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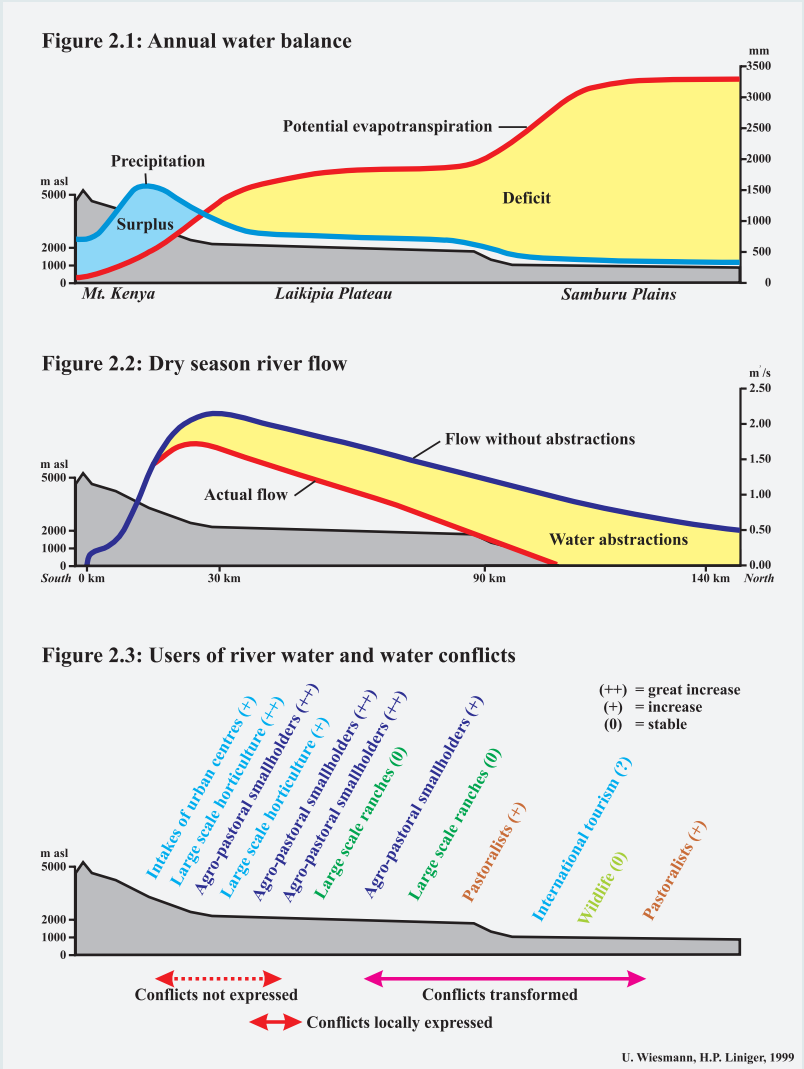
The Mount Kenya region offers a great deal of beautiful scenery and attracts tourists from all over the world. What these tourists may not see, however, is the crucial function of Mount Kenya as a water tower for its footzones and adjoining lowland areas. This function is becoming ever more crucial, as populations in these areas are growing at a rapid pace and new land use systems require far more water. These developments have set the stage for increasing conflicts over water resources; to make things worse, water is becoming ever scarcer, especially in the dry areas of the Laikipia Plateau and the Samburu Plains to the north and west of the mountain. This article summarizes the complex ecological and socioeconomic dynamics prevailing in the highland–lowland system of Mount Kenya—the Ewaso Ng'iro North Basin—and presents a multilevel strategy for mitigating the emerging conflicts over water resources.

FIGURE 1 Mount Kenya, with its glaciers, moorlands, and rain forest belt, is the water tower of the Ewaso Ng'iro Basin. (Photo by Urs Wiesmann)

FIGURE 2 Water balance, river water use, categories of water users, and water-related conflicts in a transect from Mount Kenya to the northern lowlands.



A highly diversified highland–lowland system

The Upper Ewaso Ng'iro North Basin stretches from Mount Kenya (5200 m asl) in the south to the plains of northern Kenya. The Basin is characterized by great ecological diversity and zonal differentiation. It includes the nival top of the mountain, the moorlands above the timber line, a belt of tropical rain forest, the semihumid footzone of the tertiary volcano, the semiarid high plateau of Laikipia, the escarpment, and the semiarid to arid Samburu Plains.

