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Development and the Environment: a Social and Scientific Challenge

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1. Introduction

The impact of economic development on the environment has reached such limits at local and global levels that its consequences threaten the bio-physical basis of life of many plant and animal species, and perhaps even the survival of mankind. One of the basic problems of modern development in relation to environment is the overuse of non-renewable natural resources. The burning of fossil fuels, modern agricultural practices, and industrialism have impacts on air quality and repercussions that cause massive changes in the global climate and the ozone layer, which have been relatively well documented. This paper, however, will focus on the threatening changes in renewable resources, both at local and global level.

The crisis affecting development and environment was given prominent public attention as a result of the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992, from which a number of global initiatives emerged. Developing countries represent 79.7% of the global population (UNDP, 1995), but they use only a small fraction of global non-renewable resources (WRI, 1994). They received particular attention at UNCED due to their financial need for sustainable development. Unfortunately, little real progress has been made since 1992; total development co-operation efforts have even been reduced in real terms since that date, averaging merely 0.29% of national GNPs in OECD/DAC countries (DEH, 1995).

It can be concluded from this neglect that much less attention has been given to alleviating the overwhelming overuse of renewable natural resources, such as vegetation, cultural plants, animals, soils and water in developing countries. The threat of current degradation found a global response only in the Convention on Biological Diversity, the forest agreement, and the recently signed Convention to Combat Desertification in the arid and semi-arid parts of the globe.

Progress towards finding a cohesive policy for development and the environment shows to be so slow that it remains insignificant vis-à-vis global trends. UNCED helped create global understanding of current impacts and processes, and showed the limits of current growth-oriented development strategies. Unfortunately, the commitments needed from all societies and nations – including new visions for sustainable development, responsive policies, and tangible actions – have been formulated only very slowly since that date.

Nevertheless, renewable natural resources are threatened not only in developing countries, but in almost all ecological systems. Subsistence-oriented agriculture and traditional nomadic systems are equally responsible for destruction of renewable resources, and modern agricultural and industrial systems even cause additional

destruction by their excessive use of non-renewable resources. The important relationships between global trends in resource degradation and local contexts – where land users are forced to operate within their local social, industrial, economic and ecological settings and have little means to change these – have not been sufficiently addressed, although they constitute the major obstacle to change towards more sustainable systems.

Developing countries suffer in particular from this neglect of integrated approaches to the use of renewable natural resources. Political and economic commitments, as well as inputs into both research and technological development to help understand and solve the problems of developing countries, are almost lacking. It has been estimated that only about 3% of global research budgets and workpower are invested in developing countries (SALAM, 1991), while 97% are invested in so-called developed countries. Again, over 90% of each of these budgets went into specialized research that lacks orientation and provides no integral analysis of the respective systems being investigated. It is not difficult to predict that economies employing a major portion of the population in the primary sector will particularly suffer from the combined effects of poverty and environmental degradation in the future.

The Center for Development and Environment (CDE) at the Institute of Geography of the University of Berne focuses its research and training on development and environmental problems in developing countries, and to a very limited extent in Switzerland. Apart from the historical evolution of CDE's activities since its foundation in 1988 and even prior to that time, this focus is justified when we consider the particular problems of environmental degradation and its consequences for human development in the poorest parts of the developing world. The scientific tradition of the Institute of Geography, including CDE, has been in rural and mountain areas in Switzerland and the European Alps, and in mountain systems in Africa, the Himalayas and the Andes. It evolved from the geomorphologic expeditions of Bruno Messerli and his teams in the 1960s, to more interdisciplinary research on man and biosphere in the 1970s, to long-term applied research co-operation with the assistance of the Swiss Development Co-operation (SDC) in East Africa in the 1980s, and to global networks for monitoring, evaluation and development of more comprehensive solutions to the problem of sustainable use of natural resources in the 1990s (CDE, 1995). This paper aims to document this evolution of approaches, to show that it constitutes a school of thought, and to exemplify it with illustrative examples at different levels.

2. CDE's conceptual framework and main thrusts

During its long involvement in the field of development and environment, CDE has developed three basic guiding principles in its approaches and projects:

1. Environmental degradation in developing regions can no longer be seen simply as a long-term problem endangering the resource bases of future generations. Rather it has become one of the main reasons for current economic, social and political problems which increasingly tend to erupt in conflicts over access to remaining

natural resources. Hence, solutions to stop or retard environmental degradation are crucial, not only in regard to the ecological dimension of sustainable development, but also in view of its economic and socio-cultural components (CDE 1995, WIESMANN, 1995). For CDE, this implies that its research aiming to contribute to sustainable development, has to focus on environmental problems by considering their ecological, technological, economic, social and political aspects and dimensions. This requires transdisciplinary approaches that include and combine a range of concepts and methods from both natural and social sciences.

2. Spatial extent and concentration in the primary production of local populations is one of the main direct causes for the degradation of renewable natural resources in rural areas in developing countries, especially in Africa. Hence solutions to these degradation problems have to be accepted, adapted and sustained by these populations. However, the capacity of local land users to react to environmental problems is seriously limited due to their economic marginalisation, which results in severe problems of sheer survival. For CDE this means that approaches to more sustainable development have to be devised in accordance with the options available to local land users. This requires participatory and partner-oriented approaches aiming at evaluating, strengthening and widening these options.

