

Ethiopia's highlands are degrading, but natural resources can be managed sustainably if farmers are appropriately supported. Photo: Lorenz Roten 2006

## Improving ecosystem services for food security in Ethiopia



Research featured here is based on 29 publications focusing on the Ethiopian Highlands.

### Policy message

Ethiopia and neighbouring states have the potential to improve their natural resources and enhance food security.

- To improve food security, by 2020 soil and water conservation measures need to be expanded mainly on cultivated land, from the current 10-20% to at least 50% coverage in agricultural areas.
- Conserving and sustainably managing forest areas can benefit biodiversity and generate more income from forest products.
- Good water management can boost agricultural production, generate hydropower, and benefit neighbours in the lowlands.
- Research on global and local change is vital to achieve sustainable development and food security.

- The Ethiopian Highlands, once endowed with rich natural resources, have been used for agricultural purposes for several thousand years and are now heavily degraded. These resources could, however, be restored and managed sustainably, to the benefit of present and future generations. The present day state of natural resources varies a great deal: in some agricultural areas degradation processes have been halted and even reversed, while in other parts of the Highlands natural resources are close to a state of irreversible damage. Governmental and land users' efforts to conserve soils, water and biodiversity started late in the 20th century. However, far more efforts are needed to achieve sustainable land management, avoid further spreading of poverty, and provide a sound basis for sustainable agricultural growth and food security.

### Degrading highlands

- The Ethiopian Highlands cover more than 50% of the country and provide a living space for over 90% of Ethiopia's population of about 80 million people, 60% of the country's livestock and 90% of the agriculturally suitable area. The highland area once had over 90% forest cover, but today less than 4% of the area has forests and 16% has scattered trees. Land use and land cover changes were particularly dynamic in the 20th century due to accelerated population growth and changes in land tenure policy since 1975. At the same time climate change began to have impacts, and wildlife bound to natural habitats is now restricted

to the few areas that were preserved in their natural state due to rugged topography or natural aridity. Soil erosion has been severe throughout the Highlands, though mainly on cultivated land. Today, the severity and extent of soil degradation is seriously threatening food security. In response to this threat, a number of soil and water conservation measures were successfully implemented in some parts of the Highlands, using innovative approaches and leading to secure food production and a feeling of ownership among the land users. This is highly encouraging but needs to be further emphasised in the coming decades.



