WOCAT: Regional Example of Eastern and Southern Africa[1]

Introduction

Degradation due to unsustainable land and water use has been reported world-wide, but this atlas has focused on the threat of this phenomenon to the future use of drylands. The GLASOD programme has identified water and wind erosion as the most widespread soil degradation processes and the severity of their threat to future human livelihoods in the world's susceptible drylands is documented elsewhere in this atlas. However, numerous efforts have been made to combat erosion and other land degradation processes. Many local land users employ soil and water conservation (SWC) methods on their land and these efforts to improve soil productivity are often assisted by SWC specialists, land use planners and decision-makers. However, valuable experience based on these activities is usually not available to people in other locations. In the search for better land and water management and sustainable resource use, experience must be shared on a national, regional and global basis to promote SWC and sustainable natural resource use. The aim of the World Overview of Conservation Approaches and Technologies (WOCAT) programme is to promote just such a sharing and exchange of experience. This section outlines the methodology used and the work done in eastern and southern Africa.

The WOCAT approach – a search for solutions

The WOCAT programme contributes to the sustainable development of natural resources world-wide by presenting lessons learned from successful soil and water management. WOCAT collects, analyses and distributes knowledge about proven and promising SWC practices, addressing all stakeholders in sustainable land management, including politicians, decision-makers, SWC specialists and land users. WOCAT was launched in 1992 and is an ongoing programme, organised as a consortium of international institutions (see Box 1), co-ordinated by the Centre for Development and Environment (CDE) in Berne, Switzerland.

WOCAT has developed a framework for the evaluation of SWC, which includes standardised questionnaires on SWC technologies and approaches (Liniger and Hurni 1997a and b, see Box 2), and the spatial distribution of SWC. Data are collected and experiences exchanged in regional workshops. Databases are being established in regional and national centres and a system is being set up to ease access to and exchange of information. WOCAT develops user-friendly tools for the analysis of data, including a decision support system. The main thrust is to open access to the data, to enhance exchange of information (e.g. through the Internet), and to produce outputs such as books on SWC technologies and approaches, and maps on SWC activities. In order to facilitate access to the SWC experiences collected by the programme, regional and national institutions are supported in setting up their own WOCAT database and analysis systems.

By 1997, WOCAT had collected data at the regional level from Africa and at the national level from Thailand. Initiatives have been prepared for Latin America and Central America, Asia, Australia and Eastern Europe. Depending on national and regional initiatives and funding, the programme will progress on national, regional and continental levels. WOCAT operates in all climate zones, but some of the preliminary results from the susceptible drylands of eastern and southern Africa are presented below. Although verification of these results is continuing, this presentation is designed to illustrate the ongoing activity and the need to collect further information on SWC.

[1] Liniger H.P., 1997: WOCAT: Regional example of Eastern and Southern Africa. In: UNEP 1997: World Atlas of Desertification (2nd ed.), eds. N. Middleton and D. Thomas, Arnold publisher, London, New York, Sydney, Auckland; pp. 120 – 125.

Box 1
Member and task force institutions (1997)

CDE (Centre for Development and Environment), University of Berne, FAO (Food and Agriculture Organization of the United Nations), Rome; UNEP (United Nations Environment Programme), Nairobi; ISRIC (International Soil Reference and Information Centre), Wageningen; CDCS (Centre for Development Cooperation Services), Vrije Universiteit Amsterdam; RSCU (Region Soil Conservation Unit), SIDA, Nairobi; ASOCON (Asia Soil Conservation Network), Jakarta; GTZ (Gesellschaft für Technische Zusammenarbeit), Eschborn; OSS (Observatoire du Sahara et du Sahel), Paris; IRE (Institute for Resources and Environment), University of British Columbia, Vancouver; SOCOX Consult, Lochem.

Financing institutions (1977):	SDC (Swiss Agency for Development and Cooperation), Berne; FAO; UNED; RSCU; OSS; GTZ; IDRC (International Development Research Centre), Ottawa.
Secretariat:	CDE, Bern

Box 2
WOCAT SWC definitions

SWC:	Activities at the local level which maintain or enhance the productive capacity of the soil in erosion-prone areas through: prevention or reduction of erosion, conservation of moisture, and maintenance or improvement of soil fertility
SWC technology:	Measures used in the field (agronomic, vegetative, structural and management)
SWC approach:	The ways and means used to implement a SWC technology on the ground

Soil erosion in eastern and southern Africa

Soil degradation due to unsustainable land and water use reduces the productivity of cropland and grassland and thus threatens sustainable resource use and food security in many parts of the world. The results of the GLASOD survey indicated that soil erosion by water and wind are the most dominant processes of soil degradation, and hence these processes are the focus of the WOCAT programme.

