Chapter 4
Enabling conditions

In many ways, the new generation of watershed management is still in its infancy, or at best its adolescence. Partial, local and self-contained experiences in different regions of the world are demonstrating the potential of embedded, collaborative approaches, but also the constraints to change in specific locations and the challenges in scaling-up local experiences. Many of these constraints do not depend on programme design and implementation; they are instead related to the policy and institutional environment in which innovative thrusts develop.

A number of major political and institutional changes are therefore necessary for the new generation of watershed management to mature. These include:

- policy reforms that fully recognize the multiple roles of watershed management in sustainable development and create an intersectoral framework for implementation;
- updating, improvement and enforcement of laws affecting watershed management;
- enhancement of the institutional mechanisms that link watershed-level interventions to relevant national, regional and global policies;
- stronger incorporation of sound science and local knowledge in watershed policy-making;
- strengthened capacity building and awareness raising at all levels;
- the creation of mechanisms for long-term financing of collaborative watershed management processes.

ENABLING POLICIES

At the turn of the millennium, the international community was committing itself to achieving the human and sustainable development goals that were identified in the 1990s. The Millennium Declaration (2000) and the Johannesburg Plan of Implementation (2002) emphasized the need to accelerate progress towards poverty eradication, universal access to basic services (education, health, water, sanitation, etc.) and sustainable use of natural resources. Governments are urged to develop policies to transform these principles into effective action.

Watershed management concepts and methods have an important role in this. Sound watershed management is essential for achieving Millennium Development Goal (MDG) 7, ensuring environmental sustainability, particularly its two targets of:

- integrating sustainable development principles into country policies and reversing the loss of environmental resources;
- halving by 2015 the proportion of people without sustainable access to safe water.

In addition, by enhancing the availability and use of land and water resources for food security and economic development, watershed management can significantly contribute to eradicating extreme poverty and hunger (MDG 1).

Natural resource management and poverty should be addressed as two sides of the same coin

Watershed management addresses global environmental issues that include protection of mountain natural and human ecosystems, freshwater supply, flood control, and prevention of ocean pollution. Sustainable development policies now use watershed management as a multi-purpose approach to be incorporated in different sectoral and sub-sectoral policies.

In sustainable development, natural resource management and poverty should be addressed as two sides of the same coin. Rural and urban poverty often contribute to watershed degradation, so watershed management policies must be designed within the framework of national poverty reduction and rural development strategies, with

a clear understanding of the multiple linkages between poverty and environmental degradation. Policies should address watersheds as planning and management units where natural resources can be used to achieve social equity goals.

In many countries, however, watershed management is still not addressed as an integrating element. Different policies – for agriculture, environment, water, planning, land, poverty, etc. – often work at cross-purposes or in competition, rather than complementing one another, and government departments and donors often lack convergence. Insufficient coordination and dialogue mean that sectoral efforts are not driven by real unity of intentions (Box 35). There is a need to move from compartmentalized multi-sectoral efforts to full intersectoral integration.

BOX 35

Compartmentalization of watershed management in India

India has about 16 percent of the world's people and only 4 percent of its freshwater resources. In the 1990s, the rate of groundwater extraction in India exceeded the replenishment rate by an estimated 104 billion m^3 per year, compared with 30 billion m^3 in China and 10 billion m^3 in northern Africa. The World Bank calculates that blocks where exploitation is beyond the critical level are increasing by 5.5 percent a year. In 1995, the Government of India developed guidelines for watershed development, but legislative measures to protect and manage India's water resources are hindered by a lack of integrated framework for watershed management, ineffective departmental coordination and a focus on supply- rather than demand-side mechanisms.

Water is a state responsibility, so the administrative control and responsibility for water development rests with state-level line departments. Watershed protection and development is the responsibility of three ministries and their state line agencies. The Ministry of Agriculture has worked in watershed development since the 1960s, focusing on erosion-prone agricultural land, optimizing production in rainfed areas and reclaiming degraded lands. Ministry of Rural Development watershed projects since the late 1980s address poverty alleviation through improved soil and water husbandry. The Ministry of Environment and Forests covers forest and wasteland.

Under the 1980 National Perspective Plan for Water Resources Development, a National Water Development Agency was set up to carry out surveys and prepare feasibility reports of the links between water and other sectors. The agency is in charge of water policy, but not watershed development.

The Working Group on Watershed Development recognizes the importance of macro-management for watersheds and calls for watershed development programmes to focus on regenerating the productivity of degraded lands through a single national initiative. However, there is no mechanism for linking watershed and water management, and no effective communication at either the national or state level among the various ministries concerned with watershed management, which continue to be driven by separate and differing policy priorities.

Source: Wilson, Amezanga and Saigal, 2005.

Flaws in water policies

The water sector should provide the core focus for environmental policies that harmonize the priorities of different sectors (agriculture, irrigation, forestry, etc.). However, even where there are guidelines for the integrated management of surface, ground and coastal waters, important elements of watershed systems are still often addressed as separate units, such as mountain forests (Box 36). Upstream–downstream linkages are therefore not taken fully into account. National governments should apply a watershed management perspective to review and harmonize all their sectoral policies affecting water use: household water supply, environment, agriculture, forestry industry, land planning, etc.

BOX 36

Mountain forests and watershed management in Europe

Some 38.8 percent of the EU-15's total land area is covered by mountains. These areas have a population of 54 million, and the GDP of two-thirds of them is lower than the EU-15 average. Mountain forests cover 28.1 million ha and affect the water balance of more than half of Europe.