3. The main degradation processes in rural areas are caused locally, but their ecological and hence their socio-economic effects take place on a regional scale. At the same time, local land users are bound by external economic, social and political influences, frame conditions and dependencies which tend to narrow their options and manifest themselves on the regional scale. For CDE this implies that the regional development context is the appropriate spatial level for approaching the effects and causes of environmental degradation. By taking this level as a point of departure, endogenous solutions can be sought on the local level and supporting frame conditions can be addressed on the national or even the global level. Hence the regional or sub-national focus is the adequate level to bridge micro and macro aspects and approaches to development and environmental problems.

These considerations imply that CDE has to adapt and develop conceptual and methodological approaches that are transdisciplinary, participatory and partner-oriented and focus on regional development contexts, from where local and supra-regional levels can be addressed. If CDE aims at contributing to scientific and practical progress in the field of development and the environment, it has to face the social and scientific challenges of such an approach.

However, these challenges cannot be met at once, in every project and activity. CDE has therefore developed four major thrusts, which are interrelated and combine specific conceptual and methodological aspects, and which address specific problems and topics with which CDE is concerned:

1. Integrated regional baseline studies

In the planning phase of development projects and interventions, there is a great demand for baseline information on the areas concerned. By combining a set of natural and social science methods with participatory approaches, CDE has developed a concept that allows to respond to this need for information on a short-term

basis and – at the same time – to assess key issues, problems, conflicts and possible strategies concerning the conditions necessary for economically, socially and ecologically sound regional development.

2. Long-term monitoring of key processes
Environmental aspects of development tend to be neglected due to the need to solve urgent economic and social problems, and also due to the lack of information on the quantitative and temporal dimensions of environmental degradation, its causes and measures for combating it. CDE therefore puts strong emphasis on scientifically sound long-term monitoring of key natural resources and of the effects of different land use systems and technologies within a network of test areas and sites.

3. Actor-oriented perspective of regional development
Even if environmental problems and appropriate technological solutions are properly assessed, it often happens that the problems are still not approached at the practical level. The reason is that either the proposed solutions do not fit the limited options available to local land users, or they conflict with the interests of influential and powerful actors. By making use of social science approaches, CDE therefore addresses the perceptions, strategies, options and interests of local actors within regional development contexts in order to identify promising strategies for ecologically sustainable development.

4. Conceptual development and policy-oriented transfer
With its three regionally oriented thrusts, CDE aims at contributing to more sustainable development in the regions where it works. At the same time, the knowledge and experience gained and the approaches developed can be used and further elaborated as a contribution to policy development. CDE therefore engages in policy, planning and implementation support for agencies and target groups which are active in the field of development and environment. This support is based on basic conceptual development, on the evaluation of CDE's own field experience, and on a broad institutional and personal network capable of tapping the knowledge and experiences of other agencies, scientists, experts and target groups.
Taken together, these four thrusts give an outline of the guidelines mentioned above. Ideally, they can be seen in an iterative sequence: an integrated first assessment (thrust 1) leads to the need for in-depth studies using natural and social science methods (thrusts 2 and 3), which in turn can be used in policy development in the challenging field of development and environment (thrust 4).

3. CDE's regional baseline studies – the example of the Simen mountains

It is not always possible to carry out long-term monitoring and research at specific sites, where high inputs of manpower, methodologically sophisticated approaches and long-term institutional and financial commitments are available to provide a

detailed picture of a selected environment and its development trends. When agencies decide to implement a project, they often lack local information, but do not have the willingness, the time, or the money to carry out detailed investigations. Yet they need baseline data that allow proper planning in a participatory way. For such cases CDE developed a package of methods and tools based on a specific conceptual framework. It provides the required information, both to the local land users and to project planners and institutions.

One of these packages was implemented in the Simen Mountains in Northern Ethiopia in 1994 (HURNI, 1995). The field expedition for the Simen Mountains Baseline Study (SMBS) involved 35 post-graduate professionals who carried out a participatory survey in the Simen Mountains National Park in Northern Ethiopia, covering an area of about 300 km^2, and 30 villages, situated inside and outside the Park. Various bilateral and UN agencies were preparing a set of projects including road construction, agroforestry, and tourism in this area, which had been designated a World Heritage Site by UNESCO in 1978 due to its unique wildlife and natural beauty.