These ecozones are interlinked by a variety of ecological processes, the most important being those associated with the Ewaso Ng'iro River and its tributaries. The mountain, and in particular its rain forest belt, guarantees dry season river flow due to high rainfall, low evapotranspiration and high water retention capacity (see Figure 2.1, 2.2). As potential evapotranspiration exceeds precipitation with distance from the mountain (see Figure 2.1), the perennial character of the river becomes most important in the lower zones. Mount Kenya is therefore the water tower for the footzone and the adjoining lowland areas.

A multitude of dynamic land use systems

Up to the first decade of this century, the Upper Ewaso Ng'iro Basin was used by pastoralists, mainly the Massai and the closely related Samburu. The pastoralist logic of resource use, according to which movements followed rainfall patterns, was well adapted to the high variability of precipitation in the region. During the colonial period, most parts of the high plateau and the footzone were incorporated into the so-called White Highlands and were occupied by large ranches and farms owned by white settlers. Following independence in 1964, many of the ranches and large farms were sold and subsequently subdivided into small plots for agropastoralists, who immigrated mainly from the high-potential but overpopulated farming areas lying to the south and east of the mountain. A network of regional towns and local trading centers developed concurrently with this fundamental transformation of the land use system. In recent years, some remaining large farms in the footzone of the mountain were transformed into highly technical horticultural enterprises oriented toward international markets.

All these transformations in land use systems are reflected in the present land use patterns in the region (Figure 2.3). Densely settled small-scale farming areas, urban centers, and large-scale horticultural enterprises have been established in the footzone of the mountain and have encroached partly on the forest belt. The high plateau of Laikipia is occupied by small-scale farming areas, which have so far been less densely settled, and remaining

FIGURE 3 Smallholders who immigrated from high-potential areas are struggling to earn a livelihood in the semiarid conditions of the Laikipia Plateau. (Photo by Urs Wiesmann)

FIGURE 4 In the footzone of Mount Kenya, large-scale export-oriented horticultural enterprises have been established in recent years. (Photo by Hanspeter Liniger)

"Without water, no wildlife. Without wildlife, no tourists. And without tourists, no jobs down here and no foreign currency income for the government. It is as simple as that. Go and tell this to your people up there." (Lodge Manager in the Samburu Park, lower reaches of the Ewaso Ng'iro Basin)

large-scale ranches. These land use and land tenure systems in the upper reaches have meanwhile restricted pastoralists to the edge of the plateau and the dry lowlands, where game parks and tourist resorts seeking to attract an international clientele have also been established.

A broad range of claims on water resources

Especially after independence, the transformation of land use systems and patterns in the region was accompanied by very high population growth rates, exceeding 8% annually, mainly due to immigration of agropastoralist smallholders. The resulting population increase from about 50,000 to about 500,000 inhabitants in just four decades obviously implies that demands on natural resources, especially water resources, have also increased tremendously in the 15,200 km^2 of the Upper Ewaso Ng'iro Basin.

New types of demand resulting from these newly established land uses have also added to this increase. Aside from the fresh water requirements of urban centers and tourist resorts, increased agricultural production plays the most significant role. First, agropastoralist smallholders increase small-scale irrigation in order to be able to counterbalance the high risks caused by the great variability in rainfall; although justified by the severe problems of survival they face as the largest group of inhabitants in the Basin, their claims are virtually unlimited. Second, water requirements for year-round export-oriented horticultural production are high, even though advanced technologies such as drip irrigation are used.

Pressure on the low flow of river water

The most important claims on water are concentrated on perennial mountain river water, as it is the most reliable and accessible component of the water cycle, especially during the dry seasons and during dry spells in the two rainy seasons. Accordingly, urban centers, agropastoralist settlements in the upper reaches, and horticultural enterprises place their water intakes high up on the mountain in the tributaries of the Ewaso Ng'iro River. At the same time, agropastoralist communities and individual farmers on the plateau are establishing a variety of water supply systems, fed by the same tributaries, which are mainly used for small-scale irrigation. Most of the river-based supply systems have either insufficient storage or no storage facilities to bridge the dry season. As a result, 60–95% of the available river water is abstracted during the dry seasons in the upper reaches of the Basin (Figure 2.2), with up to 90% of it being unauthorized.

