

Sustainable Management of Headwater Resources Research from Africa and India



EDITED BY

LIBOR JANSKY, MARTIN J. HAIGH, HAUSHILA PRASAD

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Haushila Prasad



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Introduction

Sustainable management of headwater resources

Martin J. Haigh, Libor Jansky and Haushila Prasad

Introduction

Headwater regions provide the source for water resources and the margins of drainage basins, and they are the first- and zero-order basins that surround every catchment. The challenge is to define appropriate self-sustainable management strategies and structures for these lands which meet the needs of the headwater habitat, including its human inhabitants, and those of habitats downstream.

The finite and vital nature of fresh water as a natural resource has long raised concern regarding the socio-economic, political, and environmental security of human activities and ecosystem health in watersheds. Better fresh water resources management improves the welfare of poor people and reduces the risk of disasters such as floods, while improved water quality leads to better health and reduced child mortality. Almost 20 per cent of the world's population depend on poor water supplies to meet their daily needs, and many of such water resources are contaminated by disease-bearing organisms and other pollutants. Given the importance of integrated water resources management, the Millennium Development Goals – a set of time-bound and measurable goals and targets for combating various environmental and development problems adopted by heads of state at the UN Millennium Summit in September 2000 – include commitments to improve water security and ensure environmental sustainability (World Bank Group, 2003). Water management must also become a central component of the new educational and train-

ing programmes that will follow the launch of the UN Decade of Education for Sustainable Development, 2005–2014 (United Nations, 2003a). The hope is that this will encourage the world's people to reflect upon the consequences of their actions and focus more closely on the work of constructing more self-sustainable lifestyles (Tilbury and Goldstein, 2003: 1).

Headwater regions are defined as places where water flow-lines originate and where much groundwater recharge occurs. They are the ultimate source of a great portion of terrestrial fresh water. Technically, these lands are the zero- to first-order catchments on the margins of every river basin (Paracchini, Folving, and Bertolo, 2000). When water qualities and yields change in headwaters, the consequences affect the lands downstream.

Traditionally, headwater sources were associated with low levels of human occupation and isolation from major industrial and economic processes. Unfortunately, in the modern era many processes challenge the quantity and quality of water produced by headwater regions. Although located in the highest and most peripheral parts of a watershed, these regions lie at the front lines of human activities including agriculture, logging, mining, road construction, tourism, hydropower generation, and water supply. In some regions a booming economy is sponsoring economic growth and infrastructural developments that threaten biodiversity, unique habitats, valued landscapes, and minority cultures found in the watershed.

Among such development activities, conversion of forests into agricultural land in headwater regions is a major source of the problem of headwater degradation. Although improvements are being observed in some parts of the world today, as a whole it is estimated that the world has lost more than 900,000 square kilometres of forest in the past decade. Participants at the World Summit on Sustainable Development (WSSD), held in Johannesburg in September 2002, gave the highest new emphasis to sustainable mountain development over a quarter of a century, and so joined hands with the movement for sustainable management of headwater resources (United Nations, 2003b). Since many headwater regions are found in mountainous areas, while providing valuable fresh water supply to the ecosystems and human communities in the extended basins, discussions on better management of headwater regions have made valuable contributions to both the International Year of Mountains in 2002 and the following International Year of Freshwater in 2003.

Frameworks for Action on Water and Sanitation and Action on Agriculture

Arising with the WSSD, the WEHAB initiatives proposed by UN Secretary-General Kofi Annan aim to provide focus and impetus to action in five key areas: water, agriculture, biodiversity, energy, and health (United Nations, 2002). All of these frameworks impinge upon the sustainable management of headwater resources, especially the frameworks for Action on Water and Sanitation and Action on Agriculture. Headwater resources often lie on the margins of national and regional socio-economic systems, and some encompass political boundaries between rival social, cultural, and military groups. In such cases, economic and social marginalization of regional inhabitants may lead to emigration and the collapse of local environmental management and socio-economic systems.

In developing societies, many headwaters have suffered through colonization by peasant farmers who have been displaced from better-quality agricultural lands. Agricultural modernization has launched waves of economic migrants into the cultivation of unfamiliar and often unsuitable terrain. In such communities the struggle for immediate survival has higher priority than any concern for the future or the surrounding environment, even where the skills and resources needed for its management exist. In such cases, the problems of environmental degradation rarely remain in the headwaters. Regions downstream suffer through water and sediment pollution, changes in the hydrological regime, and reduced natural resource supply, which may also lead to social stress and livelihood disruption.