Map 4.20 Aridity zones

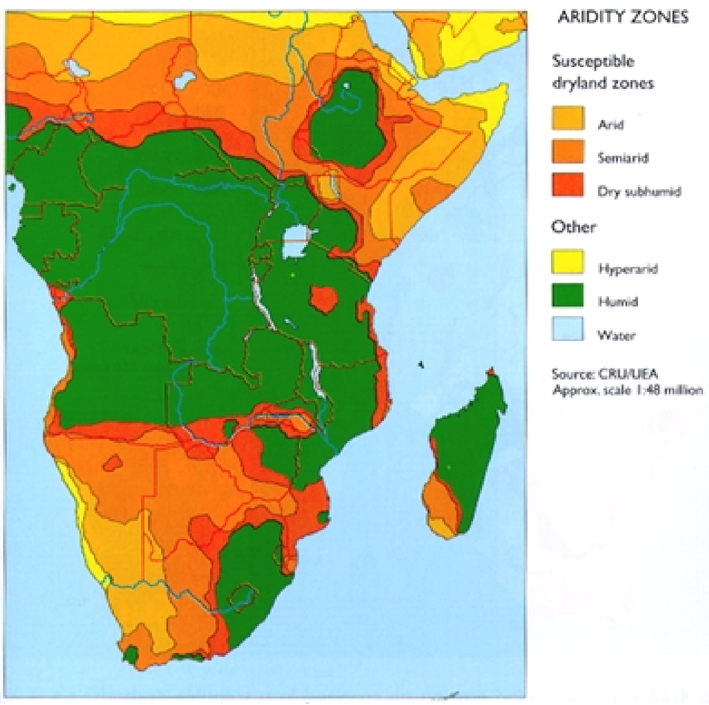
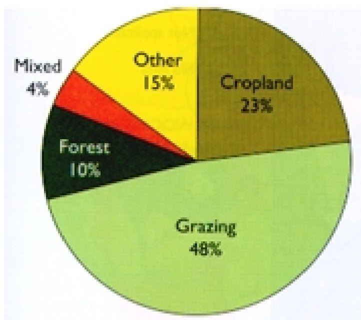


Figure 4.5 Land use types in susceptible drylands.Source: WOCAT



Just over 600 million ha of land have been surveyed in 15 countries of eastern and southern Africa: Botswana, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, South Africa, the Sudan, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe (Liniger et al. 1996). About 59% of this area lies in the susceptible drylands as defined using the timebound data set described on page 2-7 (see Map 4.20). Using the mapping polygons defined for the GLASOD Africa database (See Section 2), areas were classified by land use. As Figure 4.5 indicates, almost half of the susceptible drylands in this part of Africa are used for grazing, while nearly a quarter is cropland. WOCAT studies of SWC technologies and approaches have focused on these two land use categories.

The distribution of cropland in the region's susceptible drylands is shown in Map 4.21 and Map 4.22 indicates the severity of erosion on cropland using the GLASOD methodology. The 'not applicable' category on these and others below, indicates areas that are either not in the susceptible drylands or not used for crops, where no erosion occurs, or areas without data. The areas most intensively farmed susceptible dryland areas (where more than 50% of individual polygons are used as cropland) tend to be in the semiarid and dry subhumid zones, including coastal Tanzania, southern Mozambique, central and western Zimbabwe, or along rivers such as the Nile and Orange. Most cropland in the susceptible drylands is unaffected by erosion (Figure 4.6), but none the less 17.3 million ha of eastern and southern Africa's susceptible dryland cropland is degraded by water and wind erosion, with the largest areas so-affected occurring in the semiarid zone (e.g. Figure 4.7).

The areas most extensively used for grazing tend to be in the drier parts of the susceptible drylands, in central Sudan, central Eritrea, eastern parts of Ethiopia and Kenya, much of Botswana and Namibia, and western and northern South Africa (Map 4.23). Erosion also tends to be most severe on grazing land in the more arid areas (Map 4.24), where the greatest areas are affected (Figure 4.8). In total, 48.5 million ha of grazing lands in eastern and southern African susceptible drylands are affected by erosion. Areas subjected to particularly heavy grazing pressure can, in extreme cases, become subject to severe gully erosion (Figure 4.9).