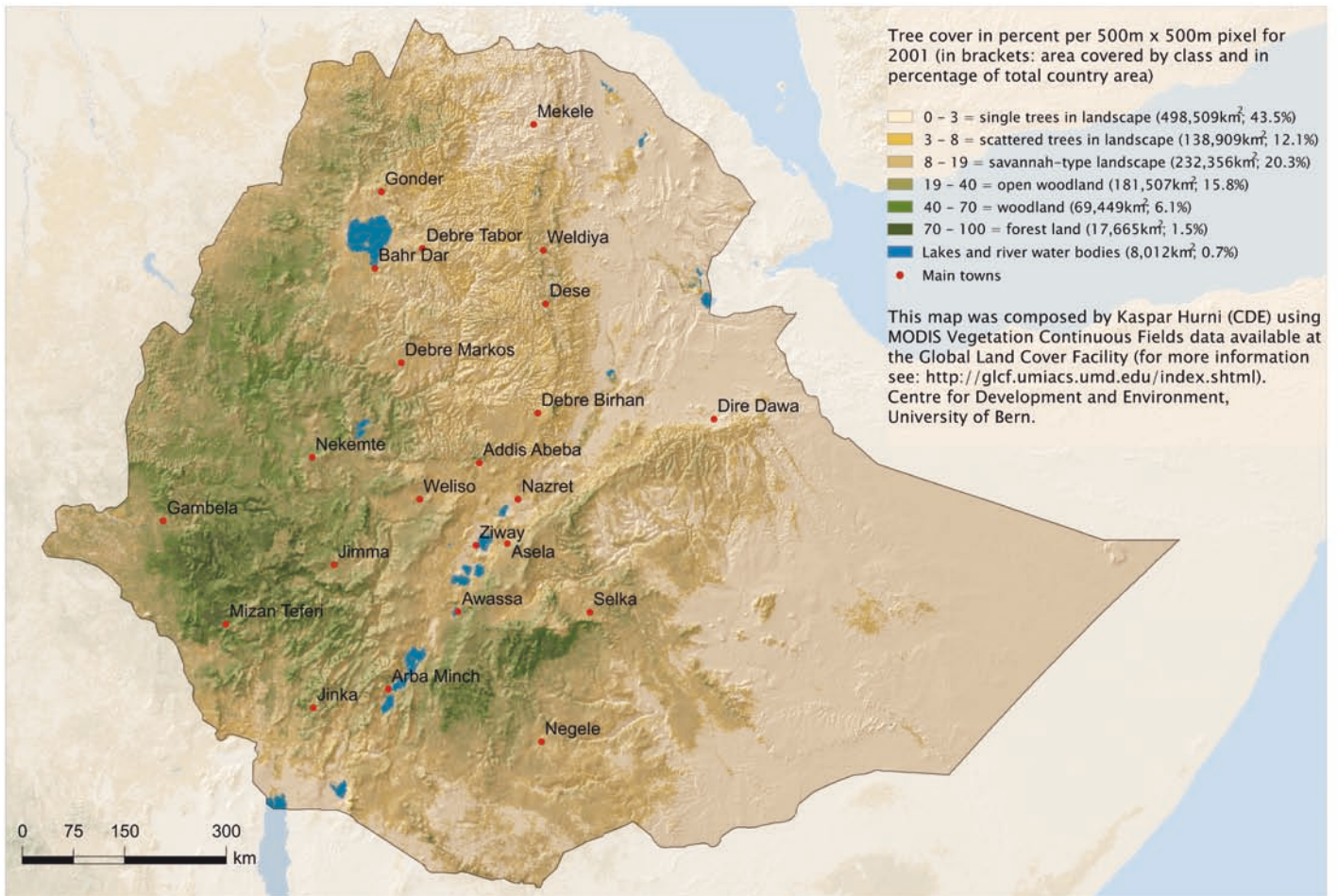


Figure 1: Ethiopia's tree and forest cover in 2001. The highlands to date are nearly deforested due to agricultural activities during the last 5000 years. Source: Hurni H, et al. 2010.

## Definitions

**Ecosystem services:** The benefits people obtain from ecosystems. They include provisioning services such as food and water; regulating services such as flood control; cultural services such as sacred places; and supporting services such as nutrient cycling that maintains conditions for life on Earth. (Source: adapted from Millennium Ecosystem Assessment 2005; <http://www.millenniumassessment.org>)

**Food security:** Exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization, and stability; food security includes the nutritional dimension. (Source: Committee on World Food Security 2009; <http://www.fao.org/cfs/en>)

**Sustainable Land Management:** A system of technologies and/or planning that integrates ecological principles with socio-economic and political ones in the management of land, to achieve intra- and intergenerational equity. (Source: H. Eswaran 1996)

## Accomplishing soil and water conservation

- The most important service provided by agricultural ecosystems in the Highlands is the production of food, feed, fuel and fibre. On agricultural lands, however, the degradation of soils is the most deteriorating process. In many places, it has reached a state where the land has turned into badlands and agriculture has been abandoned.
- Except for a few places, soil and water conservation (SWC) measures were largely unknown as a traditional practice, and had to be introduced in the aftermath of the famine of 1972-73. Food aid was combined with Food-for-Work and other incentives to stabilise cultivated lands with soil and stone bunds, reforest lands using micro-terraces, recover vegetation through area closures, and many more SWC technologies. In the past 35 years an estimated 10-20% of agricultural lands were treated; research has shown, however, that at least 50% of the cultivated area requires such measures.