These developments have led to a very significant decrease in the low flow of the Ewaso Ng'iro River in the lowlands. The median decade river flow in February dropped from 9 m^3/s in the 1960s to 4.5 m^3/s in the 1970s, 1.2 m^3/s in the 1980s and 0.9 m^3/s in the 1990s. This drop implies that the river dries up completely in climatically critical years, as happened in 1984, 1986, 1991, 1994, 1997, and early 2000. The downstream populations, as well as wildlife and related tourism, are heavily affected by the virtual loss of one of their key natural resources.

Emerging conflicts about water resource use

A great majority of the inhabitants of the Ewaso Ng'iro Basin face severe difficulties earning a livelihood, ie, the agropastoralist smallholders on the Laikipia Plateau because of their limited land resources and the difficulties of coping with the highly variable semiarid conditions and the pastoralists because of the historical loss of complementary pastures in the upper catchment. These difficulties are now severely aggravated by the heavy decrease in the low flows in the Ewaso Ng'iro Basin, and current trends indicate that problems will continue to increase in the future. Against this background, one would expect major conflicts over water resources among the different categories of water users within the highland–lowland system.

However, these water-related conflicts are not expressed as expected in social and political terms (Figure 2.3). The potential water conflicts between agropas-

toralist communities and the large-scale water users on the slopes of Mt. Kenya are rarely expressed due to the political and economic dependency of smallholders on actors in these more powerful categories. The conflicts in the upper catchment are expressed between single agropastoral communities along the courses of the tributaries as well as between the different socioeconomic strata within the communities. In addition, potential conflicts between upstream and downstream users are not expressed primarily as water conflicts but have developed into ethnic tensions, in which customary land-related issues and cultural differences may break out in the form of violent clashes.

Stakeholders contribute to the problems

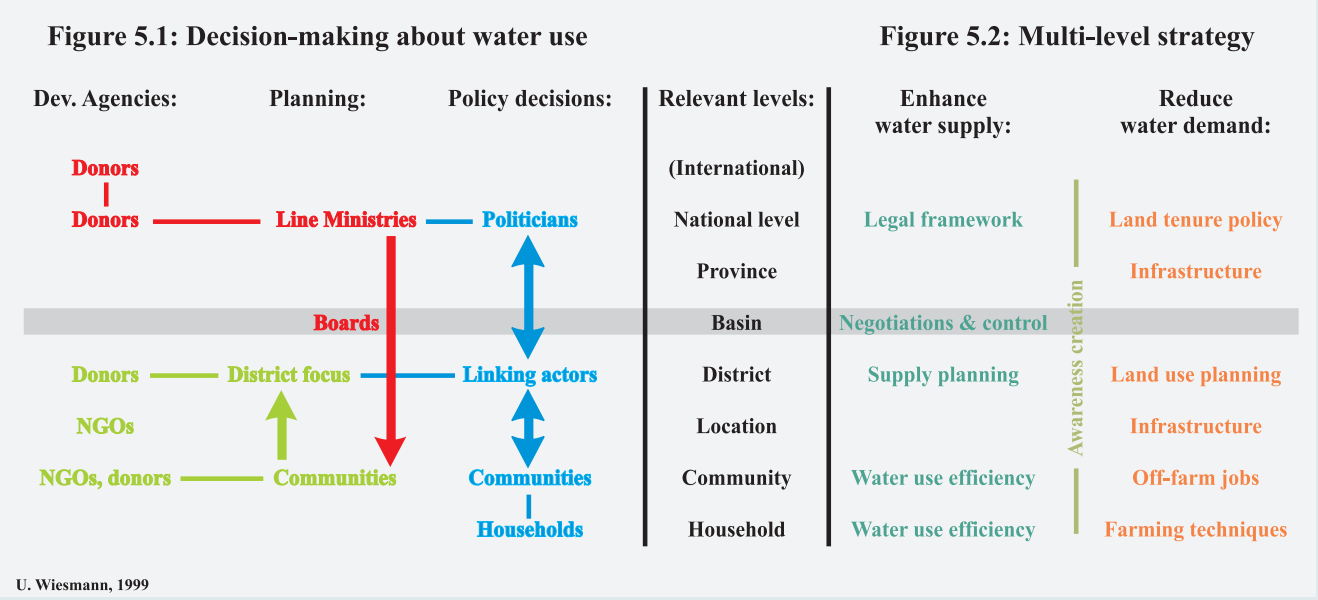
Against the background of the expressed needs and conflicts in the Basin, decision-making, planning, and implementing actors and institutions at different levels (Figure 5.1) concentrate mainly on two major development thrusts, first, on responding to water needs and related internal conflicts among the marginalized agropastoralist smallholder communities and, second, on combating growing problems of insecurity resulting from ethnic tension and poverty. This implies that the complex social, political, ethnic, and economic relations among the different water user categories and the different levels of decision-making, planning, and implementation further aggravate the problem of overutilization of river water resources. In other words, virtually all stakeholders associated with resource use and development in the Basin contribute directly or indirectly to the increase of water-related problems and conflicts, although mainly unintentionally and with no awareness of the magnitude of downstream effects.

