Chapter 1
Lessons from the past

Watershed ecology is of special importance for many people

Sor Paolo, Don Belisario and Chapaji live in different regions of the globe, belong to different social groups and hold different values and views about the world and the human condition. Nonetheless, they all struggle with the same basic problem that billions of people face: controlling the flow of water and runoff material that are dragged down slopes. This is the core focus of watershed management, which is an applied and multidisciplinary subject based on geology, ecology, environmental economics and the social sciences.

Watershed management is primarily a matter of gravity. Gravity makes rainwater flow at a speed – and with a power – that is directly proportional to the slope gradient. Rocks, soil, vegetation cover and human-made artefacts can slow the flow and divert part of it to the subsoil. Gravity makes it possible to distribute highland rainfall over downstream areas, create and renew surface and underground water resources, irrigate plants, water animals, enrich land with mineral and organic sediments, and transport biological materials such as seeds. Gravity makes watershed ecosystems highly dynamic and entropic.

Watershed ecology is very important to humankind. The world's supply of freshwater depends largely on people's capacity to manage upstream–downstream flows. Food security also largely depends on upland water and sediments. Inappropriate watershed management creates many problems. Deforestation, inadequate hillside agricultural practices and overgrazing may increase runoff, prevent the recharge of upland sources (as in Don Belisario's case) and generate seasonal torrents that spoil lowland fields (as in Chapaji's case). Badly engineered watersheds (as in the Aniene Valley) may not be able to stand heavy rains. Watercourses are also very good vectors for biological and industrial chemical pollution (as in Sor Paolo's case).

THE LONG HISTORY OF PEOPLE AND WATER

Watershed management is 5 000 years old

Ever since agriculture began, humans have been manipulating water and slopes in order to benefit cultivation and control floods and drought. By 3000 BC, early attempts to control water flow had evolved into sophisticated extended irrigation systems. Irrigation was discovered in China, on the banks of the Yellow River, and in the Fertile Crescent, which roughly corresponds to the watersheds of three major Near East rivers: the Nile, the Euphrates and the Tigris. From these cradles, irrigation diffused rapidly throughout Asia. By 2500 BC, irrigated agriculture was being practised in the Indus valley, and between 500 and 1 000 years later it had spread to peninsular India and southeast Asia. By 1500 BC, it had been reinvented in the American continent.

The Greeks, Romans and other Mediterranean people were familiar with water engineering, but they applied the technology more to urban water supply than to irrigation. Nevertheless, Mediterranean hillside terracing and tree planting on slopes – which still characterize the regional landscape – were the forerunners of modern watershed management techniques. Ancient hydraulic technology and land husbandry expertise were further refined during the Middle Ages. Well-fed irrigation systems that still function in oases on the edge of the Sahara testify to the precision and effectiveness of Arab water engineering. Major hydraulic civil–military works carried out by Italian Renaissance towns, such as Florence, demonstrate what technology was achieving in Europe by the end of the sixteenth century. The capacity to control water flow also increased in Asian, American and African societies: by 1000 AD, the Incas had refined

a sophisticated watershed management model, based on the vertical integration of different ecotypes existing in Andean watersheds. Similar approaches were developed by other upland people in Europe and Asia.

In Europe, the potential of watershed technology started to be fully exploited at the beginning of the modern era. Between the sixteenth and seventeenth centuries, the introduction of New World crops such as maize, potato and tomato, the diffusion of non-fallow cultivation techniques based on slow drainage and abundant fertilization, the suppression of the commons and privatization of agricultural lands, and the rapid improvement of machinery led to ever-increasing agricultural yields. Surpluses were essential for sustaining the growing population employed in industry, trade and services, but they also required major public investment in irrigation, land reclamation and watershed management works.

The rise of modern watershed management

By the end of the nineteenth century, engine-powered machinery was helping hydraulic engineers in the West to work on a larger scale and at a faster pace. In the first half of the twentieth century, major lowland drainage and land reclamation schemes were implemented in the United States, Europe and overseas colonies, while the discovery of hydroelectric power technology was giving additional impetus to hydraulic public works.

