of technology has shifted from a major emphasis on training professionals to training the local inhabitants who are directly involved in implementing development activities. Some of the more recently developed technologies are being used for planning and decision-making; e.g., Geographic Information Systems (GIS), global positioning systems (GPS), satellite imagery, management decision-making tools, advanced monitoring and evaluation, and participatory models.

FAO's role in sharing experiences and lessons learned in watershed management

Owing to the significant decrease in FAO field projects and the associated decrease in FAO field personnel, national meetings and technical backstopping, the sharing of technology and experiences at the national and local levels has decreased. At present, the sharing of experiences and lessons learned consists primarily of attendance, and sometimes presentations, at high-level conferences.

There is a need for networking of watershed management technology on the global scale. FAO is lagging behind as other organizations set up their own systems. This is an excellent opportunity and time for FAO to take the lead role in fulfilling this gap.

The International Year of Mountains (2002) provided FAO with a forum to share its experiences in upland watershed development. Regional and national conferences and workshops have also provided fora for information exchange between FAO and national-level professionals. The regional participatory watershed management training project in Asia (1996 to 1999) provided a forum for information exchange between FAO and participating countries. Implementation of the second phase of this project could provide the mechanisms for a sustainable network in Asia, with links on the global scale.

The existing FAO conservation guides are being formatted on CD-ROM for distribution. However, some of these documents were prepared several years ago and may need revision to reflect the current trends and status of technology development and transfer in watershed management. The most recent FAO conservation guide that specifically addressed watershed management was prepared in 1996. Periodic articles on state-of-the-art watershed management topics in journals such as *Unasylva* have provided a mechanism for disseminating information on the global scale.

Decentralization seems to have created a technology transfer gap between FAO headquarters and regional offices. With respect to forestry and watershed management, the flow of technical information between the regions and the relevant central office is lacking. This particular initiative has shed some light on this issue. The causes are most likely multiple and the solutions complex. A detailed problem analysis with subsequent solutions is warranted.

Participatory processes in the planning and implementation of watershed management activities

Global experience has shown that there is no universal model for participatory planning and implementation of watershed management activities. There is a process that would, in most cases, have similar steps. However, this process – which should include all levels and steps of

the participatory process, e.g. planning, design and implementation with all concerned stakeholders – has not been well defined. Bits and pieces of the process have been identified by various projects. The complete participatory process for watershed management needs to be mapped out in a logical manner, tested and refined.

Experience has shown that empowerment of the main stakeholders in watershed management projects/programmes to plan and implement appropriate activities is essential if the project/programme is to have any chance of sustainability. For example, regardless of good intentions, it is not enough for a project to form a community conservation committee at the grassroots level – in isolation from local governments – plan and start interventions, provide technical, financial and other required inputs to the end of the project and then expect the government to make the project sustainable by providing the required inputs into the future. This is a recipe for failure.

Participatory research methods such as participatory rural appraisal, which have been developed and employed on a wide scale in watershed management projects, have sometimes been a good instrument for initiating the participatory process. However, owing in part to the inherent nature of rapid data collection, subjective questions and answers and limitations on statistical analyses and the subsequent extrapolation of findings, the data generated by these rapid survey methods have limitations for use as baseline data for future assessment of project success. In addition, these participatory appraisal methods are only one part of the participatory process. Participatory appraisal methods, if used, should be conducted in proper sequence as part of the overall participatory process.

Participatory approaches and institutional considerations

The pendulum is swinging in support of empowering people with regards to the conservation of natural resources. There are several reasons for this, one being that past endeavours by governments to solve natural resources degradation problems on their own have for the most part been unsuccessful in terms of sustainability. Second, most national governments do not have the human or financial resources for the countrywide mitigation of natural resource degradation. Throughout the world there are examples of successful, sustainable resource conservation being carried out by local communities that have been empowered to manage their land-based resources.

Change is also occurring, albeit slowly, in governments. New policies are being implemented that permit and encourage people's management of their natural resources; e.g. land tenure, user rights, water rights, crop tenure, formal recognition of community groups and committees, privatization of communal lands, rights to the income generated from these conservation activities, etc.

The participatory process requires an active, well-trained field-level extension service in sufficient numbers to carry out watershed management activities on a large scale. The extension component is usually a weak link in the development process.

Gender issues

Review of past FAO projects revealed that gender issues have been a part of watershed management projects. However, the extent to which these issues were addressed has varied and the recommended changes have not always been made. FAO has promoted the involvement of men and women in implementing watershed management activities since the early 1970s. Through time, the importance of directly involving women in these activities has grown. The degree of success of women's involvement has varied for many reasons, including the following:

- *Inadequate project design:* All of the projects reviewed from the 1990 to 2000 period included component(s) for women. However, most of the inputs provided for these activities were minimal compared with other interventions. In addition, the designs addressed only parts of the gender issues in rural environments. Consequently, most of these activities were inadequate in terms of addressing key gender issues.
- *Cultural and social constraints:* Experience has shown that cultural and social constraints are limiting factors regarding rural women's involvement in project activities. Regardless of the level of inputs, these issues have to be considered and project activities designed to fit the norms for a particular rural setting.
- *Policy and legal constraints:* If there is no supporting policy and legislation, the involvement of women in watershed management projects will continue to be limited.

As the empowerment of people movement moves forward, the inclusion of women in the decision-making process is a prerequisite to sustainable development in rural environments.

Impacts of watershed management technologies

Watershed management technologies have proven to be effective for mitigating erosion on sloping land, stabilizing landscapes, providing clean water, and stabilizing – and in some instances improving – agrarian production systems on the small to medium scale. With modification, these existing technologies can be used successfully in most terrestrial environments inhabited by humans. The degree of success of watershed management interventions is primarily a matter of the will of the people and the scale of the activities.

Regarding the *upstream* effects, examples exist throughout the world where upland resource conservation activities have been successful on the micro and macro scales; e.g. micro- to meso-scale activities in Honduras, the Philippines, China, Thailand, Burundi, Nepal, Pakistan, Sri Lanka, India, Bolivia, Peru and other countries, and the macro-project in Santa Catarina, Brazil.

Regarding the effects *downstream*, the impact of upland watershed management activities on downstream water quantity, quality and siltation remains a controversial issue, partly because of economies of scale, and partly because of difficulties in predicting with reasonable accuracy the results of these activities. Until the magnitudes of natural and human-induced erosion and subsequent sedimentation can be quantified with reliability in a watershed, the controversy will remain regarding upstream effects on downstream infrastructures. The same applies to the quantifiable affects of land use on the hydrologic cycle and water supply and quality.

In the meantime, downstream infrastructures such as hydroelectric and/or irrigation dams are being constructed for hundreds of millions of dollars. However, in the past, when watershed management activities were to be carried out to mitigate downstream siltation of these structures, at best a few million dollars were provided to treat all of the contributing upland areas. In many catchments, the upland areas are in degraded condition before the dam is constructed, so implementing small-scale watershed management interventions is like putting a band aid on gangrene; furthermore, the results of poverty level inputs are poverty level outputs.

Sustainability and replicability of watershed management technology

The interpretation of *sustainable* in the context of watershed management interventions is a matter of perspective. Many interventions at the community, household and farm levels have continued after the project terminated. For example, woodlots were still being managed years after projects ended in Pakistan, Nepal, Myanmar, Thailand, India and the Philippines. The same applies to terracing works that have stabilized hillsides and improved agriculture production in China, Nepal, Thailand and Honduras; biophysical gully erosion control treatments that have stabilized gully cutting on sloping lands – structures that were built 15 to 20 years ago are in place and functioning as an energy modifier on the landscape, which was the original intention; and simple low-tech water supply interventions that continue after projects finish. The development process has provided many examples of low-tech and low-cost upland interventions being more sustainable than high-tech, high-cost ones.

Two key factors regarding the sustainability of watershed management interventions are financial and institutional stability/instability. As stated by some of the contributors to this assessment exercise, the “tragedy of the commons” continues to be a problem. Experience has shown that the political, social and user rights issues must be solved on common lands before interventions are sustainable.

The technical solutions available for managing soil and water resources are *replicable*, with modification to fit most landscapes inhabited by humans. These techniques are being used throughout the world. The degree of replication depends to some extent on the degree of technical skills and investment required to implement a technique. For example, high-tech, high-cost torrent/landslide control is replicable to most sites. However, the scale of these interventions is limited by the technical and financial resources available. Whereas, low-tech, low-cost interventions at the community and farm levels have potential for replication on the large scale if local technical skills are available and people are willing to implement the activities.

Important scale factors for upscaling from site, to watershed, to basin, to region include institutions, finances, and cooperation and coordination of all concerned parties. Important factors for out-scaling from plot or demonstration site to local farms and communities include biophysical considerations, finances, and the capacity of local institutions.

Development status of institutional/organizational arrangements, policy and legislative mechanisms

Watershed management is an integral part of natural resources management in many countries; more so today than ten years ago. Some countries give it more attention than others. In Asia and the Pacific and in Latin America it has been institutionalized into existing forestry and agriculture line agencies. The degree of institutionalization varies, from one or more professionals in watershed management such as in Bhutan or the Lao People's Democratic Republic, to watershed management units or divisions such as in Myanmar, Nepal, Honduras and the Philippines. Institutionalization of watershed management in Africa has been slow to develop. The reasons for this lag are beyond the scope of this exercise.

Policy and legislation that support participatory watershed management remain major issues. Governments have been slow to respond to the need for changes in existing and new policies and legislation that enhance upland inhabitants' opportunities for sustainable participation in natural resource conservation interventions. However, some progress has been made, for example: 1) the granting of user rights for communities and households on government lands in Asia, Africa and the Americas; 2) many countries' enactment of tree crop tenure rights that permit individuals or groups to harvest and market products from trees that they themselves have planted (Nepal, Bhutan, Pakistan and other countries); and 3) formal recognition of local watershed resource conservation development groups/committees.

Training and education

Watershed management training and education programmes have progressed significantly during the past decade. The results of a study by Brooks (FAO, 1992) of the Asia and Pacific region indicate that there are many talented professionals. The study also pointed out that there are excellent education institutions in the region. None of the respondents to the global survey stated that there was a dearth of well-trained professionals. The Brooks study pointed out the need for training/education of all the key actors, from policy- and decision-makers to field-level technicians and villagers who are implementing watershed management activities.

The regional FAO watershed management training in Asia project (FAO, 2000) indicated the need for training in participatory methods and interpersonal skills at all administrative, professional and technician levels.

The major training constraint that surfaces in all the study reviews is the need for more emphasis on well-designed training programmes for local government staff and for the villagers who are directly involved in implementing field-level activities (FAO, 1996; Dent, 1996; FAO, 1999).

Evaluation of FAO projects

Eight FAO projects with a watershed management theme that were implemented during the 1990 to 2000 study period were evaluated in the context of the stocktaking part of this study. Terminal and evaluation reports were reviewed and evaluated according to the following criteria:

- scale of operation;
- participatory approach;
- project design;
- major constraints;
- sustainability indicators;
- training;
- technology;
- government capacity.

A summary of the project evaluation is presented in the FAO project evaluation matrix, Appendix 3.3. The results indicate that all of the projects had a community- or group-level participatory component. Project design was unsatisfactory in two projects, with satisfactory performance for the others. None of the projects were rated highly satisfactory. The major constraints varied, but were common to the constraints that have been identified in this overall assessment exercise. Evaluation of project training components indicated a trend towards more emphasis on the training of local-level technicians and villagers. All of the projects had social and biophysical technical components. However, indicators of the performance of these technologies were insufficient for evaluation. Government capacity ranged from unsatisfactory to satisfactory. In some projects, government performance was not clearly defined. Sustainability indicators were not clearly defined in most of the projects. In addition, these indicators were not of sufficient scope and detail in any of the projects to provide clear evidence of sustainability.

Analysis of the results of the FAO project evaluation identified some points that may need attention for the improvement of future projects. These points are the following:

- Project design is lacking: e.g., overdesign in terms of expected outputs; unclear objectives; less than comprehensive design (i.e. a design that includes the required inputs for all of the key actors in the project [FAO, 1991]).
- Performance indicators need to be comprehensive and clearly defined.
- There is a need for monitoring and evaluation procedures at the project and agency levels that clearly link performance with objectives.
- There is a need for sustainability indicators that are clearly defined and linked to project objectives.

Comparison of major watershed management development issues: 1986 and 2002

During 1985–1986, FAO conducted a study on the problems of watershed management in Asia and the Pacific (FAO, 1986a). One of the outputs of this study was identification of major issues and constraints with respect to implementing watershed management development projects and programmes. These major issues and constraints were used as a baseline for comparison with the major issues and constraints that were identified in the current study. The results of the comparison are presented in Table 2.

TABLE 2
Comparison of major issues and constraints, 1986/2002

	1986	2002
Policy, legislation and regulations	The concept of watershed management (WM) had not been introduced into upland strategies or national development policies	WM has become an integral part of upland strategies in many countries
	Coherent policies to promote good WM were inadequate	Some improvements in policy, but it remains a major issue
	Inadequate coordination policies	Coordination remains a key issue
	Legislative and regulatory measures emphasized policing for enforcement	In some countries, enforcement is now being given less importance than empowerment
Institutions and organizations	WM activities were implemented through forest and agriculture departments promoting the formation of separate WM units within government technical sectors	Experience indicates that this approach is preferable to multi-agency responsibility; separate WM departments are not necessary to achieve success; and well-trained WM staff are needed at all levels
Problem identification, programme planning and project implementation	Diagnostic methods were needed for rapid assessment of biophysical and social parameters	Rapid rural appraisal method developed and used globally
	Scope of WM activities was often not clearly defined	Failure to define scope of WM activities remains an issue although further diffusion of objectives and activities has occurred, with inclusion of integrated rural development
	WM planning methods overemphasized biophysical elements and inadequately considered social and cultural issues	Social and cultural issues have become an integral part of WM planning
	Inadequate economic analysis of WM programmes	Economic analysis models remain inadequate
	Absence of operational guidelines to overcome conflicts between project objectives and administrative organizations	Little progress on making operational guidelines
Monitoring and evaluation	Monitoring often started after, rather than before, projects started	Pre-project monitoring is still rarely carried out
	Monitoring was often inadequate to evaluate achievements and outputs	The advent of verifiable indicators in project design has improved monitoring and evaluation
	Social and cultural factors not covered	Project design considers social and cultural factors
Training and education	Professionals and technicians in WM lacked broad perspective	Good progress, but they still lack people skills
	Curricula copied from external sources, with limited application to local conditions	Many institutions have modified curricula to fit local conditions
	Emphasis on university training, with lack of training for field workers	Emphasis now on training field workers, But training of local people is lacking
	WM is mostly ignored in primary and secondary education	Conservation of natural resources is taught in many elementary and secondary schools throughout the world
	Hardly any planning for development of technical personnel in most countries	Still inadequate technical personnel planning

TABLE 2 - continued

	1986	2002
Research and demonstration	Relationships between technical and social benefits of WM were not clearly understood	Remains an issue
	Causes and effects of watershed degradation in highly populated watersheds were not fully understood	Remains an important issue
	Scarcity of well-designed demonstration watersheds	Demonstration watersheds established, but of little use because of unreplicable levels of inputs and other factors
	Need for linkages among research, demonstration, extension and educational organizations	Remains an important issue
Awareness raising	Inadequate public awareness campaigns	Public awareness campaigns are an integral part of conservation education worldwide
	NGOs are not being used effectively for awareness raising	NGOs are involved in all aspects of WM
Extension	Extension networks were one of the weakest links in WM	Still an issue, although there is more resource conservation and WM extension in many countries
	Majority of extension workers had inadequate training in conservation extension	Training of extension workers is common in many countries
	Weak linkages among extension, research and training	Remains an issue
People's participation	Large deficiencies in methods used to ensure participation	Participatory processes widely used. However, the total process, including all stakeholders, has yet to be well defined
	Unsatisfactory legal, institutional and organizational approaches to involving local residents in project planning and implementation	Remains an issue, and is a key topic being considered by development practitioners
	Land tenure was a major constraint to community and farmer participation	Significant progress, as rural people have gained more user rights, land tenure and crop rights
	Community-owned land was rarely well managed	Remains a key issue in most of Asia. Reasons for poor management of community land have been documented, but little implementation progress
Investments	WM is a long-term process needing long term investments	Donors and governments are aware of the need for long-term commitments
	It was seen as unfair to expect upland communities to bear costs of WM when most benefits were enjoyed by lowland people	Remains controversial, but note recent movement towards payment to upland dwellers for environmental services provided to lowlanders

Source: 1986 issues paraphrased from FAO, 1986b, Chapter 6 – Issues and constraints

Some of the issues and constraints identified in 1986 remain important today. Some of the institutional, administrative, project planning and research issues listed in the 1986 study have been identified in this current study (Table 1). Progress has been made on several issues and constraints. For example, policy and legislative reform is occurring. Improvements have been made in training and education, awareness, extension, people's participation, and monitoring and evaluation (Table 1).

CASE STUDIES

A literature search was conducted for case studies that had been prepared for projects with watershed management as a major component. Several case studies were reviewed (Dachanee, Lakhaviwattanakul and Kalyawongso, 1996; Hoang and Nguyen, 1996; Lim Suan and Rosaria, 1996; Rice, 2000; and Warren, 1998). The following two case studies were selected for presentation in this paper: the Begnas Tal and Rupas Tal Watershed Management Project (BTRT), Nepal (Bogati, 1996) and the Project Land Management II in Santa Catarina, Brazil.

BTRT, Nepal

The Begnas Tal (lake) and Rupa Tal (BTRT) watershed management project was funded and implemented over from 1985 to 1994 by the international NGO, CARE. A case study of the project was conducted as part of the FAO regional project on participatory watershed management training in Asia.

The BTRT watershed area comprises about 173 km² of land area that includes two main lakes and three minor lakes. The area is about 10 km east of Pokhara in western Nepal. The population is about 31 000. The terrain is hilly with gentle to steep slopes. The area is rural with an agrarian economy. The nearby town of Pokhara is the major population centre of the area.

In the project area, seven village development committees (VDCs) were established and used as the primary mechanism for implementing participatory methods. The local people were involved in planning, implementation, follow-up and maintenance of individual and community watershed resource activities. Watershed management technicians who were part of the external support served as technical facilitators. Community development conservation committees (CDCCs) were organized to ensure people's participation in interventions that were relevant to their particular needs. Every household in the community was represented on the CDCC. The participatory process began with formation of a CDCC, which in turn identified its problems, prioritized its conservation needs and presented these to the VDC and the project office for consideration. At the end of 1994, 100 CDCCs were in operational status. As the project progressed, the need was recognized for a third level of communication and decision-making at the community level. Consequently, a community development board (CDB) was formed at the village level to facilitate communication between the VDC and the CDCC. All members of the VDC and the chairperson of the CDCC are members of the CDB. The end result of this process was a participatory communication pathway of CDCC to CDB to VDC to facilitating agency.

Agricultural diversification interventions have minimized the risk of crop failure and enabled farmers to earn income throughout the year. The average farmer now grows about six kinds of fruits, five different fodder crops, and cereal crops.

Following initial education and implementation by the project, with people's participation, management of natural forests was handed over to the local users. The end result is denser forest lands.

Several conservation farmers adopted improved agriculture practices, which they share with their neighbours. They have set up demonstrations on their farms, and have converted many followers. Homestead agroforestry plots and kitchen gardens provide source of income. Cash crops such as coffee, pineapples, oranges, cardamom, broom grass, vegetables and other fruits are sold at local markets.

Local women are active in forest management and conservation farming activities, and are fully involved in the decision-making process. Three major factors that facilitated active participation of women were: a clear prospect of benefit sharing; support from their families; and the small size of the CDCC.

Overall, the project was considered a success. The participatory model developed in the BTRT area was used by other development projects in Nepal; e.g., the FAO Shivapuri watershed management and fuelwood project. According to Bogati, the participatory model and many of the activities that were implemented during the life of the project have continued after the end of international assistance.

The major reasons for success of the project included:

- clear and transparent decision-making procedures by project management;
- clear and simple guidelines and flexible operational procedures to facilitate people's participation in watershed management;
- well-defined programmes, budgets, plans, implementation procedures and benefit sharing mechanisms;
- integration of a wide range of diversified watershed management activities, and guarantee of benefits;
- strong motivation among project staff.

The main lesson learned by the project are as follows:

- Interest groups for women should be formed for income-generating activities.
- Indigenous technology for the conservation of watershed resources should be evaluated before external technology is imposed.
- Training of leadership skills for local users is needed.
- Training of local users on maintenance of activities is needed.
- Mid-level field technicians should be oriented in project goals, and receive refresher training in watershed management subjects.

Santa Catarina, Brazil

The Land Management project in Santa Catarina was implemented from 1995 to 1999 with World Bank funding. The project objective was to safeguard farmers' incomes and natural resources by increasing agricultural production and income for about 81 000 mostly small-scale farmers, by promoting the adoption of sustainable, modern forms of land management and soil and water conservation, and mitigating existing upland land degradation.

Project interventions centred on the introduction of land management methods that would improve soil and water conservation and the disposal of animal, human and pesticide wastes in 520 of Santa Catarina's 1 700 micro-catchments. The major components included agriculture

extension, research, incentives to share the costs for implementing new methods with farmers, support for reforestation of critical parts of the landscape, rural access road improvement, land-use planning and mapping, environmental monitoring, training assistance to state parks and biological reserves, and project administration.

The overall project performance was rated as successful. Owing to the good performance of the project and the apparent sustainability of activities, a second project is being considered, which incorporates the successful components and lessons learned from the original project.

A case study was conducted on the Lajeada Sao Jose micro-watershed (FAO, 2002), which was one of 520 micro-catchments included in the project. This micro-watershed was chosen for study to illustrate the positive effects of improved land management on land degradation, agricultural production, water quality, and upstream and downstream beneficiaries. The watershed is about 7 744 ha in size, with elevation of about 659 m and slopes ranging from 0 to 20 percent. Total population of the watershed is estimated at 28 375, with a distribution of about 1 057 people in the upland rural area and 27 300 in the downstream urban area.

Improved land use and management (zero and minimum tillage, crop rotation, cover crops, green and organic manure, level terracing and forestation) produced on-site benefits such as reduced soil erosion. Crop production increased (maize by 40 percent, soybean by 21 percent, beans by 3 percent and tobacco by 32 percent) with subsequent increases in farm income. Owing to the downstream environmental monitoring of stream flow, the project was able to determine some of the offsite benefits of the land management interventions. One important benefit was the reduction in suspended sediment levels by 69 percent. This reduction represented a savings in water treatment costs for domestic supply of about US\$2 445 per month. This study illustrates that investment in upland watershed management-related interventions can produce downstream economic return.

Some of the important lessons learned during implementation of the project at the study watershed are as follows:

- Active participation and organization of land users are essential factors for success.
- Participatory methods need to be promoted at the micro-watershed level.
- Formal extension to and education of farmers is necessary.
- Existing farmers' organizations need to be strengthened.
- Farmers are most interested in activities that improve farm-level production.
- Environmental education of upstream and downstream inhabitants is essential.
- Decentralization of research and extension is needed.

CONCLUSIONS

Watershed management projects and programmes are being implemented throughout the world. It is considered by many to be one of the important development sectors now, and will continue to be so in the future.

As the trend continues towards empowerment of rural people to manage their natural resources, the integrated, multiple use concepts of watershed management at the community and farm levels with linkages to local and State governments will become more viable.

The watershed management development approach is not perfect in any sense. It continues to evolve with time, with ever-changing development needs. As described here, some of the major constraints that were identified in 1986 are still prevalent today. However, some of those earlier constraints have been removed, or are being given attention by the key actors in development. New approaches such as payment for environmental services are being implemented and tested. The role of national and local NGOs is becoming more important as the participatory approach is being expanded at the community and farm levels. However, the effectiveness of NGOs in implementing sustainable watershed management activities has yet to be determined.

According to Sayer and Campbell(2001), the integrated management of natural resources requires three key elements:

- Management needs to be adaptive.
- Movement along the research–management continuum is essential.
- There must be provision for negotiation among all stakeholders, with interventions that are based on (an outcome) of this process.

Sustained improvement of the well-being of poor people in developing countries, such as farmers, will require natural resource management research that gives more emphasis to: 1) management risks; 2) reduction of dependence on external inputs; 3) avoidance of long-term depletion of production potential; and 4) more careful control of environmental externalities (Sayer and Campbell, 2001).

In the 1990s, the watershed management development sector, to some extent, became ambiguous in context. The basic principles of multiple use management of renewable and non-renewable natural resources, with emphasis on soil and water resources, gave way in some projects to a more holistic, integrated rural development and agriculture production systems approach, with less importance to upland conservation of soil and water resources.

RECOMMENDATIONS

Analysis of the results of this review and assessment study suggests that a paradigm shift is warranted to refocus the watershed management development sector and improve the performance of future projects and programmes. Some of the important paradigm components and recommended changes are listed in Table 3.

TABLE 3
Preliminary recommendations of the FAO stocktaking exercise

Present scenario	Future scenario
1. Treating the symptoms of watershed degradation (i.e. deforestation, soil erosion, siltation, decreasing production) (WRDP-WMIC, 1998).	Identifying and treating the underlying causes of watershed degradation (i.e. lack of knowledge, poverty, population increase, demand for resources, improper land use). More focus on prevention rather than cure.
2. Priority focus on off-site/downstream costs and benefits of watershed management (i.e. downstream infrastructure risk, decrease in floods and sedimentation, increase in water quantity and quality for downstream users).	At minimum, equal priority to on-site costs and benefits of watershed management (i.e. improving and maintaining upland agriculture, forest, and rangeland productivity, water quantity and quality).
3. Inadequate project designs that often overestimate government capacity and assume policy changes will occur.	Project design that provides for adequate government capacity and assures policy changes.
4. Top-down research and development, and transfer of technology to local stakeholders that is driven by donors and education and research institutions.	Emphasis on stakeholder participatory learning and technology development process that builds on indigenous technologies and addresses local research needs.
5. Diffuse focus of watershed management, which often maximizes production of resources/commodities other than water and soil.	Sustainable multiple-use management of watersheds that combines water resources development with compatible economic land-based production systems (i.e. trees, crops, livestock, fish, recreation).
6. Encroachment of integrated rural development approach with multisectoral steering committees and line agencies (which, for the most part, has been a failure) into the integrated watershed management concept.	Multiple-use management of natural resources (renewable and non-renewable), with emphasis on water and soil resources in upland watersheds and with development responsibility given to the relevant line agency.

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PART 2

REGIONAL REVIEW

CHAPTER 3

SUCSESSES AND FAILURES IN WATERSHED MANAGEMENT IN THE ASIA-PACIFIC REGION (1982 TO 2002)

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BACKGROUND

Before 1980, watershed management was practised in only a few countries in the Asia-Pacific region. Pakistan, India, China, and the Philippines have had substantial watershed management projects since the late 1950s. Nepal, Indonesia, Thailand and Malaysia began watershed management during the mid-1960s with small-scale pilot demonstrations.

Increased awareness of the importance of watershed management was triggered by Erick Eckholm's 1976 book, *Losing ground*. It reported the dangers of the massive degradation of the upland areas of the Himalayas. Eckholm's doomsday scenario drew the attention of the world to the problems of watersheds in the Himalayas and elsewhere. The subsequent call to launch a global initiative against the degradation of upland areas received large support.

During the 1980s, a series of global, regional and national meetings were held where planners and researchers worked out strategies for managing watersheds. Governments began to manage watersheds through donor-supported programmes with demonstration, training, education and research components. At that time watershed management received unprecedented attention from the international development agencies, bilateral donors and national governments, and became one of the leading development paradigms.

The 1990s saw an expansion in watershed management initiatives across the Asia-Pacific region. These programmes became popular in national and international investment portfolios, as they often performed better than the integrated rural development projects that aimed to deliver everything from new roads to improved health care, and than the forestry projects that focused on increasing forest productivity.

Many integrated rural development projects failed to deliver lasting benefits. They lacked focus, were too complex to manage, often failed to benefit the poor and had management costs that were too high. Funds were illegitimately diverted for urban development, and lack of management controls led to political conflicts between local and national governments. As a result, donors began to limit support to them. On the other hand, watershed management projects gained credibility because they are more pro-poor, environmentally friendly, simpler to manage and rural-focused. They give more attention to the basic needs of rural communities, such as livestock, forestry, small infrastructure and microfinance.

Conventional forestry projects were widely criticized for their environmental impact and for ignoring local people's needs. Donors' priorities shifted from production forestry to environmental forestry, including watershed management. However, nowadays watershed management is also being criticized. This paper analyses its successes and failures, and identifies the weaknesses that need addressing in future projects in order to attract more donor and government support.

SUCSESSES AND FAILURES

A problem in evaluating the successes and failures of watershed management is the lack of baseline data. The paper by Tennyson in this volume documents the performance of watershed management programmes in the Asia-Pacific, using the baseline established in the report *Watershed management in Asia and the Pacific: Needs and opportunities for action* (FAO, 1986). The present paper complements Tennyson's paper by looking at the status of a few country-level projects. The analysis is based on project reports and the author's decade-long field observations in terms of the following fourteen issues – ranging from size of planning unit to sustainable funding – to reflect on successes and failures.

Planning unit: large versus small watersheds

Watershed management initiatives implemented in smaller areas have usually worked better than those spread over larger areas. Similarly, projects involving fewer administrative units and functionaries have been easier to manage. The many types of inputs needed in watershed management make it easier to manage and coordinate projects in small watersheds that are governed by a single or few local government units, such as commune people's committees in Viet Nam, groups of gewogs in Bhutan and village tracts in Myanmar.

Integrated rural development projects and large watershed management projects have found it difficult to achieve success because of the complexity of coordinating the many local governance bodies and their diverse interests. In such projects, managers have to spend too much time bringing together the many project stakeholders. This was the case in Nepal's Resource Conservation and Utilization Project. This 1980s United States Agency for International Development (USAID)-funded project covered a very large area. The project concept looked good on paper, but managers had to invest too much time bringing together the numerous project stakeholders.

Project focus: forest versus multiple-resources productivity

Watershed management is the process of guiding and organizing the use of the land and allied resources in a watershed to provide desired goods and services without harming soil and water resources. It recognizes the crucial importance of the interrelationships among land use, soil and water and between upland and downstream areas. Watershed projects implemented in the Asia-Pacific region have either focused on:

- the sustainable management of forests to improve forest productivity; or
- meeting communities' needs by working on forest management and protection, agricultural development (cropping and livestock) and small-scale hill irrigation, and by providing credit to farmers to buy agricultural inputs.

The first generation of watershed projects in the Asia-Pacific region focused on forest productivity. Because most watershed areas in the region are highly populated, many of these projects failed to win local support and achieved only limited success. The second-generation of projects were thus designed to improve the productivity of all types of watershed resources. These have received much more support from local communities and have been more successful.

Choice of project components: limited versus extensive

The region's watershed projects have included a diverse combination of components. Earlier projects concentrated on improving forest productivity to achieve watershed management goals. They worked well where population densities were low, for example in the Kinda Dam Watershed Project (Phase 1), implemented during the 1980s in Myanmar. They were relatively straightforward to implement because only one agency – the forest department – was responsible for their implementation. These kinds of projects, however, failed in more densely populated mountainous areas. The Tarbela and Mangla Dam Watershed Project in the North West Frontier Province of Pakistan had only limited success because it focused only on planting trees on degraded slopes. It did not consider other activities related to meeting the basic needs of local people.

In highly populated watersheds such as Phewa Tal and Kulekhani watersheds in central Nepal, people-centred integrated watershed management has been much more successful. These projects have focused on resource management and have components to promote field crops, home gardens, animal husbandry and veterinary care, irrigation renovation, water management, forest management, and savings and credit. The third type of projects, such as Nepal's Resource Conservation and Utilization Project (RCUP), included a wider range of activities such as formal research and education, water supply, environmental education in schools, and sometimes health and nutrition education. These have been more similar to integrated rural development projects and have often been unsuccessful because of a failure to coordinate the many project components and stakeholders.