Soil and water conservation on cropland in eastern and southern Africa

Soil degradation due to agricultural practices and the clearance of land for agriculture would be worse without traditional and recently developed SWC technologies. Such technologies are commonly classified into the following categories.

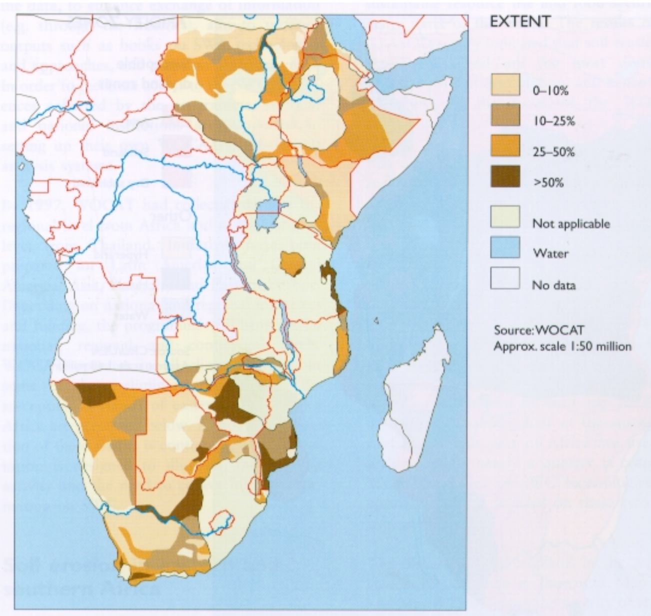
Agronomic measures, such as mixed cropping, contour cultivation and mulching, which are usually associated with annual crops. They tend to be routinely repeated each season or in rotational sequence and are therefore impermanent and of short duration.

- **Vegetative measures,** such as grass strips, hedge barriers and windbreaks, are more permanent approaches involving perennial grasses, shrubs or trees. These technologies often lead to a change in land profile and are often spaced according to slope.
- **Structural measures,** such as terraces, banks and bunds, also involve changing the profile of the land. These are permanent measures, implemented primarily to control runoff and erosion, and require substantial labour or economic inputs during construction.
- **Management measures,** such as land use change, enclosures and rotational grazing, involve a fundamental change in land use. They do not involve agronomic or structural measures, and often result in an improved vegetation cover and reduced intensity of land use.

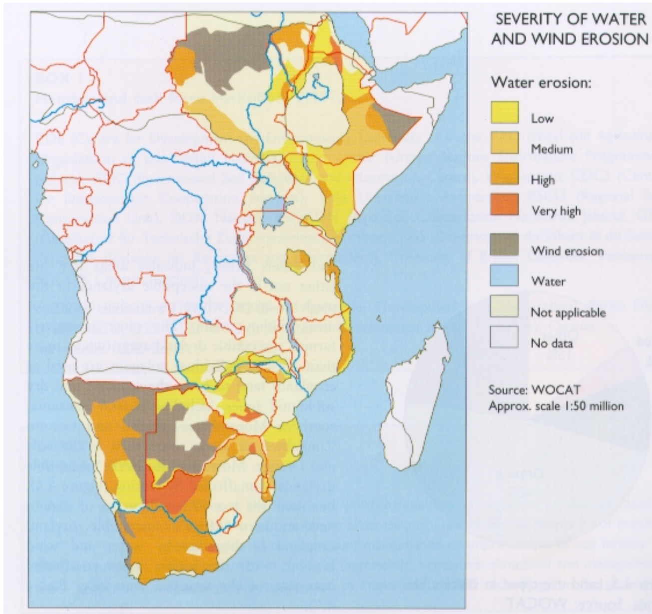
Most of the implementation of SWC technologies in the region has been achieved by land users themselves without outside assistance, but in many cases incentives have been successful in encouraging farmers to adopt SWC approaches. Such incentives include food-for-work programmes, cash payments to land users, and other forms of support such as equipment, credits and compensation for labour. Land tenure and land use rights play an important role in investment in sustainable soil and water management.

SWC was mainly applied on individually owned land and rarely on communal cropland. About half of the approaches reported had good involvement of the local community in the planning, implementation and evaluation phase. An economic analysis showed that in subhumid to semiarid environments, there was often an immediate benefit due to water conservation, and the costs could be recovered within a few years after implementation, after which SWC resulted in great benefits. In humid environments, by contrast, the total costs for SWC were often higher than the benefits, even 10 years after implementation.