After the Second World War, watershed management became an important element of development policies, as advocated by the Bretton Wood institutions and the United Nations (UN) system. Between 1950 and 1970, big irrigation schemes and hydropower dams were constructed in Asia, Africa and Latin America to promote agricultural development and economic growth while ensuring water and electricity supply. The environmental and social costs of these large-scale watershed works were often underestimated.

By the 1960s, problems with protecting artificial basins and channels from runoff and sedimentation helped to increase practitioners' and policy-makers' awareness of the importance of upstream–downstream linkages in watersheds. Watershed planning started to consider more thoroughly such processes as seasonal torrents, erosion, rapid basin saturation and downstream floods. The integrated development approach encouraged decision-makers to pay more attention also to the economic and social implications of watershed management, which became "integrated watershed management".

WATERSHED MANAGEMENT AND SUSTAINABLE DEVELOPMENT

In the 1970s, people all over the world started to notice the environmental threats affecting the planet. Following a warning from the scientific community, the UN called the Conference on Human Environment in 1972, urging Member States to pay more attention to the management and conservation of natural resources in their development efforts.

In the following years, environmental concerns became an essential ingredient of political rhetoric, mass communications and the thinking of the general public. Green movements mushroomed in the North and South, and new "ecologically sound" rules and behaviours were promoted. However, economic development and nature conservation continued to be perceived as two different and diverging goals. Environmental protection was seen as a luxury that only rich countries could afford; unindustrialized countries were expected to concentrate more on fighting poverty, disease and illiteracy.

The UN Brundtland Commission changed this view of human ecology. Its *Our common future* report (issued in 1987) emphasized the economic significance of natural capital endowments and demonstrated the important role that sound development practice can play in environmental protection. The report promoted a new type

of development, which satisfies the current needs of human populations without compromising the chances of future generations. The document refers to this as "sustainable development".

Several chapters of Agenda 21 refer to watershed management

The UN Conference on Environment and Development (UNCED), in Rio de Janeiro, Brazil in 1992, publicized the concept of sustainable development. Among other important policy documents, the conference approved Agenda 21, which has provided the essential guidelines for sustainable development policy and practice ever since. Among Agenda 21's statements on watershed management issues (Box 1), the most extensive are in Chapter 13 on "Sustainable mountain development", which includes a programme area on promoting integrated watershed development and alternative livelihood opportunities. This establishes a framework for linking:

- the development of appropriate land-use planning and management for both arable and non-arable land in order to prevent soil erosion, increase biomass production and maintain the ecological balance;
- the promotion of alternative income-generating activities, such as sustainable tourism and fisheries and environmentally sound mining;
- the improvement of infrastructure and social services in mountain areas, in order to protect the livelihoods of local communities and indigenous people;
- mitigation of the effects of natural disasters related to poor watershed management through hazard prevention measures, risk zoning, early warning systems, evacuation plans and emergency supplies.

Agenda 21 also stresses that successful watershed management must be based on local stakeholders' informed participation in natural resource management, economic growth and social change.

Agenda 21 played an important role in adoption of an integrated and participatory approach to conservation and development. It incorporated the views of economists and social scientists in watershed management; helped ecologists and foresters to understand local livelihood systems and recognize the validity of some indigenous solutions to site-specific problems; improved communications and collaboration among planners and local people; and encouraged participatory watershed management. A large number of watershed management projects and programmes were implemented all over the world by different organizations and stakeholders, many of them using integrated and participatory approaches. Watershed management institutions were increasingly involved in the global events that followed the Rio Conference – the World Summit on Sustainable Development (2002), the International Years of Mountains (2002) and Freshwater (2003), etc.