Today these regions face a variety of problems that affect not only the people residing in the headwater region, but also a greater portion of the population and ecosystems in the associated catchments. These include the provision of fresh and healthy waters and the problems of unsustainable agricultural production (Shisanya and Kwena, this volume; Subramanian, this volume). Many remote headwater regions are critical reserves of biodiversity (Rajwar, this volume) and sources of hydropower. Proper management of headwater resources has become one of the most significant modern challenges for environmental management and development.

Headwater Control Movement (HCM)

The HCM is a field-oriented grassroots movement that explores the role of environmental professionals in promoting the welfare of the environ-

ment and its inhabitants. It differs from most research networks in its attempts to link practitioners, researchers, and policy-makers from different backgrounds and disciplines in a common cause: the search for self-sustainable watershed management (Haigh and Krecek, 2000).

Headwater control is constructed on three principles.

- Headwater environments are threatened by environmental changes due to human action. HCM meetings routinely deal with problems caused by forest decline, land degradation, deteriorating water quality, and the damaging effects of air pollution, agriculture, road construction, tourist developments, and mining.
- Direct intervention can secure environmental quality. HCM meetings showcase many examples where pollution control, forestry, soil conservation, bioengineering, and/or community action have improved the vitality of the headwater environment.
- Solutions demand the practical application of coordinated and integrated environmental management. The HCM strives towards the integrated treatment of headwater landscapes – in both their biophysical and social components.

The aim remains to find an approach that unites the imperatives of environmental conservation, (self-)sustainable development, environmental reconstruction, the empowerment of headwater peoples, and the regeneration of livelihoods through policies and institutions that promote appropriate action.

Neglected thus far has been the role that could and should be played by environmental education for sustainable development, because over recent meetings it has become obvious that improved watershed management, like all environmental management, demands a change in social attitudes. This includes a shift in emphasis from granting primacy to short-term economic gains and away from belief in the still current myth that it is desirable for technology, routinely, to replace the functions of nature (Berry, 1999).

The practical disciplines of integrated watershed management involved in headwater control provide a unique collaborative environment for governmental and non-governmental organizations as well as international organizations (including some UN agencies) sharing similar goals.

The Nairobi conference was part of the Fifth International Conference on Headwater Control and it inherited some of the traditions and aspirations of its predecessors (Krecek *et al.*, 1989; Krecek, Rajwar, and Haigh, 1996; Haigh and Krecek, 1991, 2000; Krecek and Haigh, 1992; Singh and Haigh, 1995; Haigh *et al.*, 1998).

In 1989 the First International Conference on Headwater Control, held in Prague, Czech Republic, during that nation's "Velvet Revolution",

marked the beginning of the Headwater Control Movement. The HCM focuses on improving the recognition and management of headwater-related environmental changes on the ground. The movement has sought, especially at the field scale, to promote better environmental understanding through empirical research, development of improved strategies for environmental reconstruction and conservation, and the design of better environmental management. The movement was initiated in the belief that if the headwaters of a region are in good condition, then they will transmit few problems downstream; since then, the HCM has been striving towards the integrated management of headwater landscapes in both their biophysical and social components.

Today, many headwater regions in the world share a variety of common problems, such as soil, forest, and water resource degradation, pollution by various external agencies, and poor management structures. Therefore, through the HCM, attempts have been made to exchange knowledge and experiences from different headwater regions in the world in order to attain better management. Like the United Nations University, the HCM has project aims to combine environmental and economic sustainability. Its researches deal with the key economic problems of the target region, be it steep-land agriculture in the tropics, reclamation of coal-mine land in Europe's headwaters, the management of fresh water in mountains or semi-arid regions, preserving water resource quality in the context of transboundary air pollution as in Central Europe, or restoration of the environmental and economic bases of rural communities in the war-torn Balkan states.

It was recognized that headwater management is often dominated by inappropriately defined institutional frameworks oriented to the extraction of particular resources for the benefit of outsiders. Frequently, this style of lopsided management also creates problems that are transmitted downstream, sometimes even to the same outsiders, through changes in the quality of water for their own use and population inflow from the headwater regions to urban areas. Teams of experts involved in the current project aim to help local communities take control of the management of their own environment and economic activities by promoting the development of community-based, environmentally informed, and holistic local management regimes (Van Haveren, 2000).