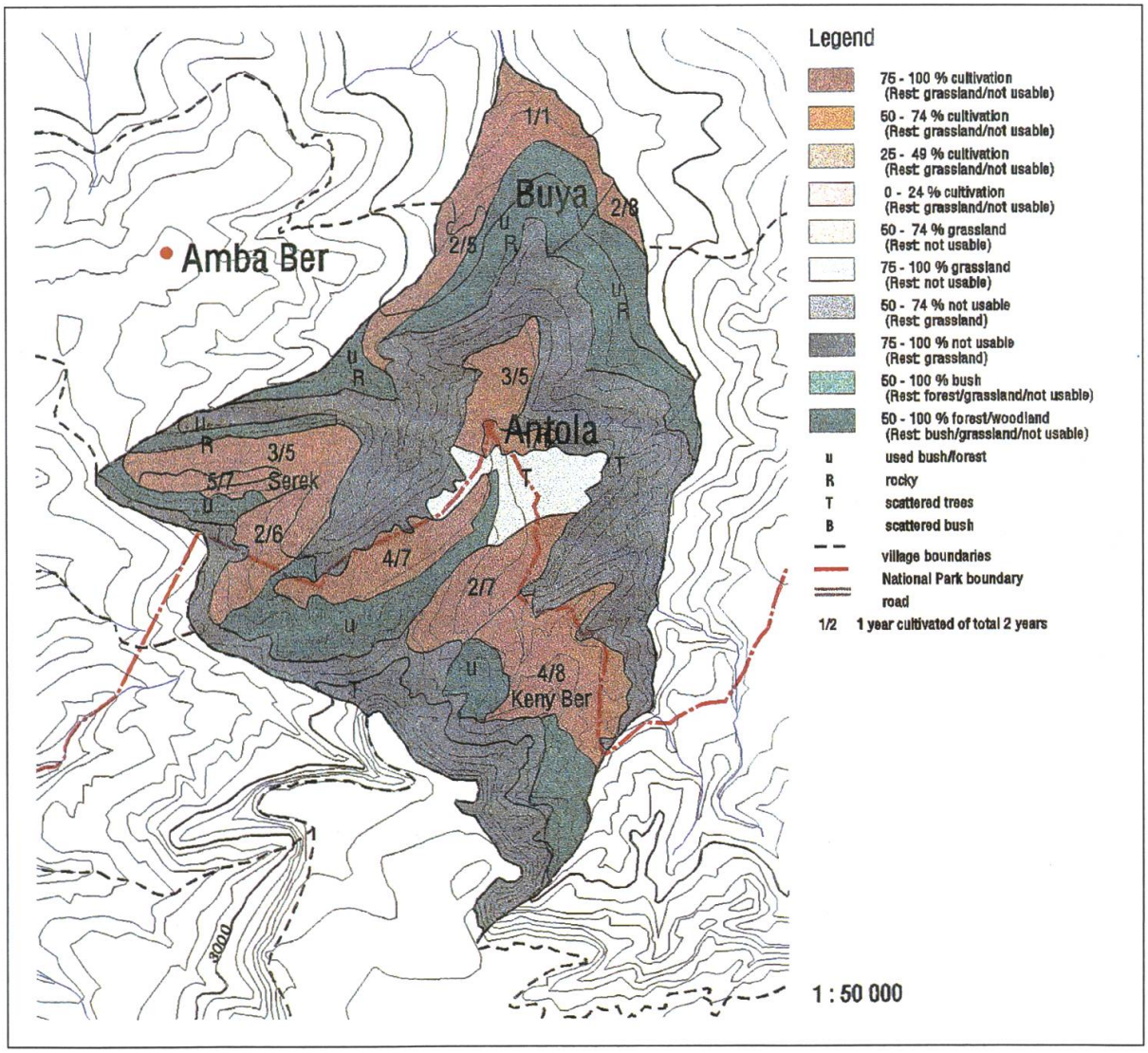
The study found that most natural resources in the area were in a very critical state. This includes not only important wildlife species such as the *Walya* ibex endemic to Simen, and the *Simen* wulf/fox endemic to Ethiopia, but also the highland forests, and particularly the agricultural soils that are rapidly degrading to an irreversible stage. Land use of various intensity was found to be prominent in over 80% of the area of the Park, leaving an actual habitat for *Walya* ibex of little more than 2000 hectares. Hence more than half of the *Walya* population of about 230 was actually living outside the Park.

A first analysis showed that park management and tourist services needed immediate and enhanced support. Unfortunately, relations between some of the park staff and some people living in the Park were tense due to the previous involvement of the staff in activities of the former government directed against some of the villages.

The study concluded that issues and principles relevant to reconciling conservation with development must be discussed and clearly stated in a participatory process, as they constitute an indispensable basis for planning an integrated development program. Based on the preliminary findings of the study, villagers may be allowed inside the Park, provided that they observe a set of rules and regulations, and that support is channeled to the villages in order to improve the livelihoods of their inhabitants. An example of a GIS analysis of a selected village is given in Figure 1.

Fortunately, land use encroachment has not expanded much in the past 20 years, although most of the area of the Park had been utilized. While the prime protection zone for the *Walya* ibex will have to be enlarged by a factor of 2.5, the other zones of the Park may be developed into a stable and sustainable buffer zone of mountain agriculture in peaceful coexistence with wildlife and tourism. Population pressure may be mitigated by developing pull factors outside the Park boundaries such as schools, clinics, roads, etc. If such measures are adopted, and co-operation with the residents is well established, the Park may even survive eventual political instability in the future.