BOX 1

Watershed management issues in Agenda 21

Agenda 21, Chapter 13 "Sustainable mountain development" includes the following statements on mountain watersheds:

> Nearly half of the world's population is affected in various ways by mountain ecology and the degradation of watershed areas. About 10 percent of the earth's population lives in mountain areas with higher slopes, while about 40 percent occupies the adjacent medium- and lower-watershed areas. There are serious problems of ecological deterioration in these watershed areas... Soil erosion can have a devastating impact on the vast numbers of rural people who depend on rainfed agriculture in the mountain and hillside areas. Poverty, unemployment, poor health and bad sanitation are widespread. Promoting integrated watershed development

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Box 1 continued

programmes through effective participation of local people is a key to preventing further ecological imbalance. An integrated approach is needed for conserving, upgrading and using the natural resource base of land, water, plant, animal and human resources. In addition, promoting alternative livelihood opportunities, particularly through development of employment schemes that increase the productive base, will have a significant role in improving the standard of living among the large rural population living in mountain ecosystems.

Reference to watershed management-related topics is also made in other chapters of Agenda 21. For instance, Chapter 10 "Integrated approach to the management of land and land resources" states:

Expanding human requirements and economic activities are placing ever increasing pressures on land resources, creating competition and conflicts and resulting in suboptimal use of both land and land resources. If, in the future, human requirements are to be met in a sustainable manner, it is now essential to resolve these conflicts and move towards more effective and efficient use of land and its natural resources. Integrated physical and land-use planning and management is an eminently practical way to achieve this… Land resources are used for a variety of purposes which interact and may compete with one another; therefore, it is desirable to plan and manage all uses in an integrated manner. Integration should take place at two levels, considering, on the one hand, all environmental, social and economic factors (including, for example, impacts of the various economic and social sectors on the environment and natural resources) and, on the other, all environmental and resource components together (i.e., air, water, biota, land, geological and natural resources). Integrated consideration facilitates appropriate choices and trade-offs, thus maximizing sustainable productivity and use

Chapter 11 "Combating deforestation" includes the following statements on watershed degradation and rehabilitation:

Forests worldwide have been and are being threatened by uncontrolled degradation and conversion to other types of land uses, influenced by increasing human needs, agricultural expansion, and environmentally harmful mismanagement... The impacts of loss and degradation of forests are in the form of soil erosion, loss of biological diversity, damage to wildlife habitats and degradation of watershed areas, deterioration of the quality of life and reduction of the options for development. The present situation calls for urgent and consistent action for conserving and sustaining forest resources. The greening of suitable areas, in all its component activities, is an effective way of increasing public awareness and participation in protecting and managing forest resources. It should include the consideration of land use and tenure patterns and local needs and should spell out and clarify the specific objectives of the different types of greening activities.

Chapter 12 "Combating desertification and drought" states:

Desertification affects about 3.6 billion hectares, which is about 70 percent of the total area of the world's drylands or nearly one-quarter of the global land area. In combating desertification on rangeland, rainfed cropland and irrigated land, preventative measures should be launched in areas which are not yet affected or are only slightly affected by desertification; corrective measures should be implemented to sustain the productivity of moderately desertified land; and rehabilitative measures should be taken to recover severely or very severely desertified drylands. An increasing vegetation cover would promote and stabilize the hydrological balance in the dryland areas and maintain land quality and land productivity.

WATERSHED MANAGEMENT IN FAO

Since the late 1980s, FAO has promoted watershed management by implementing several field projects (Boxes 2 and 3) and documenting best practices and lessons learned in several publications. In 1992, FAO was appointed task manager for Chapter 13, Agenda 21, and has been active in broadening integrated and participatory watershed management and mainstreaming watershed management and sustainable mountain development issues into policy fora since then.

From 1998 to 2002, FAO played a leading role in preparations and observance of the International Year of Mountains (IYM), whose mission statement was to "promote the conservation and sustainable development of mountain regions, thereby ensuring the well-being of mountain and lowland communities". The IYM helped to establish several international initiatives to improve the lives of mountain people and protect mountain environments.