A key objective of headwater control is the "uplift of all", as stated in Gandhian principles. As mentioned above, the headwater management project aims at aiding local communities to build self-sustaining local systems for the management of their own livelihoods and environment, including biodiversity, natural resources, cultural icons, and the services their lands provide to outside communities and habitats.

Headwater control compared to other new movements in watershed management

Headwater control is one among several emerging ideologies that compete for the soul of watershed management. It contests a dominant mind-set that still sees watershed management in shallow and mechanistic terms, as a process where different technical experts isolate particular problems or resources for attention. Keidel (1996) aptly adapted the old parable of the four blind philosophers who describe an elephant by sending seven “visually challenged people” to evaluate a watershed. Individually, they decide that this land is perfect for nature conservation, for recreation, for water supply, agriculture, forestry, fishing, and mining – each finds that the land was “made” for their own favoured use beyond all others. These kinds of debates still dominate headwater management. Worse, current watershed management still aims to resolve problems either by constraining nature or by taking the functions of nature into human control. Its key concept is “sustainable development”. However, today there exists a growing practical realization that the concept of sustainability is flawed. Sustainable, from its roots, means to hold up from below. Something is called sustainable if it is capable of being kept going through repair, maintenance, and management in “normal” conditions. Unfortunately, by extension, when such a system is not actively sustained, or when conditions are not “normal”, it becomes liable to collapse and, meanwhile, its sustenance becomes a perpetual concern, cost, and responsibility. The alternative is to design for self-sustainability, creating systems that can look after themselves, either because their support is inherent in normal pattern of land use, or because environmental management is returned to the self-sustaining hand of nature. Headwater control strives for self-sustainability. The control systems which the HCM seeks to work with and within are nature and the local community, which the HCM would empower and engage in the self-regulation of their own habitats. In this respect, the movement epitomizes a shift in values across the applied environmental sciences.

Stern and Dietz (1994) recognize three current environmental value systems. “Egoistic” values predispose people to protect environmental attributes that affect them personally. “Altruistic” values subsume concern for the environment within the welfare of human society. “Biospheric” values grant primacy to all life, including that part which is human. Similarly, the “deep ecologist”, Naess (1987), conceives the same egocentric, sociocentric, or anthropocentric and ecocentric or biocentric spectrum as a process of awakening, first to the personal self, then to the self defined as part of a human social group, and finally to the ecological self as part of the whole of living nature. Headwater control conceives

the human component as an integral part of the watershed system, and that human welfare is best served by learning to live within nature and by serving the needs of nature.

Symptomatic of alternative thinking is the FAO's landscape-lifescape perspective, as developed in its electronic conference on land-water linkages in rural watersheds. This reflects a major functional, but ultimately unhelpful, division between those whose primary focus is the physical environment and the impact of its human intruders and those policy-makers whose concern is human welfare, which must be wrought against the opposition provided by the inconveniences of the physical landscape and, often, its inhabitants. The "lifescape perspective", called a defining characteristic of watershed management, is founded in the realization that since the benefits of environmental change are shared between the upstream and downstream shareholders in a watershed, so too should be the costs. Any development of policy, however, is forestalled by the workshop's wedding to the myth that many popular conceptions of upstream-downstream relationships, as well as the bases of "much land and water management policy", are inaccurate, uncertain, or "pseudoscience" (Togneti, 2000: 13). The workshop argues that there remains a need to take action on the best evidence available, whilst recognizing that this may be partial or incorrect (Togneti, 2000).

Superficially, the newly emergent applied systems science of "ecohydrology" fits the HCM vision. Ecohydrology purports to examine the tightly coupled interactions between water and life in order to enhance the sustainability of watershed management (Zalewski, Janauer, and Jolankaj, 1997: 13). It was conceived "to accelerate the transition from descriptive ecology, restrictive conservation and over-engineered management of aquatic ecosystems to analytical/functional ecology, creative management and conservation of fresh waters" (Zalewski, Janauer, and Jolankaj, 1997). In practice, ecohydrology differs from headwater control in its academic aspect and its emphasis on water quality and aquatic ecology. One recent typical paper, styled "Ecohydrology: Rediscovering freshwater ecology" (Gopal and Chauhan, 2001), may capture an ethos that focuses on nature but sees humans as external to the system. There are many chapters in this volume that could equally be labelled "Ecohydrology", but headwater control sees human welfare as a central concern.