Approaches to watershed management: flexibility versus prototype replication

FAO has classified the Asia-Pacific region's watersheds into seven types according to their biophysical setting and socio-economic situation (FAO, 1986). The same report documents the causes of watershed degradation. It says that they are largely situation-specific; meaning that there cannot be a single approach to watershed management. Several watershed management projects have failed because they have tried to transfer a successful approach in one country to another country where conditions are different. For example, the Government of Bhutan was looking for alternatives to shifting cultivation to protect its watersheds. Farmers were encouraged to stop shifting cultivation and practise sedentary agriculture. In the early 1980s, a number of farmers were encouraged to make this move by being given new land in low-lying

areas. But most could not adjust to the new setting, and moved back to their previous villages and practices. A study suggested that it would have been better to have altered the shifting cultivation practices to minimize their harmful effects on the environment (FAO, 1995).

The experience of forestry-focused projects has shown that just planting trees often does not rehabilitate degraded watersheds. Projects have been most successful where they have introduced management practices that encourage sound land use (Brooks *et al.*, 1992). Projects that have created alternative income opportunities for resident populations have been able to improve the hydrology of watersheds by reducing local people's dependence on forest products and by encouraging the natural regeneration of forests on bare hillsides. In densely populated watersheds, projects focusing on improving food security, alongside soil conservation measures, have worked better than single-pronged forestry-focused projects. Three generations of United Nations Development Programme (UNDP)-funded participatory watershed management projects designed to protect critical watersheds, including the famous Inle Lake watershed in Myanmar, and two generations of similar projects in Hoanh Bo District Quang Ninh Province in Viet Nam have been successful as they have taken this approach. Farmers are more concerned about food security than environmental conservation, and it is therefore crucial that watershed management tends to this need.

Centrally planned versus participatory projects

Many types of participatory watershed management and project implementation were tried during the 1990s. These projects have worked better than the 1980s top-down, centrally planned ones. However, the benefits brought by projects that relied overly on external expertise have often disappeared once project support has ended. RCUP's field component relied heavily on external technical inputs and collapsed after these were withdrawn, whereas the capacity building component, including in-service training and support to formal training in natural resource management, created a sustainable impact with a large pool of watershed management experts. Projects that have focused on building local capacity to institutionalize participatory methods and approaches have performed much better. The Watershed Management in Three Critical Areas Project in Myanmar and the Participatory Watershed Management Project in Hoang Bo District in Viet Nam created significant impacts in a short time as they were designed and implemented in close cooperation with project beneficiaries, using participatory management tools.

Project design: process versus product

Some projects have failed because they were poorly designed. Projects designed in a hurry with heavy external technical assistance inputs have often not given enough attention to studying stakeholders' needs and the particular characteristics of a watershed. Local land users' needs cannot be fully understood in a short time. Such projects have encountered serious difficulties. A major USAID-supported project in Nepal, which ran from the late 1970s to the early 1980s, was designed by a team of international and national experts without involving local beneficiaries. This project was not well received by beneficiaries.

Some projects have had contradictory objectives. For example, a project's first objective may be to promote the improved and faster delivery of goods and services to local people. However, the second and third objectives may call for building up the capacity of community-based extension networks and institutionalizing participatory processes. The problem is that the first objective cannot be met without laying the foundations of the second and third objectives. In this regard, the objectives of Participatory Watershed Management in Hoanh Bo District, Quang Ninh Province, Viet Nam were revised halfway through the project to give it a more realistic goal (FAO, 2002).

Project duration: short versus long duration

Most watershed management support in the Asia-Pacific region has taken the shape of three to four year-long donor-funded projects. Most of these projects have focused on involving people in planning and implementation, something that cannot be achieved in a limited period. As a result, many projects have had a limited success owing to the clash between the limited time and the need to involve local people fully. Real people's participation takes time and involves painstaking building of capacity at the grassroots level and consolidation of field activities to ensure real sustainability.

Project organization: umbrella agencies versus interagency

Most recent watershed projects have taken an integrated approach by working on developing cropping and livestock husbandry, forestry, water management and microcredit. These projects have been implemented either under one umbrella agency or through a number of agencies working together. The implementation of Participatory Watershed Management in Hoanh Bo District, Quang Ninh Province, Viet Nam was easy, and impacts were immediate because it was organized at the district level under a single command. The management of RCUP, Nepal was located at the central level with more than seven government agencies responsible for implementing the project in three districts. Field-level coordination was a big problem, and it took a long time to produce results.

In the former case, staff from different disciplines work under a single project management. In the latter case, different agencies are assigned responsibilities in their subject areas with a steering committee coordinating implementation. These two models have advantages and disadvantages. The first one has been successful where project goods and services have to be delivered in a short time to have a rapid impact on local people's livelihoods. However, these benefits are often not sustained. The second model is more appropriate where a project aims to build local capacity and institutionalize watershed management principles. The drawback of this approach is that local people often have to wait a long time to see improvements in the meeting of their basic needs.

Project location: national versus decentralized

Watershed projects work with different levels of partners. Delivery-oriented projects tend to work well where NGOs carry them out. Projects focused on institutional and organizational

reforms, resource inventories, strategic planning and human resources development work best when implemented in partnership with national-level institutions. Myanmar's Three Critical Watersheds project produced significant impacts as it was a direct-delivery project grafted on to the local institutional set-up. However, its sustainability after the project was questionable as it excluded the government's regular extension network. Bhutan's Integrated Forest Management project was grafted on to the forest department and focused on building up the capacity of government staff and local communities. As a result, the government continued to plan and implement integrated resource management projects after UNDP-FAO project inputs were withdrawn.

The delivery of technical assistance has worked best in these kinds of projects. Projects with combined objectives have been most cost-effective when they have worked in partnership with intermediate regional government agencies. A main reason for this is that technical assistance and other management costs are greatly reduced if larger projects work at provincial levels for capacity building and monitoring and evaluation, and at the district level for delivering goods and services.

Conflicts: national policies versus project priorities

Watershed management is a new concept in many Asia-Pacific countries. Only in India, China and Thailand are there adequate legal and institutional infrastructures and trained personnel. Watershed management projects demand horizontal coordination for interdisciplinary action, vertical linkages for technology transfer, and the decentralization of authority for fast decision-making. However, many Asia-Pacific countries are characterized by centralized decision-making and a failure to connect policies and procedures horizontally among different government agencies and vertically within the same agency. Lower-level officials and technicians are often not sufficiently motivated to take timely decisions. This means that project implementation often suffers from conflicts between national policies, programmes and procedures and local needs.

Technical capabilities: biophysical diagnostic expertise versus participatory skills

Watershed management is a multidisciplinary subject. Projects have worked best in countries with good technical biophysical diagnostic and socio-economic expertise. India, China, Indonesia, Pakistan, Thailand, Malaysia, Sri Lanka and Nepal have many trained personnel. Their performance in implementing watershed management projects has been better than that of countries such as Afghanistan, Myanmar, Viet Nam, the Lao People's Democratic Republic, Cambodia, Bangladesh and Bhutan, which lack trained personnel. In countries that depend on donor funding, existing capabilities to carry out biophysical analysis are deteriorating as donors shy away from funding projects that need heavy investments in equipment, supplies and technical assistance. As a result, poorer countries have to rely more on participatory problem analysis. However, issues such as causes and effects of watershed degradation, upstream-downstream linkages and interrelationships between types of vegetation and watershed hydrology cannot be fully understood from participatory information gathering alone.

Conflicts: regular institutions versus projects

Most watershed management in the Asia-Pacific region has taken a project approach. Projects tend to establish parallel organizations for the faster delivery of goods and services, extension, training of farmers and other activities. One big problem is that project extension teams encroach on the jurisdiction of government institutions. This often leads to conflicts, and hinders project delivery.

Research

Many watershed management projects have suffered owing to the lack of research infrastructure. Watersheds are systems that house a complex web of interactions between human and biophysical factors. Many preventive and curative watershed rehabilitation measures have not been based on the findings of systematic research. For example, experience has shown that planting trees is not always good for watersheds. One study in Fiji showed that water flows were reduced by up to 60 percent in grassland areas six years after they had been planted with pine trees (Brooks *et al.*, 1992). In developed countries such as the United States, best practice guidelines have been introduced for managing watersheds. However, implementing these needs a good understanding of a country's specific biophysical setting and institutional linkages, for which research and education is very important.

Sustainable funding: programme versus project approach

Most watershed projects in the region have been funded from donor assistance. This has led to watershed management being project-oriented and focused on limited project periods, a diverse approach, temporary institutional arrangements and lack of continuity and follow-up. The third phase of the Participatory Watershed Management in Hoanh Bo District, Quang Ninh Province, Viet Nam had to be wrapped up prematurely as FAO and the Government of Belgium decided against extending the project. Several other projects have been prematurely ended owing to donors' erratic funding policies. Only countries such as India, Thailand and China have funded large projects themselves. Watershed management initiatives in Nepal have survived by convincing other donors to take over after the original donor has ended its commitment.

CONCLUSIONS

The main difficulties for watershed management are caused by its interdisciplinary approach where different technical agencies have to work together. In many Asia-Pacific countries, these agencies are poorly equipped and lack trained workforce. Coordination is often lacking for planning, implementing, monitoring and evaluating watershed management. Several countries in the region have a legacy of central planning and lack the participatory skills to make programmes people-friendly. Shortage of funds is also a major hindrance. Upland areas also tend to lack political power as they usually lie far away from the centres of power. They are generally poor and are unable to mobilize internal resources. Owing to lack of sustainable funding, the consolidation and replication of watershed management is a big problem.

In spite of these difficulties, most watershed management projects and programmes have been environmentally sustainable, economically feasible and socially acceptable. Most have succeeded in stopping the degradation of critical watersheds, creating awareness about the need to sustainably use natural resources and improving the livelihoods of deprived communities and ethnic minorities. Watershed management practices are evolving, and it has yet to become a mainstream development concept. The next generation of watershed programmes should be designed to address the many constraints.

A major strength of watershed management is its recognition from all development practitioners, politicians, planners, sociologists, technical experts and beneficiaries. Watershed management has many benefits if it is properly designed and implemented. Programmes need to promote the environmentally sound, economically sustainable and socially acceptable development of upland areas. Governments need to capitalize on the credibility earned by watershed management projects over the last two decades.

RECOMMENDATIONS

The following recommendations need acting on by the next generation of watershed management programmes and projects.

Technical issues

Future watershed management programmes and projects need to:

- develop quantitative auditing models to measure the costs and benefits of strengthening upland–lowland linkages;
- improve technical skills to separate out human and natural causes of environmental change and damage;
- strengthen technical infrastructure to make better inventories and carry out data analysis, planning and the monitoring and evaluation of biophysical resources;
- document best management practices;
- improve awareness of the watershed management concept and practices among planners, developers and beneficiaries;
- better coordinate the work of technicians, development practitioners and administrators to improve relationships among watershed management practices that benefit land conservation, food security, employment, economic growth and poverty alleviation; and
- provide more training and capacity building, including carrying out research and education to improve analytical skills for assessing watershed conditions.

Institutional and organizational issues

Up-coming watershed management projects and programmes need to address the following institutional and organizational issues:

- They can continue to be planned over administrative rather than watershed boundaries as long as the capacity of countries to audit input–output relationships of soil erosion and runoff and to analyse cost and benefits does not exist.
- Consider implementing projects with a more manageable number of administrative units and local functionaries, especially for participatory watershed management projects that focus on increasing productivity across a range of productive resources.

In upland areas, work should focus on sustainable forest management. In more densely populated watersheds, projects should aim to improve overall resource productivity by continuing their focus on integrated rural development.

Create watershed management infrastructure to support both umbrella and interagency projects by establishing nodal points at the national, provincial and district levels.

Future projects should work more closely with existing national policies, programmes and procedures, including environmental legislation and poverty alleviation policies. Where appropriate, they should support the decentralization of local government.

Future projects should aim to attract the full support of local people and local government. They should reduce their reliance on external inputs and aim to institutionalize participatory principles and methods at all levels by giving more priority to supporting organizational strengthening.

Investment in watershed management

The improved funding of watershed management initiatives must involve mobilizing more internal resources and getting longer commitments from donors. All countries need to put in place mechanisms to raise funds by, for example, requiring that a certain percentage of revenue from hydropower, ecotourism, irrigation water fees and forests goes to fund watershed management.

In several cases donors have made long-term commitments to fund watershed projects. Bhutan's Environmental Trust Fund (Government of Bhutan, 1994) was set up to fund nature conservation and biodiversity projects. The Government of Bhutan established a core fund and several donors contributed further funds to implement different environment-related activities under the government's national programme.

The interest from this fund is spent on the projects, and the capital has been locked to generate additional funding for the future projects. Viet Nam's Forest Sector Support Programme and Partnership for 2001 to 2010 is another example (Government of Viet Nam, 2001). It consists of portfolios of different investment projects. Donors are invited to make pledges to a trust fund or to a subsector activity in the programme document. A similar approach could be tried to fund the next generation of watershed management projects and programmes in other countries.

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CHAPTER 4

WOCAT: A STANDARD METHODOLOGY FOR DOCUMENTING AND EVALUATING SOIL AND WATER CONSERVATION

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INTRODUCTION

The World Overview of Conservation Approaches and Technologies (WOCAT) programme was started in 1992 by a group of soil and water conservation specialists. It has since developed a global network of institutions and individuals involved in soil and water conservation (SWC). WOCAT's mission is to provide tools that enable soil and water conservation specialists to share their professional knowledge. Such tools can help them to identify appropriate technologies and approaches and support them in field planning and implementation.

WOCAT is a global network of soil and water conservation specialists. It is organized as an international consortium coordinated by an international management group, and is supported by a secretariat based at the Centre for Development and Environment, Bern, Switzerland. A wide range of international and donor organizations in the field of sustainable agriculture and environment are represented in the network. These include FAO, ICIMOD, United Nations Environment Programme (UNEP), the Swiss Agency for Development Cooperation (SDC), DANIDA, the International Atomic Energy Agency (IAEA), the Regional Land Management Unit (RELMA) and national partner institutions in more than 35 countries. The latter consist of government departments, universities and NGOs. Recently, collaboration has started with commercial companies; a prominent one being Syngenta, the United Kingdom.

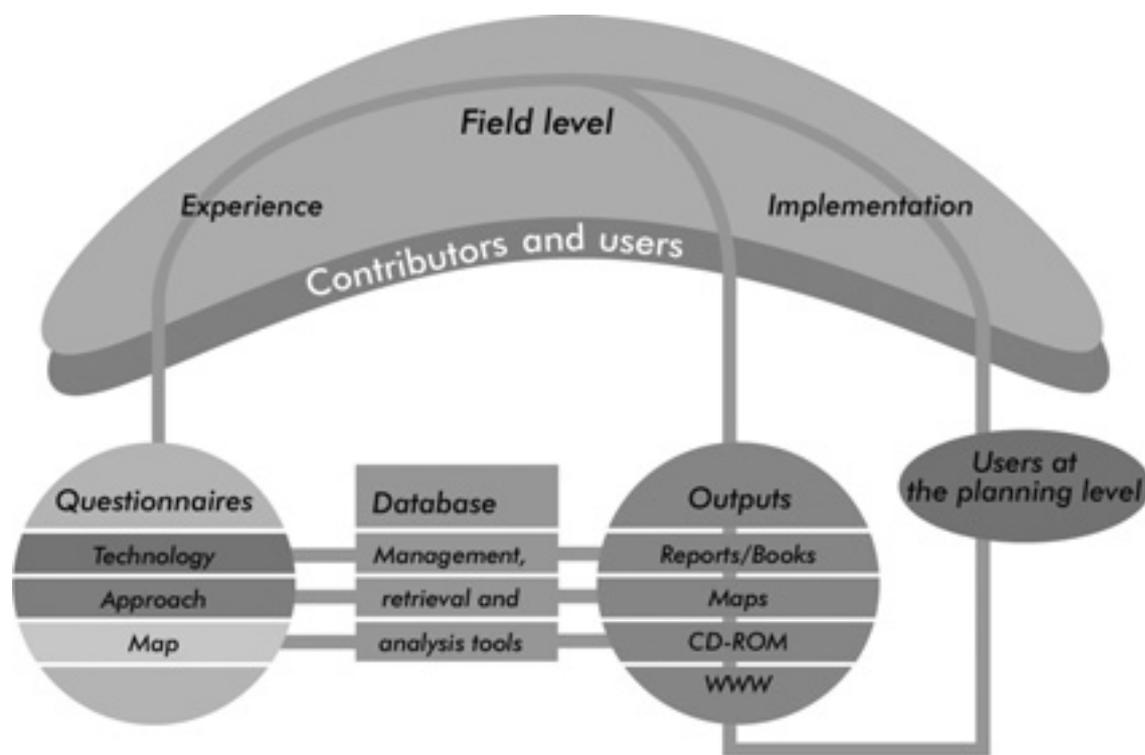
Although much is known about soil and watershed conservation, this knowledge tends to be scattered and not easily accessible. This is recognized as one of the reasons why soil degradation continues in many parts of the world, despite decades-long efforts and large investments in soil and watershed conservation. WOCAT is contributing to overcoming this problem by documenting and disseminating knowledge. The aim is to enable practitioners to learn from each others' experiences and to provide a source of reliable information over many geographic and subject areas. The information gathered helps to identify research needs and suggests how ongoing practices can be improved.

METHODOLOGY

WOCAT has developed a set of three comprehensive questionnaires to capture information about soil and water conservation technologies and field-level approaches. The questionnaires

are quite complex and so WOCAT runs training courses to show how to use them and the associated database. Participation in these training courses leads on to identifying what data trainees will collect to contribute to WOCAT.

FIGURE 1
The WOCAT process



The three types of questionnaires cover technology, approaches and mapping. These questionnaires are the main tools for collecting, recording and analysing data in a systematic and standardized manner. The technologies questionnaire asks about field activities. Technologies may be technically ideal but their successful implementation often depends on a wide range of non-technical issues. The approaches questionnaire therefore asks about factors such as required skills and technical knowledge, required and available resources, socio-economic and cultural aspects, and perceptions and acceptance by land users. The standard WOCAT definitions of important terms are given in Box 1.

Patterns of soil degradation vary at all spatial levels from the village to the global scale. The map questionnaires are designed to gather geographic information. They ask about planning issues and aim to build up a spatial overview of degradation and conservation in defined areas. This questionnaire complements the technologies and approaches questionnaires.

Responses to the mapping questionnaire show that although patterns of degradation have been mapped in many areas, there are hardly any maps on conservation achievements. Such maps are needed to identify where soil and watershed conservation measures have been effective and where they are most needed and could be effectively implemented.

BOX 1

WOCAT DEFINITIONS

Soil and water conservation (SWC) refers to local-level activities that maintain or enhance the productive capacity of the land in areas affected by, or prone to, degradation. These include activities that prevent or reduce soil erosion, compaction and salinity; conserve or drain soil water; and maintain or improve soil fertility. The WOCAT methodology was originally designed to focus mainly on soil erosion and fertility decline in erosion-prone areas. Since then it has evolved to cover other types of land degradation, such as salinization and compaction.

SWC technologies are agronomic, vegetative, structural and management measures that control land degradation and enhance productivity in the field.

SWC approaches are ways and means of support that help to introduce, implement, adapt and apply SWC technologies on the ground.

Source: WOCAT questionnaires (WOCAT, 2003a; 2003b; 2003c).

The information gathered from the questionnaires is entered into a database. WOCAT's database now includes more than 300 technology case studies and more than 200 approaches from 40 countries (some of which have still to be completed and validated). The information can then be fed back in various forms to users at the field or planning levels.

WOCAT has gathered information from more than 35 countries. It has collected most information from Africa (60 percent) and Asia (30 percent), and only a few case studies from Latin America. It has recently started to gather information from Europe. The database mainly comprises individual case studies. Efforts are under way to collect a number of these case studies into a synthesized and generalized description of specific technologies and approaches.

The WOCAT methodology has been tested and developed based on the needs and requests of collaborating institutions – most of whom are WOCAT users. Participants at national and regional workshops have evaluated the practicality and usefulness of WOCAT's questionnaires, database and outputs. The methodology has been tested and revised continuously since the first questionnaires were developed in 1994. Since 1998, the emphasis has been on collecting and using the data. The more than 30 national training workshops that have been held since 1999 have confirmed that the current questionnaires serve their purposes well, although some collaborators feel they are too complex.

USES OF WOCAT

WOCAT disseminates its information via its Web site, on CD-ROMs, in articles and at workshops. All of WOCAT's tools, data and outputs are accessible via the Internet at www.wocat.net. The database can be searched for a specific technology or approach or for

specific conditions in which these are applied. Another facility enables a technology or approach to be evaluated. Some of the information is presented as case studies on soil and water conservation technologies and approaches gathered by WOCAT. It has produced CD-ROMs that contain much of the information from the Web site, including the database, questionnaires, published reports and general information. WOCAT-related articles and papers include Liniger and Schwilch, 2002; Liniger, van Lynden and Schwilch, 2002; Liniger *et al.*, 2002; and van Lynden, Liniger and Schwilch, 2002.

WOCAT is consolidating information by subject and area to make it more useful and accessible for planning exercises and in the field. It held its first regional training workshop in Kenya in 1995. Since then it has trained more than 400 experts in Africa, Asia and Europe to document and evaluate their knowledge. WOCAT questionnaires offer experts, technicians and extension workers a common framework and methodology for documenting and evaluating their experiences. Filling in the questionnaires encourages practitioners to analyse their achievements. The information gathered by WOCAT provides higher-level decision-makers such as planners and coordinating organizations with an overview of achievements, approaches and technologies.

The WOCAT tools and processes are being used by government departments, project staff, scientists and extension workers from across the world to help:

- monitor and evaluate individual technologies and approaches, and quantify costs and benefits;
- document, identify and transfer technologies and approaches from one area to another;
- identify key topics and gaps in the knowledge that need further research;
- evaluate the results of research trials, and assess the biophysical and socio-economic suitability of research-derived technologies and approaches; and
- disseminate information for use as an educational data resource.

The main rationale for WOCAT is that the information it gathers is put to good use. It aims to promote the increased use of its information for extension, research and educational purposes. The fundamental requirement for this is that WOCAT has a volume of good-quality up-to-date information that has been checked and entered into its database. The next need is to link national and regional WOCAT activities with ongoing and potential government-, donor- and NGO-supported projects and programmes at all levels. Thirdly, WOCAT needs to tap the skills and knowledge of people and organizations involved in soil conservation and watershed management and help them to obtain technical and financial support to carry out their work. Finally WOCAT needs to broaden the common perception of its role, from being a questionnaire-filling process to being a field appraisal tool that enables research and extension workers to determine the environmental impact and socio-economic costs and benefits of technologies and approaches. WOCAT's strengths and weaknesses are listed in Box 2.

BOX 2

WOCAT'S STRENGTHS AND WEAKNESSES

Strengths:

- works at the field, national and global levels;
- considers both socio-economic and ecological aspects;
- fills a gap (nationally and globally) for the documentation and exchange of information;
- sets global standards for methods, tools and outputs;
- brings practitioners, researchers and planners together;
- provides tools and a platform for collecting a standard set of comparable information.

Weaknesses:

- questionnaires are quite complicated and some practitioners have difficulties in responding fully;
- low quality of some data.

DATA QUALITY

One of WOCAT's main concerns is the quality of the data it collects. One problem is that it is often difficult to tell whether incompletely filled questionnaires show important gaps in the data or just reflect a respondent not bothering to reply. A study on the potential for improving the data (Douglas, 2003) suggested that WOCAT should focus less on the correct filling in of questionnaires and more on providing specialists with the skills to evaluate the impacts and cost-effectiveness of their own activities. However, collecting the available data through questionnaires is an intrinsic part of this evaluation process.

Improving the quality of data received demands that respondents are more critical about their own knowledge, and that they fill in questionnaires properly. Respondents need to:

- review their knowledge and experience of technologies and approaches critically and systematically;
- recognize and challenge their technical preconceptions and biases, which often lead to wrong assumptions about problems and the effectiveness of technologies or approaches;
- avoid assuming that a technology or approach being implemented automatically means that land degradation is being controlled; and
- have a proper understanding of how land degradation processes operate under specific local conditions.

While filling in questionnaires, respondents should take care to:

- complete them in close consultation with other experts;
- undertake field verification and discussions with land users;
- provide detailed descriptions specific to the technology being documented, rather than generalized descriptions that could apply to similar technologies;
- give adequate details of technical specifications that explain how a technology performs;
- differentiate between the characteristics of the wider area in which the users of a technology are operating and the conditions specific to sites where technologies have been adopted;
- provide detailed cost breakdowns, as omitting key cost elements will give a false impression by underestimating actual costs; and

- make use of secondary data from project documents and technical manuals to document and check technical specifications and costs and benefits of particular technologies and approaches.

CONCLUSION

WOCAT is the first large-scale attempt to document soil conservation and watershed management activities in a standardized way. It enables the comparison, evaluation and mapping of technologies and approaches. The comprehensive questionnaires encourage users and contributors to take a more inclusive attitude towards their work. The main challenge is for the information collected to be widely used in the field and for planning purposes.

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CHAPTER 5

NEW TECHNOLOGIES FOR WATERSHED MANAGEMENT

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INTRODUCTION

A complex of factors determines the quality and availability of water supplies from watershed areas. The integrated watershed management approach goes a long way towards handling these complexities, and in many situations is accepted as the best approach to managing natural resource (Calder; 1998; 1999).

In India, policies have been developed and programmes run to address water problems in ways that promote equity and sustainability and alleviate poverty. Water resource management projects have ranged from major irrigation projects catering to millions of hectares of land, to small structures fulfilling the needs of one small community. Countrywide programmes have included the Drought-Prone Area Programme (DPAP), the Desert Development Programme (DDP) and the Integrated Watershed Development Programme (IWDP). Some of these programmes are still being implemented, but it is uncertain how far they have reached their objectives. Consistent evaluation has not been carried out and there has been no integrated framework for planning, monitoring and managing watershed management programmes. In addition, the integrated approach has often not been properly implemented.

The Government of India adopted integrated watershed management in its National Water Policy, 2002 (MoWR, 2002) as a key strategy to conserve natural resources. The policy calls for involving local users in planning and managing natural resources at the watershed level. However, the mechanisms to achieve this have been inadequate, and new tools need to be developed to handle the complexities of integrated watershed management. It is important that the information they produce is accessible in order to help planners arrive at appropriate decisions.

This paper shows how Geographic Information System (GIS)-based modelling of information on water, land, forests and other variables can be used in local planning to prioritize watersheds and site structures. It presents a technique for prioritizing watersheds scientifically. It also discusses the authors' efforts to account for socio-economic factors in watershed management.

INTEGRATED WATERSHED MANAGEMENT

Integrated watershed management planning should facilitate all stakeholders within a watershed to identify local natural resource issues and then to develop and implement watershed plans that promote environmentally, socially and economically sustainable development.

Integrated watershed management began in India in the 1970s. Since then there have been many changes in how it has been implemented. Until 1995, watershed development projects were coordinated within multi-sectoral programmes. A 1999 review by the Ministry of Rural Development (MoRD) and the Ministry of Agriculture (MoA) led to the 2001 introduction of common operational guidelines, objectives, strategies and expenditure norms for watershed development programmes in India. These encourage the involvement of NGOs, semi-governmental institutions, private enterprises, universities and training institutes. However, concerns are being raised that watershed development programmes are still based around the misconception that water is an infinite resource, with the collection and extraction of ever more groundwater to meet human needs (KAWAD, 2001).

Integrated watershed management does not merely involve running an inventory of different activities. It is also necessary to evaluate the impacts of proposed actions. Watersheds are the smallest units for evaluating human-induced impacts on natural resources. Therefore, although the administrative unit of panchayat village clusters remains as the implementation unit for watershed management programmes, impacts need to be assessed at the watershed level.

The main shortcomings of watershed management in India are that it often:

- does not pay enough attention to watershed hydrological boundaries;
- ignores the connectivity of watersheds and treats each one as a stand-alone unit, irrespective of downstream relations;
- ignores the hydrological characteristics of watersheds when deciding on interventions;
- ignores environmental sustainability aspects; and
- fails to monitor and evaluate impact properly.

These shortcomings are due to a number of factors, including the lack of a unified framework to account for the influence of all the elements that influence an area's hydrology. In India, a watershed is considered as the smallest unit of a drainage basin. It is essential to develop a hydrological framework to track the interconnectivity of these units. The impacts of actions at the watershed level will be experienced within the containing drainage basin. A framework is needed to assess these impacts. Such a framework needs to be well-maintained and updated to serve the needs of planning agencies and line departments. This is best done using computer modelling.

The second major problem encountered in watershed management programmes is that much of the information needed for integrated planning and management is not available at the watershed scale. This especially applies to the quantities of surface water and groundwater. It is not financially viable to measure directly local water availability and its variability over time. Hydrological simulation modelling is a very effective tool that helps to estimate water quantities in watersheds. The present study demonstrates the application of one such model that simulates the quantity of water and sediment erosion in a watershed.

SWAT HYDROLOGICAL MODEL

The Soil and Water Assessment Tool (SWAT) was developed by the United States Department of Agriculture (USDA) Agricultural Research Service (Arnold *et al.*, 1990) to simulate the land phase of the hydrologic cycle in daily time steps. It can also simulate the detachment of sediments from watersheds and model their transport through drainage systems. The SWAT

model simulates the passage of water and sediments from individual watersheds through river systems. It can factor in the effects of off- and onstream tanks, reservoirs, check dams and different agricultural practices. Its major advantage is that unlike conventional simulation models, it needs little calibration and so can be used on ungauged watersheds.

The model can show water availability under different demand and use levels, with both domestic and agricultural use factored in. It can show the situation for existing and anticipated water uses and indicate under what circumstances water shortages will occur. It completely accounts for the quantities of water that: 1) are supplied to the land by precipitation; 2) enter streams as surface runoff; 3) are used and returned to the atmosphere by natural vegetation, agricultural crops and evaporation; and 4) percolate through the root zone to recharge groundwater.

Macro-watersheds (catchment areas) are made up of a number of micro-watersheds. The use of a number of discrete watersheds in a simulation is particularly beneficial when different areas of the macro-watershed are dominated by different land uses or soils that have differing impacts on the hydrological response. In the SWAT model, the input information for each watershed is grouped with respect to weather; unique areas of land cover, soil and management practices. These are called hydrologic response units (HRUs).

Model outputs include all the water balance components of surface runoff, evaporation, lateral flow, recharge, percolation and sediment yield for each watershed. These are available at daily, monthly and annual time steps.

These technologies have been integrated and promoted through the UNDP-sponsored project GIS-Based Technologies for Local Level Development Planning, implemented by the Government of India's Department of Science and Technology. The techniques presented in the following case study were worked out by the authors during the course of this project (Gosain and Sandhya, 2001; Sandhya and Gosain, 2001)

CASE STUDY OF DODDAHALLA WATERSHED

A demonstration case study of the SWAT model was set up on the Doddahalla watershed in northern Karnataka. The aim was to show how the model can help to identify the micro-watersheds within a macro-watershed that are most in need of interventions, according to their hydrological, demographic and socio-economic status (CEE, 2001). This work was carried out in collaboration with the Centre for Environment Education, Bangalore, which was the lead organization handling the project on Prioritization of Micro-Watersheds for Better Management in Bijapur district of Karnataka under the World Bank's Water and Sanitation Programme.

The Doddahalla watershed in Bijapur district, northern Karnataka covers about 61 000 ha. It is in a chronically drought-prone area with a large agrarian population that depends on rainfed agriculture. The upstream part of the macro-watershed – covering about 31 000 ha – was considered as the area under treatment in the case study, while the 30 000 ha downstream area was the subject for the case study's detailed impact analysis. The downstream area covers the 30 villages of Indi and Bijapur taluks (subdivisions of districts).

Gathering basic information

First, hydrological modelling was used to generate information on runoff and sediment yield. This and socio-economic parameters were used to prioritize the area's micro-watersheds.

