

# Sustainable Land Management



**By Thomas Kohler**

In Eritrea, the University of Berne's Center for Development and Environment, together with the Syngenta Foundation for Sustainable Agriculture and Eritrean partner institutions, runs a comprehensive program on sustainable land use - the Sustainable Land Management Program (SLM).

## 1 A Sahelian country in the Horn of Africa

With an area of approximately 120,000 sq km, Eritrea is nearly three times the size of Switzerland, although it is one of the smallest states in Africa. It is a young state - the country only became independent in 1993 after a 30-year war with Ethiopia, of which it was previously the northernmost province.

Nature has not been kind to Eritrea, and it has all the characteristics of a Sahelian country. This applies in particular to its rainfall, which is low and varies widely from year to year, both with regard to quantity and the time the rainy season starts. The majority of the country consists of savanna, with its typical acacias, as well as steppe and desert, particularly in the western lowlands near Sudan and in the east toward the Red Sea. Only the central highlands, at altitudes between 1500 and 2500 meters, which represent about a quarter of the country's area, have sufficient rainfall to allow farming.

The plants cultivated are mainly drought-resistant local cereal varieties such as barley, rye, wheat, millet, and tef. Tef is a type of cereal found only in Eritrea and Ethiopia. In the dry lowland regions, by contrast, nomadic livestock farming predominates. The country is an ancient cultural area, and has been settled and farmed for many centuries. This long period of use has resulted in advanced soil degradation in large parts of the country, particularly through erosion. The main victim of soil degradation and the low rainfall is small farming, which is the country's economic backbone and the principal occupation of about 90% of the country's 3.5 million inhabitants.

In addition to the difficult ecological situation, the country also currently has political difficulties, particularly the devastation caused by the 30-year war and the effects of the later two-year border war with Ethiopia. The financial resources swallowed up by the two-year war are now lacking for the urgently needed establishment of infrastructure and administration facilities that are indispensable for economic development.

## **2 Land management and institutional support**

Our program aims to make a contribution to sustainable land management in this Sahel country in the following ways:

- by providing support for research and development concerning sustainable land use, particularly in the fields of soil and water conservation;
- by providing support for specific local and regional development initiatives; and
- by supporting Eritrean institutions active in the field of sustainable land use and resource management.

A guiding principle of the program is to ensure its sustainability. This is best assured through partnership with various Eritrean institutions. These include various ministries (the Ministry of Agriculture and the Ministry of Land, Water, and the Environment), the University of Asmara, and Eritrean nongovernmental organizations. To support its activities, the program is linked to a network that also includes Swiss and international development organizations. In addition, the program tries to get the local population involved in decisions directly affecting them, especially in the area of specific local and regional development initiatives. Experience so far shows that particularly in Eritrea, after its long struggle for self-determination, the idea of development partnership is well accepted.

## **3 An overview of the program's activities**

### **Support for research and development on sustainable land use**

#### **Soil conservation: research and the challenge of implementation**

Work in this field is essentially based on the Afdeyu research station in the Eritrean highlands. Measurements of soil erosion and of the effectiveness of soil protection methods are carried out here. This is done by measuring rainfall and water run-off. The appearance of the station, with clay buildings, is modest, but it has vital strategic importance, since it is the only place in the country where such measurements on soil erosion are being carried out, which even in official Eritrean eyes is seen

as one of the country's primary problems. Thanks to a long series of measurements (the station has been in operation since 1984), reliable conclusions can be drawn regarding the extent of soil erosion and the effectiveness of protective measures. A long-term approach is of the utmost importance, particularly in a Sahelian country like Eritrea, because rainfall, and therefore soil erosion and run-off, are subject to wide variation from year to year. Short-term measurements can therefore lead to completely false conclusions being drawn - and to the wrong decisions being taken in terms of policy and practical implementation.

A serious start was made two years ago on preparing the final report on the measurement results, and it is now almost completed. It is to be presented in Eritrea this year for discussion along with the most important partner organizations involved.

### **Main results on soil erosion and conservation**

On the station's unterraced test fields, both surface run-off and soil loss were high. More than 40% of the rainfall runs off the surface and is therefore lost to plant production. On the terraced fields, these values were reduced to a fraction. For example, surface run-off was only a quarter to half of the figure for unterraced fields - i.e., 10-20% of the precipitation. The soil loss was reduced from 49 t/ha to 3.5-11 t/ha. These values lie within a technically tolerable range.