From the experience of SMBS, it can be shown that planning and preparing well co-ordinated and participatory projects in a specific area require baseline information as a complement to the planned inputs. In the case of the Simen mountains, it


Legend
75 - 100 % cultivation (Rest: grassland/not usable)
50 - 74 % cultivation (Rest: grassland/not usable)
25 - 49 % cultivation (Rest: grassland/not usable)
0 - 24 % cultivation (Rest: grassland/not usable)
50 - 74 % grassland (Rest: not usable)
75 - 100 % grassland (Rest: not usable)
50 - 74 % not usable (Rest: grassland)
75 - 100 % not usable (Rest: grassland)
50 - 100 % bush (Rest: forest/grassland/not usable)
50 - 100 % forest/woodland (Rest: bush/grassland/not usable)
u used bush/forest
R rocky
T scattered trees
B scattered bush
village boundaries
National Park boundary
road
1/2 1 year cultivated of total 2 years
Amba Ber
Buya
Antola
Serek
Keny Ber
1/1
2/8
2/5
3/5
5/7
2/6
4/7
2/7
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3000
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is well worthwhile to invest at least 10% of the planned project budget of $US 12 million, i.e. about $US 1.2 million, for baseline surveys, monitoring, and impact evaluation during the life-time of the project and even thereafter. The baseline study presented here merely used one tenth of this amount. This was due not only to the efficient method of working, but also to the fact that post-graduate students of the Universities of Addis Abeba and Berne did most of the field work without pay under expert supervision.

4. CDE's long-term monitoring of test areas – the Ethiopian example

Detailed knowledge of status and dynamics of man-environment systems in a given eco-regional context requires setting up institutional mechanisms to provide for long-term environmental monitoring. In many of CDE's collaborative research programs in Eritrea, Ethiopia, Kenya and Madagascar, such monitoring was established for many years. An example is the Ethiopian Soil Conservation Research Program, SCRP, which was initiated in 1981 with the assistance of the Swiss Development Co-operation (SDC), implemented by the Ethiopian Ministry of Agriculture, and has been executed by CDE over the past 15 years (HURNI, 1982).

Although the research set-up underwent continuous methodological evolution based on experience gained over these years, and in response to the requirements of the collaborating institutions, the political conditions, the emergence of new paradigms in development co-operation, and the farming communities in which the program operated (HURNI, 1994), one basic approach remained unchanged: the monitoring of six test areas in the Ethiopian highlands, located hundreds of kilometers apart. Each test area represents one of the 9 typical agro-ecological zones of the country where rainfed agriculture is practiced.

One of these research units is situated in the area of Anjeni village, on the lower slopes of the central mountain system of Gojam region, at about 2500 m asl. In Anjeni, a one-square-kilometer catchment was chosen in 1984 for monitoring at catchment, household and plot level (HERWEG and HURNI, 1993). While climatic parameters, hydrologic processes, soil erosion and sediment loss are continuously quantified for each storm and other parameters like land use, harvest and biomass yields are quantified for each cropping season, the research teams and their assis-

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◁ *Fig. 1: An example of a GIS analysis and a view of Antola village in the Northern escarpment of the Simen Mountains National Park. Human land use occurs inside and outside the Park. Trees remained in small patches below the rock escarpments (gray color). Swidden cultivation, which encroaches on the forests from below, can be found on steep slopes and has rather short fallow cycles, leading to accelerated soil degradation due to water erosion. Source: SMBS, cf. SCHWILCH, 1996 (map and photo, dated 30. 9. 1994).*