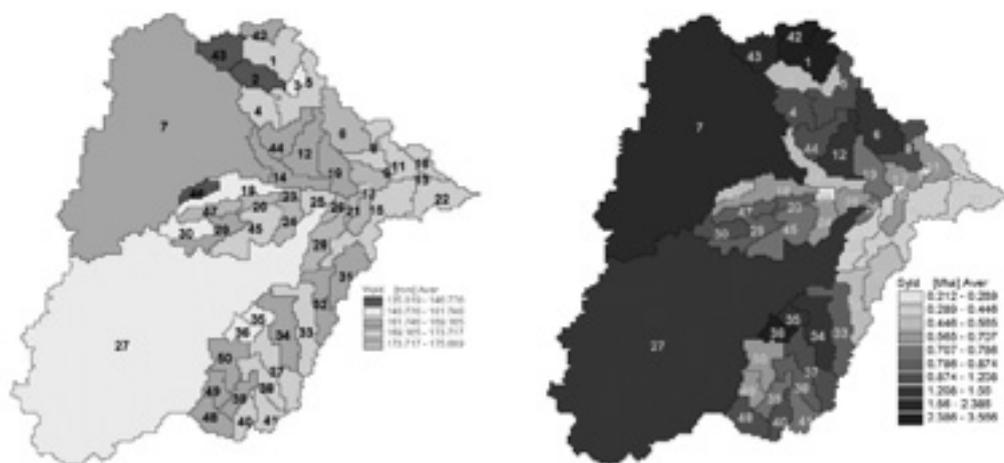
GIS technologies were used as a pre-processor to the SWAT model in order to create spatial data and organize the other data on land use, soil and weather. The model gave the flow availability and sediment yield at drainage points of each micro-watershed. GIS overlay analysis was then used to prioritize micro-watersheds according to the MoRD's guidelines. This involved generating a digital elevation model (DEM) to delineate micro-watersheds automatically. This was then overlain with the land use and soil layers to derive HRUs – areas with uniform land use and soil characteristics.

The entire watershed area was divided into 50 micro-watersheds containing 175 HRUs. The upstream part of the watershed, although it is a contiguous part of the overall hydrological area, was not subdivided into micro-watersheds, but incorporated as a single unit. The daily rainfall and temperature data (1969 to 1990) for Bijapur station was then incorporated.

The water availability (mm/year) and sediment yield (tonnes/ha) are shown in Figure 1 for each micro-watershed, with the darker-coloured areas having the highest water and sediment yields.

FIGURE 1

Water availability and sediment yield map (20-year average: 1969–1990)



Watershed prioritization

The watershed prioritization model uses the guidelines developed by the National Watershed Development Project for Rainfed Areas (NWDPRA). NWDPRA was initiated in 1990–1991 to improve agricultural production in rainfed areas and restore ecological balance. It is a centrally funded programme that operates through state-level departments of agriculture or watershed development. NWDPRA's guidelines combine physical and socio-economic criteria to prioritize watersheds for management interventions. The following are the criteria used, in order of importance:

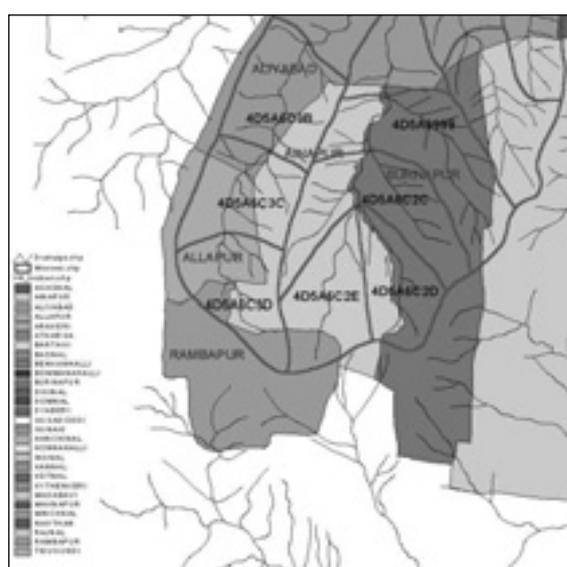
- highly eroded areas with much land degradation;
- a water scarcity problem;
- less than 750 mm rainfall per year;
- a net cultivated area of no more than 20 percent of the total area;
- an irrigated area not exceeding the state average or 30 percent of total land area; and
- no areas of long-duration or water-intensive crops.

The guidelines also recommend that priority is given to villages and watersheds that have more economically poor people and people with small landholdings. As budgets are allocated to administrative units (villages in this case), another criterion is to choose watersheds whose boundaries mostly coincide with village boundaries.

For the model, each element of these physical and socio-economic prioritization criteria was made into a GIS layer, taking the micro-watershed or village as the mapping unit. Overlay analysis was performed by taking up two layers at a time in the sequence of priority, as indicated in the list above. For physical criteria, the highest priority level was given to headwater watersheds and watersheds that had the most degraded land and minimum water availability. The hydrological modelling (Figure 1) showed that seven watersheds met these criteria.

The next step was to identify which of these watersheds cover a larger part of the involved villages. This was done by using GIS to overlay the seven selected watersheds on to the village boundaries. Four of them (4D5A6C2B, 4D5A6C2C, 4D5A6C2D and 4D5A6C2E) – areas mostly inside the green circle – were found to cover a large proportion of the two villages of Ainapur (63 percent of the area) and Burnapur (50 percent). Information was then gathered on these two villages' socio-economic characteristics, including the number of people below the poverty line, the scheduled caste and tribe population and the size of landholdings. The four watersheds all had similar levels of socio-economic development. These four contiguous watersheds were thus identified for priority treatment. Figure 2 depicts these watersheds and the village boundaries.

FIGURE 2
Watershed and village boundaries



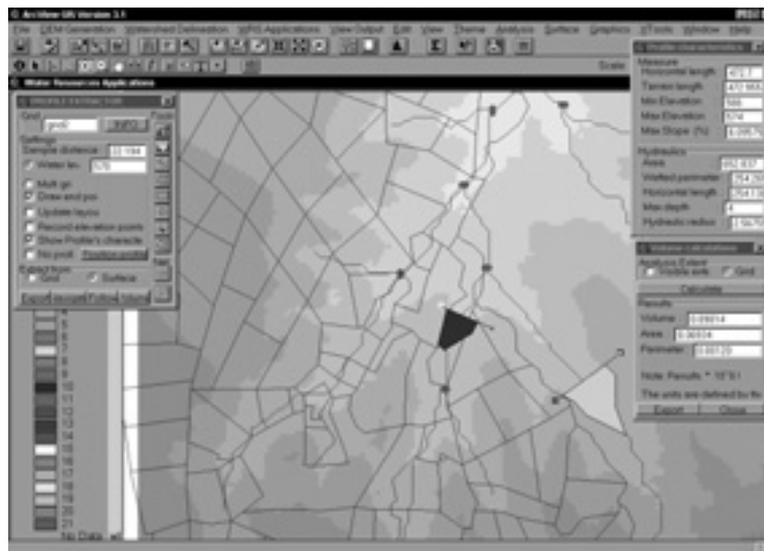
Strategies for watershed development

The next step was to generate detailed information on the four watersheds in order to help to decide which management interventions were needed. A survey was carried out to obtain detailed terrain information in order to generate a reasonably accurate digital elevation model (DEM). This was crucial to enable the latest GIS technologies to be used to show hydrological processes, including the availability of water for harvesting. This model was used to generate a map of the local drainage indicating the best sites for placing water harvesting structures, such as dams, ponds and contour bunds.

A demonstration facility was then made using ArcView software (Spatial Analyst extension) to help select the best sites for these structures. Profiles drawn on the digital elevation model give the hydraulic characteristics of the terrain, such as surface area and volume of impounded water behind a planned barrier. They show the area that would be inundated by water when superimposed on the plot or village maps. This rapidly provides the first level of feasible sites for locating structures, which can then be field tested to see their practical potential.

Figure 3 shows two alternative sites with different design parameters and resultant computations. Site 1 produced a storage volume of 0.8 ha million and a spread area of 3.02 ha for a crest height of 2.0 m, whereas site 2 produced a volume of 9.0 ha million and a spread area of 6.93 ha for a crest height of 4.0 m. This shows that site 2 is the best location for the dam as it will hold more than ten times the volume of water while inundating just over twice the area. Sites that give a comparable volume with less spread are preferred, as a larger spread leads to more evaporation and seepage loss.

FIGURE 3
Locating sites for water harvesting structures



This case study shows how computer software can compute information to help local planning for integrated watershed management. This tool has the advantage of making the factors behind decision-making more understandable to stakeholders and allows for more local participation.

DFID PROJECT ON FORESTRY AND LOW FLOWS

The project on Forestry and Low Flows, Spatial Modelling and Open GIS Dissemination of the Science Perception – India (DFID, 2002) was started in August 2002 and is due to run to March 2005. It is being funded under the United Kingdom Department for International Development (DFID) Forestry Research Programme.

The project is looking at the general perceptions of science of the interaction of water with landmasses. It aims to improve local understanding of natural resource management, improve scientific knowledge and promote improved watershed management. The goal is to help to direct development resources towards those projects that most improve the livelihoods of poor people. The project is working in pilot watersheds in Madhya Pradesh and Himachal Pradesh.

It is scientifically establishing the links between forests and low water flows. Many watershed development programmes promote large-scale afforestation in the belief that this will improve water resources, increase groundwater recharge and increase low water flows – a relation that is largely unsubstantiated.

The project is examining this relationship by setting up a hydrological model for different land uses in order to assess and demonstrate what impacts changes in land use, particularly forestry and irrigated agriculture, have on water availability. This should provide a decision support system. Water conservation structures such as check dams, percolation tanks and trenches retain storm flows and allow water to be used locally. However, when catchments or macro-watersheds reach a stage where water resources are fully used and, on an annual basis, there is little or no flow out of the macro-catchment, further investments in water conservation structures and other measures such as bunding become less cost-effective, as water that is being captured upstream is captured at the expense of other potential users downstream. The GIS-linked hydrological model that the project is developing will indicate the water quantity impacts of different kinds of decision-making relating to land use and water conservation for both watershed and downstream areas.

The project is also investigating the historical development of water policies at the state and national levels in India, and aims to assess public and donor perceptions of these policies' impacts. The project will combine this knowledge with the results of biophysical modelling of the pilot watersheds in order to recommend better water policies that take a more sustainable approach to catchment management. This will help to ensure improved water supplies, especially for the economically poor (Gosain and Calder, 2003).

The dissemination of these findings and the availability of land-use change simulations over the Internet will enable those responsible for land-use management to see the probable impact of alternative strategies. It is also proposed that the outputs of this exercise be disseminated over the Internet. This would allow local communities to see the local and basin-wide water resource implications of decisions that are made at the local level. This is practical in the light of rapidly increasing access to the Internet in India's villages, and will make it easier to carry out whole-catchment cost-benefit analysis of forests in relation to erosion, sedimentation and flooding.

CONCLUSIONS

The ability to identify micro-watersheds that will most benefit from treatment is very important for watershed planning. The first step is to generate estimates of water and sediment yield at the micro-watershed level – information that is often unavailable. The study is developing applications for identifying the interactions between administrative and watershed boundaries, and for placing water harvesting structures. Besides helping to site structures, these spatial tools help to estimate related parameters such as water spread area and available water storage capacity. This helps to make watershed management interventions more science-based. Efforts are also being made by project partners to strengthen watershed management in the pilot watersheds by promoting policy change and using cost-effective GIS tools.

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PART 3

NATIONAL AND LOCAL EXPERIENCES

CHAPTER 6

RETHINKING WATERSHED DEVELOPMENT IN INDIA: STRATEGY FOR THE TWENTY-FIRST CENTURY

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Soil degradation on large tracts of cultivable land is seriously undermining millions of people's livelihoods. Attempts to overcome this problem have been made through large investments in watershed management throughout Asia, Africa and Latin America (Lal, 2000). In India in the last three decades, watersheds have become the pivotal unit for rural development programmes. In India, about 6.2 million ha of rainfed land in 5 200 micro-watersheds was under treatment in financial year 2001/2002 at an estimated cost of US\$175 million. Yet, the coverage is far from complete.

Of India's total cultivable area of 142 million ha, 89 million ha of unirrigated land needs similar investments. This land grows 45 percent of India's foodgrains. The irrigated area has reached a production plateau of about 110 million tonnes; so, efforts to increase foodgrain production need to focus on improving the productivity of rainfed agriculture.

THE RECORD SO FAR

India's guidelines for watershed development programmes have been revised three times since their introduction in 1986. They aim to make investments in watershed management have a long-lasting impact on crop production and rural livelihoods in rainfed cropping areas. They are reviewed periodically, but only to accommodate cost escalations and revise targets. The current guidelines were introduced in November 2000, renamed as the National Watershed Development Programme for Rainfed Areas (NWDPA) of the Ministry of Agriculture. In addition to setting a framework for watershed development in the country, the guidelines proclaim a blanket investment per unit area for diverse land-water interventions and make special provisions for promoting income generation for landless people. They recommend a budget of US\$49 000 for a watershed area of 500 ha on land with a slope of up to 8 percent, and US\$65 220 for land of a slope greater than 8 percent, to cover all implementation costs. The investment level was revised from the previous US\$87 per hectare to a maximum of US\$130 per hectare.

These new guidelines have increased investment levels and promote programmes to benefit landless people; but they do not guarantee that the new programme-based top-down approaches will be successful. People's participation is largely stuck in the "you will participate in the programme" mode, and project sustainability is questionable even after two decades of experience in watershed management. The resulting lack of community ownership has meant that the investments in rural development and natural resource regeneration have mostly only realized

short-term benefits. India's large investments in rural development have not produced a matching transformation on the ground. Investment thrusts in recent watershed development programmes are trying to reverse the inefficient use of resources in many integrated rural development programmes.

TARGETS MISSED

Watershed management needs to take a multipurpose approach to improving land and increasing water availability for crop growing, livestock and human use through soil and moisture conservation measures. An effective watershed project should aim to drought-proof areas by capturing every falling raindrop. This is technically possible.

An assessment by the Centre for Science and Environment (Agarwal, 2000) estimates that if half of India's average annual rainfall of 1 170 mm were captured over 1.12 ha of land in each of the country's 587 226 villages, then the 6.57 million litres of rainwater thus collected would meet the annual cooking and drinking needs for an average village of 1 200 people. Doing this would help both to sustain surface water supplies and to recharge aquifers.

However, the National Sample Survey (NSS, 1994) reported that despite the extensive programmes carried out to provide drinking-water to rural areas, 140 975 villages (24 percent of India's total) still had a drinking-water problem. Even the watershed development programmes set up to complement the drinking-water programmes in villages did not improve the situation. As a result, much of the 420 billion hectare metres (mham) of average annual available precipitation flowed uninterrupted to the sea without fulfilling its ecological functions of enhancing surface water supplies and recharging groundwater to any appreciable extent.

The experiences of watershed development projects have been quite varied. The few successful projects are outnumbered by the many unsuccessful ones. There are situations where some successful watershed projects have not even provided for the minimum amounts of drinking-water and fodder. Many watershed projects, designed to conserve rainwater to improve irrigation, have tended to ignore communities' primary need of access to drinking-water. On similar lines, some projects have neglected to develop pastureland and propagate soil-moisture conservation practices.

A few community groups have taken the initiative themselves with some external assistance. For example, the villages of Sukhomajri in Haryana and the Chakriya Vikas Pranali scheme in Jharkhand (Box 1) have improved their socio-economic conditions in a relatively short time by linking improved *in situ* moisture conservation with economic activities that build up social capital. These examples show that watershed development is a viable model for the economic development of poverty-stricken rural areas.

BOX 1

CYCLE OF SUSTAINABLE BENEFITS

The Chakriya Vikas Pranali (CVP) – the cyclic system of development – is a pioneering method for village development. It was developed in Jharkhand, north India and promotes ecological regeneration as a source of economic growth. It offers villagers returns of more than 20 percent on their investments. Its basic strategy is for locals to make a one-time investment in the form of cash, plants and technology, and to convert it into a self-propelling process of production and reinvestment via a common village fund.

Investments in multi-tiered, multi-rooted and multi-layered planting cycles provide year-round employment for village people and provide short-, medium- and longer-term returns from grass, vegetables, fruit trees and timber, respectively. This successful system has spread to more than 600 villages in Palamau district, Jharkhand.

A typical block of 6 to 12 ha of pooled land is divided by water-retaining tie-ridges into smaller quadrants. It is then filled with plants that are intercropped to maximize the symbiotic relationships of nitrogen-fixing and nitrogen-hungry species. Yams and tubers go underground, and pulses, beans, fruits, bamboo and timber spring up from the earth. The different root systems are carefully grown together to prevent overcrowding and to maximize rainwater use.

Harvest returns are shared under a 1:3:3:3 system, so that 10 percent goes to the village welfare fund, 30 percent to the landowner, 30 percent to the workers, and 30 percent to the common village fund for investing in further development. Studies conducted by Delhi's Institute of Economic Growth indicate that the chief value of CVP lies in retaining and reinvesting surpluses through the village funds. This ensures that land-based activities, biomass production, energy and employment are maintained on a sustainable basis.

CVP makes programme replication a reality. Most other programmes are difficult to replicate owing to lack of leadership or funding, or legal hurdles. CVP is self-financed and, after the initial investments, it generates resources to trigger similar initiative in other villages.

There is a risk that landowners may opt out and drive workers away from tilling the land after it begins to be improved. However, this has not happened in any village, as the new system is giving such good returns from land that was barren until recently.

This form of land development has shown that it is possible to transform the environment, improve economic well-being and reduce social tensions through a participatory approach. Its success and prospects for replication depend on support from central and state governments.

SPREAD ELUDES IMPACT

Between 1994 and 1999, about 10 000 watershed projects went ahead in India. This large number reflects the coverage and the amount of resources being pumped in to watershed development. Although watershed programmes are one of the largest types of investment in integrated rural development, there is no central coordination unit to provide information on the actual number of watershed projects in India at any given time.

BOX 2

BILATERAL AND MULTILATERAL WATERSHED PROJECTS IN INDIA

- UK Department of International Development's (DFID) Western India Rainfed Farming and Eastern India Rainfed Farming projects
- DFID's Karnataka Water Development Project and its proposed Western Orissa Rural Livelihoods Project
- The German Agency for Technical Cooperation (GTZ/KfW) Changar Project in Himachal Pradesh
- The Swiss Agency for Development and Cooperation's (SDC) PAHAL project in Rajasthan
- The Japan International Cooperation Agency's (JICA/JBIC) support to the Attapady Soil Conservation Project in Kerala
- The Danish International Development Agency's (DANIDA) implementation of five watershed projects: two in Tamil Nadu and one each in Orissa, Madhya Pradesh and Karnataka

The World Bank is funding the Kandi Watershed Area Development Projects in Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh and Uttaranchal.

Information pooled from various sources indicates that the Government of India has allocated about US\$650 million to various watershed and wasteland development programmes over a recent typical five-year period. In addition to central government funding, the World Bank, DANIDA, Sida, SDC, DFID and GTZ are supporting the rehabilitation and development of micro-watersheds (Box 2). Most programmes have been run in the drought-affected areas including parts of Andhra Pradesh and Madhya Pradesh (Table 1).

This list is not exhaustive. Some projects are more than two decades old; others are just starting. However these interventions have not been able to prevent droughts. Madhya Pradesh is seeking additional resources to sustain its ambitious Rajiv Gandhi Mission for Watershed Development. However, the government, seeing the less than satisfactory performance of its watershed programmes, is diverting funds to the new people-centred "*paani roko anbhiyan*" programme (harvest water campaign).

TABLE 1

Distribution of watershed projects 1994 to 1999

State	Share of nationwide watershed projects
Andhra Pradesh	24.0 %
Madhya Pradesh	17.0 %
Uttar Pradesh	10.0 %
Gujarat	8.6 %
Tamil Nadu	7.0 %

Source: Hanumantha Rao, 2000

The two main problems of watershed development programmes have been the lack of any consistent criteria for selecting villages and the process of implementation. This raises several management-related questions.

The poor performance of many watershed projects has not reduced the number of new projects. Andhra Pradesh has taken up an additional 2 090 projects to treat 1 million ha since the November 2000 revised guidelines were issued. Typically, each watershed project is restricted to an area of 500 ha. Bilateral- and multilateral-funded projects usually cover many such sub-projects. For instance, the World Bank's Kandi Watershed Area Development Project in Haryana covers 619 separate watershed projects.

One of the most intractable problems in watershed development has been the lack of project sustainability. Many projects have failed to build in strategies to maintain their assets once project support ends. Feedback from several projects indicates (Joy, 2003) that many farmers only benefit from watershed projects by getting short-term paid labouring work. Because communities see few long-term benefits emanating from these projects, they have little interest in operating and maintaining project assets. This issue is being confronted by some donors in their projects.

Many watershed projects have failed in their primary objective of arresting land degradation. One study indicates that the rate of land degradation in rainfed areas in the 1990s is likely to have been more than twice the rate in the 1980s, largely because of increased soil erosion (Reddy, 2000). At the other extreme, many projects have failed because the guidelines provided a pattern of uniform treatments across diverse agro-ecological conditions, leading to a less than desired impact.

The continued lack of drinking- and irrigation water in several Indian states shows that drought-proofing interventions have failed to stop land degradation in rural areas and have failed to improve rainfed agriculture and the availability of drinking-water.

INEQUITABLE SHARING

The National Sample Survey (NSS, 1994) reported that 80 percent of rural households had landed property and earned more than 50 percent of their incomes from farm labour. This is owing to the typically small average size of landholdings (less than 0.1 ha), unfavourable moisture regimes and lack of technological inputs.

Watershed development is a rational technical concept based on the need to regenerate natural resources. However, property regimes exist that are in contradiction to the requirements of watershed management. Land is inequitably distributed and, as rights over groundwater are bundled with landownership, the landless do not benefit from any appreciable gain in groundwater recharge. With common property resources having degenerated into open access resources, the concerns of landless villagers often go unaddressed in watershed projects. Landless people's concerns rarely get addressed, as these projects are based on government guidelines that emphasize per hectare cost of land treatment.

The guidelines' fixed budgeting often fails to account for wide biophysical and socio-economic variability. Consequently, the design of most projects fails to account for local variability, and a fixation on following the guidelines rules out learning from other projects' experiences.

Watershed projects channel their limited investments into a range of on- and off-farm activities, often involving trade-offs among the interests of different stakeholders. The wide range of works now being carried out by watershed development projects means that impacts are often slow to materialize and often intangible.

These projects have gone well beyond the scientifically determined methods of soil and water conservation. This has increased the per hectare cost of conservation by taking on a new range of strategies, and has made them more complex to implement.

One study of a watershed project in Chhattisgarh showed the implementing agency's predicament in trying to complete the diverse range of activities on time (Sharma, 2001). Subsidies were made available to all households, irrespective of their economic status. Those with larger areas of land benefited most. This inequitable spread of benefits had a negative impact on local people's sense of ownership of the project and on the project's sustainability.

The long-term impact and sustainability of watershed projects is threatened by the lack of well-defined institutional spaces for the landless, only partial responses to the concerns of small landholders and inequity in benefit sharing.

The successes of the innovative project in the village of Sukhomajri, Haryana, which was completed in the early 1980s, shows how landless people can also benefit. In this project, the community designed a system that paid equal attention to the needs of landed and landless people. The rights to impounded water in the three local check dams were equally shared between the landed and the landless, and the benefits of rainwater harvesting were equally shared out by ensuring that a portion of the incremental gain (from improved crop harvests) was ploughed back into creating a fund (social capital) for community development. This held the key to sustaining project benefits. The landless in Sukhomajri village benefited by selling their share of water to the landowners.

In the same project, a sound land care system, based on the principle of social fencing (local agreements not to exploit certain areas such as no-grazing areas), helped to regenerate biotic resources and promoted a range of farm and non-farm activities that were not in the original project design. It was then for the community to make informed choices about using the rejuvenated natural resources for their benefit.

TECHNOLOGY BENEFITS FEW

Many project implementing agencies know that rainwater harvesting needs to be a priority in low-rainfall regions. However, *in situ* conservation does not help much if rainfall is scanty and erratic. Consequently, most watershed projects mainly concentrate on installing water harvesting structures such as check dams. The literature shows that the success rate of technology-based projects is no more than 25 percent (Shah, 2001; Reddy, 2000).

A recent study in Gujarat found that check dams – the favoured technology for watershed projects – directly benefited only 15 percent of target households (Shah, 2001). While the benefits of check dams can easily be computed, benefits to individual farmers from structures

such as nala plugs (gully plugs) and contour bunds may not be so immediate and substantial. Consequently, a significant portion of project costs are invested in structures such as check dams, whose costs are high and that benefit only a few – in contrast to and at the cost of structures such as gully plugs that are less expensive and benefit more people.

A typical check dam may account for 50 percent of a project's costs. The remaining budget is thinly distributed over other project components. The social activities, including self-help groups and income-generating activities, often benefit only a few families. Households and communities that have not benefited from a project should not be expected to contribute towards sustaining project initiatives.

The package of measures taken by watershed projects, from building check dams to promoting income-generating activities, has become too large and difficult to manage. Reducing the number of activities in favour of those that provide most benefits would bring down the per hectare cost of land treatment. Activities should be selected according to the relation between their costs and their benefits. Ironically, long-term environmental benefits are rarely computed in the benefits that might accrue from project interventions.

Most donors require that communities contribute about 10 percent of project costs. Choosing activities that provide the most financial benefits encourages local people to contribute, as they know that they will get a return on their investment. Once a return is attached to each activity, the community can be asked to plough back a portion of the incremental gain. This is what happened in the Chakriya Vikas Pranali scheme, and was a main reason for its success (Box 1).

The design of watershed development projects should not ignore traditional water harvesting structures. Projects can gain a lot from supporting the rehabilitation of traditional water harvesting structures. This is less costly than building new structures and gives a focus for communities' contributions and participation. Reviving community structures can lead to the rebirth of community spirit and community management, things that are crucial to sustaining the achievements of watershed projects.

Watershed development has been associated more with a technological approach. Communities and local institutions have yet to come to terms with the philosophy of watershed development. The technological approach has not realized the expected benefits and the need to integrate local wisdom and traditional systems.

CONCLUSION

The continuing drought problems in India suggest that the country's two decades of drought-proofing efforts through the watershed approach have not worked. The central and state governments are still allocating large budgets to rehabilitating and developing micro-watersheds. There needs to be fresh thinking about the watershed approach to drought proofing.

Many watershed projects have basic design flaws and implementation problems. Despite frequent reviews of the government's guidelines, watershed projects still fail to deliver. Many initiatives have only benefited a limited number of households, and rely on technological fixes that often lead to lack of community ownership.

Better-performing projects have been based on promoting communities' traditional water harvesting and conservation practices. These have had good community participation and low implementation costs. They have benefited a larger number of people and are usually based on promoting equity and ecological principles. In contrast, most watershed development programmes have a clear hierarchy of benefits and beneficiaries. Farm households benefit most from improved irrigation, followed by those farmers who get on-farm treatments such as field bunds. The landless and those who do not own livestock benefit the least. These issues are treated as more or less inevitable and have not been placed at the centre of a participatory process. The need is to initiate negotiations among different beneficiaries and stakeholders.

A review of watershed projects in Karnataka and Maharashtra concluded that watershed development is of crucial importance in India (Joy, 2003). The progress of globalization and privatization means that local natural resources, synonymous with watershed ecosystem resources, are often the last productive resources that the rural poor have access to.

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CHAPTER 7

POLICY CHALLENGES AND RECOMMENDATIONS FOR WATERSHED DEVELOPMENT IN INDIA

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INTRODUCTION

India has about 16 percent of the world's population but only 4 percent of its freshwater resources (Planning Commission, 2001). In India, the estimated rate of groundwater extraction in the 1990s exceeded the replenishment rate by 104 billion m^3yr^{-1} compared with 30 billion m^3yr^{-1} in China and 10 billion m^3yr^{-1} in northern Africa (Postel, 2000). Currently, more than 10 percent of central groundwater board blocks (the smallest administrative units for water resource management in India) are overexploited. The World Bank (1999) has calculated that blocks where exploitation is beyond the critical level have been increasing at a rate of 5.5 percent each year.

Since 1995, the Government of India has moved towards creating common guidelines as a framework for watershed development. However, concerns remain that legislative measures to protect and manage India's water resources are hindered by the lack of an integrated framework for watershed management, a lack of effective departmental coordination, and a focus on supply- rather than demand-side mechanisms. Another major problem is that disparities between the scientific and the public perceptions of the role of forests are embedded within water and watershed policy (Calder *et al.*, forthcoming).

This paper critically evaluates the current watershed policies by highlighting fundamental issues about the management of India's watersheds¹. An integrated watershed management approach is sought through the suggested policy recommendations.

BACKGROUND

Since the breakdown of traditional resource management systems began in colonial times, the main approach to managing India's natural resources has been through regulation. Until recently,

1. This paper is a result of ongoing research funded under the Forestry Research Programme (R7937, R8171 and R8174) of the United Kingdom's Department for International Development (DFID). The views expressed are those of the authors and do not necessarily represent those of the DFID Forestry Research Programme.

the management of land, water and forests happened in a top-down, centralized way with little or no involvement of local people. There was also no integrated approach to managing these resources, with responsibilities spread across several government agencies, ministries and line departments (Amezaga *et al.*, forthcoming).

There has been an increasing emphasis on watershed development in India in the past two decades. This seeks to integrate land and water management in order to reverse the continued degradation of the country's land, water and forest resources. This degradation is caused by pressures from increasing population and economic development and manifests as increasing soil erosion, declining land productivity, lowering groundwater tables, lowering quality and quantity of drinking-water, and loss of forest cover. Frequent floods and droughts are further evidence of improper catchment land use (MoA, 2002).

India's approach to watershed development has arisen from the policy level and donor preferences, and not from grassroots needs (ODI and partners, 2000). Participatory watershed management was only institutionalized in government policy in the 1990s. This has led to the emphasis in many projects shifting from technological to social interventions. The Hanumantha Rao Committee, in its review of the Drought-Prone Areas Programmes (DPAP) and the Desert Development Programme (DDP), recommended increasing people's participation. This led to the Guidelines for watershed development (MoRD, 1994), which were adopted by the Ministry for Rural Development (MoRD) in 1994. The Ministry of Water Resources' (MoWR) 1987 and 2002 national water policies have driven water resource policy at the national level (ODI and partners, 2000).

The MoRD's 1994 guidelines advocate a radical shift towards more participatory approaches to watershed development. They also call for it to happen in a more holistic way, following a ridge-to-valley approach. Unlike earlier approaches, where revenue or administrative boundaries were the unit of development, participatory watershed development programmes now take entire watersheds as their development units. This new approach seeks to improve all types of lands, including revenue, forest, community and private lands in a watershed (Amezaga *et al.*, forthcoming).

A 1999 review by the MoRD and the Ministry of Agriculture (MoA) led to a common set of operational guidelines, objectives, strategies and expenditure norms being established in 2001 for watershed development programmes. The revised 2001 watershed guidelines frame a uniform and unambiguous commitment for integrated land and water management using participatory approaches. However, the new approach is weakened by the continuing lack of interdepartmental coordination (Amezaga *et al.*, forthcoming). The new Hariyali guidelines issued by the Government of India in March 2003 seek to approach this problem by giving more emphasis to the role of the panchayat local government bodies (MoRD, 2003).

DEPARTMENTAL COORDINATION

The MoA, MoRD and Ministry of Environment and Forests (MoEF), along with their respective line departments in the Indian states, are the three main government ministries in charge of protecting and developing watersheds. Each of these ministry's programmes focuses on different aspects and activities within their subject area. The links among the government agencies with

responsibilities for India's water resources are shown in Figure 1. The National Water Development Agency was set up in 1982 to carry out detailed studies and surveys and to prepare feasibility reports of the links under the National Perspective Plan. In 1980, the Ministry of Water Resources (then known as the Ministry of Irrigation) formulated a National Perspective Plan for water resources development, which recommended transferring water from water surplus basins to water deficit basins/regions by interlinking rivers.

The MoA has worked in watershed development since the 1960s and focuses on erosion-prone agricultural lands, optimizing production in rainfed areas and reclaiming degraded lands (ODI and partners, 2000). The MoRD has been implementing watershed projects since the late 1980s (ODI and partners, 2000). It attends to non-forest wastelands and poverty alleviation programmes by working on soil and water conservation. The MoEF's remit covers forest and wasteland issues. The MoWR's mandate covers water policy, but not watershed development (Figure 1). Water is overall regarded as a state responsibility (Richards and Singh, 2001), and so the administrative control and responsibility for water development rests with state-level departments.