In collaboration with official bodies and development programs, the next step is to develop measures based on these research results and adapted to the agricultural needs of small-scale farmers. This is a long-term task of extreme importance (the small-scale farming population represents the great majority of the population), and our program will be devoting itself to this in the coming years in order to meet its responsibilities as a partner engaged in sustainable development.

The main issues involve training and education for future cadres, further training of technicians, and raising awareness among decision-makers in the fields of politics and development, as well as supervising specific measures.

### **Drip irrigation - a technology for a Sahelian country?**

Our program has also recently become involved in promoting drip irrigation. The background to this is the fact that water is an extremely scarce resource in Eritrea. It should not be forgotten that Eritrea has only a single river that carries water all year round - and, in addition, that it lies on the border with Ethiopia. During the last 40 years, the food deficit varied between 30% and 90%. Efficient water management is therefore all the more important.

Drip irrigation is one method of making water use more efficient and giving the country more secure supplies.

It uses targeted delivery of water to cultivated plants through a pipe and hose system that supplies water drop-by-drop to the root area of a cultivated plant all day long. This can achieve very large savings in water use. Unfortunately, however, the systems available on the market have so far been much too expensive for small-scale farming conditions. Cheaper systems have been developed in recent years, and have been successfully introduced in small and very small farms in India and Bangladesh.

Following an inquiry by the Swiss Agency for Development and Cooperation, we decided to investigate with the help of Indian experts, together with an Eritrean and Swiss team, whether the technical, economic, and socio-cultural conditions in Eritrea are suitable for introducing the type of low-cost drip irrigation system developed in India. The inquiry produced a positive picture (see [further information on drip irrigation](#)). At the same time, the system is being tested by various selected institutions, such as agricultural colleges, universities, and missionary stations, as well as innovative individuals, so that initial experience with it can be collected.

The introduction of drip irrigation might make it possible to combine two development goals that are often regarded as mutually incompatible: resource protection (in this case water, through economical usage) and increased agricultural production (in this case through irrigation). We are therefore eagerly awaiting the results of the test phase, which will determine how we proceed afterward.

## **Support for local and regional development initiatives**

### **Establishing community profiles**

Field activities are guided by community profiles (see references at the end of this article). These are development reports that we produce in individual villages or communities. They are written on request by the local and regional authorities. The community profiles have three aims:

- The primary aim is to document the development status of the selected community, and above all in joint discussions with the inhabitants and authorities to identify the needs and major focal points for development. Where financial resources allow, our program carries out the activities needed itself, together with local partners. When this is not possible, additional partners are sought for co-financing.

- Second, the aim is to record the development status of the community using a series of central indices (population size, land use, land ownership, infrastructure provisions, development priorities) as benchmarks for long-term observation of development trends in rural Eritrea. Long-term studies of this type, based on 10-year observation cycles, for example, have proved their value in providing a basis for decision-making in development work - particularly in view of the constant personnel changes and variations in programs that are seen in the field of development cooperation. Moreover, reliable statistical data are still largely lacking in Eritrea at the community level.
- Third, the results are intended to find their way into course work at the university and in technical colleges in Eritrea - there are as yet no textbooks on the topic of environment and society in rural Eritrea, and almost no teaching materials are available. This is a widespread shortcoming in Africa, and our program hopes to be able to remedy it.

### **Specific project work requires close collaboration with reliable local partners**

All these activities require close collaboration with official bodies, companies, and the local population - a task that would be impossible from a base in Switzerland, and in which a reliable local partner is needed. Many development programs maintain a local coordination office for this purpose, staffed by foreign experts. Our program has taken a different route, with coordination of specific development activities being transferred directly to a local Eritrean association. This is Vision Eritrea, a nongovernmental organization that has gathered considerable experience in implementing rural development projects in recent years - particularly in the health care system and in constructing wells.

In close collaboration with our program, Vision Eritrea planned the field work for the community profiles of Adi Behnuna and Deki Lefay (in the southern highlands). Vision Eritrea also coordinated repair work on the wells in Afdeyu, and the building of a hospital clinic (Deki Lefay) and a school (Adi Behnuna). Our experience with Vision Eritrea has so far been very good, and we will be continuing our partnership with this agency.