According to the European Observatory on Mountain Forests (EOMF), several negative trends are affecting the status of mountain forests in Europe:

- growing instability and ageing stands, including overstocking of living and dead wood;
- damage from pollutants, game, logging, fires, tourism and recreation activities;
- loss of biomass density and biodiversity;
- lack of natural regeneration and reduction of management practices;
- decreased forest revenues and declining local knowledge and practices.

Forests used to be an asset, providing security and solutions to many different problems. Now, however, many mountain people view them as a liability or danger. The flood events of 2002 in Central Europe confirmed that, along with extreme climatic events and downstream infrastructures, the abandonment of productive practices in mountain forests is threatening the functioning of watersheds all over the continent.

To address this situation, in 2002 the International Consultation on Mountain Forests recommended that the EU adopt the following fourfold approach:

- *Widening perspectives:* mountain forest resources and communities are part of larger ecosystems and processes. They influence mountain massifs, the conservation of natural and cultural assets, rural development patterns, water and watershed management processes, and economic, social and territorial cohesion – people should be kept on the land.
- *Reinforcing locally adaptive management:* if mountain forest resources and communities are to be sustainable, their management must be adapted to local conditions and situations. It should take account of both local knowledge and interdisciplinary research.
- *Sharing responsibilities:* the natural conditions in mountain regions and the interrelationships between upland and lowland areas require the sharing of responsibilities, involvement of local communities, promotion of governance and collaborative management, and strengthening of solidarity at different levels.
- *Sharing benefits:* under appropriate management, mountain ecosystems provide many benefits to lowland regions. Alliances, coalitions, partnerships, agreements and contracts for forest conservation and management between local and non-local actors help to share these benefits at all levels.

Source: Zingari, 2005.

Compartmentalized water management is particularly common in sub-Saharan Africa. In the late 1990s, most African countries developed new water policies that define stakeholders' roles in integrated water management and provide for new multi-layer water management institutions. Water rights and ecological reserves are more fully recognized, and negotiation platforms for shared resource use and management have emerged in some places (Box 37). In most countries, however, these new policies have not been fully implemented, because funds, human resources and local involvement are lacking (Box 38). Linkages between watershed management and water policies tend to be self-contained at the local level, but effective water policies require multi-sectoral interventions at the national or transnational level.

BOX 37

Water sector reforms in sub-Saharan Africa

Over the last two decades, new strategies and supporting institutions for natural resource management have emerged throughout sub-Saharan Africa. There is a shift from centralized and State-driven natural resource management to decentralized and community-based regimes. As part of this, water sector reforms in several countries address the environment as a legitimate water user, and emphasize pollution control. Water management functions are decentralized to the catchment or watershed level, so stakeholders have more say in the management of water in their own areas. The following are some examples of these reforms.

In 1998, after long stakeholder consultations, **Zimbabwe** passed a new water act based on economic efficiency, environmental sustainability and equitable use. The act treats groundwater and surface water as parts of one hydrological system. Water cannot be privately owned, and water rights have been replaced with short-term water use permits; renewal is subject to water availability and evidence of efficient use. Watershed and sub-watershed catchment councils of stakeholders have been formed. Pollution is better controlled through the polluter-pays principle. Fees for commercial water services are retained by the National Water Fund to finance the statutory services provided by the Zimbabwe National Water Authority.

In 1996, the Parliament of **Ghana** established the Water Resources Commission (WRC) to regulate and manage the country's water resources and coordinate related government policies. WRC comprises the major regulators and users in the water sector, providing a forum for integrating and balancing the different interests of water institutions (hydrological services, water supply, irrigation development, water research, environmental protection, forestry and minerals) and civil society stakeholders (indigenous leaders, women's associations, NGOs, etc.). Since 2001, a Water Management Fund has financed conservation activities, information systems, local watershed management institutions and research. The income of this fund comes from a raw water charge (a 0.7 percent tariff increase), licence fees and fines for offences.

Since 1994, government policy in **South Africa** has focused on equitable and sustainable social and economic development for the benefit of all people. In 1997, the Cabinet adopted a National Water Policy with three main objectives: equitable access to water, sustainable use of water, and efficient and effective water use. The National Water Act is based on these objectives and provides for the protection, use, development, conservation, management and control of South Africa's water resources. The National Water Resource Strategy describes how water resources are protected, used, developed, conserved, managed and controlled in accordance with the policy and law. A vital element of this strategy is the progressive decentralization of water resource management to catchment management agencies and local-level water user associations, which allocate the available water among competing user groups.

Sources: Makukira and Mugumo, 2005; Odame Abaio, 2005; Rademeyer, 2005.

Inadequate watershed legislation

Inadequate or outdated watershed management legislation and regulatory measures constrain all regions. Legislation and measures in most Asian and African countries are particularly inadequate for intersectoral collaboration and the allocation of funds and authority. Many legal issues concerning watershed management cannot be settled, because laws are obsolete, contradictory or lack clear guidelines for application. Countries need to reform their laws, based on sound watershed management principles.

Lack of enforcement of existing laws constrains the embedding of watershed management principles in conservation and development policies (Box 38). Watershed authorities should have the power to harmonize rights and enforce decisions. For example, at the territorial level, laws and regulations could be enforced by strengthened watershed authorities with legislative and judiciary, as well as executive, branches.

BOX 38

Why water sector reform has not performed as expected in Zimbabwe

Although Zimbabwe has a legal framework for integrated water management (Box 37), this is not reflected on the ground. The following paragraphs explain some of the reasons for this failure.