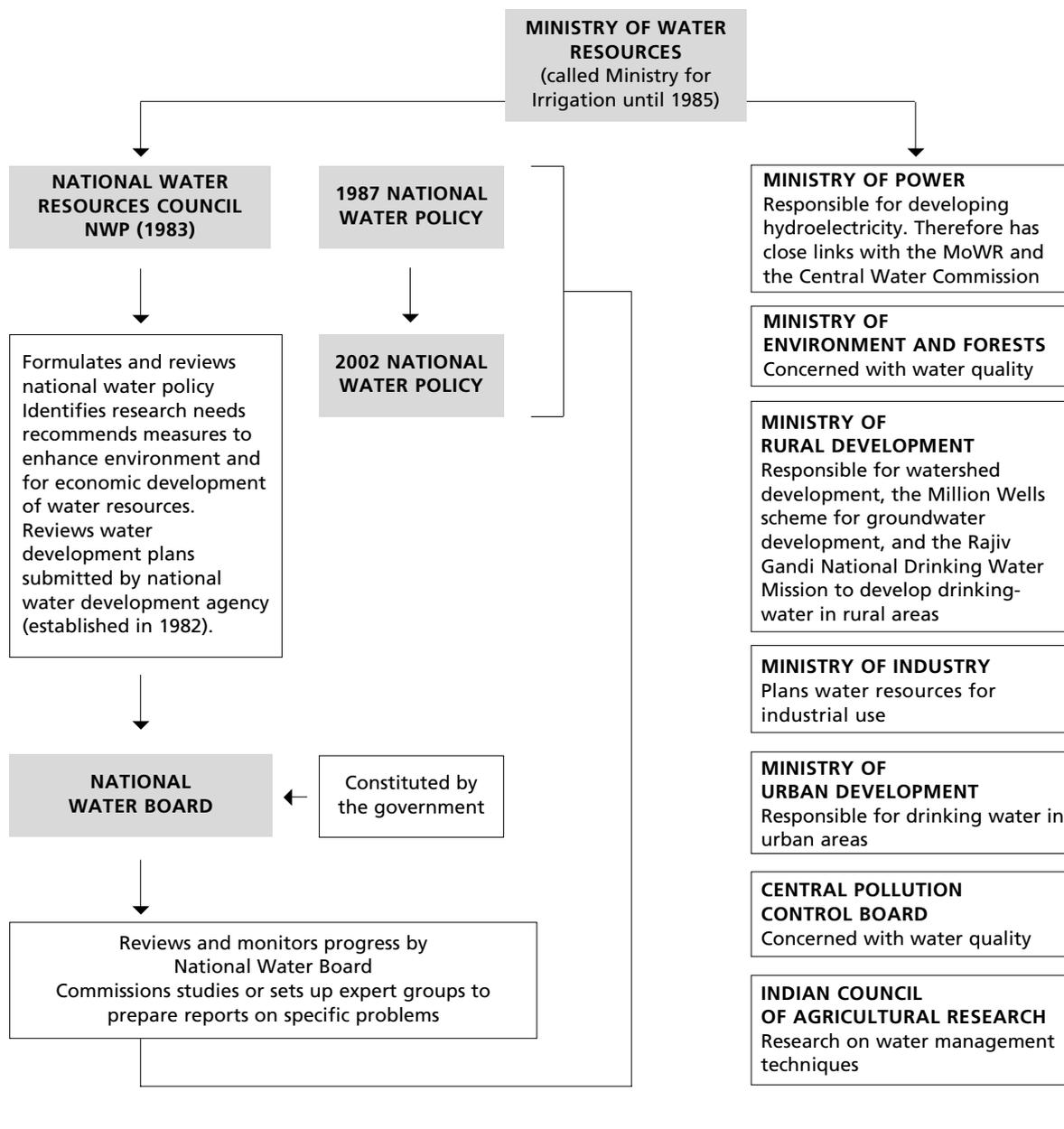
The Government of India has been advocating the integrated management of watershed programmes since the mid-1990s. The tenth plan's Working Group Report on Watershed Development: Rainfed Farming and Natural Resource Management (Planning Commission, 2001) recognizes the importance of macro-management for watershed development. It calls for watershed development programmes to focus on regenerating the productivity of degraded lands through a single national initiative.

However, in spite of the development of common guidelines, no mechanism has been put in place for integrated watershed development from a water resources perspective. Furthermore, there is no effective policy-level communication at both the national level and within individual states among the various ministries concerned with watershed management. The three ministries that are most involved in watershed management (the MoRD, the MoA and the MoEF) are driven by separate and differing policy priorities. The working group report on watershed development for the Tenth Five-Year Plan recommended an integrated approach, but maintained the compartmentalization among various ministries and line departments. If one ministry is working in one implementation area, then no other ministry can work in the same area. However, the Planning Commission states clearly that "it would be desirable to have a single national initiative for the watershed development programmes" (Planning Commission, 2001).

The working group report recommends the opposite to its posited integrated approach by decreasing the overlapping responsibilities of concerned ministries and line departments. It recommends more coordination, but not improved cooperation. It also says that the MoA wants to be given the responsibility for programmes to regenerate degraded lands and wastelands because it has the required technical workforce. It claims that the Department of Land Resources (DoLR) lacks technical expertise, especially on productive activities. The DoLR, on the other hand, wants the single national initiative to happen under the MoRD. A further problem is that, although the MoEF is responsible for coastal watersheds, it does not recognize water resource management as being within its mandate.

The lack of links among the various ministries and bodies responsible for watershed development programmes means that a solution to India's water resource situation is not supported by policy. The increasing overextraction of groundwater in coastal areas is contaminating water resources

FIGURE 1
Indian government agencies concerned with water resources



with saline water, as seawater is pulled into terrestrial zones. This is recognized in the National Water Policy (MoWR, 2002) as a major problem in water resource management. The MoEF neither has the means nor is supported by policy to resolve this problem.

SUPPLY AND DEMAND MANAGEMENT ISSUES

Government and private sector efforts have focused on increasing the amount of available water, rather than reducing demand by building new wells and de-silting tanks, dams and canals to transfer water from one basin to another, and by putting in place rainfall harvesting structures (KAWAD, 2001). Water management policies seem to be based on the assumption that water will continue to flow from upper to lower catchments in unlimited quantities, regardless of the amount of water extracted or harvested. It recommends that a series of small sunken water harvesting structures be placed all over the landscape, and along drainage lines, to allow for the equitable distribution of water (Planning Commission, 2001).

Such structures retain storm flows to allow water to be used locally. However, when all the water resources of a catchment or macro-watershed are fully used on an annual basis, there is little or no flow out of macro-catchments. In this situation, further investments in water conservation structures and other measures such as bunding are less cost-effective, as water is captured upstream at the expense of downstream users (Gosain, Rao and Calder, 2003).

The guidelines of the National Watershed Development Project for Rainfed Areas (NWDPPRA, 2002) define surplus runoff as that which goes outside the watershed area. It defines one of the criteria for a successful watershed project as about 50 percent of surplus runoff being conserved or harvested in the watershed. This highlights the policy focus on local benefits and the lack of attention to effects on downstream users.

Batchelor, Rama Mohan Rao and Manohar Rao (2003) conclude from water audits carried out in the Karnataka and Andhra Pradesh Rural Livelihoods Project that intensive water harvesting has altered the spatial and temporal pattern of availability and access to surface and groundwater. This has brought many benefits but, especially in semi-arid areas, these benefits have had significant negative trade-offs in low rainfall years.

Demand for water is outstripping supply owing to attitudes founded on the belief that there is unlimited scope for augmenting water resources. State policies are encouraging the inefficient, unsustainable and inequitable use of water (Batchelor, Rama Mohan Rao and Manohar Rao, 2003).

POLICY MISCONCEPTIONS

Much watershed policy is based on misconceived linkages among forests, other land uses and water. Decades of research (Bosch and Hewlett, 1982; Calder, 1992; Scott and Lesch, 1997; Brunijnzeel, forthcoming; Calder *et al.*, forthcoming) have shown the limitations of the conventional wisdom relating to forests and water. This disparity needs to be addressed before sound land and water policies can be established (Calder *et al.*, forthcoming). The idea that planting forests increases runoff, regulates flows, increases rainfall and reduces erosion is unfounded but still widely quoted in policy.

Common water and water forest misconceptions include the following notions:

- *Forests increase runoff and local rainfall:* In most cases, rainfall is not linked to forests. In those situations where a positive relationship does lead to a small increase in rainfall, the increase in evaporation more than compensates for the small increase in rainfall, leading to an overall

decrease in the available water resources. The new understanding gained through transpiration and interception experiments has determined that in very moist and dry climates evaporation from forests is higher than that from shorter crops. Therefore, except in very few circumstances, runoff will consequently be reduced (Calder, 1999).

- *Water harvesting is a benign technology:* In specific cases, water harvesting structures can produce benefits. However, intensive drainage line treatment can cause significant reductions in downstream water resources, inducing severe hardship for people lower down the catchment (KAWAD, 2001).
- *Runoff in semi-arid areas is 30 to 40 percent of annual rainfall:* At scales larger than the micro-watershed, annual runoff is lower than 30 to 40 percent. In large areas of India, for example, mean annual runoff is lower than 5 percent of annual rainfall. Groundwater extraction, soil water conservation and construction of water harvesting structures have all contributed to a further reduction in mean annual runoff (KAWAD, 2001).
- *Forests increase infiltration:* Forest soils usually have a higher infiltration capacity than crops or pasture, but owing to rainfall interception they are usually drier than in clearings under grass cover (Gallart and Llorens, 2003).

A number of water- and land-related myths have a very high level of acceptance within watershed development programmes and are disseminated widely through a variety of media and political outputs (Batchelor, Rama Mohan, Rao and Manohar Rao, 2003), as shown by the following two examples from high-level government agencies:

Watershed management through extensive soil conservation, catchment-area treatment, preservation of forests and increasing the forest cover and the construction of check dams should be promoted. Efforts shall be to conserve the water in the catchment (MoWR, 2002).

Vegetating the upper reaches ... to enhance the stream flow besides increased groundwater recharge are the other possibilities ... (Planning Commission, 2001).

Rectifying the misconceived conventional wisdom incorporated in policy is crucial to advancing watershed development and management. Further efforts need to be directed at scientific research and ensuring that research findings are better disseminated and connected to land-use planning, forests policy and decision-making (Calder *et al.*, forthcoming).

CONCLUSIONS

The main problems identified in this paper could be tackled through policy change to put in place: 1) a better enabling environment; and 2) demand management incentives and disincentives. These would promote the more efficient use of water (KAWAD, 2001). A better enabling environment will involve institutional, legal, macroeconomic and sectoral policy changes. The incentives and disincentives will involve restrictions and zoning of water resources and accurate public information.

The policy focus on increasing water supply is having serious negative effects on vulnerable rural livelihoods. These effects are felt throughout basins and in catchments lower down. Policy needs to acknowledge the connectedness of watersheds through the landscape by integrating water resource management policies and associated mechanisms from source to sink. To promote equity and sustainability, watershed development needs to attend to the management of resources from the point of input through to the coastal zone. The lack of policy recognition of the close interrelationships of water resources across the landscape is a serious cause for concern. The experience of India's major watershed development projects is that well-synchronized projects will not achieve their objectives without a national framework for evaluating water resources (Gosain, Rao and Calder, 2003).

The lack of integration in watershed management mechanisms and water resource development between the national and state levels, and between ministries and their line departments, means that areas such as Karnataka will continue to suffer decreasing groundwater levels. The number of closed catchments will increase unless such a framework is adopted. Policies and practices are needed that are based on accurate information, seek long-term solutions and emphasize promoting water resource management at all levels (Batchelor, Rama Mohan Rao and Manohar Rao, 2003).

Appropriate frameworks need to be developed to evaluate the impacts of watershed development on water resources. They need to take into account impacts on hydrological functions on larger temporal and spatial scales. Taking into account the new emphasis on panchayat institutions, they will have to enable the assessment of impacts at the panchayat and catchment levels. This information needs to be regularly updated to reflect the most accurate ground-truthed data or infrastructure requirements in order to promote sound natural resource management (Gosain, Rao and Calder, 2003).

The need is for policy that facilitates institutional coordination and consistency among all parties involved in watershed development. It also needs practices based on validated scientific findings, demand- rather than supply-side mechanisms and the macrolevel treatment of watersheds as a complex sequence of interrelated units from source to sink.

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CHAPTER 8

WATERSHED MANAGEMENT EXPERIENCES IN GTZ-SUPPORTED PROJECTS IN INDIA

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BACKGROUND

About US\$400 million is spent on watershed development programmes in India each year. Over the last decade, these programmes have worked to alleviate poverty, build up sustainable livelihoods and rehabilitate degraded lands. It is estimated that international donors provide about US\$100 million of assistance each year towards rehabilitating India's watersheds. Of this, the Federal Republic of Germany contributes about 15 million euros per year (US\$18 million). A substantial part of these funds goes for environmental protection and sustainable natural resource management. German support for watershed management is linked to its overall support for poverty alleviation and environmental protection, with poverty alleviation as the main focus of its support to watershed-related projects. The rehabilitation of the half of India's degraded land (170 million ha) located in undulating semi-arid areas is a priority. German Agency for Technical Cooperation (GTZ)-supported projects aim to apply socio-technical solutions for sustainably rehabilitating land and other natural resources in order to enhance productivity and reduce poverty.

WATERSHED MANAGEMENT IN INDIA

Community-based watershed management has become the guiding principle for rehabilitating natural resources in India's rural areas. Natural resource management in India has evolved from a purely technical, top-down approach in the 1970s, to the current decentralized participatory approach (Box 1). The Ministry of Rural Development's Hariyali guidelines on watershed development (MoRD, 2003) have given village-level local government – the panchayati raj institutions – a pivotal role in managing natural resources. They now have the responsibility for managing local watershed projects.

BOX 1

WATERSHED PROJECTS IN INDIA, 1970S TO 2003

1970s: Target area/technical approach, externally imposed. For example, Drought-Prone Area Programme and Desert Development Programme.

1980s: Target area approach with some community involvement. Mainly integrated watershed development projects such as the Integrated Wastelands Development Programme. Also Social Forestry.

1990s: Joint forest management, watershed and eco-development projects. Foreign donors provided much support to a participatory approach working with non-formal village bodies.

2000s: Watershed Development and Swajaldhara Rural Drinking-Water Programme. These projects take a participatory approach, promote livelihoods and work through panchayati raj institutions (PRIs). They aim to empower PRIs for planning, implementation, and monitoring and evaluation of micro-plans. In 2003 the Hariyali guidelines for watershed development were updated to involve PRIs in watershed management.

GTZ-SUPPORTED PROJECTS

GTZ is one of the main international technical cooperation agencies supporting watershed development in India. Its recent support has been directed towards natural resource management-based panchayat micro-plans, impact monitoring, environmental services based on upstream and downstream linkages, and climate change in watershed management. It has supported watershed management projects in eight Indian states across a range of geographical and socio-demographic conditions. These projects have been in Rajasthan, Uttaranchal, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, Jharkhand, Himachal Pradesh and Maharashtra. Box 2 describes five of the main projects.

BOX 2

GERMAN-SUPPORTED WATERSHED PROJECTS IN INDIA

Indo-German Bilateral Project: Watershed Management (1989–2005) – provides advisory and financial support for integrated watershed management and is focused on capacity building, monitoring and evaluation.

Indo-German Watershed Self Help Program (WOTR) – promotes watershed self-help programmes, focusing on building capacity of NGOs and community-based organizations. Current phase runs from 2001 to 2004.

Indo-German Changar Eco-Development Project – aims to reduce environmental degradation by focusing on building capacity of village development committees/panchayati raj institutions, natural resource development, building capacity of local animators, and building capacity of future institutions for programmes such as Himachal Pradesh Eco-Development Society as a knowledge centre. The first project phase ran from 1994 to 1999, with the current phase II planned for 1999 to 2006.

Reorganization and Strengthening of Watershed Training Institutes in Maharashtra (2002–2005). This initiative is working to reorganize and strengthen Maharashtra state's Water, Soils and Watershed Management Training Institute.

Capacity Building and Strengthening of Decentralized Watershed Management (2003–2007) – aims to build the capacity of all relevant watershed management actors through training and other kinds of capacity building.

GTZ is working with many government bodies and NGOs in watershed management. At the central government level it has worked with the Ministry of Agriculture and the Ministry of Environment and Forests; and at the state level with the Ministry of Agriculture (Government of Maharashtra), the government of Himachal Pradesh and others. The links with government organizations have allowed experiences to be shared with policy-makers. Project monitoring and evaluation has allowed for lessons to be learned. These lessons have been disseminated at the regional, national and international levels, and supplemented with watershed development-related publications.

The main NGOs and semi-governmental bodies it has worked with are Maharashtra's Watershed Organization Trust and the Himachal Pradesh Eco-Development Society. It has also worked closely with the German consulting company, RODECO Consulting.

GTZ APPROACH TO WATERSHED MANAGEMENT

GTZ defines watershed management as the process of guiding and organizing land use and the use of other resources in a watershed in order sustainably to provide desired goods and services to the people without adversely affecting soil and water resources. This definition recognizes the interrelationships among land use, soil and water, the linkages between uplands and downstream areas, and the numerous types of stakeholders.

GTZ's approach to watershed management is built around encouraging people's participation, on the premise that a watershed development project can become sustainable only when local people own and maintain project-created assets. Across India, watershed development is now planned to happen through local elected panchayati raj institutions.

GTZ supported project's work to:

- develop the capacity of human resources, local communities and local institutions;
- effect management of natural resources – soil, land, water and forests;
- improve farming systems through crop management, pasture and fodder development, livestock management and organic farming;
- build sustainable rural livelihoods by adding value to farm and non-farm products and services;
- manage conflicts such as among social groups and between upstream and downstream users; and
- establish backstopping mechanisms such as linkages with line departments and markets.

A key feature of the GTZ approach to watershed management is working to manage the many, often competing, demands on a watershed, such as the water needs of agriculture, households, industry, livestock, forests, wildlife and tourism. Its projects also advocate for a universal policy that harmonizes work across human and natural resource management sectors. They promote the decentralization of decision-making, monitoring and evaluation, and capacity building. Decentralization is promoted through:

- the decentralized development of village water resources;
- self-help resource management planning and implementation at the village and ward levels;
- developing decentralized knowledge centres; and
- building up the capacity of local animators.

Monitoring and evaluation is being promoted through using:

- hydrological monitoring and decision support systems;
- remote sensing and Geographic Information Systems (GIS);
- guidelines for impact assessment; and
- participatory impact monitoring with the direct involvement of communities.

The capacity of government organizations, NGOs, community-based organizations and panchayati raj institutions is built by:

- strengthening and developing their ability to manage watersheds in a participatory way that promotes self help;
- building up their knowledge about soil and water harvesting and conservation techniques;
- promoting savings and credit programmes and micro-enterprise development;
- establishing linkage mechanisms;
- promoting alternative sources of energy; and
- developing and testing ways of improving crop cultivation, agroforestry, horticulture, livestock and fodder development, and community forestry.

LESSONS LEARNED

GTZ's experiences in India suggests that the best approach to watershed management is by working in a participatory way, using sound local technologies and sharing the costs and benefits. In line with the government's policy, GTZ's watershed projects take revenue villages or panchayats as the unit of implementation and then work with local stakeholders to plan, design, implement and monitor interventions, and prioritize activities that strengthen local livelihoods. This all helps to build a sense of local ownership.

The use of sound locally adapted technologies that are technically mature and have been tested makes projects attractive to local people. Such technologies should be selected with farmers or user groups and must have low complexity, risk and initial costs. Ideally, they should demonstrate visible positive effects, including profitability, within short gestation periods. As far as possible, projects should aim to promote the sharing of costs and benefits equitably between resource-poor people and better-off community members, and between upstream and downstream users.

GTZ's experiences in India show the importance of forging good institutional linkages when implementing a project. There is a crucial need for long-term supporting actors who can provide technical backstopping after project support has ended in order to avoid situations in which the impacts of promising innovative projects are short-lived or limited. GTZ therefore has the policy of phasing-out temporary organizational structures and services that have been created to run projects. The aim is to institute post-project networking, technical backstopping and linkages among permanent stakeholders in order to continue the processes and positive impacts achieved by the project. Figure 1 shows all the main institutional links in a watershed management project, from the state down to the village level. The end of a project is likely to see the removal of the project implementing and coordinating bodies and offices, leaving NGOs working with government agencies and local elected bodies to carry on project works and ensure project sustainability.

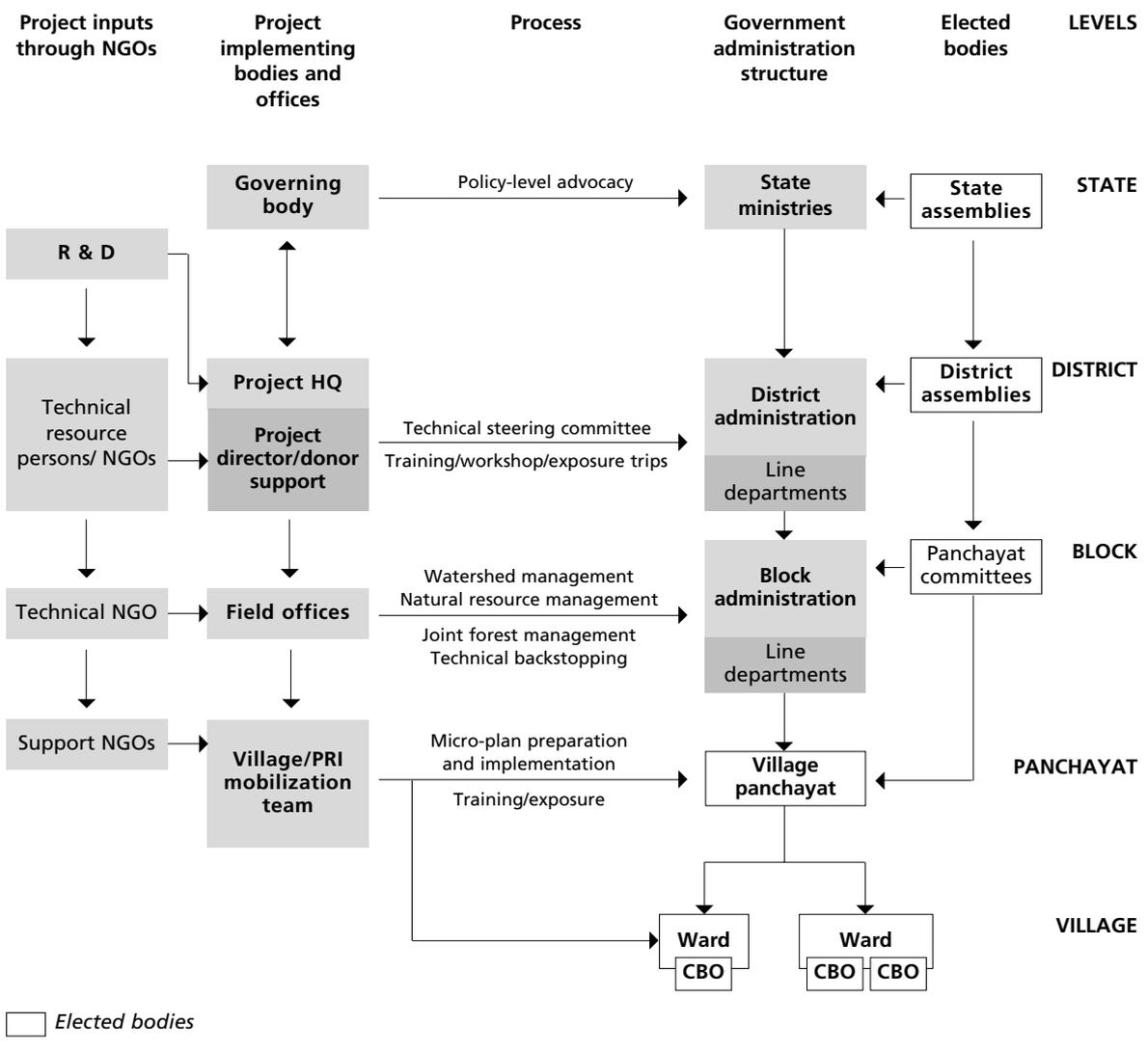
CONSTRAINTS

Sound watershed management is constrained by the following factors.

Building and strengthening competent organizations. It is difficult to put in place a system for continuously building up the capacity of government organizations, NGOs and community-based organizations. This is needed, as the technical competence of most social organizations is weak. Many also have inadequate focus on gender issues and difficulties in adequately attending to issues of equity, operation, maintenance and management once project funding ends.

Mobilizing finances. Usually, the budget provided by the government is insufficient to carry out adequate watershed management work. Projects tend to create dependency on external funding. Maintaining investments is a great challenge, as watershed development does not attract private investors. More effort needs to be put into mobilizing local financial resources.

FIGURE 1
Institutional set-up for managing natural resources



Monitoring and evaluation. The main problems for monitoring and evaluating projects are the lack of baseline data, impact data and common monitoring guidelines. Wherever participatory impact monitoring is introduced it is often difficult to sustain it post-project.

Decentralization of government schemes. The future role of state governments and line departments in watershed management is not clear. In particular, technical and financial responsibilities among state government departments, PRIs and project implementation agencies are unclear. Other challenges include:

- the lack of horizontal and vertical convergence and coordination, such as the need to converge panchayat micro-plans and village resource management plans;
- frequent failures to reach the resource-poor and women;
- adjusting watershed management for the distinctive conditions of Himalayan areas; and
- the lack of directives and mechanisms to ensure line department support for decentralized planning and implementation.

Distribution of costs and benefits. The equal distribution of costs and benefits between landless and resource-poor people and better-off farmers needs intensive facilitation. In addition, up to now, the sharing of benefits between upstream and downstream users has not happened. The rights of users to forests and common lands need to be made clearer.

FUTURE THEMES

The main emerging themes that need attention in watershed management in India are:

- watershed management and climate change;
- improving horizontal and vertical coordination among the various schemes promoting integrated resource management;
- improving approaches and structures;
- avoiding conflict and discrimination;
- identifying new mechanisms for financing watershed management;
- making landless and resource-poor people benefit more;
- distributing costs and benefit, including the sharing of benefits between upstream and downstream users based on the environmental services provided;
- co-financing between local implementing agencies and donors; and
- building linkages, including to improve coordination among international donors.

Environmental protection and sustainable natural resource management will continue to be a focal point of development cooperation between India and Germany. Future support is planned for disseminating successful approaches through a national intersectoral programme. The focus will be on building the capacity of training institutes to train facilitators who work with users to develop participatory watershed management further.

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CHAPTER 9

WATERSHED MANAGEMENT IN INDONESIA

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BACKGROUND

Formal watershed management began in Indonesia during the 1970s in response to massive flooding of the city of Solo in Central Java. Experiences since then have shown how, in a developing country such as Indonesia, environmental issues are foremost and need to be addressed by many kinds of development projects. The challenge in watershed management is to protect upland watersheds. These areas provide many local, regional and countrywide benefits. The key is to promote development strategies that help rural low-income groups without environmentally and economically destructive forest removal.

Forest and land degradation is directly linked to food security (FAO, 1985). The loss of soil and productive capacity in uplands is usually directly evident, but downstream effects may not be. Sedimentation and excessive stream flow from the uplands often disrupt downstream irrigation and hydropower generation facilities. This has serious social and economic implications.

Figure 1 illustrates the causes and effects of the degradation of watersheds in Indonesia and elsewhere. Soil erosion, sediment-filled reservoirs, frequent flooding, polluted water and drinking-water shortages are the results of unsuccessful land and forest protection and rehabilitation. The causes range from poor law enforcement to lack of job opportunities.

The main recent developments have led on from the Ministry of Forestry's (MoF's) new guidelines on watershed management planning (MoF, 2000a), forest and land rehabilitation (MoF, 2000b) and the development of micro-catchment models (MoF, 2000c).

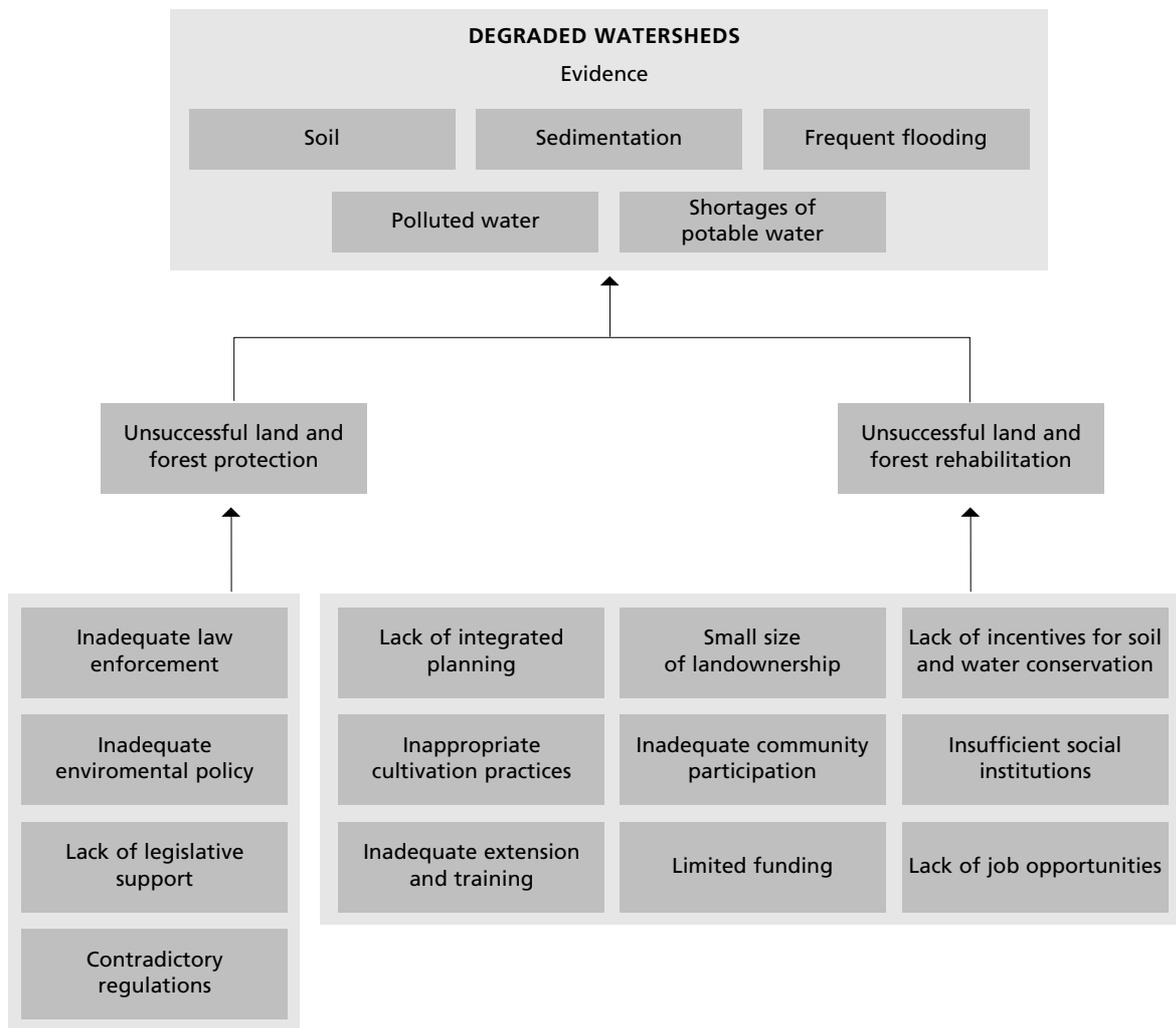
IDENTIFYING PRIORITY WATERSHEDS

Indonesia has about 470 watersheds, which vary in size and condition. Many are degraded to some extent. The Indonesian government has set about prioritizing those watersheds that most need management interventions. This began after the MoF in 1999 issued a decree to carry out this work (Ministerial Decree 284/1999). In response, a systematic and scientific way was developed to decide which watersheds are most in need of interventions. An analytical hierarchy process was developed (Figure 2).

The process takes into account the range of main land use, hydrology, social, economic and institutional factors. Several sub-factors were identified within each factor, and a way of

measuring each was developed or identified (see column 3, Figure 2). For example, the relative hydrologic importance of a watershed is accounted for by measuring its discharge levels, sediment content, pollutant content and sediment delivery ration. A ranking scale was developed for each of the column 3 indicators to give a score for each sub-factor. The final overall score is arrived at by weighting the relative importance of each factor and sub-factor. This process takes the factor of land use as the most important, accounting for 40 percent of the total weighting, within which land cover accounts for 20 percent and land suitability 10 percent of the total score.