Over the years, some of the measures were neglected, while more were maintained and gradually built up into terrace systems that provide a better basis for agricultural production. Research has shown that the overall production at the level of farms and catchments has increased significantly when looking from a 20-year perspective. Food security, however, is not guaranteed through these measures alone, since inter-annual variation due to climate variability and other factors remains high. Moreover, despite these successes, the doubling of the population in the past 25 years has led to reduced per capita production.

Until recently only degraded landscapes in the food-insecure areas and communal lands hit by recurrent droughts were primary targets for action, while so-called food-secure areas and private lands were left aside. Only if all agricultural land in need of SWC is treated within the coming decade, food security will be based on a sound natural resource base and offer a long-term perspective.



## Safeguarding forest areas

Biodiversity helps regulate ecosystems, e.g. it supports the provision of clean and regulated water from forest systems which may provide timber and non-timber forest products for humans and animals. Policy should ensure that forests are used and managed sustainably. The existing forest margins should be fixed as they are today, and in the long-term, forest cover should be expanded, degraded forests and woodlands regenerated and biodiversity improved. Tree plantations such as eucalyptus can satisfy the immediate need for fuel and construction wood, but cannot be considered as forests. Their species composition does not allow for a functioning ecosystem with biodiversity, water regulation and soil protection. Such tree plantations may be seen as agricultural land use. Some of them could be enhanced by interplanting indigenous trees, until a forest status is reached.

A further area for policy intervention is the numerous tree groves around the Ethiopian Orthodox churches in the Highlands. These are often the last sources of indigenous tree species and can provide seeds for nurseries. By supporting the Orthodox Church in preserving and expanding its grove forests, biodiversity of tree species will be better ensured, and nuclei for the development of natural forests can be created.



## Negotiating wise water use

One of the most underutilised resources in the Ethiopian Highlands is water. A considerable share of the water runoff is not used in the Highlands, though irrigation schemes in lowland Egypt and Sudan have tapped it since ancient times. While this contribution to Ethiopia's lowland neighbours must be maintained for a multitude of reasons, the country's water resources can be better regulated and used for hydropower generation, as well as other uses such as agriculture, domestic water supply and industrial use, before being released to the lowlands.

Such a policy has been pursued in the past 2 decades and is now gradually bearing fruit. Because irrigation areas are being expanded, their overall

- effect on lowland water availability
- needs to be observed and negotiated with the neighbouring countries in mutual agreements between water users and deliverers.

- With expanding agriculture and soil degradation in the Highlands, immediate surface runoff has increased and less is retained in the soil and groundwater. Crop production is increasingly suffering from water stress, and the effects of drought have become more pronounced. Water conservation at the field and farm level can improve yields and food security. It is fortunate that the total runoff from the watersheds will not be significantly reduced even once SWC measures are fully implemented. Good water management thus can boost agricultural production, generate hydropower, and benefit the lowland neighbours.

## Anticipating change

- Ecosystem services in the Ethiopian Highlands and their effects on food security are still not sufficiently known to be able to inform decision-making and policy formulation. It is therefore important to invest more in research on natural resource management, from plot, farm and field, to watershed and basin levels. Monitoring, predicting and anticipating possible implications of climate change are vital for achieving sustainable agricultural development and food security. Other change such as expansion and intensification of traditional and modern agriculture, foreign investments into production systems such as biofuels or food for export, and population growth and land degradation will also have to be observed.