Land reform: Water sector reform was launched at the same time as land reform in Zimbabwe. While water sector reform promoted equitable and sustainable utilization, more stakeholder participation and introduction of the user-pays principle, land reform aimed to redistribute land and encourage greater utilization of national land resources. The two policies seemed to complement each other, but their objectives proved conflictive. Many established farmers did not pay for water permits, because they were uncertain about occupying the land after the land reforms; new farmers were reluctant to pay for water use because it had not been paid for previously. New settlers were also more interested in consolidating their land claims than in attending water management meetings.

Political interference: In a bid to retain popularity, politicians made water as cheap as possible, undermining the pricing policy, which has to raise sufficient funds to maintain high standards of water service delivery. Politicians also protected defaulters of water permit payments from disconnection.

Donor withdrawal: Initially, the water sector reform was donor-driven. By the time the catchment councils were being launched, however, there was only one donor left to support two of the seven pilot catchments.

Financial stability: Fees for water permits – based on user- and polluter-pays principles – were expected to finance water service provision, topped up with government contributions of public funds. However, as already described, water fee revenues have been less than expected, and government budget allocations have been minimal.

Poor collaborative process: Catchment councils with representatives from local authorities, industry, commercial farmers, communal farmers and other interested parties were expected to find common solutions to water problems. However, each of these groups is interested in protecting its own interests only and there is little understanding or negotiation among them. In addition, council members have not been paid for their input into water affairs, meetings have become less frequent and user groups have been merged to reduce expenses. Water management stakeholders have therefore not been able to meet often enough.

Weaknesses of the coordinating agency: The Zimbabwe National Water Agency did not have enough staff to cope with the sudden demand for expert services, so it could not provide the services and functions financed by the Water Fund.

Source: Makukira and Mugumo, 2005.

In addition, special problems arise when rights to watershed resources are held under several different property systems that are sanctioned by different authorities. Such situations can lead to conflicts between local entitlements and national law (Box 39).

BOX 39

Assessing multiple property right systems in watersheds: the CAPRi framework

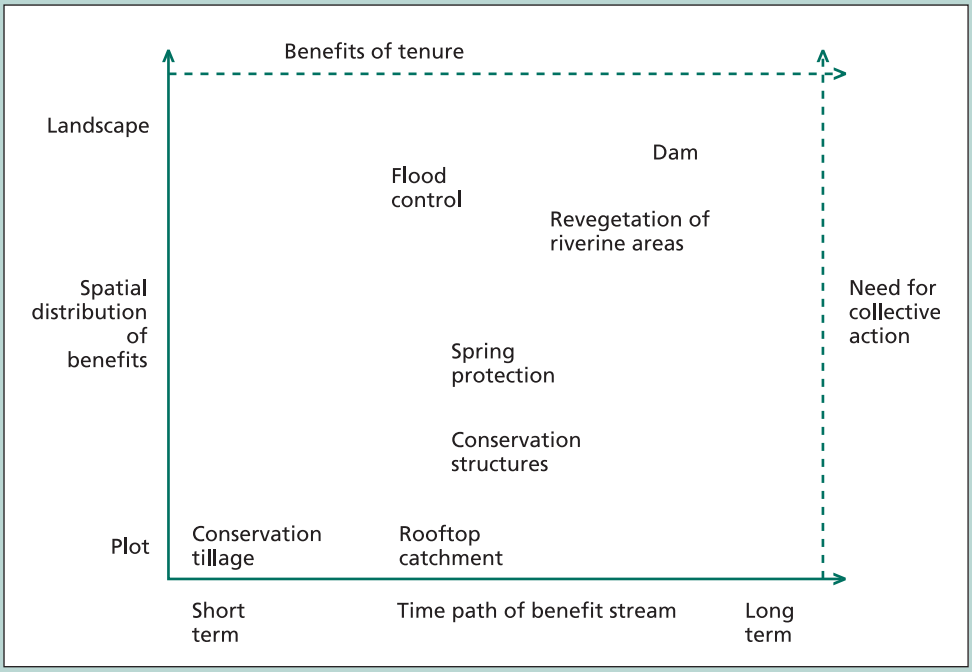
Conventional views of watershed rights presume that a single legal source of authority defines and enforces a single set of rules and laws governing people's access to, use and management of resources and their benefits. The legal pluralism approach recognizes that there are usually many institutions and sources of authority that affect people's use of watershed resources.

When applied to property rights, legal pluralism sets out to understand how individuals obtain access to and control over resources. This is governed not only by State-enacted rules and regulations, but also by norms and rules of behaviour that are generated by forms of social organization, such as villages, ethnic groups, associations and the State. Property rights can be influenced by statutory law, religious law, customary law, project law, organization law and local norms. Different types of law are supported and sanctioned by different social authorities, which tend to have different strengths and weaknesses; people with claims or complaints regarding watershed resources are likely to appeal to the laws and social authorities that support them the most.

The Collective Action and Property Rights (CAPRi) programme has developed a simple conceptual framework (Figure) to depict the importance of property rights and collective action for the adoption and management of different types of agricultural technologies and natural resource investments. The key components of the framework are:

- duration of investment, which implies the value of long-term security of land tenure;
- spatial distribution of effects of investment, which implies the benefits to be obtained from collective action in resource management.

The figure indicates that watershed/catchment management is a resource investment that requires both secure property rights and strong collective action.



Source: Swallow et al., 2005.