FIGURE 1
Causes of watershed problems in Indonesia



The relative weightings were agreed on in a democratic and consultative way as the process was being developed. The range of stakeholders, including government officials, watershed professionals and academics, decided on the relative importance of the various biophysical, socio-economic and other factors that act on a watershed and govern the benefits to be realized by interventions. This helped to overcome disciplinary bias where, for example, a hydrologist would tend to assign most importance to hydrological factors.

It took more than a year to collect all the data for the 470 watersheds. This work was carried out by the 31 regional watershed management centres (BPDAS – previously BRLKT). It took another year for the central office of the Directorate General for Land Rehabilitation and Social Forestry (RLPS – previously RRL) to process and check the data and assign a ranking to each watershed.

Watersheds with a score of between 100 and 200 were categorized as priority III, 201 to 300 as priority II, and more than 300 as priority I. The priority I-type watersheds are those in greatest need of attention. This exercise found 60 priority I watersheds, 232 priority II watersheds, and 178 priority III watersheds. The ministry plans to review the status of its watersheds every five years.

The main problem in carrying out this exercise was the availability of data. Where data were not available, the parameter could not be defined exactly and was estimated. About 60 percent of watersheds had complete data – mostly those in Java and Sumatra.

As an illustration, Lake Toba watershed on Sumatra is one of the 60 priority I watersheds. It is characterized by large areas of degraded land, severe soil erosion, high population pressure and a large investment in building a multipurpose dam. It is a priority 1 watershed because, among other things, the zone has a large dam in an area where increasing population pressure on natural resources is leading to increasing land degradation. In contrast, Bintan Island watershed is a priority III watershed because it has less degraded forest and land, much less soil erosion, low population pressure and no large investments in infrastructure.

This kind of categorization has been very useful to focus attention on the areas most in need of watershed management interventions. It could be used in other countries better to direct watershed management investments. The precondition is to have a relatively complete resource database.

FOREST AND LAND REHABILITATION

The rehabilitation of degraded forests and lands is a priority for the Indonesian government. Reforestation is carried out by developing plantation forests and by enrichment planting in degraded natural forests. This is mostly done by private concession companies and State companies. Logging concessions are usually granted on condition that the company reforests the area afterwards. However, many concessionaires fail to replant areas they log. Only a few have successfully established plantation forests for industrial timber production. The MoF's Directorate General of Forest Production Development coordinates this work.

Afforestation and reforestation outside of concession areas is planned by the MoF's Directorate General of Land Rehabilitation and Social Forestry (DGLRSF). So far, most forest and land rehabilitation has taken place in critical watersheds (priority I). A specific hierarchy plan of each watershed has been formulated by regional watershed management centres. These plans are made up of a macro-plan for the whole of a watershed, a technical plan for the rehabilitation of land and soil conservation by sub-watersheds, and detailed technical designs for reforestation and land rehabilitation by site. The plans are formulated with framework analysis to consider biophysical and socio-economic factors.

FIGURE 2
Analytical hierarchy process for prioritizing watersheds

FACTORS	SUB-FACTORS	INDICATOR	RANKING SCALE	NOTES
A. LAND USE (40)	1. Land cover (20)	$LCI = \frac{PVL}{\text{Watershed Area}} \times 100\%$	LCI > 75% (good) LCI = 30 – 75% (fair) LCI < 30% (bad)	LCI = land cover index PVL = permanent vegetated land Source: land cover and land use map
	2. Land suitability (10)	$LS = \frac{SA}{\text{Watershed}} \times 100\%$	LS > 75% (good) LS = 40 – 75% (fair) LS < 40% (bad)	LS = land suitability SA = suitable area Source: land suitability map
	3. Erosion index (EI) (7)	$EI = \dots \times 100\%$	EI ≤ 1 (good) EI > 1 (bad)	Erosion calculation based on guidelines for field design of land rehabilitation and soil
	4. Land management (3)	Crop type (C) and soil conservation practices (P)	C x P = < 0, 10 (good) C x P = 0, 10 – 0,50 (fair) C x P = > 0,50 (bad)	C & P value is from table in LRSC guideline, 1998
B. HYDROLOGY (20)	1. Discharge (8)	a. $WRC = \frac{Q \text{ max}}{Q \text{ min}}$ b. $CV = \frac{Sd}{Q \text{ average}} \times 100\%$ c. $WUI = \frac{\text{Water need}}{\text{Water supply}}$	WRC < 50 (good) WRC = 50 - 120 (fair) WRC > 120 (bad) CV < 10% (good) CV > 10% (bad) The lower the WUI the better	Q= water discharge WRC = water regime coefficient CV = coefficient of variation Sd = standard deviation WUI = water use index
	2. Sediment content (8)	Sediment concentration (S_c)	The lower the S_c the better	Based on data from stream flow monitoring stations
	3. Pollutant content (4)	Biophysical and chemical concentration	Based on valid standard	Standard in Government Regulation No. 20/1990
	4. Sediment delivery ratio (2)	$SDR = \frac{\text{Total sediment}}{\text{Total erosion}}$	SDR < 50% (normal) SDR 50 – 75% (less than normal) SDR > 75% (degraded)	SDR = sediment delivery ratio Field measurement, calculation, data from stream flow monitoring station

FACTORS	SUB-FACTORS	INDICATOR	RANKING SCALE	NOTES
C. SOCIAL (20)	1. Individual concern (10)	Positive individual conservation activities	Present/absent	Data from related institution
	2. People's participation (7)	Participatory percentage of people in group activities	> 70% (high) 40 – 70% (medium) < 40% (low)	Observation data or report from related institution
	3. Population pressure (3)	Population pressure index (PPI) $PPI = z \times \frac{f \text{ Po} (1 + r)}{L}$	PPI < 1 low PPI = 1 – 2 medium PPI > 2 high	t = time in 5 years z = agricultural land for proper life of each farmer f = proportion of farmers against population in watershed Po = population in year 0 L = agricultural land area r = population growth per year
D. ECONOMIC (10)	1. Dependency on agriculture (4)	Actual Erosion Tolerable erosion	> 75 % (high) 50 – 75 % (medium) < 50 % (low)	Calculated/household/year or from related institution data
	2. Income (2)	Agricultural contribution to family income	Statistic Centre Bureau	Data from related institution
	3. Land productivity (2)	Family income per year	Decrease/unchanged/increase	Data, Central Bureau of Statistics
	4. Environmental merit (2)	- Production/ha per year - Internality from externality - Cost sharing	Present/absent	In the tax form or contributions for environmental fund
E. INSTITUTIONAL (10)	1. Role of local institutions (4)	Role of local institution in watershed management	Have a/no role	Observation data
	2. Government support to local communities (2)	Government intervention	High/medium/low	Observation data
	3. CISS (2)	Conflict	High/medium/low	CISS = coordination, integration, synchronization, synergy.
	4. Group business activities (2)	Number of business units	Increase/unchanged/decrease	From related institution

The MoF began working on forest and land rehabilitation in the 1970s. These activities are now coordinated by the Directorate General of Land Rehabilitation and Social Forestry and its regional watershed management centres. There are 31 of these centres, and their activities focus on upper watersheds where most critical lands are found. They work to rehabilitate land and forests so as to increase vegetative coverage, increase the infiltration of water into the soil to reduce direct runoff, reduce soil erosion and sedimentation, and increase farmers' incomes. These centres work with local people in priority watersheds and sub-watersheds to reforest protected forests, establish community forests on private lands, promote agroforestry and soil and water conservation techniques, such as terracing, grass barriers and alley crops, and install check dams, gully plugs, drainage improvement and infiltration wells.

The rehabilitation of degraded forest and land in all of Indonesia's 470 watersheds is not possible without people's participation. This participation is crucial for combating forest and land degradation because the rate of degradation – about 2 million ha per year – is faster than the rate of rehabilitation – about 0.6 million ha per year. Therefore, the government has introduced an awareness programme to encourage local people to plant trees, conserve forests and promote soil and water conservation.

NATIONAL MOVEMENT ON FOREST AND LAND REHABILITATION

The National Movement on Forest and Land Rehabilitation was launched by the Indonesian President on 21 January 2004 in Yogyakarta, Indonesia. The stage had been set for this when the three ministries of Social Welfare, Economy, and Politics and Security introduced a collective regulation in March 2003. This has encouraged coordinated efforts to protect, rehabilitate and replant forest land.

This movement is to be implemented in 21 of Indonesia's most degraded watersheds and ten priority II watersheds, over a total of about 3 million ha. The aim is to rehabilitate the forests in these areas over five years using a US\$1.4 billion reforestation fund. This programme started in 2003, with target area coverage as shown in Table 1.

TABLE 1

Target coverage of National Movement on Forest and Land Rehabilitation

Phase	Year	Area (ha)
I	2003	300 000
II	2004	500 000
III	2005	600 000
IV	2006	700 000
V	2007	900 000
Total		3 000 000

Reforestation programmes by private forest concession companies have been largely unsuccessful owing to lack of control and a failure to address local communities' needs. Regreening initiatives carried out by local people have also been unsuccessful owing to lack of planning. The national movement aims to integrate the work of the government and local people, with central government providing seedlings while local government and local people plant the seedlings in the field.

The programme is promoting the planting of desirable tree species. It works by the central government coordinating activities and the local government supervising implementation. It is promoting public and private participation and harnessing the contribution of the army to rehabilitate remote forests and land areas. Monitoring and evaluation is being done using satellite images.

LOANS FOR WATERSHED CONSERVATION

Improved upland agriculture, community forest and agroforestry have been promoted under several schemes. One of the most successful was introduced in the 1990s to give out low-interest loans to be repaid over five years. The scheme is targeted at small-scale and poor farmers living in upland watersheds. The credit is meant for improving soil conservation structures such as terraces and control dams. In general, poor farmers cannot build these themselves because of the expense involved. This initiative will have benefits both to the upland and downstream parts of the watershed.

In most parts of Indonesia, this credit scheme has been successful, creating conservation farming systems and putting in place soil and water conservation measures. However, in some places its implementation has not been sustainable. Some farmer groups have failed to repay loans partly because no fines were imposed for failing to meet repayments. In addition, some farmers spent the money for measures other than conservation purposes. The main problems have been related to the top-down nature of the scheme and the lack of control from local, provincial and central government and the bank. The scheme has been postponed and is being evaluated to improve its control mechanisms. The government is optimistic about introducing a revised scheme to help the poor in upland areas.

MICRO-CATCHMENTS

Policy-makers need facts and figures on the extent of the problems of watershed degradation and the effectiveness of various measures to reverse it. This information can be generated from micro-catchment demonstration plots that represent forest and land rehabilitation and social forestry activities. The ideal schematic flow of policy formulation is illustrated in Figure 3, with policy flowing from the micro-catchment level on to the sub-watershed, watershed and basin levels, to influence national policy. At the micro-catchment level, the left side of Figure 3 represents the "ideal" conditions (a demonstration site), and the right side the actual condition of micro-watersheds in the same sub-watershed. Policy should be made by aiming to take measures that transform the actual situation into the "ideal" condition, from the micro-watershed level through to national policy in a bottom-up way.

In 2004, the Directorate General for Land Rehabilitation and Social Forestry (DGLRSF) plans to set up such models at the micro-catchment level in its 31 regional watershed management centres, in order to provide data and information and to act as demonstration plots, field laboratories and ecotourism centres.

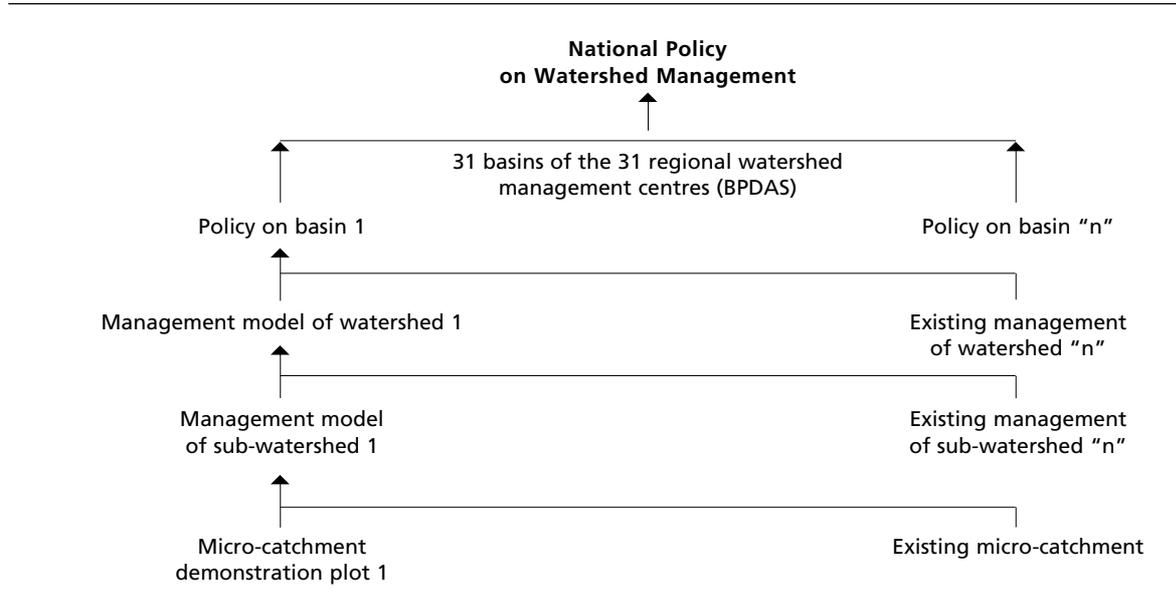
These micro-catchment sites need to be supported by local government and the people. The sites should: 1) not exceed 1 000 ha; 2) have degraded land (critical lands); 3) be accessible; 4) be located in one district; 5) be part of a priority I watershed; 6) have agricultural land, forest land and settlements; 7) not have large areas of karst geology; and 8) include issues of public importance related to watershed management, such as flooding problems and infrastructure protection.

POLICY-MAKING

Water resource management in Indonesia is mainly the concern of the Ministry of Settlement and Regional Infrastructure (previously the Ministry of Public Works). However, water resource management is related to many sectors, including forestry, agriculture and regional development. The government established a Coordination Team of Water Resources Management in 2001. It is headed by the coordination Minister for Economics, with day-to-day activities controlled by the Minister for Settlement and Regional Infrastructure. Team members come from 14 government and non-governmental institutions, including the ministries of Forestry, Agriculture, Home Affairs, and Environment, and the National Development Planning Board.

The coordination team’s main task is to formulate policies related to water resource management and to recommend the drafting of legal regulations and policies. It is also responsible for reviewing and evaluating policies, programmes and all activities related to water resource management. The team has established a secretariat with a steering committee, an executive team and separate working teams for water resources regulations, watershed regulation, water quality control and irrigation management.

FIGURE 3
Ideal, bottom-up formulation of national watershed policy



The MoF is represented on the steering committee by the Director-General of Land Rehabilitation and Social Forestry, on the executive team by the Director of Watershed Management and Land Rehabilitation, and on working teams 1 and 2 by officials from the Watershed Management and Land Rehabilitation Directorate. The coordination team is revising the Water Resources Law, 1974 and preparing about 40 water resources management-related regulations, policies and guidelines. These concern the watershed management funding systems, water quality control, flood and drought control, irrigation management and funding, and stakeholder participation in water resource management. The aim is to promote cost-sharing between the government and stakeholders, and local people's participation in water resources management and watershed conservation. These activities ran from 1999 to 2003 funded by a World Bank loan.

The MoF introduced its guidelines for watershed management implementation in 2001. These promote integrated watershed management and call for setting up regional integrated watershed management fora. Regional watershed management centres have been set up to enable the establishment of such fora in priority watersheds in central Java, east Java, north Sumatra and south Sulawesi.

PROBLEMS AND SOME SOLUTIONS

Many stakeholders see watershed management as concerning only a particular component such as the water regime of downstream lands. In some cases this has led to the failure to produce proper development plans for watersheds. For example, in the past, extensive degradation of upstream land was not taken into account when a downstream dam for hydropower generation or irrigation was being built. However, the life of the dam was shortened owing to high rates of sedimentation resulting from soil erosion in upland areas. To overcome this problem, stakeholders need to know about integrated watershed management that attends to all the major biophysical, social, economic and cultural aspects of a watershed.

Officials responsible for watershed management and local administrators have often failed to cooperate. One of the main reasons for this is that watershed boundaries often do not correspond with administrative boundaries, and as a result, other natural resource management and development initiatives go ahead within administrative boundaries. This often generates conflicts and complex problems, as usually no single institution is responsible for managing a watershed's natural resources.

The new watershed management fora are designed to address this problem. They will be set up in all watersheds to alleviate problems. They will be made up of traditional local leaders and representatives from local administration, NGOs, community-based organizations, universities and other stakeholder organizations. The fora will accommodate stakeholders' interests in watershed development. At least four fora were set up last year by regional watershed management centres in central and east Java, north Sumatra and south Sulawesi.

Most watershed management projects have not been sufficiently monitored to assess their impact on downstream areas. As a result, there is scepticism about the downstream benefits of watershed management. The frequently unrealistic expectations of benefits have also led to

suggestions that watershed management does not work. Therefore, monitoring and evaluation needs to be improved to show what does work.

Although it is true that forest cover often reduces runoff and protects soil from erosion (Anwar, 2001), it is wrong to believe that forests alone can prevent floods and drought. This frequent misconception on the part of decision-makers, planners and managers needs to be replaced by a rationality based on facts (Enters, 2002). Rehabilitating forests and lands will protect reservoirs from siltation, but planting trees all over the place, as is often recommended by politicians, will not prevent floods and drought. Much money is misspent in this way and would be better used for protecting forests from illegal logging and other sources of destruction.

CONCLUSIONS

In general, forestry programmes in Indonesia are directly related to and support water and watershed conservation. They are implemented by determining priority watersheds, developing integrated watershed management plans, developing national and regional forest land-use plans, establishing conservation and protection forests, and reforestation and rehabilitating critical lands.

Watershed management in Indonesia suffers from a number of problems caused by a failure to apply the basic concepts underlying the sound management of watersheds. The failure of many watershed management stakeholders to understand the holistic approach to managing watersheds has caused some programmes to fail.

Part of the problem is that previous initiatives have ignored local priorities. A new paradigm in watershed management is needed that gives attention to local norms and knowledge. Such a strategy will be better accepted by local people and be more environmentally sound. Whatever, the fundamental principle is that watershed management should not be top-down, but should take the integrated bottom-up approach with the active involvement of local people.

Provincial and district development is mostly planned within administrative rather than natural boundaries. This leads to the further degradation of natural resources owing to the lack of institutional coordination of adjacent provinces or districts when designing development plans for cross-border areas. This especially relates to conservation areas and protection forests, and to associated upstream and downstream interactions. One side often wants to protect, while the other wants to exploit border areas, which from a watershed point of view should be managed within one development plan.

In summary, the sustainable management of forest, land and water resources demands:

- watershed management to go ahead using natural boundaries as the unit of intervention;
- improved institutional and community capabilities
- improved institutional coordination at the national and regional levels; and
- cost- and benefit-sharing mechanisms that reward upland poor people for providing environmental services to downstream communities.

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CHAPTER 10

INTEGRATED WATERSHED MANAGEMENT FOR SUSTAINABLE UPLAND DEVELOPMENT AND POVERTY ALLEVIATION IN LAO PEOPLE'S DEMOCRATIC REPUBLIC

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INTRODUCTION

The Lao People's Democratic Republic (PDR) is a mountainous land-locked country with a relatively low population density. Its population of approximately 5.1 million people is poor with a per capita gross domestic product (GDP) estimated in 2002 to be only US\$331. The upland areas of the country are marginalized and have a high incidence of poverty, lower than average incomes and little social and economic infrastructure. Lao PDR has rich biodiversity resources and contains the least exploited and least damaged ecosystems in Southeast Asia. However, unsustainable resource management is beginning to reverse this favourable situation. Forest cover has declined from 70 to 47 percent over the last 50 years owing to the clearing of lowland forests for permanent agriculture, logging, reservoir construction, shifting cultivation, fires and the use of chemical defoliants during the Indochina war.

The government recognizes the importance of conserving its natural resources as it strives for economic development. The preservation of natural resources as a basis for sustainable development is highlighted in its latest Five-Year Plan (2001–2005). During the last decade, the government has introduced laws and decrees to support the sustainable use and management of natural resources.

Eighty-seven percent of Lao PDR's land is classified as upland land. In these areas, more than 60 potential sites for hydropower generation have been identified on tributaries of the Mekong River. It has been estimated that the country has a generating potential of 18 000 MW, of which only 640 MW has been developed. Hydropower installed in a sustainable way would greatly benefit the country's socio-economic development.

The major issues in the fragile upland areas are the interlinked shifting cultivation, food insecurity and poverty. The government is committed to reducing shifting cultivation significantly by the year 2005. In Lao PDR, more than 90 percent of income-earning adults make their livelihood in the agriculture and rural sectors. Most farming systems are extensive

with low productivity. While economic reforms are raising living standards in urban areas, rural households have benefited little. The Prime Minister's Decree 01 calls for promoting comprehensive and integrated rural development with more participation from local government and communities.

The Ministry of Agriculture and Forestry is applying integrated watershed management as a key strategy to address these issues. This approach was endorsed by the 2002 National Agriculture and Forestry Conference. It is being implemented within the national planning framework to improve understanding of the natural resource base and socio-economic situation in priority watersheds. It includes getting the agreement of local stakeholders more effectively to address poverty alleviation and the conservation and development of upland watersheds. The Ministry of Agriculture and Forestry is collaborating with provinces and districts to develop integrated watershed management plans.

GOVERNMENT POLICY

During the last ten years the Government of Lao PDR has introduced a draft of new legislation that supports the sustainable management of natural resources (Budget Law, 1994; Forestry Law, 1996; Water and Water Resources Law, 1996; Land Law, 1997; Mining Law 1997; Electricity Law, 1997; Agriculture Law, 1998; Environment Protection Law, 1999; and Processing Industry Law, 1999). It has also been following the policy of area-based development. In the uplands this involves planning by watershed areas.

In 1999, the government developed its Strategic Vision for the Agricultural Sector (MAF, 1999). This recognizes that socio-economic development can take place more rapidly in the already developed lowlands than in the uplands. In the more ecologically fragile uplands, the vision is to reduce shifting cultivation and reverse poverty by promoting the more sustainable use of natural resources. This also involves conserving forest areas that have important hydrological and biodiversity protection functions. The government recognizes that forests play an important role in supporting livelihoods as many households obtain much of their food from forests.

The government's vision for the year 2020 aims to shift the country from a subsistence economy to a market economy through the sustainable use of natural resources. This vision gives high priority to encouraging more appropriate land use. It prescribes the three types of land use as: 1) intensive lowland agriculture in the plains areas; 2) mixed agroforestry as the main production system in sloping areas; and 3) forest conservation and protection for upland steep areas.

The targets of the government's Fifth Socio-economic Development Plan (2001–2005) that relate to integrated watershed management are to:

- ensure the progress of social security and political stability;
- create continued economic growth;
- reduce poverty by half;
- introduce a food security programme;
- solve the problem of shifting cultivation and prohibit opium plantations by creating new jobs and other income-generating opportunities;
- enhance national saving;

- reform State and private enterprises;
- develop human resources; and
- support the development of modern industry in the next stage.

The government is using integrated watershed management as an important tool to achieve its short-term (five years) and long-term (20 years) development goals. The objectives of the 2001–2005 Five-Year Plan include 7 to 7.5 percent annual GDP growth; 4 to 5 percent annual growth for agriculture; agriculture and forestry products accounting for 47 percent of GDP; and a population of around 5.9 million with a per capita GDP of US\$500 to \$550 by 2005.

As a follow-up to the Strategic Vision for the Agricultural Sector, the government produced a master plan for agriculture and natural resources. This identifies a number of programmes and specifies projects to support the government's vision of sustainable development of these sectors.

The April 2002, the National Agricultural and Forestry Conference agreed that integrated watershed management should be applied by all districts for sustainable natural resource management and poverty alleviation. At the conference the prime minister said:

Our development strategy has to follow an area-based approach. Development in the lowlands and on the major plains shall emphasize an integrated and decentralized agriculture and forestry programme. Development in the uplands shall follow a watershed approach to develop sustainable agroforestry systems and conservation in the context of sustainable use of the natural resources and decentralization. We believe that the development strategy will lead to realizing our goal in alleviating poverty in most upland areas in the context of environment-friendly livelihood systems.

INTEGRATED WATERSHED MANAGEMENT

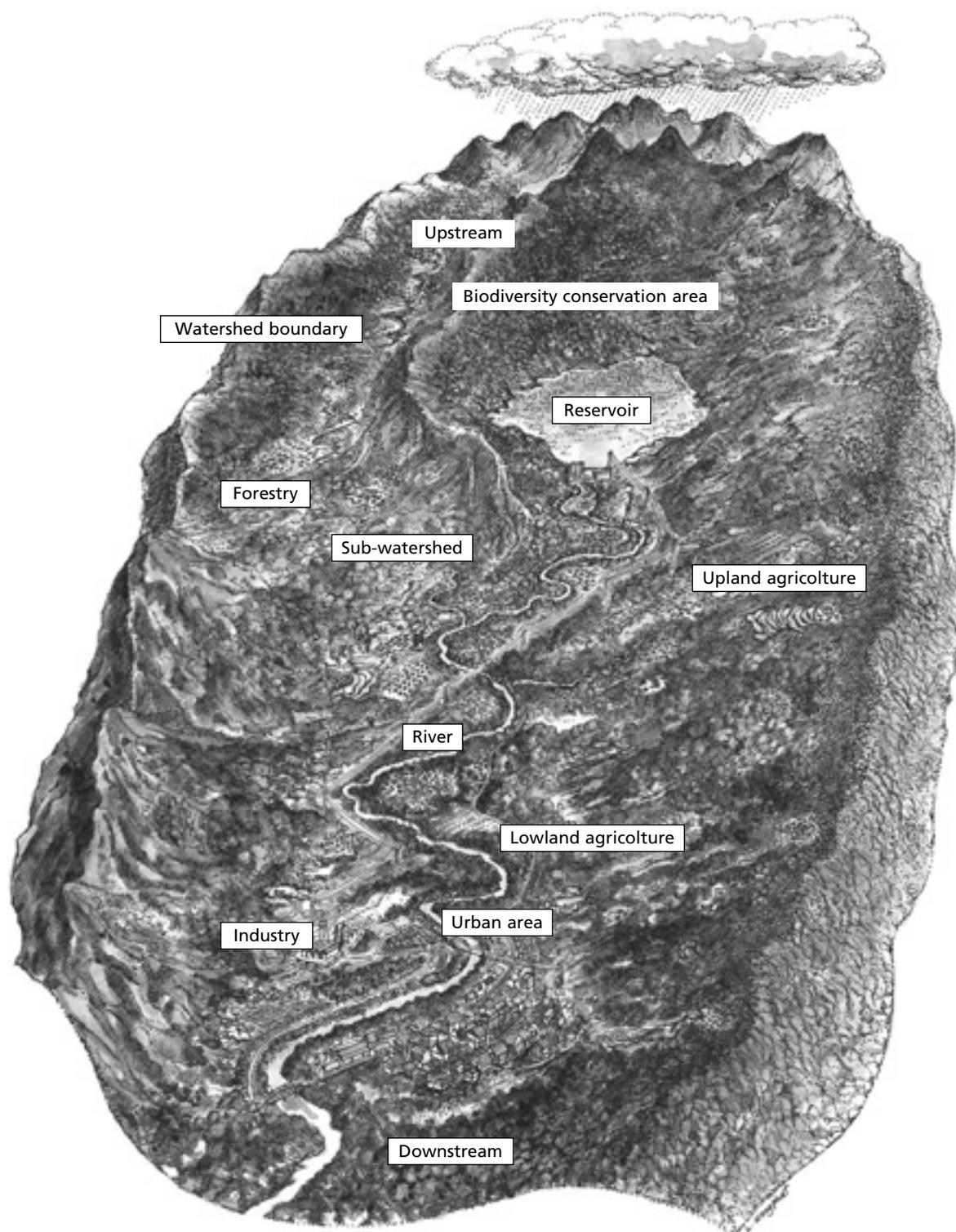
FAO (1986) defines watershed management as:

The process of formulating and carrying out a course of action involving manipulation of natural, agricultural and human resources on a watershed to provide resources that are desired by and suitable to society, but under the condition that soil and water resources are not adversely affected. Watershed management must consider the social, economic and institutional factors operating inside and outside the watershed.

Integrated watershed management is a holistic area-based planning process that extends the government's policy on sustainable natural resources management and development activities. Figure 1 shows the extent of a watershed and indicates the management issues – from biodiversity conservation in the uplands to the needs of lowland agriculture and urban areas in the lower areas – that need to be considered across a typical watershed.

DANIDA, among other donors, has supported the Ministry of Agriculture and Forestry to develop integrated watershed management as a holistic area-based planning framework. The Mekong River Commission has classified watersheds into five categories and has digitized contour lines and river network and generated digital terrain models for the whole of the lower Mekong River basin. These data are proving very valuable for watershed planning. An information system showing road networks, village locations, land-use types, soils and land suitability has also been developed.

FIGURE 1
Schematic view of a watershed

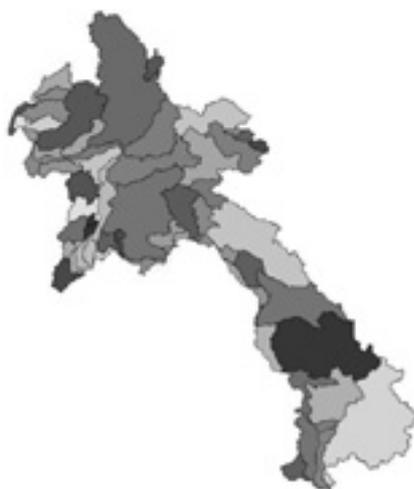


Source: Lao DANIDA National Capacity Building Project

Watersheds in Lao PDR

Lao PDR is covered by 64 watersheds (Figure 2). Fifty-three of these, accounting for 91 percent of the country's land area, drain into the Mekong River. The other 11 watersheds drain into Viet Nam from Xieng Khouang and Huaphan provinces. The Mekong River Commission has developed a watershed directory that gives the boundaries of all first-order watersheds of the Mekong River system and gives information on their physical characteristics.

FIGURE 2
Lao PDR's watersheds



Source: MRC Watershed Classification Project, 2000

Some of the first-order watersheds or river basins such as the Nam Ou in northern Lao PDR are very big and cover several provinces, whereas some are small covering only part of a district. It is important to distinguish between different levels of watersheds in relation to the administrative boundaries and sectors within areas as shown in Table 1. This hierarchical division of watersheds is incorporated in the government's policy on decentralization.

TABLE 1
Watershed levels in Lao PDR

Level	Indicative area	Administrative area	Key agencies
Mekong River	International		Governments of Mekong riparian countries Mekong River Commission
	National	Whole country	Government of Lao PDR Water Resources Coordinating Committee Lao National Mekong Committee Ministry of Agriculture and Forestry
River basin or large watershed	More than 1 600 km ²	Province	Provincial governments Provincial agriculture and forest services (PAFS)
Watershed	100 to 1 600 km ²	District	District governments District agricultural and forestry offices (DAFO)
Micro-watershed	Less than 100 km ²	Village	Village development committees (VDCs)

The provincial level is responsible for making strategies on natural resources based on the area's potential and priorities, including considerations of where to build infrastructure, site biodiversity conservation areas and linking areas with market opportunities. The districts are responsible for budgeting and planning and are therefore the key administrative level for developing integrated watershed management plans. District-level integrated watershed management plans can be aggregated into provincial level watershed plans.

Manageable watershed planning units

River basins or large watersheds need to be split into smaller units to allow districts to develop integrated watershed management plans that promote and support activities to be carried out in collaboration with villages (VDCs). As a general principle, the maximum manageable size should not exceed the average size of a district (about 1 600 km²). The actual size of watershed units should furthermore be agreed on a case-by-case basis according to:

- number of villages and households and their distribution;
- infrastructure;
- available natural resources: principally forest, land and water;
- economic development potential;
- area of high biodiversity importance;
- hydropower potential; and
- biophysical features.

The Ministry of Agriculture and Forestry is promoting the development of model watersheds to serve as examples of different geographical locations and to show the effects of socio-economic and biophysical factors. The aim is to use these areas to develop further the concept of integrated watershed management. A number of model watersheds have been developed and have led to at least five integrated watershed management plans.