Map 4.21 Extent of cropland in susceptible drylands



Map 4.22 Water and wind erosion on cropland in susceptible drylands



The first analysis of SWC activities in eastern and southern Africa shows that most of these activities are concentrated on cropland. In the susceptible drylands as a whole, structural measures are by far the most commonly used technologies (Figure 4.10) but Map 4.25 indicates distinct regional differences. While structural measures predominate in eastern African susceptible drylands, agronomic measures, and to a lesser extent vegetative measures, are also common in southern Africa.

Assessment of the impact of SWC on cropland shows achievements in all of the countries (Map 4.26) and medium to high effectiveness was found on the large majority of croplands in all three susceptible dryland zones (Figure 4.11). Comparison of Maps 4.25 and 4.26 with Map 4.22 indicates the success of largely agronomic practices in keeping erosion to low or medium severity in southern Mozambique and western Zimbabwe, for example, and the successful application of structural measures in keeping water erosion at low severity in south-eastern Sudan. Combinations of technologies are also often used: both structural and vegetative measures are shown in Figure 4.13, an area in the Machakos region of Kenya.

Figure 4.6 Water and wind erosion on cropland in susceptible drylands. Source: WOCAT

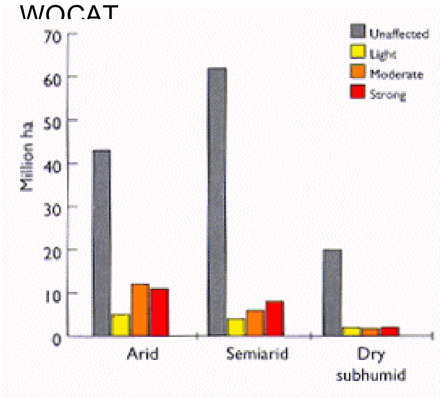
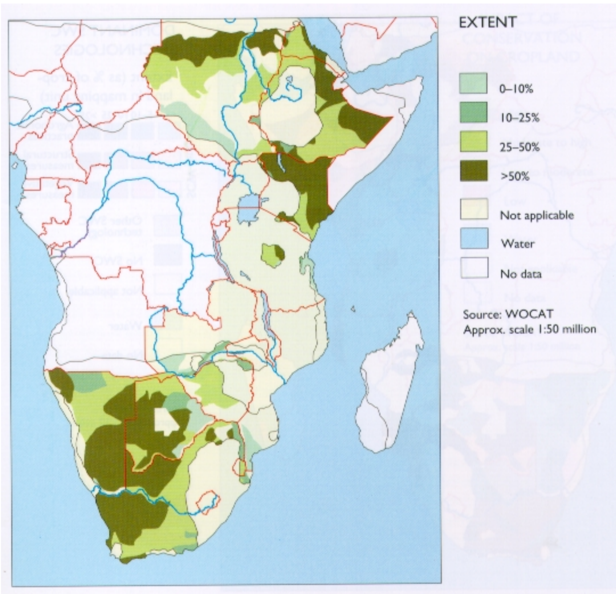


Figure 4.7 Soil erosion on ox-ploughed steeply sloping cropland in Ethiopia. Source: WOCAT

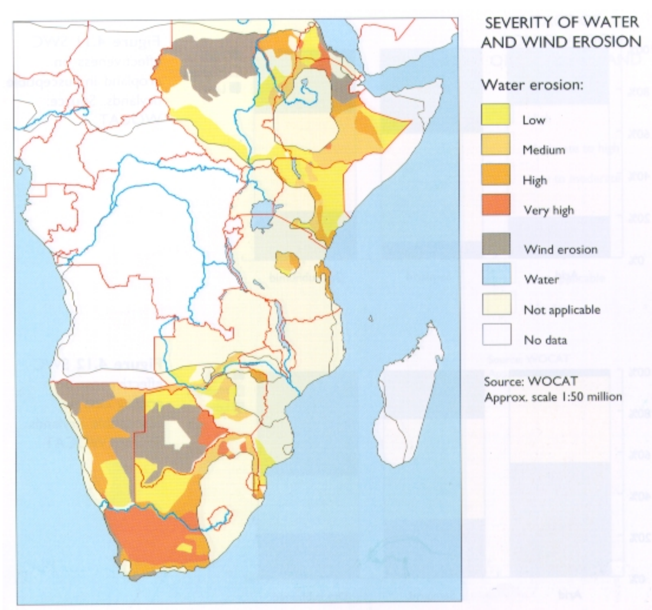
SWC on grazing land in eastern and southern Africa

Few SWC activities were reported on grazing land in eastern and southern Africa, and the overall effectiveness of such schemes was lower than for cropland, particularly in arid regions (Figure 4.12). Nevertheless, some were considered to be highly effective, mostly in southern Africa (Map 4.27). The few described technologies comprise management and vegetative measures (Figure 4.14), the aim being to improve rangeland mainly by controlling grazing, and thus improving vegetative cover. Even though many experiments have been done using structural measures, SWC specialists do not find them appropriate for the vast areas, especially considering the high costs compared with the productive value of the land.