MICRO–MACRO LINKAGES

Even in programmes that cover large land units such as river basins or administrative regions, collaborative watershed management focuses on intensive interventions in small geographical areas, often corresponding to sub-watersheds. Major watershed management programmes are "federations" of site-specific micro-interventions within a common institutional, methodological and operational framework.

The rationale for this micro-approach to large-scale programmes is twofold: (1) the complexity and specificity of watershed hydrogeological, ecological and socio-economic processes are best captured at the local level; and (2) implementing intensive watershed management interventions in critical locations, such as upland catchments or areas exposed to human-induced hydrogeological degradation, is more cost-effective than trying to control extended systems, such as river basins.

Collaborative watershed management and global change

The so-called "adapting mosaic" environmental policy scenario was described in a recent appraisal of the expected long-term global impact of having many integrated natural resource management and sustainable development micro-initiatives at the watershed level (MEA, 2005). In this scenario, global environmental crises are addressed through small, watershed-based initiatives, undertaken by decentralized institutions and embedded in broader sustainable development processes (Box 40).

The adapting mosaic scenario contrasts with the "technogarden" scenario, which addresses ecosystem problems through the intensive use of technology and ecological engineering, and with the "global orchestration" and "order from strength" scenarios, which expect environmental problems to be solved by global economic growth and redistribution or through *laissez faire*, respectively.

Although the global orchestration, technogarden and adapting mosaic scenarios may all have positive impacts on human well-being in both industrial and developing countries by 2050,[1] the latter two scenarios are expected to perform better in protecting environmental goods and enhancing environmental services.

FIGURE 4
The four Millennium Ecosystem Assessment scenarios

[1] The *laissez faire* order to strength scenario is expected to lead to economic growth based on increased environmental degradation and inequitable distribution of wealth.

BOX 40

Collaborative watershed management's contribution to a sustainable future

To explore the possible future of ecosystems and human well-being, the Millennium Ecosystem Assessment (MEA) global study developed four scenarios based on different assumptions about the driving forces of change and their possible interactions.

Global orchestration: This scenario depicts a globally connected society that focuses on global trade and economic liberalization. It adopts a reactive approach to ecosystem problems, but takes strong steps to reduce poverty and inequality and invest in public goods such as infrastructure and education. Global economic growth in this scenario is the highest of the four scenarios.

Order from strength: This scenario depicts a regionalized and fragmented world, concerned with security and protection, emphasizing regional markets, paying little attention to public goods and adopting a reactive approach to ecosystem problems. This scenario has the lowest economic growth rates (particularly in developing countries), which decrease with time, and the highest population growth of the scenarios.

Technogarden: This scenario depicts a globally connected world relying on environmentally sound technology, using highly managed, often engineered, ecosystems to deliver ecosystem services, and adopting a proactive approach to ecosystem problems. In this scenario, economic growth is relatively high and accelerates, while population in 2050 is in the mid-range of the scenarios.

Adapting mosaic: This scenario depicts regional watershed-scale ecosystems as the focus of political and economic activity, and foresees the rise of local ecosystem management strategies and the strengthening of local institutions. Investments in human and social capital focus on improving knowledge about ecosystem functioning and management, resulting in improved understanding of the resilience, fragility and local flexibility of ecosystems. The scenario is optimistic about people's capacity to learn, but prepared for sub-optimal management of ecosystems. Styles of governance vary greatly among nations and regions, with some investigating adaptive management alternatives, while others use bureaucratically rigid methods to optimize ecosystem performance. Outcomes are very diverse: some areas thrive, while others develop severe inequality or ecological degradation. Initially, trade barriers for goods and products are increased, but information barriers nearly disappear because of improved communication technologies and rapidly decreasing costs. Eventually, the focus on local governance leads to failures in managing global commons. Global environmental problems, such as climate change, marine fisheries and pollution, intensify. Communities cannot manage their local areas because global and regional problems are infringing on them, and communities, regions and nations develop networks for the better management of global commons. These networks adopt solutions that have been effective locally, and are particularly effective in areas with mutually beneficial opportunities for coordination, such as along river valleys. Sharing good solutions and discarding poor ones improves the approaches to social and environmental problems ranging from urban poverty to agricultural water pollution. As more knowledge is collected from successes and failures, much service provision improves.

Source: MEA, 2005.

The adapting mosaic scenario is expected to be the most cost-effective for key watershed variables such as water availability and quality, erosion control, genetic resources, pest control, storm protection and cultural adaptation. Given that the technology and public work investment required by the technogarden scenario are beyond the reach of many developing countries, the adapting mosaic, based on collaborative watershed management, would represent the most appropriate and viable alternative for sustainable development.

Scaling-up micro-experiences

Mosaics of self-contained, sub-watershed-level efforts embedded in local societies and cultures need more than local-level scaling-up policies if they are to restore and improve environmental goods and services. Governments need to link decentralization policies to national frameworks that mobilize the central-level inputs required to implement sound territorial watershed governance. Flexible and adaptive national guidelines should define the autonomy of local initiatives and the support they can expect from central government and higher-level institutions.

The watershed management policies of national governments should harmonize local institutions and establish institutional linkages at the regional and national levels. Policies should include criteria for funding local initiatives and clear procedures for prioritizing critical watersheds. Local project objectives and strategies should be based on national watershed guidelines and strategies.

Regional fora for transboundary watershed management

Strong international and regional fora promote negotiation among upstream and downstream administrative units or countries, particularly where local interventions affect transboundary watersheds and river basins.