OBJECTIVES OF INTEGRATED WATERSHED MANAGEMENT

Integrated watershed management in Lao PDR aims to:

- alleviate poverty and improve living standards by improving sustainable livelihood opportunities for households and communities whose needs are met from a watershed's natural resources;
- improve the conservation and protection of forest areas that are important for preserving biodiversity and protecting water resources;
- improve the conservation and management of natural resources within watersheds for sustainable economic productivity, while maintaining and enhancing these resources' social and environmental functions;
- improve water resource management within watersheds in order to: 1) provide adequate quality water for all users within the watershed and downstream; and 2) protect human

settlements, lowland farms, power generation and transport infrastructure, and downstream fish ponds from flood and sedimentation damage; and

- increase the marginal productivity values of the natural resources of land, water and forests (i.e. increasing the productivity of one resource without decreasing the productivity of others).

The main challenge of integrated watershed management in Lao PDR is to find ways in which these objectives can all be met simultaneously. The characteristics of different watersheds vary. Some are important for their biodiversity and as water sources and so call for total protection, while for most watersheds in Lao PDR, the ultimate goal is to promote the sustainable and equitable use of natural resources. This requires establishing mechanisms based on assigned land use and water rights in order to allocate and enforce these rights among competing sectors such as fisheries, tourism, irrigation, hydropower, domestic and industry. This calls for developing and adopting more productive forest, crop and livestock management practices that enhance and sustain the natural resource base.

INTEGRATED WATERSHED MANAGEMENT PLANNING

Integrated watershed management planning is a five-stage process (Figure 3). The first two stages involve identifying a watershed and developing an integrated management plan. Stages 3 and 4 involve each sector planning and implementing its activities in collaboration with local people, following agreements made in the integrated watershed management planning process. Finally, the implementation of all sector plans is monitored and evaluated, and findings are fed into a new round of planning to update the plan. Plans should be live documents that are regularly updated.

The ministry's guidelines for developing district-level integrated watershed management plans (MAF, 2002) recommend following a seven-step procedure (Figure 4). These plans serve as frameworks for managing natural resources based on a district's biophysical and socio-economic assessments. Although the planning process for each level of watershed is similar, the needs and requirements differ. For example, watersheds with low population densities and limited economic development potential require fewer interventions because commercial and human pressures on the natural resources are low and sustainable. The highest priority in these watersheds is to protect the resource base through carefully planned zoning and land-use allocation and sustainable socio-economic development, in line with indigenous, village-based resource management. In contrast, plans for watersheds with high population density and high economic development potential need to address the problem of natural resource degradation that often arises from development activities.

In watersheds with hydropower potential, important issues include the resettlement of communities and the downstream impacts of hydropower development. In these areas natural resource conservation zoning is needed to preserve and regenerate forest cover on upstream steeply sloping and erodable land. Hydropower development needs to pay close attention to the management of upstream areas in order to prevent damage to hydropower structures. This can be done, for example, by setting up a watershed management fund made up of an agreed percentage of turnover.

FIGURE 3
Integrated watershed management process

1. Watershed identification and analysis

Watershed analysis:
 Develop watershed profile and diagnose problems

SECONDARY DATA SOURCES

- MAF technical departments: NAFRI, DOA, DOI, DOLF, NAFES, etc.
- Lao agencies: STEA/ WRCC, MIH, MCTPC etc.
- Bilateral projects in Lao PDR
- Mekong River Commission
- Regional Institutions: AIT, RECOFTC, WOCAT, ICIMOD, etc.
- UN: FAO, UNDP, etc.
- CGIAR: ICRAF, ILRI CIFOR

2. IWM strategy and plan

Integrated watershed management plans give the priorities and directions for future natural resource management for an area. These plans should be regularly updated

3. Subsector implementation plan

Action (work) plans are developed for priority subsectors based on directions given in IWM plans with specific links to other sectors

4. Implementation

Implementation of subcomponents by village, district, province, central level or donors

5. Monitoring and evaluation

- M&E according to identified indicators
- Output of M&E should feedback to coordinating unit
- Assess training and HRD needs

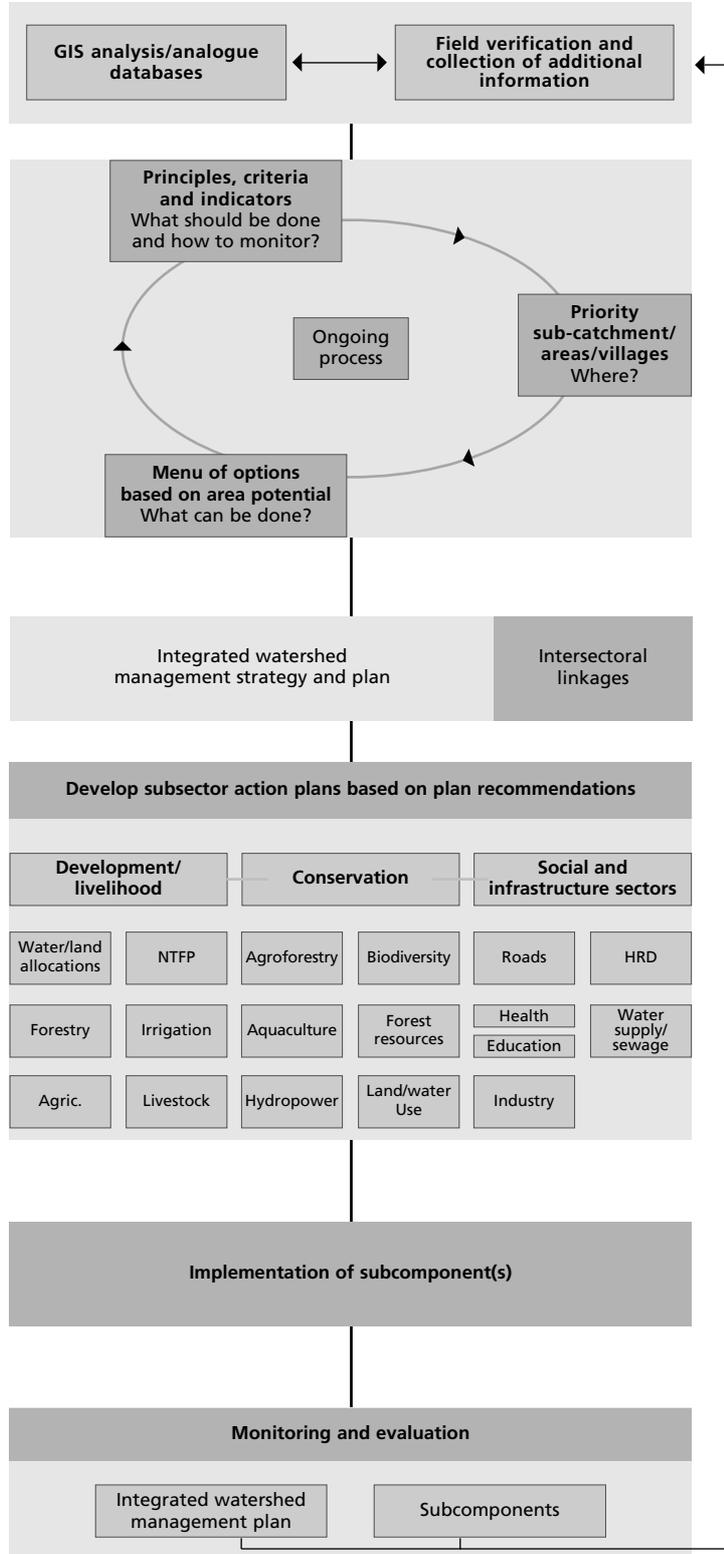
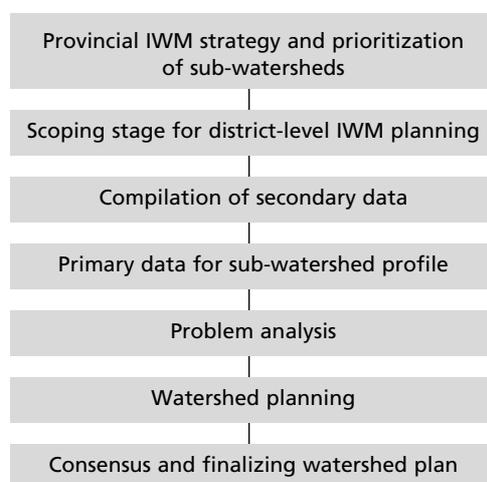


FIGURE 4
Development of district-level integrated watershed management plans



Producing detailed plans for watersheds of more than 1 600 km² is costly and involves extensive consultation. Therefore, such plans are normally only justified if large infrastructure investments exist or are planned for an area. Where resources and technical capacity are constrained, plan making should be simplified and applied, and regularly scaled up in line with available resources.

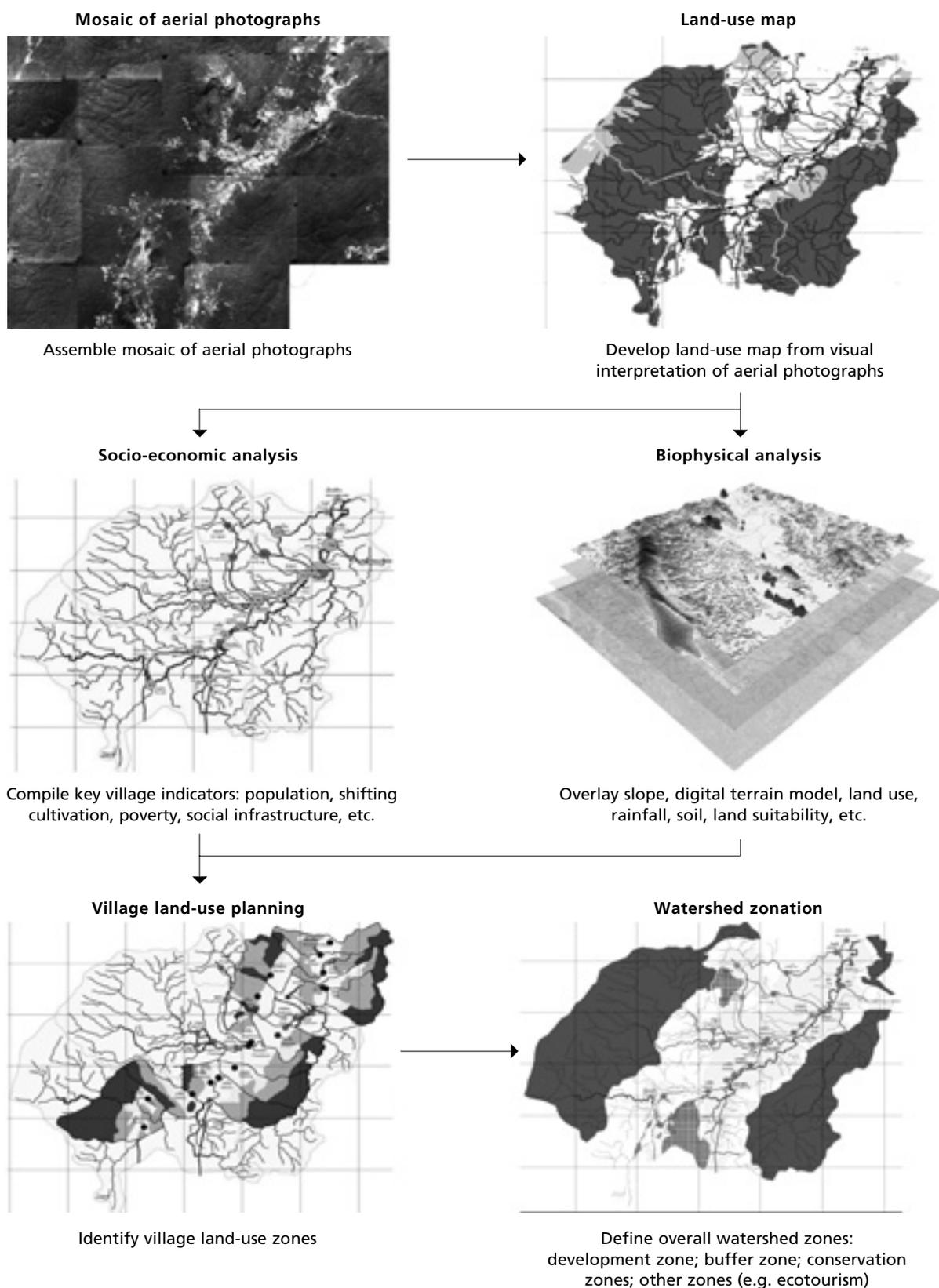
LAND-USE PLANNING AND WATERSHED ZONATION

The land-use planning process in Lao PDR is generally divided into eight steps (LSFP, 2001). This planning plays a very important role in integrated watershed management. Experience shows the importance of carrying out an overall socio-economic and biophysical assessment before individual villages delineate their land. In the Nam Tong Integrated Watershed Management Plan, Vientiane such an analysis was not carried out, and as a result agricultural land was allocated as forest land and vice-versa. Traditional land-use practices should be identified and incorporated into land-use planning. The delineation of village boundaries should begin by local people identifying their village's boundaries and the common lands that they use and have rights to. Villages can then zone their lands according to the most appropriate use. This can then be aggregated into overall zones for the whole watershed, including development, buffer, conservation, and even ecotourism zones.

This overall watershed zonation is important for defining future land use and for identifying potential areas for agricultural development and biodiversity and water resource conservation. Figure 5 illustrates the process of developing watershed zones by combining socio-economic, biophysical and land-use analysis. The process uses aerial photographs, land-use maps and socio-economic and biophysical analysis to assist village land-use planning and to identify different zones in a watershed. The different zones will commonly include development zones, conservation zones and buffer zones.

This integrated watershed management planning helps village land-use planning by carrying out biophysical and socio-economic assessments of their areas. These assessments often raise issues

FIGURE 5
Process for zoning a watershed



concerning the use of common lands such as forests, pastures and streams. Common resources are often degraded when villages cannot agree on their use. The fragmentation of village land is another issue that needs considering. Villagers often use land close to their settlements and further away, in line with traditional arrangements or owing to the limited availability of agricultural land.

DEVELOPING INTEGRATED WATERSHED MANAGEMENT

The integrated management of watersheds in Lao PDR is in its early stages. The approach is still being developed in a number of ways including the further development of guidelines, human resources, information management and demonstration sites. Concepts and guidelines have been developed for district-level planning, but they need further development based on experiences from training and demonstration watersheds.

Many staff involved in watershed planning, especially at the district level, have insufficient skills. There is a great need to build up their capacity to communicate, deal with data and information, and plan. Central-level planning staff have been trained on integrated watershed management planning, information collection, Geographic Information Systems (GIS) and remote sensing. Provincial and district staff have been trained in areas where demonstration watersheds have been developed. As well as upgrading basic and technical skills, there is an immediate need to build up a core group of integrated watershed management facilitators at the central and provincial levels to facilitate planning.

The Ministry of Agriculture and Forestry is establishing an information centre to coordinate data collection within the ministry and support districts and provinces with data analysis and the generation of maps for planning purposes. The ministry is also promoting collaboration with partners, such as donors and training and research institutions, to exchange information.

Model watersheds

Lao PDR has very diverse biophysical and socio-economic features, and therefore needs development models for different types of watersheds in order to assist in the development of other watershed plans in areas with similar characteristics. Model watersheds also need to cover the planning process and implementation, with feedback mechanisms to allow for learning from experiences. Model watershed planning processes have developed at Nam Tong, Nam Tin, Nam Neun and Nam Et Phou Loei watersheds (see Boxes 1 to 4).

BOX 1

NAM TONG WATERSHED

The Nam Tong watershed in Vientiane Province, northern Lao PDR covers 556 km² and contains 27 villages. The area has a wide valley with relatively good soil conditions. It has medium levels of immigration. Shifting cultivation is not a major problem, although a few households still practise it. Although the area is self-sufficient in rice, some households lack enough rice at certain times of the year and thus live below the poverty line. The area has relatively good market access, mainly to the capital city Vientiane, and good development potential for diversified agriculture and aquaculture. To maintain the present 70 percent forest cover of this area, the land-use options of diversifying agriculture, livestock and aquaculture have been identified during the watershed planning process.

BOX 2

THE NAM TIM WATERSHED

The Nam Tim watershed in Bokeo Province, northern Lao PDR covers 220 km² and has 23 villages and a population of about 10 000 people from a number of ethnic groups. Twenty-one villages with a total population of about 6 500 are located outside, but practise shifting cultivation in upper parts of the watershed. The government has built a reservoir in the area to irrigate 1 200 ha of land. The Nam Time Integrated Watershed Management (IWM) Plan was produced in 2002 by a watershed facilitation team under the Department of Planning, together with provincial and district officials. It identified pressure from shifting cultivation as a serious problem. This problem has been aggravated by outside villagers also practising shifting cultivation in the area, leading to erosion and land sediment loads that are reducing the storage capacity of the reservoir. The major threat to the watershed function has been identified as this shifting cultivation. The management plan proposes protecting the watershed's headwaters and introducing improved agricultural practices and alternative income-generating activities.

BOX 3

NAM NEUN WATERSHED

The Nam Neun watershed in Xieng Khouang and Huaphan provinces in northeastern Lao PDR is a mountainous area of 6 881 km² with about 400 villages that practise shifting cultivation, upland rice farming and livestock raising. Local people also gather non-timber forest products (NTFPs) and grow some opium. Prospects for improving the management of natural resources include promoting vegetable and fruit tree farming, small-scale handicraft production and improved management of NTFPs collection. Paddy farming is limited to a few river valleys. Activities proposed in this area's watershed plan address not only conservation, development and upstream-downstream linkages, but also poverty alleviation and the eradication of opium cultivation.

BOX 4

NAM ET PHOU LOEI NATIONAL BIODIVERSITY CONSERVATION AREA

The Nam Et Phou Loei National Biodiversity Conservation Area in Huaphan and Luang Prabang provinces, northern Lao PDR is a mountain range with an area of 4 200 km² that has high levels of biodiversity. It contains the headwaters of four major watersheds, including the Nam Neun watershed. The area has about 110 villages in its buffer zone. A further 35 villages are located inside the conservation area and mainly practise shifting cultivation and produce some opium. The planning process recommended focusing on the sustainable use of the area's natural resources, because this is an important biodiversity conservation area. The plan emphasis for the headwater areas should be on: a) integrating conservation and development activities; and b) participatory management of natural resources.

The four examples were part of the Ministry of Agriculture and Forestry's efforts (with DANIDA support) to develop the capacity of planners at the central, provincial and district levels to develop watershed management plans. It has led to improved awareness of the IWM approach. Experiences from IWM planning have been disseminated at numerous events, such as at the ministry's annual agricultural and forestry conferences. This has raised the demand from districts and provinces for support to develop integrated watershed management plans throughout the country. In two cases, this has resulted in increased financial support from the government to develop IWM plans. Vientiane and Sayaboury provinces have funded provincial watershed planning as the provincial authorities realized the benefits of systematically analysing socio-economic and biophysical aspects in planning and, at the same time, using the planning exercise to build up staff skills.

The Ministry of Agriculture and Forestry, as the lead agency, is preparing to implement the Nam Ngum River Basin Development Sector Project with about US\$22 million support from the Asian Development Bank and the French and Japanese governments. This project aims to develop and implement integrated watershed management plans for the entire Nam Ngum River basin in northern Lao PDR, which covers 16 watersheds over an area of 16 906 km². It will demonstrate and test further the integrated watershed management approach on a large scale.

VISION FOR INTEGRATED WATERSHED MANAGEMENT AND THE SUSTAINABLE USE OF NATURAL RESOURCES

The Ministry of Agriculture and Forestry aims to allocate more resources for upland development, based on integrated watershed management plans. Mechanisms and procedures for incorporating such planning into the national planning framework are being developed in collaboration with the Committee for Planning and Cooperation.

The Ministry of Agriculture and Forestry recommends that all provinces develop strategies to manage their watersheds. In the same way all districts should develop watershed plans either by themselves or along with neighbouring districts, depending on the biophysical boundaries of their watersheds. The Ministry of Agriculture and Forestry has a GIS and mapping facility under the Department of Planning, which can be used to delineate watershed boundaries.

The government has the vision that by 2010 integrated watershed management plans will be developed for the whole country at the district and provincial levels. The emphasis in the

current Five-Year Plan (2001–2005) is on developing watershed plans for all eight northern provinces that contain the country's priority watersheds. This will support the government's plan to reduce shifting cultivation by 70 percent and alleviate poverty in northern Lao PDR.

Integrated watershed management plans need to be made for the areas around all hydropower projects, including the downstream impact area. These plans need to include environmental and socio-economic analysis of the upstream area and should assess the investments needed in these areas. All natural resource-based projects working with district and provincial authorities should include a watershed management planning process as part of their design.

The interdisciplinary approach of integrated watershed management includes carrying out environmental impact assessments. The Ministry of Agriculture and Forestry, supported by the Science, Technology and Environment Agency, is investigating how to incorporate such impact assessments into integrated watershed management.

To fulfil these goals, the skills of all levels of staff need building up and the planning tools improving. All levels of staff need more basic and technical training. This is best undertaken on the job or linked to actual watershed planning. There is a continued need to develop tools for watershed planning, implementation, and monitoring and evaluation. The focus should be on developing simple and practical tools that apply to the context of Lao PDR.

The Ministry of Agriculture and Forestry is setting up an information centre to support districts and provinces developing local watershed management plans. However, the centre still needs to be linked to and provided with modern communication facilities.

Interventions for promoting agriculture and rural development need to be implemented according to integrated watershed management plans in order to improve rural livelihoods through the sustainable use of natural resources.

The government is committed to applying integrated watershed management to combat poverty and manage the natural resources in fragile upland areas. It is incorporating integrated watershed management into the national planning framework. As well as the government's own resources, there is a great need for more collaboration with international donors. The government is striving to establish more partnerships to promote sustainable development in its fragile mountain areas. Time is limited and action is urgently needed.

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CHAPTER 11

WATERSHED MANAGEMENT IN NEPAL: CHALLENGES AND CONSTRAINTS

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WATERSHEDS: A CONTEXTUAL BASIS

Nepal's terrain is dissected by many rivers and streams to form a complex of watersheds. Natural and human-induced processes operate on these watersheds. The main processes that lead to the degradation of watersheds are landslides, soil erosion, floods, biodiversity loss, and unsustainable water extraction and farming practices. These lead to the loss of soil fertility, the depletion of water tables, the drying up of springs, desertification and sedimentation. A study carried out 20 years ago found that about 10 percent of Nepal's area was covered with very degraded watersheds (Table 1). Only 33 percent of the country was under "very good condition" watersheds.

TABLE 1

Watershed conditions in Nepal, 1983

Watershed conditions	Proportion of land
Very poor	10%
Poor	3%
Marginal	19%
Good	35%
Very good	33%

Source: DSCWM, 1983 referred to in Guragain et al., 2002.

Himalayan watersheds have relatively high population densities with nearly all the people relying on watershed-based resources for their livelihoods. The frequent natural disasters are partly caused by the overexploitation of natural resources and lead to large losses of life and property, principally in downstream southern plain areas (Box 1). Much landscape degradation is associated with the heavy monsoon rains. Parts of Nepal suffer from desertification, glacial lake outburst floods (GLOFs) and avalanches. Watershed management has paid little attention to threats to biodiversity, but it is an important issue.

BOX 1

SOME FACTS ABOUT LAND DEGRADATION IN NEPAL

- About 1 140 ha of land in 35 districts was lost in the 1993 monsoon to landslides and flooding.
- 41 800 ha of land was damaged in 1995.
- 74 000 ha of cultivated area in 16 districts in east Nepal was affected by drought in 2001.
- From 1983 to 2000, about 20 000 lives were lost to natural disasters; landslides and floods accounted for about 30 percent of these deaths.

A watershed is an area above a given point that is drained by a stream system. Watersheds are hydrologic units that have been used as the major spatial units for land, water and soil conservation by planners. Programmes and policies have focused on stabilizing the watershed environment. Integrated watershed management involves working on the natural and human resources in a watershed in accordance with the social, political, economic and institutional factors that operate within the watershed and its river basin (Easter, Dixon and Hufschmidt, 1991).

Himalayan watersheds have a complex physiography from the interaction of physical, biophysical and human activities. They generally have a weak geological structure and shallow soils, and are tectonically unstable and fragile. Most are characterized by steep slopes, large variations in altitude over short distances, incised river and stream beds with scars from landslides and gullies, large boulders in narrow watercourses from mass wasting and floods, sparse vegetation, agricultural fields and scattered human settlement.

Most cropland is carved out of hillsides by building terraces. Mountain farms usually have a few cattle and poultry. Households use their local common lands and forests for livestock grazing and as sources of fuelwood, fodder and timber.

It is only in recent times that roads, salaried jobs, health care and schools have reached these areas. This has had a large effect on natural resource use and management patterns, even in remote mountain watersheds, often disturbing the balance between nature and humans.

Food security and environmental degradation are two of the main challenges facing humanity in the twenty-first century (Lal, 2000). Protecting and strengthening watershed ecosystems is one of the main strategies to address these two issues.

Misconceptions about the causes of environmental degradation and food insecurity have often led to watershed management initiatives failing to deliver. This paper highlights the main watershed management issues concerning Nepal. It covers the approaches of watershed management adopted by the Government of Nepal, the links between population pressure and government policy, the land and food situation, information gaps on watershed management, and policy directions and constraints for watershed management.

GOVERNMENT WATERSHED MANAGEMENT

The indigenous management of Nepal's watersheds revolved around building terraced fields for crop production. Formal watershed management in Nepal began with the establishment of the Department of Soil Conservation and Watershed Management in 1974. Three years of work (1975 to 1977) in the Phewa Tal catchments in west-central Nepal by the Department of Soil and Water Conservation, Agriculture, Forest and Water Supply was the first project to work for the integrated management of a water catchment (Fleming, 1983).

The second half of the 1990s saw the adoption of a participatory and integrated approach to watershed management (Sharma, 1999). This involves the use and conservation of land, water and forest resources at the farm household and community or watershed level to improve livelihoods and human development (Sharma *et al.*, 1997). Chapter 10 of the government's Tenth Five-Year Plan (2002–2007) says, "Priority will be given to integrated watershed management to conserve the underground water and soil in the Chure-Bhawar and Terai areas by coordinating the work of agriculture and water resources sectors" (NPC, 2003). The plan significantly recommends the integrated watershed management approach, although it only names the Chure hills and the Terai areas.

POPULATION PRESSURE AND MACROLEVEL POLICY

Nepal's population has grown from 9.4 million in 1961 to more than 23 million in 2001. The 2001 census recorded about 7 percent of these people living in the mountains, 44 percent in the hills and 48 percent in the Terai plains. Much of the population growth has occurred in the Terai, as it has grown from more than 3 million in 1961 to more than 11 million in 2001.

In the 1950s, the government focused on relieving population pressure on the steep and environmentally fragile hill and mountain areas. The First Five-Year Plan 1956–1961 promoted a rehabilitation programme in the Terai. It sought to settle landless hill people there to provide them with a means of livelihood. The government took unsettled areas of the Terai for the planned resettlement of poor hill peasants. The Rapti Doon Multi-Purpose Development Project was the first such project (NPC, 1963). Successive five-year plans promoted resettlement in the Terai and its foothill valleys. They also promoted off-farm activities for income generation, and the introduction of high-yielding crop varieties and hybrid domestic animals. Most of these programmes were launched with advice from Western experts.

By the time of the Eighth Five-Year Plan 1992–1997, the national priority had turned to alleviating poverty. An important strategy for achieving this was to promote off-farm and foreign employment. Government policies assisted the existing trend of going abroad to work. In 2003 there were between 400 000 and 500 000 Nepalese working in foreign countries, not including the hundreds of thousands working in India. This has brought much foreign currency into the country, but has caused some problems. Although it has relieved population pressure on mountain watersheds, it has deprived these areas of workers. This has led to increasing wages for agricultural labourers. Wages have reportedly doubled in the past decade, from US\$0.67 (NR 50) per day in 1990 or 2 *pathis* of grain (6.3 kg) to US\$1.33 (NR 100) per day in 2000 (grain is now rarely accepted as payment). Over the same period, the price of agricultural products only increased by about 50 percent. This has led to decreasing labour

inputs in the farming sector, which in turn has led in many places to the abandonment of basic tasks such as terrace maintenance and the subsequent environmental degradation of mountain watersheds (Poudel, 2000; 2003).

Other important trends have been urbanization, the reluctance of young people to do farm work, the increasing use of modern amenities and the increasing use of manufactured goods. This has reduced the self-reliance of local communities.

The mass movement of people away from the hills and mountains has reduced population densities in some areas. It has been estimated that in 1952 to 1954 rural-to-rural migration (mostly from the mountains and hills to the Terai) accounted for 65 percent of total migration in Nepal. That figure stood at 91 percent in 1961, increasing to 93 percent in 1971 (Kc, 1983). The 1981 census reported 26 042 people having migrated from the mountains and hills to the Terai in the previous ten years. Among all migrants to the Terai, 67 percent were from mountain and hill districts. This trend continues, as the 2001 census reported that 16 percent of the Terai's population were internal migrants and 4 percent international migrants (who had moved there since 1991).

The population increase in the Terai has led to the destruction of swathes of Terai forests, especially along riverbanks. This has exacerbated riverbank cutting and flooding. The continued loss of life and environmental destruction is due to the failure to carry out integrated watershed management.

LAND AND FOOD

Nepal covers an area of 147 181 km². It has three main ecological belts in its mountain, hill and Terai areas that extend from west to east. The mountains and hills make up about 83 percent of the area, and the Terai 17 percent. Less than a quarter of the land is suitable for agriculture, and forest covers just over a third of the area. A considerable area is covered by steep and rocky terrain. Much of the hill and mountain areas are very fragile and vulnerable to landslides and mass wasting. Terai lands are regularly threatened by flooding and sedimentation.

Nepal, therefore, has only a limited amount of land that is suitable for mechanized farming. The National Sample Census of Agriculture, Nepal 1991/1992 (CBS, 1994) reported that about 2 597 400 ha of Nepal's land was under private ownership, of which 6.8 percent was in the mountains, 40 percent in the hills and 52 percent in the Terai. Of that total, 2 323 400 ha (89.5 percent) was arable land, of which 162 300 ha was in the mountains, 871 300 ha in the hills and 1 289 700 ha in the Terai. The average holding size was 0.96 ha, varying from an average of 0.68 ha in the mountains to 1.26 ha in the Terai. The mountains and hills have comparatively smaller landholdings.

The Nepal Living Standards Survey (CBS, 1996) recorded 83 percent of Nepalese households practising agriculture, including 98 percent of all mountain households, 87 percent of hill and 76 percent of Terai households. Agriculture is therefore a major source of livelihood for most Nepalese and it is the amount of land that often determines people's livelihood security. The same survey found that more than 50 percent of total households had less than adequate food consumption, with mountain people as the most deprived at 63 percent with inadequate food.

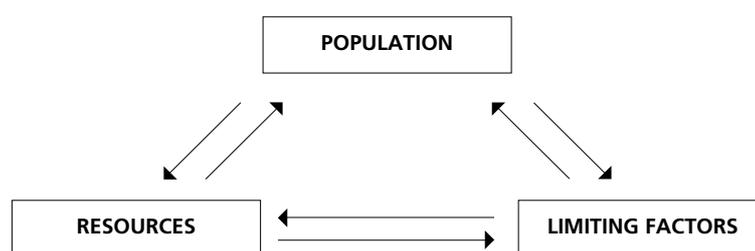
By calculating the total crop production per district and its calorific value, Subedi (1995) recorded that only one mountain district, one hill district and two Terai districts had relatively good food security. Eight of Nepal's 16 mountain districts, 13 of the 39 hill districts and three of the 20 Terai districts had poor food security. A 1997 ranking of Nepal's 75 districts ranked 25 as poor and deprived, of which nine were mountain districts, seven hill and nine Terai districts (ICIMOD, 1997).

The reliance on agriculture and the poverty and hunger of many Nepalese means that sound land management should be a government priority. But the periodic five-year plans have failed to give enough attention to this. Measures need to be taken to make the distribution of land more equitable and the land more productive, and to counteract land degradation. These can be achieved through the sound management of watersheds.

INFORMATION GAPS

It is difficult for proposed management activities to achieve their goals without a proper understanding of the many interrelated physical, biophysical and human factors that act on watersheds. However, this is often lacking in watershed management.