Map 4.23 Extend of grazing land in susceptible drylands



Map 4.24 Water and wind erosion on cropland in susceptible drylands



The fact that most of the grasslands in eastern and southern Africa are open access areas, or areas under communal management, has often been cited as a key problem with regard to improving its management. Even though traditional systems have managed to use grazing land sustainably in previous centuries, many of these systems do not seem to work any more. The expansion of cropland at the expense of the best grasslands and population growth is usually cited as the reason for the failure of traditional systems today. New, innovative approaches and technologies face the challenge of finding management solutions that are supported by the local people and do not involve very high costs. The fact that large areas under grazing are already badly degraded also means high costs for rehabilitation. Grazing lands have been neglected in the past and major efforts will be needed to improve productivity and food security in the semiarid and grasslands. WOCAT therefore promotes GRASS: Grass cover for the Recovery of Arid and Semi-arid Soils (Liniger and Thomas 1996).

Figure 4.8 Water and wind erosion on grazing land in susceptible drylands. Source: WOCAT

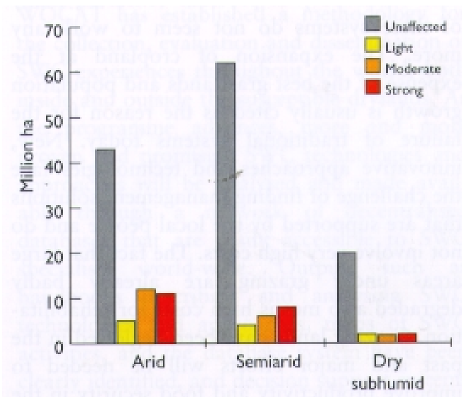


Figure 4.9 Gully and sheet erosion on heavily-grazed semiarid land in Kenya

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Figure 4.10 SWC measures on cropland in susceptible drylands. Source: WOCAT

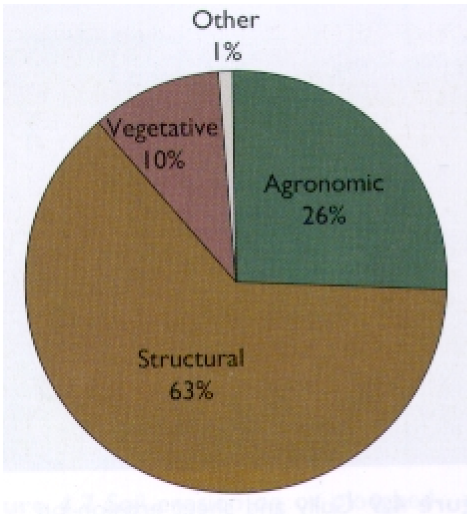
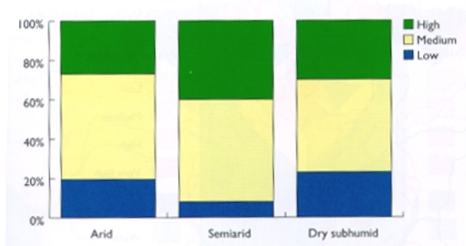