In 2002, the need to take stock of existing experiences and rethink the watershed management paradigm led FAO to launch a comprehensive inter-regional review of integrated and participatory watershed management. This initiative was part of the implementation of Chapter 13, Agenda 21 and of the follow-up to the International Years of Mountains and Freshwater. It involved more than 80 institutions and more than 300 professionals.

BOX 2

FAO-promoted watershed management field projects in the 1990s

FAO implemented the following eight major watershed management projects between 1990 and 2000:

- Participatory Watershed Management Training Project, 1996 to 1999, Asia region (FAO/Netherlands);
- Participatory Upland Conservation and Development, 1992 to 2000, inter-regional: Bolivia, Burundi, Nepal, Pakistan, Rwanda and Tunisia (FAO/Italy);
- Shivapuri Watershed Management and Fuelwood Project, 1985 to 1999, Nepal (FAO/Norway);
- Participatory Watershed Management, 1995 to 1999, Viet Nam (FAO/Belgium);
- Mithawan Watershed Management, 1995 to 2000, Pakistan (FAO/Japan);
- Watershed Management: Three Critical Areas, 1993 to 1999, Myanmar (FAO/United Nations Development Programme [UNDP]);
- Watershed Planning and Management, 1993 to 1997, Pakistan (FAO/UNDP);
- Suketar Watershed Management, 1989 to 1997, Pakistan (FAO/UNDP).

All eight projects included community or group participation and invested considerable resources in training local technicians and villagers. All projects had social and biophysical-technical components, but there were insufficient indicators to evaluate the performance of these. Most projects lacked sustainability indicators.

Future projects need to pay more attention to:

- project design, to avoid overcomplicated expected outputs, unclear objectives and complex designs;
- comprehensive and clearly defined performance indicators;
- monitoring and evaluation procedures that clearly link project performance with objectives;
- sustainability indicators that are linked to project objectives.

The broad objectives of the FAO watershed management review, which was mainly implemented during 2002 and 2003, were: (1) to collect and disseminate the information needed to assess watershed management as implemented during the 1990s; and (2) to support and guide development of a new generation of more effective watershed management projects and programmes.

Four regional consultations (Europe, Latin America and the Caribbean, Asia and Africa) were held and their proceedings published. The review process culminated in an inter-regional conference at Sassari, Sardinia, Italy where recommendations for policy-makers were summarized in the Sassari Declaration (Box 4).

The following chapters are based largely on findings of the FAO review. The ideas and recommendations presented are the results of work in progress; they are meant to promote further reflection and creative thinking about future watershed management projects and programmes.

BOX 3

The Inter-Regional Project for Participatory Upland Conservation and Development

The FAO Inter-Regional Project for Participatory Upland Conservation and Development (PUCD) was funded by the Italian Cooperation. It ran from 1992 to 2000 in selected pilot watersheds of Bolivia, Burundi, Nepal, Pakistan, Rwanda and Tunisia.

PUCD's main aim was to identify and field test methods and techniques for promoting and consolidating people's participation in the sustainable management of upland watersheds. Its immediate objectives were to:

- establish participatory and integrated watershed management at the selected sites;
- incorporate the participatory and integrated watershed management approach into national policies for rural development and natural resource conservation, and into decentralized planning systems;
- replicate successful methods, techniques and tools through communication and training.

Project management was based on action learning. National field teams prepared yearly work plans through participatory assessment, planning, implementation, evaluation and replanning exercises with local stakeholders such as communities, grassroots organizations, the private sector, government line agencies, local authorities, non-governmental organizations (NGOs) and other development institutions.

The teams ensured that lessons learned could be applied both within and outside the project areas. A coordination unit at FAO headquarters systematized the lessons learned and mainstreamed the project experience within FAO and other international organizations. Case studies, field guides and communication materials were published.