The fora should be mechanisms for regional integration, based on synergy among national agencies and ruled by ad hoc international river basin management agreements. Fora should identify priority areas and set up networks of local collaborative watershed management initiatives.

Exchange of knowledge and experiences among the countries that share a river basin should be facilitated, in order to develop a common policy framework and ensure long-term commitment and steady funding to relevant institutions. This is an important priority for sub-Saharan Africa, which has many transboundary river basins. In the past, a lack of transboundary agreements constrained investment and the development of subregional watershed management initiatives. Recent developments in transboundary river basin management across Africa are promising, and include the Nile Basin Initiative, the Lake Victoria Development Programme, the Nkomati River Basin Agreement, the Niger Basin Authority and Lake Victoria Environment Management Programme. Much can be learned from these.

EVIDENCE-BASED POLICIES

Linkages between science and watershed management policies are a burning issue. Policy-makers find it difficult to accept the current level of uncertainty about watershed processes and tend to rely on outdated, oversimplified models, which create wrong assumptions and misconceptions. Watershed management policies are often based on myths or common wisdom, rather than scientific evidence (Boxes 41 and 42).

Enhanced communication between watershed scientists and policy-makers

Watershed management policies must be grounded on sound evidence, and the gap between science and policy can be filled by enhanced communication between politicians and practitioners. The research community should convey its findings to policy-makers in clear and ready-to-use formats, describing complex watershed

BOX 41

The impact of misconceptions on watershed management policies in Asia

The concepts underlying integrated water resource management (IWRM) were developed in the early 1990s and are supported by development organizations, which see them as prerequisites for achieving the MDGs. However, some watershed management policies have had perverse outcomes because they have been based on misconceptions. The following are some examples:

- In Southeast Asia, half a million livelihoods may have been lost because of logging bans based on misperceptions of forest and flood interactions.
- In India, watershed development projects with insufficient understanding of land and water interactions have resulted in reduced access to common property water for poorer people, unsustainable rates of groundwater depletion, closure of catchments, and serious downstream and environmental impacts.
- In China, afforestation programmes were based on very optimistic perceptions of the benefits of forests to the water environment, and may be damaging rural livelihoods, disadvantaging minority ethnic groups, reducing downstream and transnational water flows, and reducing food production.

The development community has to implement IWRM concepts in a wider resource management context and confront complex and messy real-world situations. It is important to:

- understand how the belief systems underlying scientific and public perceptions have evolved within different stakeholder groups, and how to enable more science-based policy development;
- develop management support tools, ranging from simple dissemination tools to detailed hydrological models, to help implement new land and water policies;
- understand the impacts of land and water policies on society's poorest; many existing policies do not benefit the poor significantly and may even result in perverse outcomes;
- recognize how different land and water-related policies affect the ownership of water resources; watershed development policies that promote increased water infiltration may transfer what was effectively a common property resource – the water running into a communally owned village tank or government-owned river – into an effectively privately owned resource of the landowner, who can afford to install electrically pumped groundwater supplies, or forest owner, whose forest consumes more water than most non-irrigated land uses;
- develop best practice guidelines for land and water management based on cross-regional experiences of research and policy development; this could include developing better management tools and sharing knowledge through bridging research and policy networks.

Source: Calder, 2005.

management processes in straightforward messages that prompt action and trigger investment. National research frameworks that feed relevant information into watershed management policy-making are also needed. National watershed management master plans, including mechanisms for identifying priority areas and hot spots, should be developed, and reviewed and adjusted frequently, based on sound monitoring and evaluation data. Relevant indicators and an appropriate information system should be identified and established. Existing databases need to be homogeneous and interfaced.

BOX 42

Watershed management and population dynamics in Nepal

It is difficult for watershed management programmes to achieve their goals without fully understanding the many interrelated physical, biophysical and human factors that act on watersheds. In Nepal there is a lack of evidence-based information for watershed planning. Benchmarks and changes resulting from watershed management interventions are seldom quantified, and the resource endowments and fragility of watersheds are rarely evaluated. Time series data for human-induced factors are lacking, and most studies fail to separate natural from human causes.

Among the misconceptions that this has caused, one of the most important for national development is the belief that migration from the Middle Hills to the Terai lowland would decrease upstream degradation and improve watershed management at the river basin level. The migration of landless Middle Hills farmers to rehabilitated lowland areas was first promoted in the late 1960s. Projects developed infrastructure and off-farm income-generating activities and introduced high-yielding crop varieties and hybrid domestic animals. Most of these projects were donor-funded and assisted by Western experts.

The impact of this policy on upstream–downstream linkages is not clear. Mass movements of people have reduced population densities in some Middle Hills areas and prevented the local population from growing beyond carrying capacity, but the population of the Terai lowlands increased from 3 million in 1961 to 11 millions in 2001. As a result of the migration, half the national population has settled in a fragile, flood-prone, unhealthy, tropical rainforest ecosystem. Decreased population pressure in the Middle Hills has not led to improved soil conservation and water management. Between 1991 and 2001, the cost of wage labour is estimated to have doubled in the Middle Hills, while rice prices increased by only 50 percent. Local farmers therefore have little incentive to maintain the paddy terraces that are vital for food security and watershed management

Devastating landslides and mass wasting in the Middle Hills are blamed on local people's overexploitation of natural resources, rather than on a combination of natural events and ill-conceived policies. Floods and heavy sedimentation in the Terai are attributed to mass wasting in the hills and mountains, with little consideration of other human factors such as the accumulation of sediment in downstream dam basins and irrigation channels and intense interference in riverbank areas. Watershed management policies need to be reappraised in the light of these multi-layer and multi-sectoral interactions.