The need for a multilevel strategy

Given the ecological, socioeconomic, and sociopolitical realities in the Basin, it is obvious that there are no easy solutions to the problem of overutilization of river water and the corresponding problems of securing a livelihood and resolving multiple conflicts. On a regional basis, bottom-up approaches alone, which aim to address needs and conflicts at the grassroots level, will contribute further to problems in the Basin beyond the local level. But top-down approaches, which aim at basin-wide water supply planning and water use regulations, will also fail due to problems of acceptance and the unmanageable systems of control that would be required for their implementation.

"My people are suffering from unreliable rainfall in this dry area. This river runs through our area and has water throughout the year. We are determined to use this water and your project can help us get it." (A subchief, negotiating with an NGO on the Laikipia Plateau)

FIGURE 5 Stakeholders in water-related decision-making at different levels and components of a multilevel strategy for more sustainable use of water resources in the Ewaso Ng'iro Basin.



"We are creating jobs for the people and income for the nation. We are doing that with the most advanced and efficient water use technologies. Hence, there is no reason to blame us for the water problems downstream." (Manager of a horticultural enterprise in the foot-zone of Mount Kenya)

FIGURE 6 Due to overutilization of river water in the upper catchment, access to water has become the most limiting factor for downstream pastoralists. (Photo by Hanspeter Liniger)

Consequently, there must be a search for solutions that do not consist of single approaches but combine different approaches and measures into a concerted strategy. Due to the severe limitations of stand-alone bottom-up and top-down approaches, such a strategy must address several levels, including relevant decision-making processes from the local context to the national level (Figure 5.1). Moreover, it should not concentrate only on the problems of overutilization of water resources but must also address the severe problems of securing a livelihood, as well as the various conflicts directly or indirectly related to water use. In this sense, a multilevel strategy would include aspects that can be summarized by the key words multiscale, multistakeholder, and multisectoral.

Components of a multilevel strategy

At first glance, in view of the complexity of the dynamics and the problems in the Ewaso Ng'iro Basin, it seems impossible to design and implement a strategy that includes all the above aspects of a multilevel approach. However, one way out of this dilemma would be to split the general strategy into single components agreeable to the actor categories and stakeholders concerned, and to concretize them at a level where sectoral implementation is possible. Along these lines, a long-term collaborative effort that began more than 20 years ago, involving the Universities of Nairobi and Berne in cooperation with the government of Kenya, has identified feasible components of a multilevel strategy. Without going into details, two separate groups of components, which are mostly on the way toward being implemented by a broad range of institutions at different levels, can be listed.