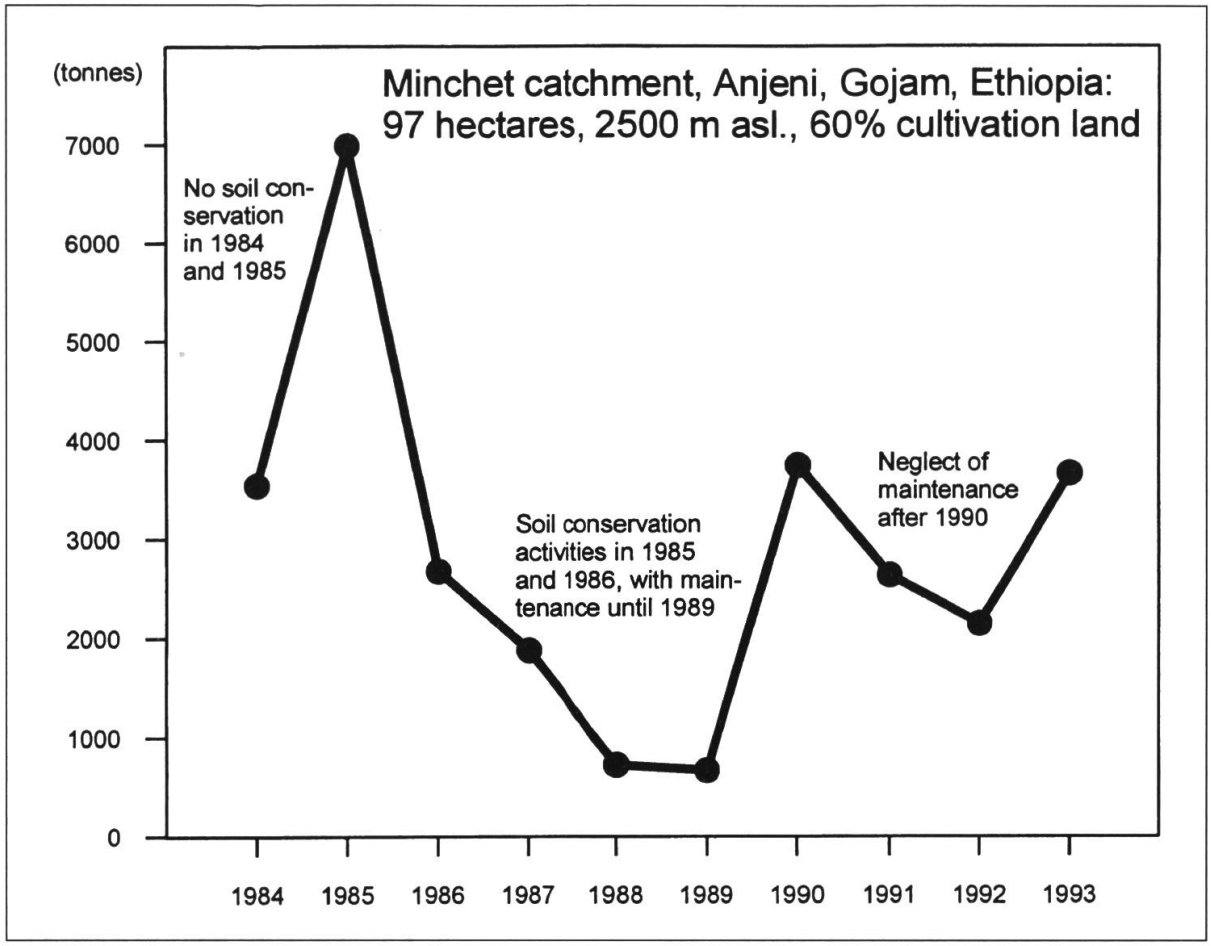

Fig. 2: Annual suspended sediment losses of the Minchet Valley. The catchment is situated at 2450 m asl in the region of Gojam in central Ethiopia. About 60% is cultivated land, 30% is grassland, and the rest is village or reforestation land that was closed to grazing in 1987. For each dot, representing the annual total sediment loss from the catchment, several hundred measurements of suspended sediment yield were integrated with storm runoff assessments for every storm throughout the 10-year period. Source: Data by SCRP, analyzed by BOSSHART, 1995.

tants also collect demographic information, data on soils and topography, and carry out economic studies at irregular intervals. Together with experiments in soil conservation on plots and in whole catchments, the direct effects of conservation measures can be assessed with these monitoring data over the years.

One example is given in Figure 2 that shows sediment losses in the period 1984–1993. The introduction of soil conservation structures in 1986/88 immediately led to reduction of sediment loss in the catchment, but failure to maintain the structures after 1989 increased soil erosion losses almost to pre-conservation levels again.

Many other conclusions can be drawn from such long-term monitoring data, including conclusions about changes in land use, in agricultural productivity, in climate, in population and settlement, in the status of soil degradation, just to mention the most obvious examples. Furthermore, detailed mapping of soils, land use, and settlement allows the use of these sites as verification spots for remote sensing infor-

mation, a value often neglected in developing countries. Finally, modern technologies like Geographical Information Systems (GIS) are used to store and retrieve information on each test site, while central laboratories in Addis Abeba assist in the analysis and interpretation of the data collected.

Major requirements for monitoring programs are not only institutional backing at the national, regional and local levels, but also staff dedicated to provide adequate information, to carry out work in remote areas, to upgrade continuously the precision of the information, and to make the results available to different users who all have their own specific requirements. Finally, it is absolutely mandatory that the methodologies applied remain unchanged over the whole of the observation period in order to allow long-term comparisons.

5. CDE's actor-oriented perspective – the example of the Ewaso N'giro basin

For solving or alleviating environmental problems, sound knowledge of environmental degradation processes, their causes and effects, as well as the development of options for remedial action on the technical and planning levels are necessary. But this is no guarantee that the problems will be tackled in practice, not even when the proposed solutions were elaborated in a participatory and partner-oriented process.

One case in point is presented by an example taken from the Upper Ewaso Ng'iro basin in Kenya, which extends from the north-west of Mt. Kenya to the Laikipia Plateau and to the lowlands of Samburu. Within this basin of 14,000 km², CDE and its Kenyan partners studied environmental degradation processes (e.g. DECURTINS et. al., 1989), land use and socio-economic dynamics (e.g. KOHLER, 1987 or WIESMANN, 1992a), and developed strategies on the technical (e.g. LINIGER, 1989) and the planning level (e.g. LEIBUNDGUT et. al., 1991 or WIESMANN, 1992b) within the framework of the long-term Laikipia Research Program (LRP). However, in spite of all the research and transfer activities of LRP, the situation in regard to the degrading and over-utilized water resources shown in Figure 3 did not change for the better. On the contrary, the dry season low flow of the Ewaso Ng'iro diminished further, causing severe problems for the downstream pastoral population as well as for tourism and wildlife (e.g. LINIGER, 1992).

The reasons for this continued ecologically unsustainable development are at least fourfold:

1. The immigration of agro-pastoral smallholders from high-potential areas of Kenya still continues, doubling the population on the semi-arid Laikipia Plateau every ten years and increasing water demand.
2. Due to severe problems of survival, these agro-pastoral immigrants apply complex strategies that hardly give scope for experiments with new technologies regarding land use.
3. Perceptions, strategies and expectations of the influential or decision-making actors within the formal and informal social hierarchies of the region concerned differ significantly from those of local actors.