Source: Poudel, 2005.

The role of watershed environmental economics

Economic facts from sound environmental economic assessments are essential in convincing decision-makers about the relevance and value of watershed management investments. Watershed management should incorporate more cost–benefit analyses and other economic valuation methods.

The role of local cultures in watershed management

The development of sound watershed management policies requires more than the mainstreaming of natural science and environmental economic evidence. Watershed ecology is primarily a human ecology, so a thorough understanding of watershed stakeholders' views, logic and knowledge is also necessary. For instance, it is important to consider the role that local technologies, practices, knowledge and customs play in local land and water management systems. Watershed management policies tend to overemphasize research-based knowledge at the expense of indigenous knowledge.

There is scope for gathering local watershed management cultures, evaluating their benefits and sustainability, and incorporating them into policies. This would facilitate the intercultural dialogue and social negotiation on which sound collaborative watershed management is based.

BOX 43

Mountain universities in Cuba

Informing and training local stakeholders improves integrated watershed and natural resources management and increases collaboration between technical experts and local populations.

In the late 1980s, Cuba established four mountain universities as part of its integrated mountain development policy. The universities aim to increase awareness and capacity among both specialists and local people through the creation of agroforestry technicians and extensionists.

Agroforestry technicians are professionals with the capacity to select and introduce innovative production and utilization techniques for local resources, and to manage and direct the adoption of these. Their main role is transferring technology and technical expertise.

Extensionists disseminate knowledge and sensitize the local population. They act as the messengers of community issues, mediating between universities and research centres and small farmers. At the mountain universities, extension students and teachers work on local issues with the community through educational, social and technical projects that are supported by research centres, the Ministry of Science, Technology and Environment and the National Association of Small Farmers (ANAP).

Knowledge sharing among small farmers is promoted by the farmer-to-farmer extension supported by ANAP and the universities.

The universities hold courses in agro-ecology and sustainable agriculture, forest science, sustainable coffee and cocoa production, rural extension, environmental awareness and water resources management. Courses focus on training professional agronomists who have agricultural and environmental expertise and organizational and management capacity. Of the 945 graduates between 1990 and 2002, an estimated 85 percent went on to work in the Plan Turquino (Box 26).

The universities' curricula focus on local environmental and agricultural issues. The mountain universities are important centres for experimenting and implementing research to benefit local people. Students' degree theses aim to solve the problems that face local production.

Any student can attend the courses, which are free and include accommodation close to the university. Each university has about 100 students who come from local mountain communities and towns in the valleys.

Courses for practitioners are also planned with the aim of improving the knowledge of non-specialists. Most of these will be for farmers who have higher education and land that can be used for experimental pilot projects for new agro-ecological techniques, and who are reference points for the community. This helps to involve local people more fully in the processes of change, experimentation and project implementation.

Source: Berini, 2004

CAPACITY BUILDING AND AWARENESS RAISING

Strengthened technical and communication skills among watershed management professionals and raised awareness among local stakeholders and the public are further important conditions for the take-off of the new generation of watershed management programmes.

Reform of educational curricula for watershed practitioners

To address the knowledge shortfall, technical schools and universities need appropriate watershed management curricula, which focus on practical implementation and give watershed professionals an interdisciplinary perspective. Comprehensive training programmes on collaborative management, action research and upstream–downstream interactions are also needed.

Training curricula should recognize cultural diversity as an important factor in professional practice. Methodologies and tools for conducting fieldwork under local conditions and in consultation with local stakeholders should be included; regional and international networks can help with this by providing supplementary learning through e-learning technology and other means.

Informing and educating local stakeholders

Capacity building at the municipal and regional levels needs more attention. Continuing education processes should be launched to increase the capacity of professionals, administrators and local stakeholders to understand and manage the intersectoral processes and approaches necessary for effective watershed management (Boxes 43 and 44).

Raising public awareness

Awareness strengthens local stakeholders' involvement in collaborative watershed management processes. Visual evidence generated by GIS is particularly effective in enhancing people's awareness of the interdependencies between watershed management and other sectors. People also need to be educated about water use, particularly for times of scarcity.

FINANCING COLLABORATIVE WATERSHED MANAGEMENT

Without steady financing, decentralized institutions are unlikely to succeed in collaborative watershed management. Although mechanisms are being tested for engaging the non-profit and private sectors in watershed management, the public-good nature of watershed environmental services justifies the use of public sector funding.

Public sector financing

National governments often have to create and maintain watershed infrastructure, because most rural communities lack the capacity to do so themselves. Core funding for collaborative watershed management should come from national governments, with local cost-recovery mechanisms providing complementary finances. Many governments do not invest enough in watershed management, and public sector participation needs to be strengthened.

Cost sharing mechanisms

The financing of collaborative management should be long-term, flexible and based on cost sharing. It should include incentives to support private initiatives in watershed conservation (Box 45). There are some interesting donor-funded watershed financing schemes in Latin America (Box 46), but in most countries public sector funding for watershed management is increasingly scarce. In addition, financial mechanisms and incentives to promote private sector investment and cost sharing by civil society stakeholders are often inappropriate. Owing to frequent changes in the political composition of governments and administrations, many watershed management plans are disrupted or discontinued after a four to five-year start-up programme.