Figure 4.11 SWC effectiveness on cropland in susceptible drylands. Source: WOCAT



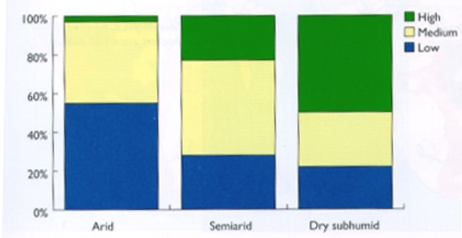
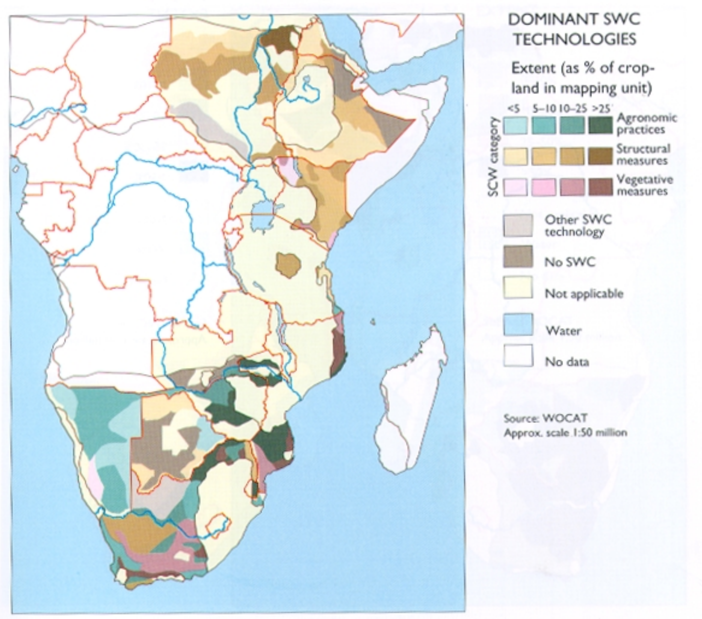


Figure 4.12 SWC effectiveness on grazing land in susceptible drylands. Source: WOCAT

Map 4.25 Dominant SWC technologies used on cropland in susceptible drylands**.**



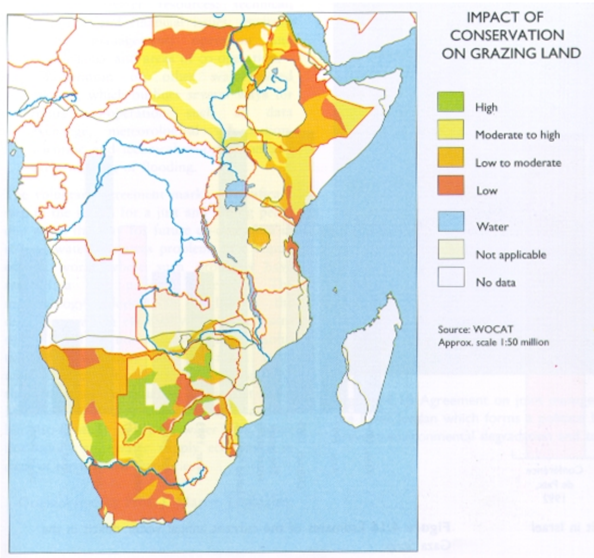
Outlook: the global programme

WOCAT has established a methodology for the collection, evaluation and dissemination of SWC experiences throughout the world, both inside and outside the susceptible drylands. As the programme advances, more and more proven and promising SWC technologies and approaches will be analysed and made available through a network of decentralised databases that are easily accessible to

SWC specialists world-wide. Outputs such as handbooks describing and analysing SWC technologies and approaches, maps of SWC activities, and the database system have been clearly identified, and decision support systems are under development. National, regional and international institutions are invited to join the global programme of WOCAT and to carry out their own WOCAT activities.

Original text by H.P. Liniger.

Map 4.26 Impact of conservation on cropland in susceptible drylands



Map 4.27 Impact of conservation on grazing land in susceptible drylands

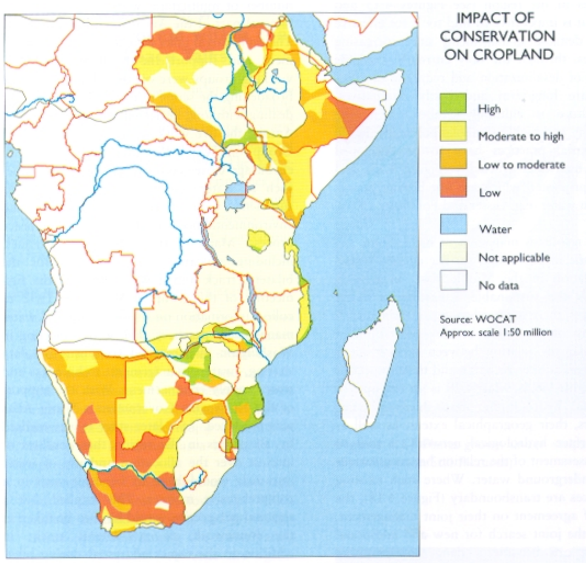


Figure 4.13 A combination of vegetative (grass strips and trees) and structural (terraces) measures used in Machakos, Kenya have successfully prevented erosion and runoff which still affect nearby fields

Figure 4.14 Protection from grazing has allowed the vegetation cover to increase in this area of Baringo District, Kenya