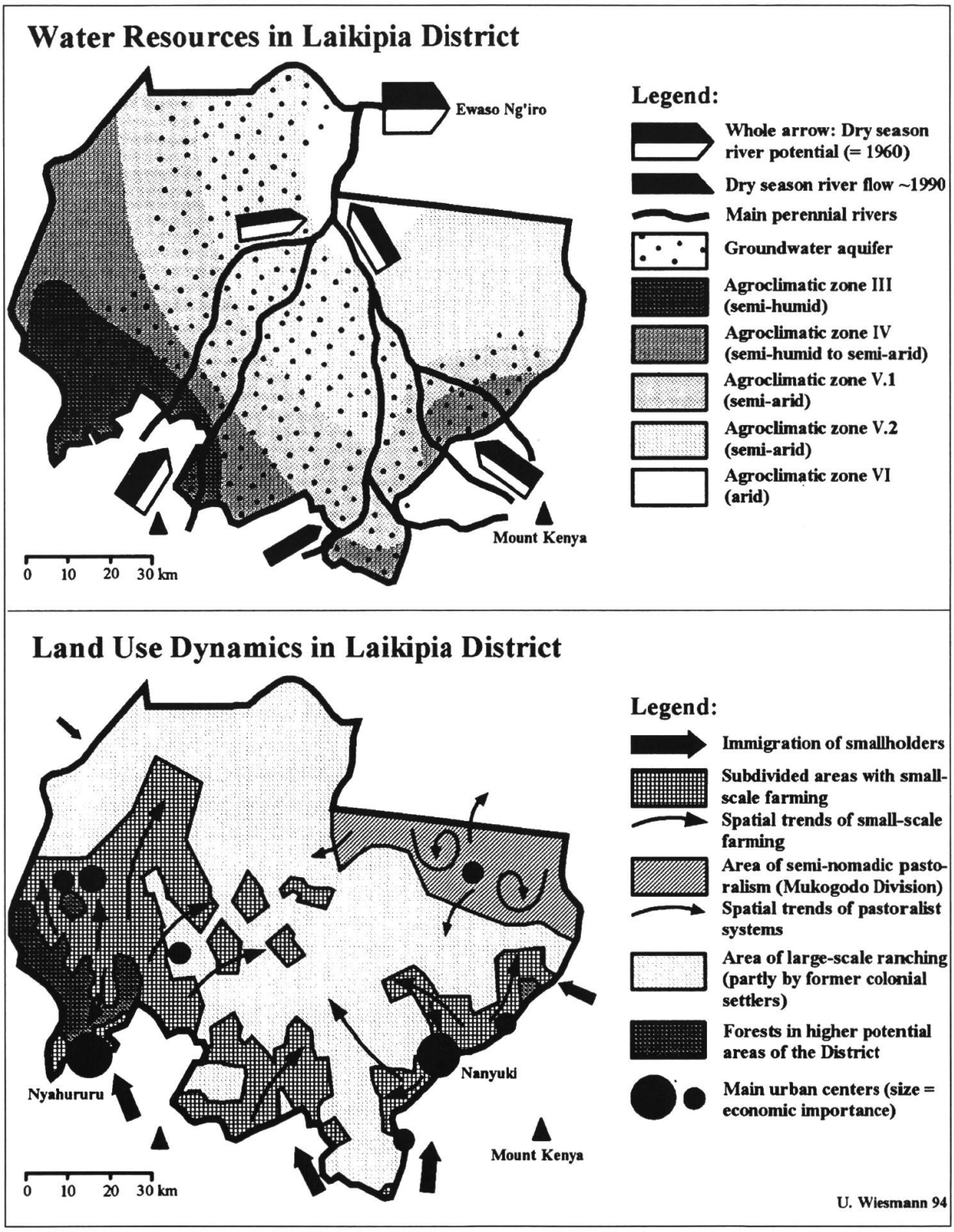

Fig. 3: Water resources and land use dynamics in Laikipia District in the Upper Ewaso Ng'iro basin, Kenya. The subdivision of former large-scale ranches after the independence of Kenya in 1964 lead to the immigration of agro-pastoral smallholders coming from high-potential areas. This caused the population to increase by a factor of 10 and reduced the dry season low flow of the Ewaso Ng'iro River below the critical value of 1.5 m^3/sec due to pressure on water resources. Source: Different data and studies by LRP.