BOX 44

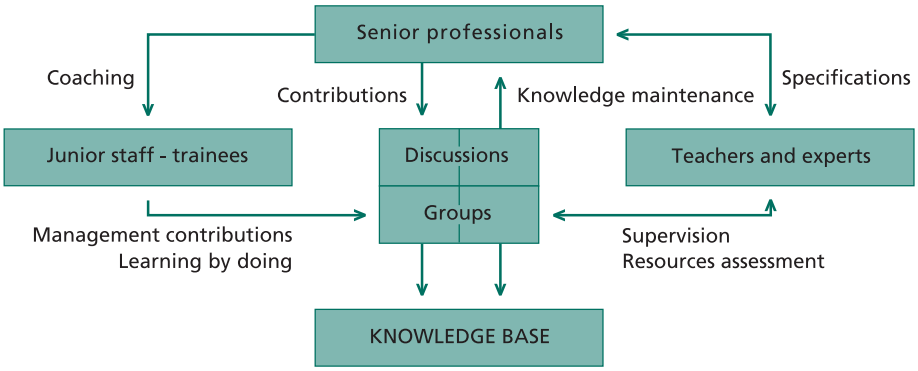
A virtual learning community to support the European Water Framework Directive

The International Network of Basin Organizations (INBO) was established in 1994 at Aix-les-Bains, France. Its aim is to promote integrated water resources management at the river basin level as an essential tool for sustainable development.

INBO has recently launched a continuing education programme for European water professionals, with financial support from the European Commission's Leonardo da Vinci Programme. The project consists of a continuous education and training scheme, based on collaboration among peers to implement the Water Framework Directive (WFD) through a virtual learning community (VLC). Results of the learning process will feed the knowledge base for future users. Interaction is multilingual and includes a translation program. The initiative involves river basin organizations, universities, water training centres and others.

The target group consists of junior and senior executives from European INBO member organizations who are implementing the WFD. The VLC will help participants to learn by doing. Junior integrated water managers will be trained by senior staff, who share their existing expertise (both formally and informally) with their younger colleagues, while updating their own knowledge. A total of 20 junior staff trainees will be divided into working groups, each responsible for one aspect of the WFD. Group leaders will distribute tasks among the individuals, organize exchanges, moderate fora, synthesize the various contributions, provide complementary materials (documents, testimonies, case studies, etc.) and organize Internet conferences with experts; all these activities help to improve the quality of work.

Functioning of INBO's virtual learning community



All trainees will contribute to all groups, prepare inputs on sub-topics and present monographs on various aspects of WFD implementation. Group discussions will be open to senior professionals, so that theory can be compared with hands-on practice. Teachers will define the course path and milestones, supervise the exchanges, guide the students and help them to analyse the external inputs, provide additional resources, and assess the results to validate the knowledge acquired. Senior group members will guide each group's analysis of its own work, and help it to mobilize complementary resources.

Source: Neveu, 2005.

BOX 45

Collaborative agreements between farmers and a water supply company in Germany

About 27 percent of the agricultural area in Germany's North Rhine-Westphalia state is under cooperative agreements, such as the Stevertal reserve agreement between water supply companies and agricultural water users.

Stevertal reserve supplies drinking-water to about 1 million people. One-third of its 880 km^2 watershed is used for intensive agricultural production, which caused increasing water contamination from fertilizer and pesticides and growing conflicts between agriculture and local water supply companies during the late 1980s. In 1989, a cooperative agreement among water supply companies, farmers and the local authorities aimed to reduce water and soil pollution. The agreement is a voluntary contract, which imposes land-use changes, such as the substitution or reduction of chemical fertilizer and pesticides, in exchange for compensatory payments and free advisory services for farmers. About 42 percent of the farmers and 61 percent of the agricultural land in the watershed are involved in the agreement, along with the water supply companies of four municipalities, local water authorities, the state's Ministry of Environment, Agriculture and Consumer Protection, the Chamber of Agriculture and several small agricultural associations.

Free educational and technical services and awareness building for farmers provide essential support to the cooperation agreement. Farmers' concern for and understanding of environmental issues is growing, and the image of agriculture and water supply companies has improved. The measures brought in under the agreement have led to increased biodiversity in the region.

An effective monitoring system enables participants to evaluate environmental and economic outcomes and change or improve measures. Owing to the large project area, there are very few controls of farmers' activities, but the environmental and economic improvements imply that these are performing well. Groundwater pollution has decreased significantly, leading to considerably lower costs for drinking-water extraction. Agricultural productivity has also increased, owing to better, more cost-effective management practices.

Sources: Freisem, 2002; INFU, 2001.

The role of donors

In Africa, Asia and Latin America, international donors have a huge role in financing watershed management. This has led to a proliferation of donor-instigated jargon and approaches, with national governments paying lip service to these in order to secure funding. This confusing situation calls for the harmonization of bilateral and multilateral cooperation policies, based on clear, long-term agreements.

Watershed trust funds

Watershed trust funds are capital asset funds that are established through central government allocations, donor grants and local tax revenue. These are invested in financial markets to ensure a steady source of funds for watershed management programmes. Capital disinvestment is restricted by the trust fund holder (the government), but collaborative watershed management institutions receive the interest generated by the fund. Some countries have already established environmental or forest trust funds, which they use to finance watershed management activities (Boxes 47 and 48).

Market-based financing mechanisms

In order to decrease their dependency on donors, developing countries should also consider market-based sources of finance for watershed management. Industrialized country experiences of mechanisms for transforming the environmental services produced by watersheds (e.g., water, power and carbon sequestration) into cash for collaborative management processes through PES schemes are of particular interest (see also Chapter 2 and the Annex). The potential for tapping and enhancing this type of private sector involvement in developing countries is still unclear, however.