FIGURE 1
Relationship of population, resources and limiting factors

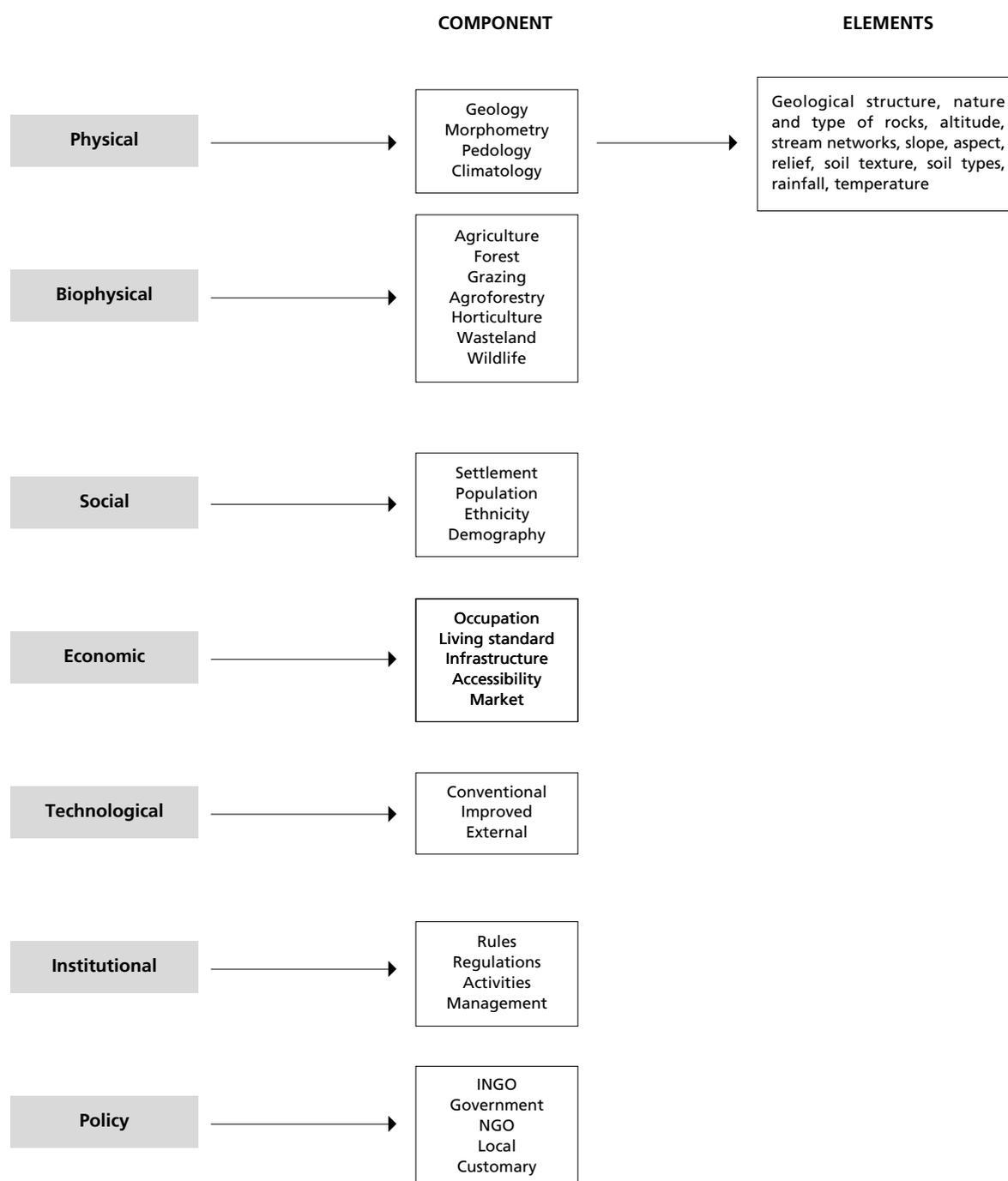


Source: Poudel, 2003.

Figure 1 illustrates the interrelationships among population, resources and limiting factors in mountain watersheds. In a watershed, the local population demands various services from a watershed's resources. Various physical, legal and institutional policies regulate demand and supply. For example, steep slopes and large rivers restrict the flow of resources and goods and services. A high demand will cause pressure on resources, and once this pressure passes a certain threshold, watershed environments begin to deteriorate. Studies of watershed management therefore need to gather information about the population, resources and limiting factors.

Planners and managers can use watersheds as functional units to consider physical, socio-cultural, economic and institutional factors, and develop comprehensive and integrated development plans to achieve specific objectives (Figure 2). GIS-based tools and techniques are very useful for analysing the situation in watersheds. Information provided in this way helps to increase understanding about environmental processes and to analyse and assess the impact of interventions (Michalak, 1993).

FIGURE 2
Watershed-based sources of information



Source: Poudel, 2001; 2003.

In Nepal, there is a lack of information and management plans at the watershed level. Achet (1999) points out that “benchmarks and changes resulting from an intended watershed management intervention need to be quantifiable”. Quantitative indices of watershed parameters need developing for different sizes of watersheds within different regional contexts. For Nepal, 5- to 25-km² sub-basin areas have been suggested as the size range of a sub-watershed (Achet, 1999). The “micro-catchment development model” should be adopted to solve local-level problems.

Nepal’s watersheds have not been properly evaluated according to their resource endowment and degree of fragility. The Nepalese government does not have a land parcel system that delineates land by most appropriate use. Watershed-based data are available only by administrative unit, and these units only sometimes coincide with physical boundaries. Time series data for human-induced factors are lacking, and most studies have failed to separate out natural and human causes.

In mountain watersheds, energy and matter flow downwards with gravity. This has on- and off-site effects from source to sink, and watershed management has to account for these flows. In Nepal, the devastating landslide and mass wasting in the upper watersheds are usually blamed on local people overexploiting natural resources. But many catastrophes are natural events. In the Terai, floods and heavy sedimentation are partly the result of mass wasting in the hills and mountains. The overall causes are complex. Dams are also responsible for floods in lower watersheds. The accumulation of sediments in river channels, intense human pressure on riverbank areas, construction, and excavation of channels increase the risk of downstream flooding. Watersheds need to be studied to scrutinize multi-layer, multisectoral, and multi-date interactions.

POLICY DIRECTIONS AND CONSTRAINTS

Watershed management needs to consider every sector and component relating to a watershed in order to be able to plan for integrated management. Many policy documents stress the need for watershed management for poverty alleviation, environmental sustainability and nation building, but many of these documents are silent on implementation strategies.

In Nepal, watershed management is covered in seven pieces of legislation: Soil and Watershed Conservation Act, 1982; Land Act, 1964; National Parks and Wildlife Conservation Act, 1973; Environmental Protection Act, 1996; Forest Act, 1993; Water Resource Act, 1992; and Local Self-Governance Act, 1999. However, this legislative framework suffers from overlapping responsibilities, unclear jurisdiction for implementation, lack of clear-cut resource allocation for watershed management and lack of emphasis on ground-level coordination. Specifically, the Soil and Watershed Conservation Act has not been effective owing to overlapping responsibilities, lack of resources and poor coordination (Guragain et al., 2002).

The separate acts are directly related to the sectoral ministries, departments and local bodies, whereas watersheds are composite units. For example, the Local Self-Governance Act, 1999 gives the right to protect or manage local resources to local bodies (VDCs and district development committees), but other acts work through central bodies and district line agencies. This leads to overlapping of responsibilities on jurisdiction, accountability and liability.

Management strategies have usually been given in an abstract form of the theoretical point of view by watershed managers and planners. There has also been the conceptual issue of perceiving watershed problems in a subject-wise way, in terms of, for example, forestry, agriculture, land development or poverty alleviation. Management strategies have called for people’s participation, but there is a gap in understanding about the level of participation. Policy documents have failed to explain who is to gain and who could lose from participation. The interests of people living along a watershed vary, from upstream source to downstream sink vary, and implementation must:

- identify who the stakeholders are;
- make it clear whether watershed management is the responsibility of local people, stakeholders outside the watershed or central-level managers;
- specify the appropriate size of area for forming focus groups or community-based organizations; and
- specify how interboundary resource use disputes are tackled.

Another serious problem is that the Department of Soil Conservation and Watershed Management’s district offices often lack adequate resources and skilled personnel. Strategies are needed to cope with these problems with clear “do’s” and “don’ts” (Table 15.2).

TABLE 2
Do’s and don’ts of watershed management

Do	Don't
Stress positive aspects and promote win-win solutions	Use reductionist discipline-based solutions to complex problems
Help participants generate lasting success to justify political decisions	Provide unnecessary financial incentives, with hidden agendas
Adopt holistic approach to natural resource management, linking biophysical and socio-economic issues	Use excessive instrumentation to analyse water, soil and biota
Encourage the two-way flow of information	
Ensure long-term continuity	
Improve marketing systems	
Generate non-farm income	
Strengthen institutional support	
Attend to farmers' real needs	
Aim to benefit non-farmers	

Source: After Lal, 2000.

CONCLUSIONS

Maintaining environmental quality and food security is the major challenge of the twenty-first century and is directly related to watershed management. Watershed territorial units cover a large part of the world’s land area. The ultimate target of watershed management is to improve environmental quality and food security. Participatory integrated watershed management has become the accepted approach to managing watersheds.

The major challenges for adopting participatory integrated watershed management lie at the policy formulation level, in information gaps, identifying watershed parameters, integrating the various parameters and taking a holistic approach. The main problems in the legislation are overlapping responsibilities, unclear jurisdiction for implementation, lack of clear-cut resource allocation and inadequate attention paid to grassroots coordination. These problems can be overcome by clearly identifying the responsibilities of individual users, defining watershed resource stakeholders, delineating the appropriate size of watersheds to implement watershed management activities and forming community-based organizations to allow for people's participation and promote sound indigenous practices.

RECOMMENDATIONS

Watersheds have several components. The most difficult part of analysing watersheds is to combine several spatial factors to give the overall picture of the processes at work. To combine factors in this way involves rating each one. Future studies need to build consensus on how to carry out this rating. This is quite difficult and often involves subjective judgments.

The most pressing issue concerning watershed management is inconsistencies in socio-economic databases. Even single-date socio-economic databases of watersheds are not available, never mind time series information. Watershed studies collect socio-economic information only as per need at the time of a study. Such data cannot give information over time about people, as illustrated in Figure 1. Census data are only available for administrative units and not for micro-watersheds. This needs recording at the VDC level. It would greatly help if VDCs – the lowest statutory unit for census survey and local-level planning – were delineated according to watershed boundaries.

A general consensus needs to be developed by watershed managers and planners on the scale of operation, where there are clearly defined physical boundaries. All parts of a watershed may not need urgent attention. The micro-catchment development model should be adopted to solve local watershed-related problems according to the need of discrete areas.

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CHAPTER 12

DECENTRALIZED WATERSHED MANAGEMENT: EXPERIENCES FROM THE SOIL CONSERVATION AND WATERSHED MANAGEMENT COMPONENT – NEPAL

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INTRODUCTION

The Natural Resource Management Sector Assistance Programme (NARMSAP) began in February 1998 and is run under Nepal's Ministry of Forests and Soil Conservation with support from the government of Denmark. NARMSAP has five components (Table 12.1). The Soil Conservation and Watershed Management Component (SCWMC) comes under the Government of Nepal's Department of Soil Conservation and Watershed Management and is set to run until mid-2004.

TABLE 1
NARMSAP's five components

	Component	Description
1	Community and Private Forestry Component (CPFC)	Mainly training development of government staff and forest users. This component follows up on the DANIDA-supported Community Forestry Training Project (1989 to 1998)
2	Tree Improvement and Silviculture Component (TISC)	Technical backstopping to the community forestry programme to follow-up on the DANIDA-supported Tree Improvement Project (1992 to 1998)
3	Central Level (Institutional) Support Component (CLSC)	Institutional support to forestry sector institutions - mainly the ministry and departments of forests and soil conservation
4	Soil Conservation and Watershed Management Component (SCWMC)	Implementation of integrated soil conservation and watershed management programmes
5	Community Forestry Field Implementation Component (CFFIC)	Implementation of community forestry programme: taken over from World Bank support in 1999

Source: Sthapit, 2000.

The Nepal–Denmark Watershed Management Project (NDWMP, 1996 to 2001) was a pilot project implemented in Dhading, Nuwakot and Rasuwa districts. One of its main aims was to pilot participatory planning and implementation modalities. Since the project ended, its soil conservation and watershed management activities have continued to receive support under SCWMC. This paper describes SCWMC's decentralized approach to project management.

SCWMC APPROACH

SCWMC has promoted a decentralized and participatory approach to managing watersheds. It works through local groups, promotes holistic planning and has given a good degree of budget authority to these groups. The system aims to be transparent, and encourages transparency and accountability among beneficiaries and government staff.

SCWMC is supporting district soil conservation offices to implement their programmes in 24 sub-watersheds through about 700 community development groups, representing about 30 000 households and covering 1 308 km² in 20 hill districts (Including five sub-watersheds of the three NDWMP districts, and 19 sub-watersheds of 17 other districts).

Working through groups

NDWMP (1996 to 2001) went ahead by involving local people in planning, implementing and monitoring interventions. The local farmers were involved in most steps of the project cycle. Activities were targeted to groups of households and carried out mostly through community-based organizations. The project formed local user and coordination groups at the ward, micro-watershed and settlement levels. The groups formed at the micro-watershed level have proven best for integrated watershed management. The ward-level groups have eased the integration of community plans into village development committees' (VDCs') local government planning. The settlement groups have been best at implementing specific local activities.

Experience led to the project shifting its focus from micro-watershed and ward groups to settlement-level groups. The main problems of micro-watershed groups were that the common interest often did not follow micro-watershed boundaries, and these boundaries are usually not the working unit for other government line agencies. The conclusion was that the micro-watershed was not an appropriate unit for forming user groups and for inter-line agency coordination.

Many of the wards in the three project districts are made up of upper hillside and lower valley areas. The people living in these two type of area in each ward usually have differing needs. For example, people in valley bottoms want improved irrigation, while people on the ridge tops want to protect their water sources. In Rasuwa district these differing priorities led to ward groups being unable to agree on which activities to implement with their limited budgets. In addition, because of the relatively large size of these groups – about 100 households – it was difficult to bring everyone together for regular decision-making meetings. In late 2000/early 2001, the project therefore began to form settlement-wise community groups called community development groups (CDGs). These have worked well, as settlements tend to have a cultural cohesiveness and a common development interest. They have functioned well as appropriate local development units.

Group formation

Although it is best if all households within a sub-watershed join a CDG, the process is voluntary. On the other hand, the project aimed to make sure that no households were left

out because of caste, religious or other kinds of discrimination. CDGs are made up of between 20 and 50 households. The problem with very small groups is that they still need the same input from development workers, as most work is group based. However, groups that are too big can suffer from internal tensions and difficulties in following democratic decision-making. Many CDGs have been registered at their district administration offices as non-governmental organizations (NGOs). These community groups have worked well in SCWMC's soil conservation and watershed management programmes.

Budget support

A key issue has been the level of budgetary support for CDGs. NDWMP (1996 to 2001) aimed to allocate its budgets based on communities' needs. Overall budgets were planned in line with communities' agreed planned activities. This bottom-up planning approach allowed the intended beneficiaries – the communities, with assistance from field staff – to prepare and propose relatively big projects. This helped them to build up their skills so that they can approach other donors for funding.

From early 1998, the project made 50 000 Nepalese rupees (NR) (in 2003 NR74 = US\$1) available to each group, irrespective of its size. However, this led to groups splintering to form new groups that were entitled to the 50 000 rupees. This threatened community cohesiveness. Thus, from financial year 1998/1999, the project moved to allocating an amount to each group based on the number of member households. These funds, mostly for physical works and income-generating activities, are allocated for a five-year period according to the formula given in Appendix 1. This commitment from the project allows groups to plan for five years. This system avoids controversy and has worked well.

All group members have to pay an annual membership fee. The groups have developed good feelings of ownership of their programmes and there has been good local involvement in deciding how the money is spent. The guaranteed limited budgets have led to groups prioritizing their real needs.

Budget transfer

At first, CDGs were not able to carry over unspent budgeted amounts to the following year. This led to groups aiming to finish their budgets by the end of each financial year in any way that they could. The expenditure estimates they prepared were made to match exactly the amount allocated, irrespective of cost and with actual costs usually being less than the estimates. Some groups also prepared fake bills to appear to have spent all the money. This system encouraged the misuse of resources.

SCWMC learned from this, and from the beginning of 1999/2000 changed its strategy to allow unspent budgets to be carried over to the next year for years one to four. However, groups must carry out public auditing of their expenditure and must justify why the money was not spent before they are allowed to carry it over. This has led to groups making better use of their resources by not spending recklessly at the end of financial years and by aiming for cost saving so as money can go for genuine needs.

Group contributions

The amount allocated to CDGs is invariably not enough to meet a community’s development needs. Many CDGs bridge this gap by adding their own contributions of money, labour and materials. The level of contribution has varied, depending on the type of activity, number and status of the beneficiaries, location and other factors. Appendix 2 presents the complex community contribution matrix used up to fiscal year 1998/1999. The communities have since introduced their own contribution system, which is more rigid and has fixed rules.

The initial project approach was to supply resources not locally available to help mobilize internal resources for development. Thus, the project generally paid for skilled labour, transport and materials such as cement that needed to be brought in from outside. Locally available materials and unskilled labour were contributed by group members.

However, this approach resulted in a focus on building large structures that needed more expensive external inputs in order to generate more subsidies to the local community rather than simple low-cost labour-intensive structures. Partnering the poor also became more difficult as they often could not afford the fixed contributions. Figure 1 shows how low-cost structures made from local materials can provide more benefits. In this case, at Chhotetar, Kumpur sub-watershed, Dhading it was decided to build a conservation pond to collect irrigation water. However, instead of digging the pond by hand it was decided to build a raised conservation pond with stone masonry walls and concrete flooring. The cost was estimated at NR85 445, of which the project provided 80 percent and the community 20 percent. A monitoring visit in April 1999 found little water in the tank and cracks in the walls. Simply digging the pond would have been much cheaper and much less costly to maintain.

FIGURE 1
Comparing a cement tank and a mud-walled conservation pond: Kumpur sub-watershed, Dhading

Raised conservation pond with cement-stone mortar wall and concrete floor	Conservation pond with a mud wall covered with vegetation and a clay floor
<ul style="list-style-type: none"> • High cost: needs external project support to build. • Needs engineering design and technical supervision. • Needs skilled labour and construction materials (stone and sand) that may not be available locally and can be costly. Cement is major cost. • Normally single use, such as storing water for irrigation. • Maintenance involves using expensive-to-procure cement. 	<ul style="list-style-type: none"> • Low cost: made by farmers with local materials. • Needs no engineering design and supervision. • Uses unskilled labour and local materials. Normally labour-intensive, using locally available labour. • Multiple use: storing water for irrigation, fish farming, drinking, bathing for livestock, and others. • Farmers can maintain it without external assistance. • Easy maintenance as cracks seal themselves.
	

The cement pond shown in Figure 1 cost NR85 445 to build. It soon developed cracks in its wall and floor. In contrast, any cracks that form in the mud-built pond either seal themselves or are easily repaired. The low-cost mud pond is easily replicated by communities in contrast with the cement pond.

The project changed the system from 2000/2001 to allow groups to negotiate and justify any level of contributions for an initiative (SCWMC, 2003a). This led to attitudinal changes in the groups and made it easier for the project to give preferential support to poor people, according to flexible subsidy norms decided on by communities.

An important part of project staff work became convincing group members to increase their contributions. One strategy for doing this was to make groups compete with each other to carry out more activities with their limited budgets by making higher levels of contributions. Encouraging CDGs to implement more activities from their limited budgets has become a major aim of solid conservation and watershed management. This serves as an important indicator of people's interest.

Holistic planning

Project staff help CDGs to prepare community development plans. However, initially this help was inadequate, leading to plans being prepared with only a few household members who were often the local elite groups. As a result, the plans often reflected the elite groups' needs, and the needs of less well off members were ignored. SCWMC has used vision-based planning and the service, economy, environment and democratic norms (SEED) concept to encourage the more equitable spread of benefits.

Vision-based planning: The project started to use vision-based planning from fiscal year 2003/2004 (SCWMC, 2003b). This involves communities agreeing on and then trying to fulfil a development vision by carrying out a range of activities. It involves identifying needs by mapping community resources and the local social set-up. It helps communities to prepare their own plans by prioritizing and designing activities for proper resource use and sustainability. It also supports the involvement of poor and illiterate people in planning.

Vision-based planning is carried out through participatory rural appraisal exercises. For example, a community may set its development vision as becoming "a well-protected and healthy village". Having a well-protected village could be fulfilled by having a well-managed watershed. Achieving this could involve setting the specific objectives of reclaiming all local degraded lands and applying soil conservation treatments to local gullies and landslides.

The next step would thus be to identify degraded lands on a resource and social map, list measures for reclaiming these lands, and then prioritize the measures and areas for reclamation. Gullies needing treatment would be identified by mapping them, listing the measures for treating them, and deciding which gullies needed treating first.

Fulfilling the healthy village vision would involve all households having access to safe drinking-water and the use of a latrine. To identify the activities needed to provide safe and accessible drinking-water for all households could involve:

- mapping all houses on the resource and social map;
- identifying households that do not have easy access to safe drinking-water;
- assessing all potential water sources;
- listing water source protection measures; and
- prioritizing water source protection measures.

The same exercise would then be carried out to identify the households without access to a latrine. The group, assisted by development staff, can then draw up a list of the activities needed to fulfil the community's vision. The group then has to identify the resources needed to carry out the work, and consider their availability.

This holistic-type planning helps communities to understand their needs, irrespective of caste, religion or wealth. It also helps them to seek assistance from different development agencies, and mobilize and manage local resources.

SEED: Alongside the vision-based planning component, field staff have also introduced the SEED concept to help in local planning. Balanced development should have the four dimensions of service, economy, environment and democratic norms (SEED); (LDTA, 1997). In rural Nepal, the main services are roads and drinking-water, communication, education, health and irrigation systems. The main economic activities are agriculture and cottage industries, and the main environmental activities are forestry, soil conservation and hygiene. Ideally, communities should prioritize activities that can provide services, promote production, protect the environment and promote democratic norms. For sustainability, activities need to be included in packages of measures.

When deciding whether to invest in watershed management activities, a community should analyse the benefits that will accrue and follow social and democratic norms to design the activity by considering all four aspects of SEED. Land-use and erosion control works will protect the environment; building intakes, piping and taps will provide drinking-water; and building ponds will collect water for vegetable farming, thus benefiting the local economy. This makes for a complete package that attends to all four aspects of SEED (Sthapit, 2001).

Accountability and transparency

The component aims to decentralize resource control. This has encouraged community accountability and transparency and had led to community members developing feelings of ownership and responsibility for their programmes. This has reduced the misuse of funds. Many executive members who joined up expecting personal benefits have handed over their positions on committees to more development- and service-oriented people.

SCWMC allows no expenditure of CDG money without authorized people signing bills or vouchers. It assigns budget accountability to the CDGs, and the responsibility for local auditing to the target communities themselves. The component demands that CDG members approve expenditure before the final payment for any activity can be made. Project policy is to cut off funding where misuse is proven until any misused money is recovered. Similarly, to carry over unspent money to the next year involves CDGs holding a general assembly to endorse that year's expenditure records.

RECOMMENDATIONS

System replication

The SCWMC programme has been directly funded by the Danish International Development Agency (DANIDA). The decentralization of budgetary responsibilities is a new venture that demands a process- rather than a target-oriented approach. Replication by government line agencies would need the government to change radically the way its district line agency offices deal with their budgets, especially for budget accountability and carrying over unspent budgets to the following year. This would involve revising programme budgets at the beginning of each new fiscal year to adjust for the carried over amounts. The existing government system for the justified revision of programme budgets is a lengthy and cumbersome process.

It is recommended that budgetary control for local development initiatives is handed over to communities, and community-level planning is adopted as widely as possible. The main need is to convince policy-makers of the benefits of this.

Quality and scope

Communities take the lead in implementing activities. However, lack of timely and adequate technical backstopping from field staff and lack of expertise of community members have often led to poor quality control. This has also been caused by communities trying to implement more work from their budgets by compromising on quality. The component has not acted against community groups for carrying out below standard work.

The new package approach has reduced resource constraints. However, communities want to fulfil the service rather than the environment aspects. This will threaten sustainability in the long run. In addition, since the project decentralized resources, communities have been pressuring field staff to allow them to direct resources away from soil conservation and watershed management to building schools, water supply and irrigation canals – things beyond the scope of the programme.

It is recommended that quality control be improved through building awareness about the consequences of poor-quality work, and that facilitation and technical backstopping be improved.

Administration

Community groups have to account for all their expenditure by presenting proofs to the district soil conservation offices before they can receive their next payments. The project has provided record keeping and accounting training, but many groups, especially those that lack literate people, find it difficult to keep records.

It is recommended that only literate group members are appointed as treasurers. If this is not possible, accountants need to be hired. Line agencies also need to give more support to CDGs on record keeping.

Service attitude

A team of one female motivator and one mid-level technician (ranger, junior technician or overseer) is assigned to provide social mobilization and technical backstopping for every 300 to 400 households. These teams have developed more service-oriented attitudes, but have mostly still not been following a full participatory approach. However, understanding that communities have the right to demand services, while field staff have the duty to provide them, is increasing among communities.

It is recommended that field staff movements and service calendars be made public so that communities are able to monitor how well field staff carry out their duties. In addition, evaluating field staff's performance will make them adopt a more service-oriented attitude.

Group sustainability

A major issue to consider is whether or not groups continue to receive support from the government line agencies that promoted their formation. The problem is that each agency forms its own subject-specific groups, meaning that groups tend to fold once agency support is phased out. This is one of the biggest constraints to group sustainability.

At the end of fiscal year 2002/2003, SCWMC phased out support to about 182 CDGs. Support to a further 317 groups will be phased out at end 2003/2004. Although the less active CDGs are likely to fold; the more active ones are realizing that they need to join with other groups to survive and be active. Some CDGs are refusing to form new groups to implement activities for other line agencies and are pushing for these agencies to work through existing CDG structures.

The difference between CDGs and user groups such as community forestry and irrigation user groups is that CDGs are formed to cover all aspects of development whereas user groups relate to a particular resource and only include users of that resource.

This paper recommends that local people are divided into groups made up of several households based on common interests and physiography and be given a neutral name (such as community development groups) to make it possible for different line agencies to use them. This name is more suitable than subject-specific names such as "mothers' group" or "soil conservation group". Local people should decide on group membership. Such groups should be registered under the Local Self-Governance Act, 1999 on the recommendation of VDCs to give them a legal status.

It is also recommended that the Local Self-Governance Act is amended to empower VDCs and district development committees (DDCs) to make all development agencies use such groups to implement development activities. Getting wards, VDCs and DDCs to channel all local development works through CDGs would also create a continuous institutional linkage and ensure that these groups continue even after a line agency ends its development support. This would enable the more integrated implementation of all kinds of development.

Coordination

Watershed management demands coordinated support from different line agencies. However, the differing policies of line agencies and their lack of coordination often make it difficult to coordinate efforts and services to community groups. SCWMC conducts twice-yearly district- and field-level workshops to coordinate line agencies' support to CDGs.

District technical group workshops are held to bring together district line agency chiefs. These workshops give them the chance to work out how they can integrate their support to CDGs. Participants come from district forest, agriculture, livestock, drinking-water, irrigation, cottage industry, women's development and local development offices. District administration office, CDG representatives and representatives from the local agricultural development bank and police also sometimes attend. DDC chairpersons lead the meetings, with district soil conservation officers acting as secretaries. They usually take place twice a year, with the first at the beginning of the fiscal year to review and plan the support to communities and the second at mid-year to allow community input into line agencies' district plans (SCWMC, 2003a).

Field technical group workshops are also held twice a year for field- and VDC-level line agency technicians. At these fora, field staff from different line agencies work out how to deliver integrated support to CDGs. These meetings are usually held by VDCs, with VDC chairpersons leading them and district soil conservation officers or field-level soil conservation technicians as secretaries. The main objective is to facilitate field-level line agency support to CDGs.

It is recommended that development resources (mainly money) from all sources are channelled through grassroots organizations to promote holistic development. This would promote coordination among different service providers including government and non-governmental agencies and private enterprises. A major problem remains that the district and field technical groups lack any legal basis.

CONCLUSION

Decentralization is crucial to developing community ownership and accountability for development programmes. More grassroots development resources and responsibilities need to be handed over to community groups. Decentralization is the only sustainable strategy for watershed management in countries such as Nepal.

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APPENDIX 1: COMMUNITY DEVELOPMENT GROUP BUDGET ALLOCATION

SCWMC supports CDGs for five years with one year of start-up, three years of implementation and one year of phasing-out, as shown in the following tables (SCWMC, 2003a; 2003b). Transportation costs to the road head are also covered and are payable at the rate of NR50 per household in the first and fifth years, and NR100 in the other three years.

Budget allocation calculations for CDGs per household

"Walking days" and distance from road head													
Days	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Distance in km	≤ 3	3-9	9-15	5- 21	21-27	27-33	33-39	39-45	45-51	51-57	57-63	63-69	69-75
Physical budget, including all transport cost (NR)													
Year 1	550	575	600	625	650	675	700	725	750	775	800	825	850
Year 2	1 100	1 150	1 200	1 250	1 300	1 350	1 400	1 450	1 500	1 550	1 600	1 650	1 700
Year 3	1 100	1 150	1 200	1 250	1 300	1 350	1 400	1 450	1 500	1 550	1 600	1 650	1 700
Year 4	1 100	1 150	1 200	1 250	1 300	1 350	1 400	1 450	1 500	1 550	1 600	1 650	1 700
Year 5	550	575	600	625	650	675	700	725	750	775	800	825	850
Total	4 400	4 600	4 800	5 000	5 200	5 400	5 600	5 800	6 000	6 200	6 400	6 600	6 800

Example: In year 3, a group that lies one day’s walk from the road head gets NR1 300 per household for two days, including one day’s on-road transportation costs (NR100) and one day’s off-road transportation cost. This group has 35 households and therefore its total due physical budget for programme year 3 is NR1 300 x 35 = NR45 500.

Income-generating activities budget ceiling for CDGs

Budget allocation per household (NR)				
Year 1	Year 2	Year 3	Year 4	Year 5
200	300	600	600	300

Example: In year 3, a CDG of 35 households gets NR600x35=NR21 000.

APPENDIX 2: COMMUNITY CONTRIBUTIONS MATRIX (FINANCIAL YEAR 1998/99)

Type of activity	Material		Transport	Labour		Technical advice
	Locally available*	Needs procuring		Unskilled	Skilled	
Land productivity						
On-farm conservation	●	+	●	●	+	■
Conservation pond	●	■	+	●	+	■
Fruit tree plantation	●	+	●	●	●	■
Grass plantation	●	■	●	●	+	■
Nursery	●	+	●	●	●	■
Natural hazard prevention (including: gully treatment, landslide treatment, torrent control, stream bank protection, degraded land rehabilitation)	+	■	+	+	■	■
Development infrastructure protection						
Irrigation channel protection	●	+	+	●	+	■
Trail protection	+	+	+	+	■	■
Road slope stabilization	+	+	+	+	■	■
Water source protection	●	■	+	●	■	■
Shelter belt/green-belt/buffer strip	+	■	+	+	■	■
Community soil conservation extension demonstrations						
Community	+	■	+	+	■	■
Private	●	+	+	●	+	■

Key:

Notes: *Stone, sand, soil, timber, bamboo, seed, planting material and other resources can be procured locally, paying only labour cost and, in some cases, a nominal royalty.

● Communities contribute 100 percent.

+ Contribution negotiable.

■ Project provides and pays for almost everything.

CHAPTER 13

SUCCESSFUL WATERSHED MANAGEMENT: A NEPALESE VILLAGE CASE STUDY

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INTRODUCTION

About two-thirds of the world's degraded land is in Asia and Africa, where most of the world's poor live. Of this, about 9 million ha are so badly damaged that they have lost nearly all their biological functions and are unlikely to be restored to productivity. Some 300 million ha need restoring; something that is beyond the capacity of most developing nations.