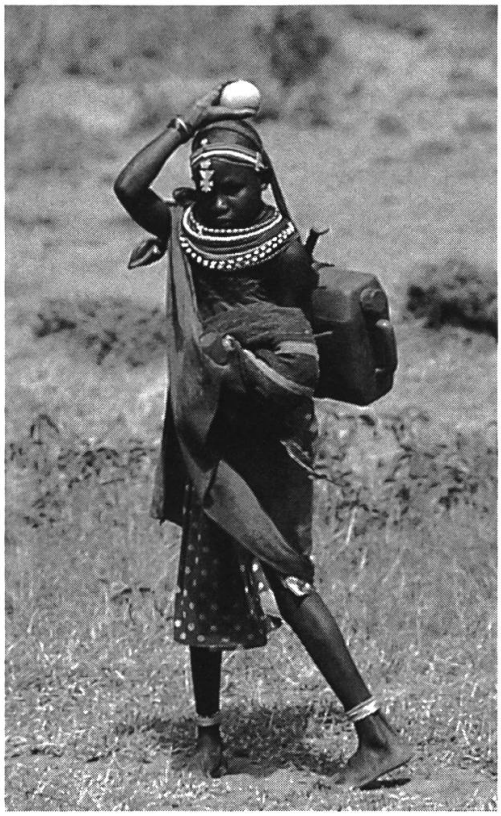

Fig. 4: Samburu girl in search of water in the lower Ewaso Ng'iro basin. Here, the local population, mainly Samburu pastoralists, is badly affected by the overuse of the water resources upstream. (Photo: U. Wiesmann, 1992)

4. The regional planning and decision-making structures are not suitable for coping with the degradation problem, as the national policy transfer through line ministries conflicts heavily with the grassroots-oriented planning procedures practiced on the regional level, which in turn is dominated by other particular interests.

All this implies that more sustainable planning, management and use of the water resources within the Upper Ewaso Ng'iro catchment does not just depend on better ecological and technological understanding, but requires approaches that fit into the strategies and expectations of the different actors involved and include mechanisms to resolve conflicts between these actors. These requirements presuppose an in-depth knowledge of the strategies, options for action and expectations of the different actors as well as of the formal and informal decision-making structures related to the use, management and planning of resources.

With other partners from Switzerland and Kenya and within the framework of the LRP, CDE is engaged in a specific research project dealing with the above mentioned aspects by studying local and influential actors as well as linking planning procedures and decision making processes (see e.g. WIESMANN, SOTTAS, FLURY, 1995). This research is based on a theory of social action that refers to dynamic interactions between norms, values and practices, and combines different methods such as participant observation, qualitative and quantitative interviews, organizational analysis, and participation in policy-making and planning procedures.

Some preliminary results of the ongoing research have already been taken up by the transfer unit of the LRP, a number of development agencies active within the region, and the District administration, which strengthened and reactivated regional

co-ordinating and controlling bodies on the catchment level and supported local initiatives that fit well with the options for action and the requirements for sustainable water use. Alongside further practical conclusions for sustainable planning, management and use of the water resources of the Ewaso Ng'iro basin, it can be expected that the actor-oriented research approach in regional development will also contribute to further developing and refining the concept of the negotiating processes, which CDE's environmental mandate sees as an indispensable step towards achieving sustainable use of resources in a regional context (CDE, 1995).

6. CDE's policy-oriented concepts and transfer – the examples of the environmental mandate and of WOCAT

Many challenges in the field of development and environment have been reformulated in recent decades. Questions related to so-called transversal issues, i.e. to problems that touch several scientific disciplines, sectors of expertise or administrative units, became more and more important in discussions focusing on environmental problems in development. As a matter of fact, the environmental mandate given to CDE by the Swiss Development Co-operation (SDC) with the intention to provide advice and support to SDC on matters related to environmental aspects in development, emphasized exactly this transdisciplinary approach from its very beginning in 1989.

Following this approach, however, implies a complete reorientation of research routines. A rather abstract idea, primarily normative in character, and commonly summarized by the concept of sustainable development, has become the center of interest. Deviations from reality as it is perceived lead to the definition of environmental problems. However, definitions are often based on reductionist views of reality and are therefore not adequate for the reorientation of research concepts. Moreover, the call for development-oriented research to be efficient raises the question of transferability, i.e. how the results of such research can be translated into meaningful actions. The following ideas are formulated as a contribution to answer this question in the light of the experience gained at CDE.

1. The involvement of the actors concerned, the actor groups and stakeholders must become the guiding principle for the reorientation of research as well as for the implementation of its results and recommendations.
2. The discussion of research results should not be limited to disciplinary circles of expertise. Likewise, efforts to obtain new findings and to gain new insights should not be confined to furthering disciplinary knowledge only, but should also contribute their share to overall understanding of problems and processes related to development and the environment. Moreover, the link between *orientation knowledge* and *action-oriented know-how* should be strengthened, for it is exactly the lack of this link that has brought research into a position where it helped trigger, or foster, processes that later were found to be unsustainable for society and the environment.
3. Linking action-oriented know-how and orientation knowledge poses a problem to all those members of the research community who are firmly entrenched in tra-

ditional disciplinary thinking. Experience shows that building up links between these two fundamentally different types of knowledge and competence is a long-term endeavor. Working on this link has in fact always been one of the major challenges for CDE. Competence in linking action-oriented know-how and orientation knowledge can *a priori* be built up in a team only, and such a team differs from a traditional team by its communication capacity. In such a group the individual members, apart from advancing disciplinary expertise, carry disciplinary competence, feeding their results into the common research process that is characterized by a wide range of issues, approaches and methods.

4. This mode of work differs clearly from the routines in our universities. It seems that the universities, in spite of the heralded academic freedom of research, are not yet able to live up to this old challenge raised in the theory of science and aptly symbolized by the term *universitas* itself – despite the fact that this challenge is getting more and more important in view of the complex problems that must be solved in today's world.