BOX 46

A watershed protection fund in Ecuador

Most of the water supply for Ecuador's capital Quito originates in two watersheds in the ecological reserves of Cayama-Coca (4 000 km²) and Antisana (1 200 km²) in the Andes. Although these are both protected areas, their watersheds are threatened by agricultural production and extensive livestock grazing, with impacts on both the quality and quantity of water for drinking, irrigation, power generation and recreation. The destruction of forests and grassland contributes to degradation of the high plateau and is assumed to affect the stream flow, causing floods in winter and drought in summer.

In 1998, the Watershed Protection Fund (FONAG) was created to finance the environmental conservation of upstream reserves by municipalities and upstream land users. Conservation measures are implemented according to a collectively developed management plan, which is adapted to the environmental plans of the two ecological reserves.

FONAG became operational in 2000, and is managed by a private asset manager. Its Board of Directors comprises representatives of the municipality, conservation organizations, the hydroelectric company and water users. The fund is independent of the government, but cooperates with the environmental authority so that FONAG activities are in line with the conservation objectives of the ecological reserves.

FONAG received an initial donation from the United States Agency for International Development (USAID). User contributions vary; for example, the water supply company pays 1 percent of potable water sales, while other subscribers pay annual fixed amounts. Currently, the fund has nearly US$2 million, and investment bonds for 2005 are estimated at about US$500 000.

Source: Echavarría, 2000.

BOX 47

Environmental trust funds and watershed management in Bhutan and Viet Nam

Improving the funding of watershed management initiatives involves mobilizing more internal resources and getting longer commitments from donors. All countries need to establish fund-raising mechanisms by allocating a share of the revenue from hydropower, ecotourism, irrigation water fees and forests to watershed management. Environmental trust funds supported by international donors can be instrumental in this.

The Bhutan environmental trust fund was set up to finance nature conservation and biodiversity projects. Donors contribute to the government's core fund for implementing environment-related activities under its national programme. Interest from the fund is spent on projects, while the capital is locked to generate funding for future projects. The fund is administered by a steering committee of policy-level government officials and major donors.

Viet Nam's trust fund for forests was set up in 1999, under the Ministry of Agriculture and Rural Development. The fund is supported by international donors to implement the Forest Sector Support Programme (FSSP) and other government programmes for the forest sector, including the 5 million ha reforestation project. The trust fund's objectives include: (1) aligning donor support more closely to the priorities identified in the FSSP framework; (2) targeting poverty alleviation for donor support to the forest sector; (3) harmonizing aid to the forest sector and reducing transaction costs; and (4) supporting the transition towards a sector-wide approach.

In June 2004, the Vice-Minister of Agriculture and Rural Development and representatives of the Ministry of Foreign Affairs of Finland and the embassies of the Netherlands, Sweden and Switzerland signed a Memorandum of Understanding (MOU) establishing the trust fund. Since then, other international partners have signed the MOU and joined the fund.

Source: Upadhyay, 2005.

BOX 48

A conservation trust fund in the United States

The Zuni people have farmed the area of the present Zuni reservation in western New Mexico, the United States for more than 1 500 years. They use floodwater to irrigate this arid area, and have a tradition of managing resources sustainably. Over recent generations, however, the farmed area has decreased from 12 000 acres (4 860 ha) to about 1 000 acres (405 ha). Reasons for this decline include increased alternative sources of food and jobs and the degradation of soil and water resources.

In 1978, the Zuni sued the United States government for damage to federal land through mismanagement. The case was settled in 1988 and a trust fund of US$17 million was established through the Zuni Land Conservation Act of 1990 to restore the watershed using indigenous methods of land and water management. Interest from the Zuni Indian Resource Development Trust Fund goes to environmentally sustainable projects that include fish and wildlife, range conservation, hydrology monitoring, erosion control and a native seed bank. This has created nearly 50 jobs, making it one of the region's major employers.

In 1992, the Zuni conservation project drew up a watershed restoration plan to meet the needs of the community. User groups formed around issues raised at a series of consensus building workshops, with project activities discussed and approved by a tribal council of elders. Activities included Zuni women's use of indigenous methods to grow traditional subsistence crops such as squash, maize and beans. Garden design and the use of rock mulching and swales are based on revived traditional techniques for conserving water, soil and nutrients in an arid landscape.

Management plans were prepared to restore highly eroded areas, including those subject to sheet erosion, active gullies and arroyos. Grazing land was restored through animal control. Riparian protection measures included the restoration of channel meandering to allow water to reach floodplains during intense summer rains; channels were stabilized with vegetation through grazing management and small water spreading structures; and upstream swales slowed runoff on highly compacted soils, increasing infiltration and vegetative restoration. A methodology for local volunteers to monitor riparian health and water quality was taught in high schools. Annual monitoring of the sediment in stream channels is a reliable indicator of watershed restoration.

GIS mapping established existing land uses and targeted priority areas for restoration. Water distribution systems for livestock were extended to allow eroded areas to recover and to distribute horses, cattle and sheep more evenly across the watershed. Experimental gully control measures found that brush and rock structures, built by hand with on-site materials, filled with silt and trapped water for vegetation growth, thereby achieving much better erosion control than larger and more expensive earth or cement check-dams, most of which washed out with intense summer thunderstorms, causing gully deepening and bank erosion.

Sources: Enote, 1996 and Fleming, 2003.