Closer to the aspirations of the HCM are the various movements for sustainable agriculture, not least the "better land husbandry" (BLH) approach, which has been constructed through field projects in Kenya's Kakamega region and elsewhere in Africa (Hudson and Cheatle, 1993). BLH has grown from recognition that a large proportion of the money invested in conventional technical soil and water conservation (SWC) has been wasted. Structures constructed have not been maintained and

land management recommendations introduced to local communities have not been adopted or maintained (Shaxson, 1997). The problem was that these measures did not sufficiently address the personal needs of the farmer, for whom production is infinitely more important than soil erosion. BLH, therefore, has strived to promote systems of farming that meet both the socio-economic needs of the farmer and the needs of the soil. BLH shifts emphasis from the volume of soils lost to erosion and the mechanical protection of the soil to the quality of the soil in the fields and its organic development, and from the needs of the whole watershed to the livelihoods of those who manage that soil through their land-husbandry practices (Shaxson, 1996; Shaxson *et al.*, 1997; Bunch, 1982).

BLH is good headwater control, and it illustrates the way ahead though the changing of human attitudes from “control” to “accommodation” and “self-control” or Gandhi-style *swaraj*, where the long-term sustainability of the human habitat is identified with the health of the whole habitat. Institutional constraints are a major obstacle to effective headwater management, and new institutions which are local, flexible, and holistic are needed. Central to this development is the emerging concept of “basin citizenship” (Van Haveren, 2000), where citizenship involves both rights and duties, including stewardship for lands managed as a public trust.

It is understandable that a “declaration” is as strong as its implementation, and in this respect the Nairobi Headwater Declaration (Appendix 1) has made a good claim to proving itself as a potent influence on those who will work on the sustainable management of headwater resources in the future. Several outcomes are immediately evident.

First is the development of an international commission “to provide direction and continuity for headwater issues and to create an awareness of headwater concerns at governmental level”, which is being developed by a team led by Haushila Prasad of Kenyatta University, Kenya, and colleagues at Banaras Hindu University, India.

Second is the aim to pay “greater attention . . . to applied environmental education aimed at building capacity for headwater management and changing social attitudes against wasteful and polluting uses of headwater resources”. A team led by Martin Haigh prepared a special session on education for sustainable development at the Annual Conference of the Royal Geographical Society, London, September 2003, and was contracted to do the same at the International Geographical Congress in Glasgow, August 2004. This work has generated two special theme issues of the *Journal of Geography in Higher Education*, which has been ranked in the top dozen or so international journals for both geography and education, to be released near the start of the UN Decade of Education

for Sustainable Development (United Nations, 2003a; Higgitt, Haigh, and Chalkley, 2005).

Third concerns the advice that “greater attention needs to be paid to the special roles and hydrological functions of headwater wetlands and peat lands, which should be a special focus for future headwater workshops”. Under the leadership of Josef Krecek, the International Association for Headwater Control hosted a special NATO Advanced Research Workshop on the Environmental Role of Wetlands in Headwaters, which was held in Mariansky Lazne, Czech Republic, in December 2003 (Krecek and Haigh, 2005).

Fourth, and most important, builds on the advice that “UN agencies should continue their work with all stakeholders to appraise their situations, to identify gaps in knowledge, needs and constraints, and to support them in their efforts to resolve their problems and undertake practical action towards more self-sustaining and environmentally sensitive development” and on the headwater movement’s concern for peace and environmental reconstruction in the new Balkan states. Under the leadership of Professors Miodrag Zlatic, Stanimir Kostadinov, and Nadia Dragovic, the World Association for Soil and Water Conservation (WASWC) launched a workshop on the natural and socio-economic effects of erosion control in mountainous regions at Belgrade University, Yugoslavia, in December 2002 (Zlatic, Kostadinov, and Dragovic, 2003). This sought to reconstruct pre-war patterns of cooperation amongst the watershed managers of the Balkan states and set up an international working party. The WASWC working party reconvened under the wing of Professor Georgi Gergov in Sofia, Bulgaria, in July 2003, and in the presence of potential donors, including the United Nations University, launched a series of projects that included the creation of a Balkan database for the World Overview of Conservation Approaches and Technologies (WOCAT), a group to share experience of the special problems of integrated watershed management in post-socialist economies fronted by Professor Ivan Blinkov of FYR Macedonia, and a practical project for the management of a major international watershed. Later the team added a fifth activity, which was to undertake a campaign for the creation of an international land reconstruction research reserve on the coal-mine-damaged lands of the Maritsa-Iztok basin, a project fronted by colleagues at the Poushkarov Institute of Soil Science and Agroecology, Sofia.