- Global change research will involve a variety of scientific disciplines as well as concerned stakeholders, such as

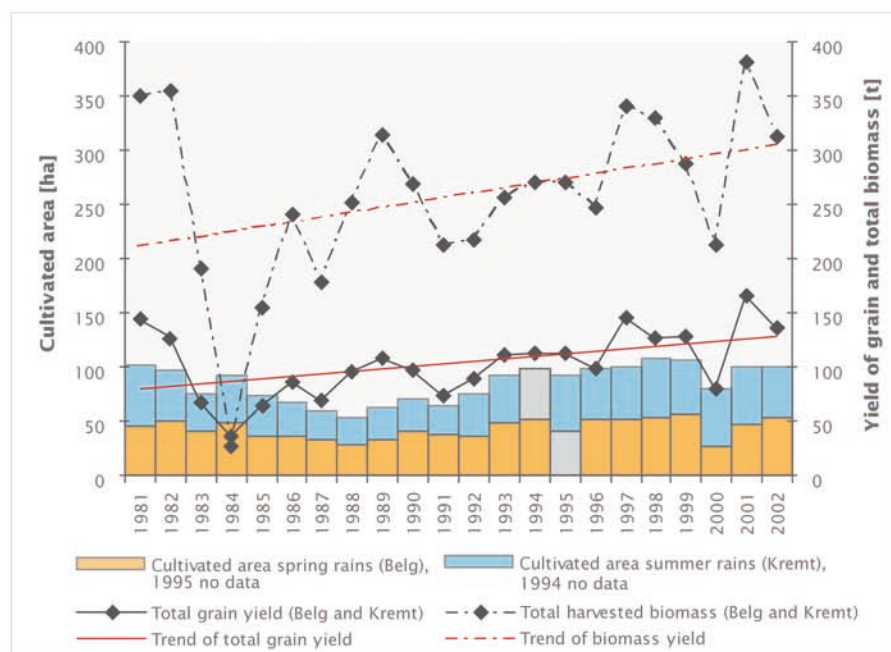


Figure 2: Long-term increase of total yields of grain and biomass (without grain), and cultivated area under crops for the two rainy seasons in Maybar, Ethiopia, from 1981 to 2002. The 1.13 km<sup>2</sup> catchment was conserved in 1983. Source: Soil Conservation Research Programme and Amhara Regional Agricultural Research Institute. Data analysed by Mirka Loetscher 2003.





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## NCCR North-South case studies on sustainable land management in the Ethiopian Highlands

**Policy implications for soil and water conservation:** The present-day distribution of SWC measures is related to policy decisions taken over the past 35 years. Recently, backed with research results, a policy shift towards more decentralised approaches was observed, combined with a higher emphasis on those areas that do not yet show high land degradation but have the highest rates of deforestation and soil erosion. In addition, research showed that the policy to invest external resources in communal rather than in private lands still prevails and has a negative impact on long-term food security. Source: Amare Bantider

**Sustainable land management for food security:** Food security will only be enhanced if both highly degraded and severely degrading areas are addressed at the same time. Technologies, measures and approaches, however, are different for these two categories, as it is more challenging to halt soil erosion processes on good land while safely draining surplus runoff, than to retain all runoff on degraded land in drier areas. Source: Hans Hurni

**Land cover and land use changes are site-specific:** A number of studies exploring land use and land cover changes have been carried out in the Ethiopian Highlands. They confirm the extent and severity of change and discern two major patterns: deforestation and land degradation started much earlier in the North and East of the Ethiopian Highlands than in the Western parts, where it was initiated on a larger scale only in the past century. Source: Gete Zeleke

**Soil degradation is more urgent than climate change:** In the Lake Tana Basin, a study confirmed that rainfall in the past 50 years does not show a downward trend but an increase in overall runoff. This may be due to the expansion and intensification of agricultural land use and degradation of the upland areas. Policy decisions addressing land degradation have the potential to lead to more sustainable land management while also addressing future impacts of climate change. Source: Birru Yitaferu

land users, government and private investor representatives, and the researchers themselves. Investment into university education and research funding must become a major goal of government policy. Research partnerships with institutions in countries that face similar problems and potentials, and with institutions in the glo-

bal North that have better access to technologies and networks, can be a means to strengthen research capacities in Ethiopia and link local research with the outside world.

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