An initial group of components addresses problems of water use and water needs directly, which means that they concentrate on sustainable and need-oriented supplies of river water. A key criterion of these components is to maintain a low flow of at least 1.5 m^3/s in downstream parts of the Basin. From the top to the bottom levels, the following components are promising in this respect (Figure 5.2):

1. At the level of the entire Basin: Fostering negotiations among categories of water users on the amount of river water available to each category. Amounts are best negotiated among water user associations, as self-control mechanisms can be established and coordinated in each case by the catchment board.
2. At the district planning level: Establishing water supply development plans to ensure that both funds for implementation and implementation efforts are applied in the most needy communities and to establish location-specific supply principles, taking into account the allocated portions of river water and the availability of other components of the water cycle. A pilot plan has been devised for Laikipia District, establishing a framework within which concrete implementation at the local level can be realized in a participatory manner.
3. At the level of single supply systems: Increasing water use efficiency and water storage capacities by setting conditions for assistance in rehabilitating or implementing single water supply systems. Experience has shown that this requires increased coordination and common understanding among governmental and nongovernmental agencies.
4. At all levels: Supporting the above components of negotiation, planning, and implementation by awareness creation and provision of support for decision-making. This requires well-founded knowledge of the human and natural environments, monitoring of human impacts in the Basin, and the development of decision-making support tools that provide easy access to this information and help in the search for appropriate management options. It also requires clear commitment from authorities at different levels and is thus related to aspects of good governance.

The above group of strategic components addresses the supply side of the water problems in the Basin, which implies that, even if they are fully implemented, problems will persist due to the virtually unlimited demand for water. A second group of com-

ponents must therefore indirectly reduce or divert demands for river water. Examples of such components can again be identified at different levels (Figure 5.2).

1. At the household and farming level: Water demand for small-scale irrigation by agropastoral smallholders can be reduced by diminishing the risk of crop failure in semiarid areas. Experience has shown that drought-tolerant crops and water conservation technologies can reduce water demand if they fit into local farming systems and household strategies.
2. At the regional planning level: The pressures of demand for water can be decreased and the potential for innovation increased by enhancing off-farm activities that are part of agropastoral smallholders' household strategies. Experience has shown, eg, that credit schemes or improved infrastructure in rural centers can promote off-farm economic sectors. This means, eg, that establishing electricity in centers becomes part of an integrated water strategy.
3. At the national level: There is a danger that the success of a multilevel water strategy will have little effect if further immigration into the upper parts of the Basin cannot be retarded. But this would require limiting the further subdivision of large ranches, which in turn requires amendments to national land tenure policies. Experience has shown that such changes at the national policy level can be justified by linking them to arguments for wildlife protection and environmentally friendly tourism.

A flexible and iterative learning process

These brief examples of components of a multilevel water strategy for the highland–lowland area of the Ewaso Ng'iro Basin illustrate that the implementation of the strategy is bound to be a flexible, long-term process that involves different actor categories and institutions at different stages. This means that the process will entail implementation of single components, as well as monitoring, evaluation, and modification, measured against the background of contributions toward solving the highly complex problems of water use, water needs, and related conflicts in the overall Basin. It is therefore bound to require continuous social and institutional communication as well as a willingness to modify the strategy after learning from successes and failures.

Researchers can make a significant contribution to such a multilevel strategy by providing findings to support continuous communication and learning processes. However, this requires that they also take part in learning processes and not overestimate the convincing power of stand-alone information. Researchers must thus take account of the fact that the key to solutions lies in continuous sociopolitical negotiations at different levels, in which research can play a crucial role in promoting greater awareness and more informed decision-making. This crucial role also implies that research will not just be limited to the initial stages of strategy development but must be incorporated by society and decision-makers on a continuous basis.

FIGURE 7 The regular drying up of the formerly perennial Ewaso Ng'iro River is affecting downstream populations, wildlife, and international tourism. (Photo by Hanspeter Liniger)

FIGURE 8 The establishment of a non–river-based water supply system in the upper reaches is part of a multilevel water strategy in the Ewaso Ng'iro Basin. (Photo by Urs Wiesmann)

FURTHER READING

Ojany FF, Wiesmann U, editors. 1998. Resources, actors and policies—towards sustainable regional development in the highland–lowland system of Mount Kenya. *Eastern and Southern Africa Geographical Journal (ESAGJ),* 8:Special Number.

In this Special Number of the ESAGJ, *main research and transfer results of a long-term collaborative effort by the Universities of Nairobi and Berne and the Government of Kenya are presented in 10 papers that contain contributions from 21 authors. The journal can be ordered through F. F. Ojany, Department of Geography, University of Nairobi, PO Box 30197, Nairobi, Kenya, or through the MRD Editorial Office.*

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