According to the final evaluation, PUCD "has largely achieved its objectives. Its pilot, open-ended and flexible design has been instrumental in proving that … the participatory and collaborative management process is a very adequate strategy to trigger local development, empower people and contribute to natural resources conservation and sustainable management. The 'learning-oriented' approach has enabled the progressive redefinition of project strategy, field procedures, technologies and tools according to the specific and changing circumstances at the different levels."

PUCD provided a learning environment in which people from different countries and different backgrounds put the policy statements of Agenda 21, Chapter 13 into practice. It also created a group of professionals from FAO and other institutions who are aware of the pros and cons of the new approach and capable of carrying out the necessary work.

BOX 4
Sassari Declaration

Within the context of the Millennium Development Goals and with the intent of preparing for the next generation of watershed management, the objectives of the international conference "Integrated Watershed Management: Water Resources for the Future" were to: (1) provide an adequate opportunity/platform to all concerned parties to share information and contribute to a better understanding of the current status of watershed management; and (2) provide advocacy and support for the implementation of effective watershed management at different levels. Conference recommendations are as follows:

1. There is a need to focus increased global and regional attention on watershed management because watersheds integrate resources, environmental services, uses and users; watersheds connect people who may never meet and may vary greatly in terms of wealth, livelihoods and culture; good planning requires good understanding of linkages between upstream and downstream hydrologic and land-use systems; investments are long-term and generate benefits and costs across large distances; and interventions that are good for individuals or communities may be detrimental to wider societal interests.

2. Outputs from the Sassari conference and the associated regional workshops should be used to develop a set of guidelines for the next generation of watershed management programmes that can be applied to the design and screening of new projects.

3. Some of the key elements of the guidelines for the next generation of watershed management programmes include: a multisectoral approach; a combination of bottom-up and top-down planning, monitoring and evaluation; clear procedures for environmental impact assessment of interventions, including dams and reservoirs; networking among key stakeholders; consideration of socio-economic and cultural aspects and natural processes; gender balance in decision-making; embracing new approaches for sharing knowledge and learning; sustainable finance; compensation mechanisms; capacity building at all levels; reforming governance, linking surface, groundwater and coastal water sources; a shift from looking at supply to demand of water; efficiency of water use; coping with hydrologic extremes and natural hazards; and the integrated management of water, vegetation, soils and sediments.

4. Guidelines for the next generation of watershed management programmes should be tested and demonstrated in pilot cases, with planning and implementation from local, national and transnational scales. These pilot cases should include institutionalization of watershed approaches into national systems.

5. Considering the need for integrated approaches to watershed management, it is recommended that donor agencies, financial institutions, government departments, civil society organizations and the private sector commit to long-term intersectoral and innovative planning, finance and execution of watershed management.

6. Because watersheds often span political boundaries, watershed management should be seen as an integrative approach that has value in understanding and resolving conflicts between upstream and downstream communities and countries.

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Box 4 continued

7. Because rural and urban poverty is a significant contributing factor to watershed development and degradation, it is recommended that the multiple linkages between poverty and watershed management be better understood and considered in the planning of both watershed management and poverty alleviation programmes.

8. It is recognized that there is an urgent need to build capacity of all stakeholders (including watershed inhabitants and professionals at the local and national levels) to understand and manage the multisectoral processes and approaches necessary for effective watershed management.

9. At present, land and water governance institutions and policies are often inadequate to support the integrative and multisectoral approach needed to implement watershed management. It is therefore recommended that: (1) institutions for integrated basin management be established and strengthened with appropriate legal status, resources and financing; (2) there be more effective and equitable communication among local communities, managers and policy-makers; and (3) policies be based on clear evidence and tested principles.

10. Access to a minimum amount of safe water should be recognized as a fundamental human right of all people.

11. Considering that the management over land and water resources is highly fragmented at all levels, it is recommended that consideration be given to establishing an international forum that focuses on integrated watershed management, including land-use and human activities that have an impact on water.