The challenge for the future will be to ensure that these initiatives produce both positive and practical results. Meanwhile the HCM rolls onwards towards its Sixth International Conference at Bergen, Norway, in 2005, under the guidance of Einar Beheim. This meeting will address between five and seven key themes. Those agreed are conserving soil

and water quality in headwaters (WASWC); interactions between forests and environmental quality in headwater catchments and lakes (IAHC); space research and GIS techniques for identification and classification of headwater catchments; holistic watershed planning in headwater areas; and assessment of environmental impacts in headwaters. Two further themes are contending for attention, and candidates include the Balkan states projects and education for sustainable development.

Conclusion – Key issues for the future

The Nairobi Conference on the Sustainable Management of Headwater Resources was conceived as a contribution to the International Year of Mountains and the International Year of Freshwater. Such concerns reflect two major themes of this and previous gatherings. However, the real context was the WSSD, the UN's World Summit on Sustainable Development in Johannesburg. Hopefully, this will build on the impetus for international environmental management that was initiated at UNCED in Rio in 1992. Of course, there are many questions about the ability of both government and intergovernmental agencies to deliver on the promises. Further, despite Rio, it is a fact that environmental decline continues at an alarming rate. However, Rio did begin to affect the way environmental policy is formulated and it is hoped that this will continue. As for this meeting in Nairobi, lost in Johannesburg, it is unlikely that the HCM could have made its voice heard. But Nairobi's larger status of being an independent "break-out conference" and the major support provided by the United Nations University and sister agencies may allow its outcome, the Nairobi Headwater Declaration, to have a greater impact.

Headwater control (the HCM) began as a federal conference of NGOs. NGOs stand for the belief that they can improve the world by "thinking globally and acting locally". More than a decade ago, at UNCED (Rio), the NGO Forum produced a set of alternate treaties, which also set out a prospectus for the NGOs. They worried about the "erosion of basic values and the alienation and non-participation of almost all individuals in the building of their own future" (UNCED NGO Forum, 1993: 5.4). They recognized "the central role of education in shaping values and social action". This education would include developing "an ethical awareness" and "a respect for all life cycles", and it would self-impose "limits on humans' exploitation of other forms of life" (UNCED NGO Forum, 1993: 5.21). The human dimension of headwater management remains its major challenge. Let us hope that the Nairobi Headwater Declaration and these scientific proceedings can advance better and active self-

management of headwaters by their human populations and a more self-sustaining integration of the human within nature.

Meanwhile, many questions remain to be answered, including the following.

- Are we sharing lessons learned locally in science and technology effectively?
- Are we engaging community participation properly?
- Is our technology really working?
- Are we really directing our research efforts to the most appropriate and necessary targets?
- Are our activities sustainable?
- Are our management structures appropriate?
- Do we have the best policies?

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Edited by Libor Jansky, Martin J. Haigh and Haushila Prasad

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Headwaters are the source of freshwater resources, the margins of drainage basins and the first and zero order basins that surround every catchment. The challenge is to define appropriate, self-sustainable, management strategies and structures for these lands which meet the needs of the headwater habitat, including its human inhabitants, and the needs of habitats downstream.

The contributors to this book strive to anticipate emerging and future problems; to discover integrated solutions to the problems already caused by land degradation, natural hazards and development processes; and to help develop better land management, environmental protection and landscape regeneration practices and policies. They also address the many challenges that remain: the concern for effective sharing of local experience in science and technology, community participation, the role of education, effectiveness and limits of current technology, the selection of appropriate policies and goals, modes of effective management, and the sustainability of current activities.

Sustainable Management of Headwater Resources provides an understanding of current and prior situations and provides scientific analyses of local and regional headwater issues in India and Africa. The authors analyse the current situation through field experiments that provide reliable information on the status of headwater resources in these regions.

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