5. Unfortunately, any broad approach applied to issues in development and environment therefore is carried out in a *niche*, operating without the moral support, and often without the acknowledgment of the universities, and also across their academic and administrative structures. There are some occasions for stimulating contacts with mainstream disciplinary researchers, or with academics looking for ways to combine experiences from different scientific disciplines, but they are few and far between and rather the exception than the rule.

Coming back to the environmental mandate of CDE: the main thrust of its activities was to deal with two major issues. First, there was the question of the environmental sustainability of development activities. This was taken up from the mandate's inception in 1989 and was addressed in a broad and multidisciplinary approach involving staff of SDC as the main user group of the mandate's output. The results of this participatory research process have been published in a report, which gives an outline of the principles of ecological planning for planners and decision makers in development (CDE, 1992). This publication was later complemented by the so-called *Impact Hypotheses* (CDE and SDC, 1994). This tool, written as an easy-to-handle manual, describes interactions in man-environment systems and makes projections about how these interactions might be affected by development activities.

The second of the mandate's activities had its focus on the problem of sustainability, dealing with sustainable use of natural resources. This issue, one of the major topics of development discussions in the 1990s, was addressed at the conceptual level, and the main findings were outlined in a paper published in 1995 (CDE, 1995). The paper defines natural resources as components of nature that are of use to human communities. Resource use hence always reflects a particular social situation, and it changes in relation to space and time. Sustainability is therefore primarily a question of evaluation.

Development organizations take part in processes of evaluation and decision making about the use of resources. They play a dual role: they advance their own aims and ideas about sustainability while also supporting the process of public debate over sustainability which should include all stakeholders concerned.

Departing from the findings obtained in writing up the conceptual paper mentioned above, work is now in progress to formulate a training program on sustainable use of natural resources. The training envisioned employs an autodidactic approach that will allow local development specialists working in rural areas to confront and examine environmental issues on a broad scale, departing from issues that originate from the local setting in which they actually work.

Finally, a global input towards sustainable use of soil and water in agriculture is attempted by WOCAT (World Overview of Conservation Approaches and Technologies), a program coordinated by CDE. Under the roof of the World Association of Soil and Water Conservation (WASWC), WOCAT developed a comprehensive framework for the evaluation of soil and water conservation in its initial phase (1992–94). It carried out participatory data compilation in 19 African countries in 1995, supported national and regional initiatives in other African regions and on other continents, and is currently developing a number of prototype outputs in the form of maps, handbooks, and decision support systems as well as software including Internet use at a lager stage. Funded by SDC (Swiss Development Cooperation) and a number of international supporters like FAO, UNEP, and IDRC of Canada, WOCAT has been restructured recently into a consortium, where international, national, and regional members collaborate on equal terms for the purpose of elaborating a standardized, comparative, and guiding global overview of soil and water conservation. WOCAT has a long term perspective and is scheduled for a duration of about 10 years.

7. Conclusions and outlook

Looking back on CDE's experiences over the last decade, what are the main lessons to be learnt? And looking into the future, what are the main challenges ahead? And how can they be tackled?

In regard to challenges, there are many, and one is prompted to start with the realm of *science*. Certainly one of the main challenges in this respect is to maintain a long-term perspective in an environment characterized predominantly by short-term cycles of thought, whether in regard to policy formulation, administration, or data collection. While the need for short-term considerations is indisputable, especially in view of the pressing problems of the countries of the South, it should be borne in mind that long-term perspectives have their merits, too. Was it not thanks to long-term time series on global environmental parameters, and on socio-economic dynamics, that the alarming trends of global environmental development have been revealed? Long-term monitoring of key processes will thus remain a mainstay for CDE. This includes developing adequate concepts and tools, running effective programs, and transferring the main messages to the users.

Other challenges are *institutional* in nature: here, the main challenge probably is maintaining the concept of transdisciplinarity within a disciplinary world. As it has been shown, this challenge does not get smaller within a university environment. For CDE, transdisciplinarity means primarily advancing and fostering links between researchers, but also between researchers and politicians, planners and implemen-

ters, and the population, on a basis of complementing experience. Going one step further, it also implies combining different approaches considered adequate to confront the issues at stake, even if some approaches may not be *en vogue* at times. Bottom-up processes may thus have to be combined with top-down decision-making procedures in order to find solutions leading to sustainable use of natural resources. To find the best mix between these two diametrically opposed procedures is certainly a major and long-term challenge. Resolving conflicts in resource allocation depends on the development of a new culture of political debate in many countries of the South, and not only there.

The third challenge could be called *socio-cultural*. This involves elements of transdisciplinarity as described above, but goes much further and implies an effort for better mutual understanding. This understanding is based, first of all, on a process of intercultural communication that confronts us with fundamentally different ways of thinking, explaining and acting. This is a major personal challenge, as it often calls in question our own patterns of perception and action. But mutual understanding is also based on mutual personal interest between individual personalities, and one of the main experiences of CDE has been to realize that intercultural communication, sharing of experience, and transdisciplinarity do work on a sustainable long-term basis whenever there is a feeling of mutual personal interest between the individuals involved. We might call this sympathy, or friendship. It is not least in this respect that Bruno Messerli led the way in many instances and has been a source of inspiration to all of us.

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