### **Capacity building in the field of sustainable land use and resource management**

#### **The University of Asmara - Eritrea's central educational institute**

An important partner for our program is the College of Agriculture and Aquatic Sciences (CAAS) at the University of Asmara. Our collaboration with the CAAS started even before the beginning of the project, with the college taking the initiative to involve the Afdeyu field station systematically in its study

courses - first for the purpose of guided study trips on soil and water conservation, and second for student research projects. Starting from this basis, collaboration continually expanded.

Last year our program enabled an assistant at the CAAS to receive a fellowship grant to study for a Master of Science degree in soil science at the University of Aberdeen. The candidate completed his M.Sc. within a year, with honors. He returned to Eritrea despite the war, and has since been working in teaching and research at the CAAS, helping reduce the college's dependence on foreign lecturers. After this positive experience, we decided to provide support for a diploma study in Wageningen (the Netherlands) on the topic of land management, as well as another diploma course at the University of Pretoria, although in the latter case the University of Asmara is paying for most of the costs.

New perspectives for collaboration are beginning to emerge at the Geographical Institute at the University of Asmara. There is a definite need for support. For example, 10 professors and lecturers share the use of one old PC. It is obvious that the effectiveness of research and training is bound to suffer in these conditions. The Institute's management will soon be presenting its proposals regarding further collaboration. The focus is to be on setting up a small core group on the topic of "sustainable land management."

### **Mapmaking and training with the Water Resources Department**

Maps are crucially important as decision-making aids for sustainable land use and planning. Our program is already in the second year of carrying out training and further education courses for geographic information systems (GIS), in which the potential and limitations of modern spatial information technologies are presented and discussed. These courses are being held on the initiative of the Water Resources Department at the Ministry of Land, Water, and Environment, which is also responsible for the organization and for providing premises and equipment (computers for the participants).

The courses are extremely popular in Eritrea, going beyond ministerial boundaries. In the last course, held in October 2000, technicians from eight different ministries took part. This means that in addition to the actual training, the course has important networking effects, with the participants exchanging experience and often maintaining contact afterward. During the training courses, the Sustainable Land Management Program has also produced a set of digital maps of the whole of Eritrea. The fundamental data they contain provide support for planning work in sustainable land management. However, they can also be used much more widely.

For example, the maps are being used as the basis for building the telecommunications network in Eritrea (the cellular phones project). The city of Asmara is also using the maps, as well as a satellite image provided by our program, as the basis for its land register plan. This plan is crucially important, as it will provide binding solutions to previously unsolved land ownership issues dating from the socialist period - an important contribution to sustainable land use in the suburban area, where horticulture makes an important contribution to the population's food security.

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#### **4 Spin-off effects of the program**

The expertise acquired in the course of the program led to additional inquiries during 2000 - real spin-off effects of our involvement in Eritrea. Although these do serve the purposes of development in general, they are not directly in accordance with the SLM's mandate, and an additional charge was therefore made to the clients concerned.

Examples of these spin-offs include producing a half-tone map of the border area between Eritrea and Ethiopia for the UN peace mission (commissioned by the UN); preparing detailed maps for mine clearance work in war zones (commissioned by the Halo Trust, the organization entrusted with mine clearance by the UN), and producing a vector map of the entire border area for the United Nations Mission for Eritrea and Ethiopia - the UN peacekeeping force (the map was commissioned by the Swiss Department of External Affairs). All of these spin-offs produce synergistic effects, with the SLM in turn benefiting from the intermediate products prepared.

In addition to spin-off effects, the SLM has also recently been providing contact services for institutions and programs hoping to become active on development issues in Eritrea. These have included providing contacts for SUN 21, for example - an international conference on renewable energies, organized by the Basle Chamber of Commerce, which is hoping to become involved in Eritrea in the field of solar energy. The result of these contact services is that, as its first specific project, SUN 21 is now planning to provide support for water heating at a district hospital.

#### **5 References**

Ghebru Bissrat and Thomas Kohler. Soil and Water Conservation Management in Eritrea: Current Status and Trends. Proceedings of the AEAS/University of Berne Collaborative Workshop held in

Asmara, February 17th-20th, 1998. Wabern-Berne: Association of Eritreans in Agricultural Science (AEAS), 1999. ISBN 3-9061 51-36-0.

Lukas Frey, Shirin Sotoudeh, and Brigitta Stillhardt. A Baseline Study for Sustainable Development of the Deki Lefay Community, Eritrea. Berne: University of Bern Center for Development and Environment, 1998.

For further information see the [Center for Development and Environment at the University of Berne](#).