Land degradation is a serious threat in the Himalayan ecosystem. Of India's 226 million ha of land with biological potential, 90 million ha are very badly degraded and are no longer productive owing to denudation, waterlogging, salinization and other factors. There is growing awareness of the need to ensure the ecological security of the Himalayas in order to protect the livelihood security of local people and the millions who live downstream. India and Pakistan's main grain growing area – the Indo-Gangetic plains – is irrigated with water from the Himalayas.

It is crucial for the sustainable development of the Himalayan region that the economy of hill farmers is improved. Cropping and farming systems need to be made more economically viable, in balance with local environments. Growing demands for food and fodder have led to agricultural cultivation extending to marginal lands. The soils in these areas are often shallow and nutrient-deficient. The lack of irrigation facilities also leads to low productivity. This has led to increasing soil erosion and low productivity on the numerous small hill farms. Poor socio-economic conditions and small and scattered holdings make it difficult to practise commercial agriculture.

INTEGRATED WATERSHED DEVELOPMENT PROJECT

Objectives

The Integrated Watershed Development Project (Hills-II) started in April 1999 and is due to end in March 2005. It has a budget of US\$24.4 million and is being run by experts from different line departments. It is World Bank-funded and operates in Haryana, Jammu and Kashmir, Punjab, Himachal Pradesh and Uttaranchal.

One of its working areas lies in northeast Haryana in the most degraded watersheds of the Siwalik hills and their adjoining piedmont plains. The Indo-Gangetic plains lie to the south. The project area has been identified as one of India's eight most degraded rainfed agro-ecosystems. The project

area extends to 70 472 ha, covering 219 villages in the districts of Panchkula, Ambala and Yamuna Nagar.

The geology of this area is mostly unconsolidated sedimentary clays, sandstones and conglomerates. These are very fragile and form steep slopes. The project area has an annual average rainfall of about 1 200 mm, with 80 percent falling during the monsoon. The area experiences extreme climatic conditions with temperatures ranging from -5°C in the winter to over 40°C in the summer.

Much of the project area covers *kandi* lands. *Kandi* is the local term for the strip of undulating land that lies between the Siwalik hills and the alluvial plains. These areas are severely dissected by creeks (*choes*). They have high rainfall, high levels of runoff and deep water tables. They are covered in scrub forest that provides low-grade grazing for cattle. These areas suffer from drought for much of the year, and the people who live there are economically very poor.

The project is working to improve the productive potential of these areas using watershed treatment technologies and participatory community action. It aims to decrease soil erosion, increase water availability and alleviate poverty in the contiguous areas of the Siwalik hills. Its main strategy for promoting project sustainability is local people's participation.

In the project area, decreasing vegetative cover and severe soil erosion cause severe water, fodder and fuelwood shortages. Reversing natural resource degradation is the key to promoting rural development in these areas. The project aims to benefit the more marginalized and vulnerable groups who rely on natural resources for their subsistence. It involves all stakeholders in project planning and implementation and aims to build up the capacity of communities to take responsibility for maintaining the assets created under the project. The strategy is to link community-based organizations to the panchayati raj local government institutions to take joint responsibility for these assets.

Project components

The project is being implemented through stakeholder participation and by promoting a number of mechanical and vegetative measures for watershed development and protection, improved livestock management, rural road rehabilitation and institutional strengthening. The two major components of the project are institutional strengthening and watershed development and protection.

The institutional strengthening component supports stakeholders in planning, implementing and maintaining measures that improve their watersheds. It is also working to strengthen the research, extension and training functions of project implementing agencies. The watershed development and protection component encourages local people to adopt vegetative technologies and to build mechanical structures. These are chiefly:

- on arable land: building contour vegetative barriers; repairing terraces; planting vegetative field boundaries; promoting silvipasture, farm forestry and on-farm fodder production; and setting up rainfed horticulture cropping system demonstrations; and
- on private non-arable land: building vegetative and shrub barriers in contour trenches on common and forest land; developing pastureland; promoting silvipasture, afforestation,

- drainage line treatment and gully stabilization; protecting stream banks; building water harvesting structures and village ponds; controlling roadside erosion; and treating landslides;
- other activities: livestock and animal husbandry improvement, and rural infrastructure development.

CASE STUDY OF THATHAR VILLAGE

The contributions of IWDP (Hills-II) can be seen by looking at how the project helped to transform the socio-economically poor village of Thathar. This village is in Dangri sub-watershed, which is one of the five sub-watersheds where the project works. It lies 60 km from the state capital of Chandigarh.

Situation of Thathar

When the case study was carried out the village of Thathar had:

- a population of 277 in 69 households, with 53 Gujjars (graziers) and 16 scheduled caste (so-called low caste) households;
- 14 of the scheduled caste households owned less than 1 ha of land, while 33 of the Gujjar households owned more than 1 ha;
- 468 livestock, including 229 cows, 86 buffaloes and 95 goats;
- 259.6 ha of village land, of which 39.6 ha was cultivable and only 1.5 ha was irrigated cropping land; and
- 220 ha of uncultivable land, of which 180 ha was forest land, 20 ha in stream beds, 2 ha common grazing land, 2 ha under habitation and 16 ha barren land.

The local people relied for their livelihoods on agriculture, livestock rearing and seasonal day labouring in the reserved forests or for public works departments far from the village. The only public amenity in the village was a middle school. There was no road, health centre, bank or market. The nearest health care centre is 6 km away and the nearest veterinary care centre 15 km away. The village's water supply came from a neighbouring village. It was erratic during the dry season, and during monsoon time flash floods and landslides often cut the supply off.

In Thathar, 51 percent of males and 23 percent of females were educated. This relatively high figure is due to there being a middle school in the village. However, children attended school irregularly, as most sons were taken to assist their fathers in herding the cattle far away while daughters had to help their mothers collect fuel and water when the men were away.

Participatory rural appraisal

Phase 2 of IWDP (Hills) started in April 1999. After an initial training camp on participatory rural appraisal techniques for field staff, a team of forestry, horticulture, agriculture and animal husbandry technicians and institutional development experts carried out a participatory rural appraisal of the village.

Resource mapping found that villagers brought 60 percent of their fuel from the local forests, with the 40 percent balance coming from cow dung and crop residues. Ninety percent of livestock fodder came from the forest and 10 percent from farmland. It was also found that the average yield of a cow was only 1 to 1.5 litres of milk, and 2 to 3 litres for a buffalo. For five to six months of each year, the village men took their cattle to graze the wet areas of Satluj in the Punjab owing to local shortages of water and fodder.

The team helped local people to draw up their annual agricultural calendar of activities (Table 1). They also mapped out the hour-wise daily engagement of men and women and the monthly and source-wise availability of fodder. It was recorded that *Syzygium cumini*, *Toona ciliata* and *Emblica officinalis* were the most useful forest trees, while *Emblica officinalis*, *Mangifera indica*, *Citrus* sp. and *Carissa opeca* were the villagers’ preferred fruit trees.

It was found that the first provision of any kind of important facility to this remote village had been the setting up of a primary school in 1986. It was upgraded to a middle school in 1995. The only two other developments were the 1989 fitting of a drinking-water supply system and the 1996 fitting of solar lighting.

The PRA exercise found that the preferred income-generating activities for women were “stitching”, carpet weaving, rope-making and plant nursery work.

TABLE 1
Village agricultural calendar

January	Labouring work, collecting fodder from forests and fields
February	Migrating with cattle and labouring work
March	Harvesting grain and collecting hay and wheat straw
April	Harvesting and threshing wheat and gram
May	Labouring work
June	Tilling fields and repairing bunds
July	Maize and sorghum sowing
August	Weeding
September	Harvesting kharif crop
October	Thrashing harvest, labouring and arranging fodder
November	Sowing wheat and other crops, labouring
December	Fodder and fuel collection

The villagers reported that their main problems were:

- lack of accessibility to the outside;
- lack of irrigation water;
- soil erosion;

- scarcity of fodder and fuel;
- unemployment;
- lack of health facilities.

The other problems were poor crop and milk yields, livestock health problems, low-quality fruit plants, lack of higher education facilities, lantana and parthenium weed infestation, and lack of drinking-water for livestock.

The participatory appraisal made every effort to understand local people's problems and encourage them to identify solutions. The information was compiled into a village development plan and reviewed by the villagers before being finalized.

A village development committee (VDC) was formed with membership of one male and one female from every household, on payment of a 10 rupees fee for each. An executive committee was elected, and the VDC was registered with the Registrar of Societies. A scheduled caste person was elected as pradhan (president). There already existed a local forest management group called the Hill Resource Management Society (HRMS). However, the project had to form a new group, as HRMS included people from other villages.

The VDC signed a Memorandum of Understanding with the project to address the Thathar villagers' main two priorities of connectivity and water for irrigation. This laid out how work would be carried out by the VDC, and the details of cost-sharing and how the new structures would be maintained.

Project works

Shortly after the work started, benefits began to emerge. A water source was located and a sub-surface dam built. The villagers carried galvanized piping from the nearest road-head to build the new irrigation system. The resulting supply of irrigation water brought major changes to local people's economic conditions and lifestyles.

The VDC set about building a 1.5-km long bridle path by widening the existing footpath. The village is now accessible by jeep almost all year round. This widened the scope for development, as farmers can sell their surplus grain and vegetables, while households with less land have easier access to labouring jobs.

Local people also established 23 ha of tree plantations and installed structures to stabilize gullies, including crate wire and dry stone masonry structures reinforced by vegetation. Water was piped from another natural spring and is now irrigating about 16 ha of land belonging to 16 households. These households have formed a water users group.

All farmers grew vegetables during 2001/2002. The main crops grown during the monsoon (*kharif*) are maize, paddy and sorghum and during the winter rabi season, wheat mustard, vegetables and *berseem*. Off-season vegetables tomato and chilli are also now being grown. Other vegetables grown are onion, turmeric, ginger, arbi, *bhindi*, *brinjal* and cauliflower. In 2002/2003 about 3 tonnes of vegetables were sold. All of these vegetables were introduced by

the project. Farmers have also planted 475 fruit trees, mainly mango, guava and lemon. Livestock care is being provided by regular visits from project technicians.

Unlike previous similar initiatives, the project's tailoring programmes focused on teaching local people how to make clothes by hand. Other initiatives had given out sewing machines. These had been very popular, but people had been attracted to the scheme in order to obtain the machines rather than to learn about making clothes.

CASE STUDY LESSONS

Prior to the project starting work, the village suffered a from severe water scarcity, reducing green cover and increasing soil erosion. Shortages of water and fodder meant that during the dry season the men had to graze their cattle in faraway areas.

The project's interventions were welcomed by local people, who took ownership of them through the participatory approach. They donated their labour and held monthly meetings, contributed to a village fund, worked on resolving conflicts and set up women's self-help groups. This resurgence of the village led to people's proper representation in the executive body of the VDC and the appointment of a scheduled caste person as village president. This project has reached the poorest of the poor in a very remote village.

The main environmental benefits of the project have been:

- the rehabilitation of large areas of land;
- improved stream water availability in drier periods;
- more farmyard manure available owing to adoption of stall-feeding; and
- improved availability of fuelwood and water means that old men, women and girls have to spend less time carrying out arduous collection tasks.

The socio-economic status of the village has dramatically improved in many ways, with women's household work reduced by their easier access to water, fuel and fodder; increased employment at home; and improved diets. There have also been many significant indirect benefits with:

- women's increased skills and earning capacity improving their status in the eyes of men – as a result they now participate more in village decision-making;
- families finding it easier to find good marriage partners for their children;
- improved incomes increasing local people's credit-worthiness;
- the status of the VDC pradhan has increased, and government officials now take more notice of him;
- villagers improving their ability to plan, design and implement;
- increased confidence of villagers and increased spirit of competition within the village and with neighbouring villages;
- improved technical and local knowledge about low-cost soil conservation, drainage and water harvesting techniques; and
- transparency, accountability and participatory monitoring and learning have taken root in villager's attitudes.

Outsiders have also benefited. For example, the improved availability of fodder and water has meant that villagers no longer take their cattle to the Punjab each year – therefore reducing grazing pressure on the area in the Punjab.

Some of the project works have however had disadvantageous effects. An increased indiscriminate use of pesticides accompanied the move to growing more vegetables, and the move to growing more paddy rice has meant less fodder, as paddy straw does not make good fodder.

Of all the lessons from the project's experiences in Thathar village, probably the major one is the importance of good leadership. The election of a member from the low-status scheduled caste part of the community encouraged scheduled caste people to become involved. This has been found elsewhere where such a leader causes other members of his/her caste group to participate as, for example, in Singhwala village, Markanda watershed.

The following are other lessons learned:

- Participatory rural appraisal is a good tool to identify community needs and get people's commitment to share costs in the form of labour. Planning and working together in this way means that assets created under the project are more likely to be well maintained.
- It is better to have one institution per village. For better maintenance, user groups should be promoted.
- Skill development is more important than distributing machines or goods.

CHAPTER 14

EVOLUTION OF WATERSHED MANAGEMENT: THE SRI LANKAN EXPERIENCE

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INTRODUCTION

There is evidence that sound watershed management practices existed in Sri Lanka before the colonial period, which began in the early 1800s. The central hills, from where all Sri Lanka's major rivers originate, were under natural forest cover while the valleys were under agricultural production watered by an intricate system of irrigation reservoirs and canals. The degradation of watershed resources began with the large-scale clearing of the central highlands for plantation crops in the latter part of the nineteenth century. Removal of forest cover and the associated soil erosion were the main problems identified by scientists as far back as 1873 (Government of Ceylon, 1931).

In 1927, the director of agriculture's annual report drew attention to the need to check soil erosion. A few years later, a committee on soil erosion documented the damage caused by plantation crops. The government began to address the problem by introducing the Land Development Ordinance in 1935, which aimed to prevent soil erosion and protect stream sources. A Soil Conservation Act was introduced in 1951.

Until the late 1970s, the government was primarily concerned with controlling soil erosion and relied heavily on regulatory measures to achieve this, along with some limited soil erosion control activities. Around this time it realized that this approach was failing to control soil erosion. The pressure of escalating and competing demands on the land, and the resultant degradation made it imperative to shift the focus from controlling soil erosion to the larger issue of environmental protection and management. This led to the development of more comprehensive, watershed-based action programmes.

WATERSHED MANAGEMENT PROJECTS

The late 1970s saw the first holistic, broad-based watershed management projects in Sri Lanka. The first projects were mainly sectoral based, and were owned and implemented by State institutions. Since then there has been a change over to more participatory, people-driven and implemented projects (Table 1). Another important focus of many projects has been to build up the capacity of institutions involved in watershed management.

State-owned projects

Sri Lanka's first watershed management project – the Watershed Management Project – was established in the Upper Mahaweli Watershed in the central hills of Sri Lanka in 1976. It was set up in response to the problems caused by the gradual expansion of non-plantation agriculture and the implementation of the Mahaweli Development Programme. This programme carried out multipurpose development of the country's largest river, the Mahaweli Ganga, to provide electricity from hydropower and to open up and develop irrigated land in Sri Lanka's dry zone. The Land and Water Use Division of the government's Department of Agriculture implemented this project with assistance from FAO. The main objective was to study the impacts of differing land uses on soil erosion and rainwater runoff. Since then, many watershed management projects have been undertaken in different parts of the country (Table 14.1). The United States Agency for International Development (USAID)-supported Reforestation and Watershed Management Project ran from 1980 to 1988.

The first watershed management projects were directly implemented with the State's institutions carrying out almost all planning, implementation and monitoring functions. An important part of these initial projects was developing institutional capacity by supporting the post-graduate training of high-level officials. The establishment of experimental watersheds in the Watershed Management Project provided crucial baseline information. The only involvement of local people was as labourers to carry out project works.

These interventions were unclear about who the beneficiaries were. The implementing agencies focused on achieving the project's physical targets and there was hardly any benefit monitoring or evaluation.

Integrated project

The German Agency for Technical Cooperation's (GTZ's) Upper Mahaweli Watershed Management Project took a number of new initiatives (GTZ, 1998). The setting up of user communities to run project activities was one of the project's main features. Activities included establishing sloping agricultural land technology (SALT) and promoting income generation by integrating crop and livestock farming. The project's benefits went directly to farmers. This project also tried to win the support of line agencies to coordinate its activities. The Government of the United Kingdom-funded Forestry/Land Use Mapping Project supported the GTZ project by providing with information.

The limited involvement of communities in project planning and execution and the limited spread of benefits were the major drawbacks of State-owned and integrated projects. It was realized that the State alone could not manage and protect land, water and forest resources. Subsequent projects were designed to be more people-friendly.

Projects to empower farmers

The projects launched in the early 1990s were based on working in partnership with farmers. The participation of local land users was built into watershed management projects. The need to take a more participatory approach to planning, executing and monitoring projects was

TABLE 1

Selected watershed management projects in Sri Lanka 1975 to 2003

	Project and donor	Implementer	Duration	Project activities/components/outputs
State-owned projects	Watershed Management Project (FAO/UNDP)	Department of Agriculture	1975–1981	Two experimental watersheds set up and monitored to find effect of land use on runoff and soil erosion. Staff training for M.Sc. in UK
	Reforestation and Watershed Management Project (USAID)	Forest Department	1980–1988	Established 10 000 ha of pine plantation in upper watershed areas Set up 4 micro-watersheds to find effect of pines on runoff and soil erosion Staff training for M.Sc. in USA
Participatory and institution building projects	Upper Mahaweli Watershed Project (GTZ)	Mahaweli Authority of Sri Lanka	1987–1996	Promoted sloping agricultural land technology (SALT) Promoted crop–livestock integration for income generation Farmer training Coordination with 25 other agencies
	Forestry/Land Use Mapping Project (ODA)	Mahaweli Authority of Sri Lanka	1989–1998	Developed capabilities (GIS, databases, etc.) to provide information for planning and managing watersheds Monitored sedimentation of 4 large reservoirs in upper watersheds
Integrated watershed management projects	Participatory Forestry Project (AsDB)	Forest Department	1993–2002	Empowered users State provided policy, legislation, credit and extension support Land given to farmers on long-term leases Annual and tree benefits directly to farmers
	Shared Control of Resources (SCOR) Project (USAID)	IWMI	1993–1998	Increased user control over natural resources through State–user partnerships Created farmer companies
	Swedish Co-operative Centre's Project (SCC)	Department of Co-operatives (National Cooperative Council)	1995–1997	Provided services such as soil testing, input supply and marketing to farmer groups Trained farmers Independent NGO was formed after project period to continue activities
	Environmental Action 1 Project, Pilot Land Management Project (World Bank)	Ministry of Environment	1997–2000	Micro-watersheds selected to pilot test appropriate techniques and treatments for rehabilitating degraded land through community participation Implementing agencies worked with villagers to prepare and implement micro-catchment plans
	Upper Watershed Management Project (AsDB)	Ministry of Environment	1998 on going	On- and off-farm soil conservation Forest gardens and buffer zone planting Relocating farmers from environmentally sensitive areas Giving landowners titles to their land Drafted National Policy on Watershed Management

recognized. Another important aspect was to promote the spread of benefits over a large number of people to help alleviate rural poverty.

The Asian Development Bank (AsDB)-funded Participatory Forestry Project promoted the participation of local communities in forestry development. Its objectives were to:

reduce poverty and rehabilitate environmentally degraded areas by promoting tree planting by rural communities; and
strengthen the institutional capacity of the forest department to expand its programmes for planting non-forest trees; carrying out non-farm research, extension and education; and developing the capacity of rural people to run village tree nurseries.

This project began in 1993 and took an innovative approach. It promoted participatory reforestation by setting up a cadre of volunteer motivators to motivate farmers to plant trees. It gave incentives for reforestation on private holdings and State lands and trained local people in seedling production so that they could grow trees for private sale once the project finished. The success of this project was shown by its target increasing from an initial 15 000 ha of trees planted in 1993 up to 46 000 ha in 1998, with an actual achievement at the end of 2002 of 52 782 ha (Sathurusinghe, 2003). However, it would be difficult to replicate the successes of this project in the non-forestry sector because of the greater complexity of the issues and the larger number of institutions involved.

Institution building projects

The Shared Control of Resources (SCOR) project was implemented by the International Water Management Institute (IWMI) from 1993 to 1998. It aimed to improve the productivity of land and water resources by piloting institutional mechanisms for sharing the management of watershed resources. These mechanisms included setting up resource user groups at the grassroots level. These were grouped together to form resource organizations, which were in turn grouped to form resource user councils. Farmer companies were set up to work as independent businesses. The farmer companies that emerged have continued and have mostly been successful. However, the project's mid-level institutions – its resource user groups, resource user organizations and resource user councils – have “failed” (Jinapala, Merry and Somaratna, 2000). An important lesson from this has been that the long-term sustainability and impact of new technologies and new production and conservation practices rely largely on having effective institutional arrangements.

The Swedish Cooperative Centre's project was implemented in four watersheds in two districts from 1995 to 1997. It also attempted to develop local institutional mechanisms by organizing farming communities to cooperate and take collective action (Gibbon *et al.*, 1998). A key part of the project was its intensive training programmes. An independent NGO was formed to continue the project's activities after it finished.

However, the Participatory Forestry Project's farmer companies and the Swedish project's NGOs have found it difficult to keep up their work. This has been one of the main failures in watershed management projects.

UPPER WATERSHED MANAGEMENT PROJECT

The evolution of the approach taken by watershed management projects from earlier projects to the present day is shown in Table 2. The Upper Watershed Management Project (UWMP) is being implemented by the Ministry of Environment and Forestry with the assistance of AsDB. It is taking most of the current approaches to watershed management. It began in 1999 to address forest and land degradation problems in four critical watersheds by promoting the conservation, upgrading and use of natural resources; improving farmers' economic and social conditions; and strengthening institutions.

TABLE 2
Past and present approaches of watershed management projects

Previous approach	Present approach
Unisectoral with no need for coordination	Multisectoral with much coordination
State-owned	State- and user-owned
Implemented by paid State employees	Implemented by users, NGOs and the State
Capacity building of State employees	Capacity building of beneficiaries and State employees
Beneficiaries are not clear	Beneficiaries are known
No involvement of users	Involvement of users at planning, implementation and monitoring stages
Gender concerns not included	Gender concerns included
Cost recovery is not a concern	Emphasis on income generation and cost recovery
Hierarchical governance	Distributed and market-led governance

The project's design takes into account the lessons learned from previous projects. It is promoting participatory processes for integrated watershed management (Sharma *et al.*, 1997). The project is strengthening the institutions involved in watershed management by improving knowledge and skills, introducing improved techniques for sustainable resource use, introducing novel tenure arrangements and improving coordination and linkages. The aim is to have sound institutional arrangements and technically strengthened institutions.

The training of farmers in conservation, production and entrepreneurial skills was supposed to be a major UWMP activity. It was intended to be packaged in ways that would help to develop local institutions. However, four years after the project began, this training component has yet to get going. It is hoped that the new national watershed management policy will enable the setting up of an appropriate institutional mechanism for watershed management in Sri Lanka.

NATIONAL WATERSHED MANAGEMENT POLICY

UWMP produced a penultimate draft of the National Watershed Management Policy in 2003. The project is seeking comments on it, although it is likely to be accepted without any major changes, as its drafting involved extensive consultations. Its major objectives are to:

- conserve, protect, rehabilitate, use sustainably and manage watersheds, while maintaining their environmental characteristics, with people's involvement;
- justify the continued provision of funds in the national budget for sustainable watershed management by evaluating the services provided by watersheds, and
- coordinate and monitor all activities in watershed areas, and secure a system of integrated watershed management.

To achieve these, policies have been formulated for: a) conservation and protection; b) watershed management; c) watershed management investment; and d) coordination and integrated management. The policies on coordination and integrated management include:

- coordinating the activities of all agencies at the rural, divisional, district, provincial and national levels through watershed management committees that include representatives of rural committees and officers of the government institutions;
- establishing watershed management units under chief provincial secretaries;
- eliminating policy gaps in managing natural resources in relation to watershed management in order to bring all related sectors closer to each other; and
- giving watershed management its due place in the national educational curricula.

Of these four, it will be the first coordination policy one that will provide the most challenges to take forwards.

CONCLUSIONS

Over the past three decades, watershed management projects in Sri Lanka have evolved to become much more people-friendly. One of their main failures has been their inability to set up a sound institutional mechanism to sustain project activities after a project ends. The success of watershed management crucially depends on having an effective hierarchical institutional set-up from the rural to the national level. The performance of the proposed watershed management committees remains to be seen, as this policy is against the government's overall policy of reducing government by not setting up new public institutions.

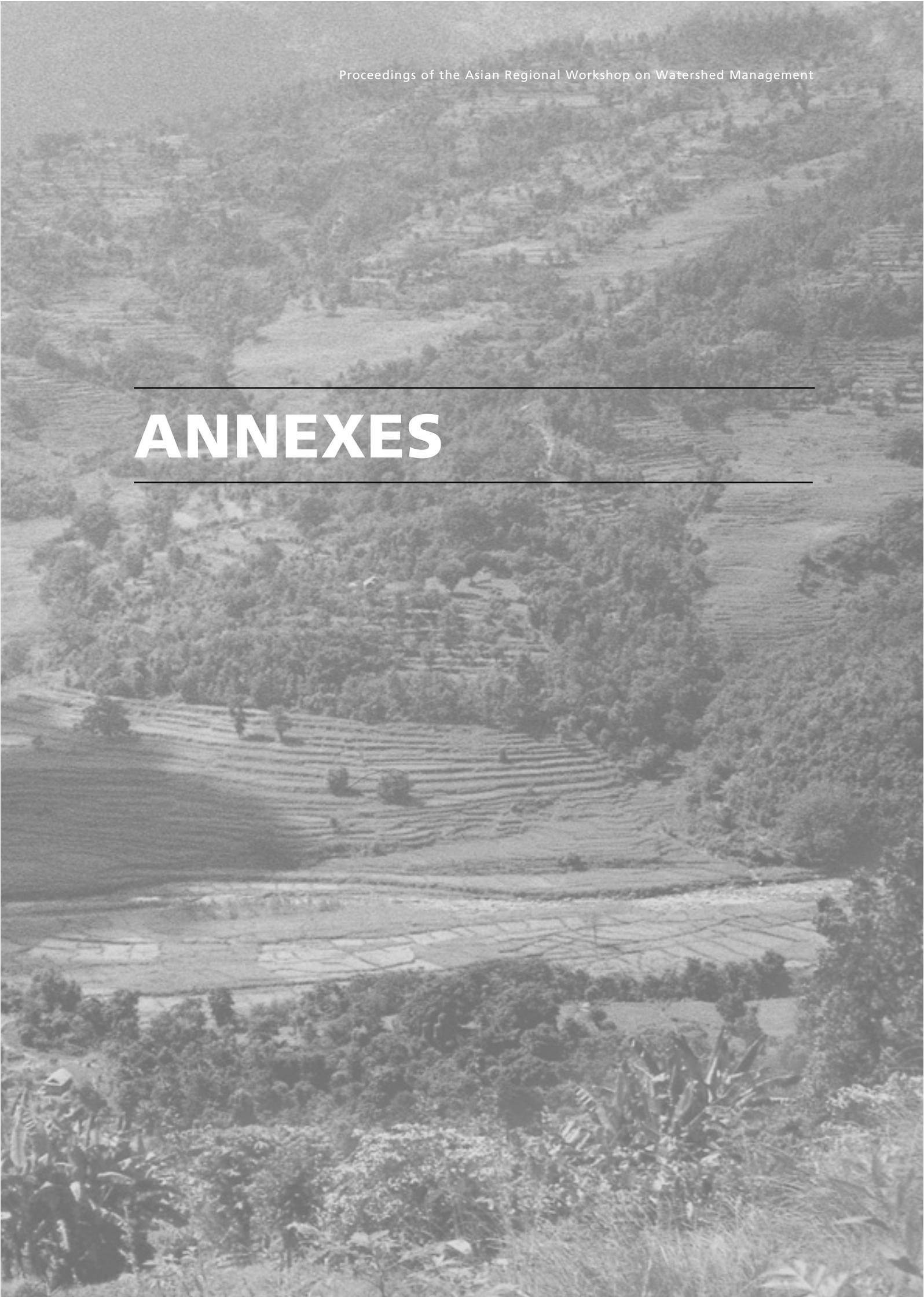
It seems it would be best to form the proposed watershed management units by restructuring existing institutions. The lack of institutional collaboration in the past has been a major weakness. The proposed integration of rural-level organizations is a great challenge for the next generation of watershed management projects in Sri Lanka.

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ANNEXES



ANNEX A

WORKSHOP PROGRAMME

THURSDAY, 11 SEPTEMBER

08.30 - 09.00 Registration

Session 1: Welcome address and overview presentation

09.00 - 09.30 Welcome address: Gabriel Campbell, Kazuyuki Tsurimi, Larry Tennyson, and Roger White

09.30 - 10.00 Moujahed Achouri: *Preparing the next generation of watershed management projects and programmes*

Session 2: Presentation/discussion of technical papers

Chairman: Keshar Man Sthapit, rapporteur: Sanjeev Bhuchar

10.15 - 11.00 Larry Tennyson: *Assessment of watershed management strategies and approaches: 1990 to 2003*

11.00–11.45 Kumar Upadhyay: *Successes and failures in watershed management in the Asia–Pacific region (1982 to 2002)*

11.45–12.45 Shashindra Singh: *Case study of watershed management from Nepal*

12.45–13.15 Comments on presentations.

Session 3: Presentation/discussion of technical papers (contd.). Country presentations

Chairman: Shafiq ur Rehman; Rapporteur: Richard Allen

14.30 - 15.00 Keshar Man Sthapit, *Decentralized watershed management: experiences from the Soil Conservation and Watershed Management Component – Nepal*

15.00 - 15.30 Elgoda Ranawakage Nimal Gunawardena: *Evolution of watershed management: the Sri Lankan experience*

15.30 - 16.00 Godert van Lynden: *WOCAT: A standard methodology for documenting and evaluating soil and water conservation*

16.30 - 17.00 Mudit Singh, *Design of watershed management projects*

Session 4: Presentation and discussion of technical papers (contd.)

Chairman: Samran Sombatpanit; Rapporteur: Godert van Lynden

16.15 - 16.45 Syaiful Anwar, *Watershed management in Indonesia*

16.45 - 17.15 Ashvin Gosain: *New technologies for watershed management*

17.15 *Discussions*

18.30 - 20.30 Dinner hosted by Gabriel Campbell, director general ICIMOD, at the Himalaya Hotel

FRIDAY, 12 SEPTEMBER

Session 5: Presentation/discussion of technical papers (contd.)

Chairman: Mudit Kumar Singh; Rapporteur: Nyima Tashi

08.30 - 09.00 Hawa Singh Lohan, *Successful watershed management: a village case study*

09.00 - 09.30 Sudhirendar Sharma: *Rethinking watershed development: Strategy for the twenty-first century*

09.30 - 10.00 Ria Wilson: *Policy challenges and recommendations for watershed development in India*

Session 6: Presentation/discussion of technical papers (contd.)

Chairman: Nyugen Tu Siem; Rapporteur: Dr Sanjeev Bhuchar

10.45 - 11.15 Rajan Kotru, *Watershed management experiences in GTZ-supported projects in India*

11.15 - 11.45 Khriشنا Poudel: *Watershed management in Nepal: Challenges and constraints*

11.45 - 12.15 Sharad Rai: *Summary of December 2002 SAARC conference* (published separately)

12.15 - 12.45 Discussion on working groups led by Larry Tennyson, Kumar Upadhyay and Moujahed Achouri

Session 7: Group discussions, conclusions, and recommendations

14.00 - 15.30 Working Groups

Group 1: Innovative approaches and methodologies for effective watershed management, with special focus on the conservation and sustainable use of water resources.

Facilitator: Moujahed Achouri; Rapporteur: Herath Mantharithillake

Group 2: Appropriate strategies for meaningful research and linkages between research and implementers; and strategies and approaches for technology transfer and dissemination.

Facilitator: Larry Tennyson; Rapporteur: Roger White

Group 3: Innovative approaches and methodologies for effective watershed management, with special focus on economic and social considerations.

Facilitator: Kumar Upadhyay; Rapporteur: Thomas Enters

15.45 - 17.30 Group discussions

SATURDAY SEPTEMBER 13

Session 8: Plenary discussion

08.30 - 09.30 Groups reporting

09.30 - 10.30 Conclusions and recommendations

11.00 Closing session

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ANNEX C

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WORKING GROUP 1

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