

# THE NATURAL FORESTS AND ENVIRONMENTAL CONSERVATION IN THE SOUTHERN HIGHLANDS OF TANZANIA

P.K.T. Munishi and R.P.C. Temu

Sokoine University of Agriculture, PO Box 3010, Morogoro, Tanzania

## ABSTRACT

*All over the world, the importance of natural forests to people and to all living organisms is increasingly being recognised. Among one of their most important roles is the contribution of forests to environmental conservation. The natural forests of the Southern Highlands of Tanzania play a significant part in the conservation of soil and water resources, the amelioration of the micro and macro-climate, and the conservation of the fauna and flora. The major threats to natural forests and the environment in the Southern Highlands of Tanzania include the interrelated problems of deforestation, bush fires, overgrazing, soil erosion, and watershed degradation, which results in pollution, sedimentation of dams, and floods. The effects of all these have been a loss of soil fertility and a diminution of the productivity of the land in terms of agricultural production. Several remedial measures have been undertaken, including the prevention of deforestation, tree planting, the creation of increased public awareness of the problems (for example, of the damage caused by fire), pasture establishment or improvement to reduce overgrazing, conservation of water resources and prevention of soil erosion by contouring. Few of these measures have so far achieved much success. More effort is therefore needed to encourage the conservation of the Southern Highland's forests. This should include prevention of shifting cultivation, use of coal instead of wood fuel, enrichment planting using appropriate indigenous tree species, law enforcement and various forms of agroforestry. The support of the extension services, the integration of land use activities and the involvement of the people are all important if conservation is to be a success.*

## INTRODUCTION

The natural forest is an amazing and intricate ecological network, and the importance of tropical forests to the well being of people and all other living organisms is increasingly being recognised. The tropical rainforests alone, which include those of the Southern Highlands of Tanzania, are believed to contain more than three million different species, of which only one-sixth are well known. Apart from their unique fauna and flora, natural forests are important in the collection, storage and release into streams of water on which the people in the surrounding area depend. For example, the forests of the Southern Highlands of Tanzania are a major source of important rivers such as the Kiwira, the Songwe, and the Great Ruaha. The roots of the forest trees help bind and stabilize the hence preventing soil erosion, landslides and land degradation. The forests are also a source of fuelwood, building material, fruits, vegetables and medicinal plants (Mgeni, 1986; Iversen, 1988, 1990; Ruffo *et al.*, 1989).

The role of natural forests in climate regulation and the maintenance of hydrological cycles has been known some time. Recent evidence suggests that substantial alterations in the amount of forest cover may affect the global climate (Longman and Jenick, 1987; Lulandala and Kimboka, 1984).

Problems concerning the conservation of the natural forests of Tanzania, including those of the Southern Highlands, were noted as long ago as 1966 (Hedberg and Hedberg, 1968), and more recently their destruction and degradation have been subjects much written and talked about in seminars, symposia, workshops, newspapers and radio programmes, both at national and international levels. The recent Rio de Janeiro meeting (1992) on environmental issues emphasized the urgent need to conserve the natural forests of the world and the environment at large. This paper examines aspects

of natural forest conservation. It briefly lists the problems associated with the conservation of natural forests and the environment in the Southern Highlands of Tanzania, describes some remedial measures already underway and suggests further steps that could be taken to conserve this valuable resource.

### THE NATURAL FORESTS AS A RESOURCE OF THE SOUTHERN HIGHLANDS

The main vegetation types of Tanzania include afro-alpine heath and moorland, forest, woodland, savannah grassland, bushland, thicket and swamp. By inference from relics of the original vegetation, and from the modified cover that now exists over the area, most of the Southern Highlands below 2000 m were at one time covered by 'miombo' woodland (*Brachystegia - Julbernardia* woodland). High rainfall, high altitude areas like Rungwe are largely covered by evergreen forests and bamboo thickets, while in some areas at the very highest elevations, afro-alpine grasslands occur. In the more arid areas like the Usangu Plains north-east of Mbeya, bush or scrub characterized by *Acacia-Commiphora* associations occur. Natural grasslands occur in the seasonally waterlogged plains such as the Usangu Flats and the Lake Rukwa area (Armitage, 1981, 1982). The forests of the Njombe Highlands, like other forests of the Eastern Arc mountains of Tanzania, are important catchment areas. In addition, these forests contain a large proportion of valuable timber species, including *Hagenia abyssinica*, *Entandrophragma holstii*, species of *Ocotea* and *Podocarpus* and other ecologically important lower plant species such as *Bryophytes*.

In the miombo woodlands, valuable timber species like *Pterocarpus angolensis*, *Azelia quanzensis*, *Sterculia quinqueloba* and species of *Chrysophyllum* occur. Other species in the woodlands, such as *Brachystegia*, have potential for use as furniture and general purpose woods.

Some of the natural forests have been set aside for conservation as national parks, game reserves and game controlled areas, while others have been delineated as forest reserves. Those in Mbeya Region have been described by Armitage (1981).

### ENVIRONMENTAL CONSERVATION OF THE NATURAL FORESTS OF THE SOUTHERN HIGHLANDS

As previously mentioned, the natural forest types of the southern Highlands include miombo woodland, highland (evergreen) forest, bushy and scrub vegetation and natural grassland. These forests are important in the conservation of water and soil resources, the amelioration of the micro and macro-climate, and the conservation of the micro and macro-fauna and the gene pool in general.

#### Conservation of water resources

The natural vegetation cover of tropical soils helps maintain a hydrological balance in which runoff is minimal. If the hydrological balance is disturbed, for instance by clearing the vegetation cover, problems of erosion and land degradation are intensified.

Many forests in the Southern Highlands of Tanzania are designated as catchment forests, that is, forests managed mainly for the conservation of water resources. The catchment forests are important for water storage and yield, not only to areas nearby but to places far from the sources. Water storage in the forest may be in the form of a lake or reservoir, as groundwater flow that produces stream base flow or contained within the biomass of the catchment. The water storage capacity of a catchment forest is influenced by the plant species composition of the area. For example, Bryophytes play a great role in fog condensation, accounting for large amounts of water conservation in the montane, high altitude forests (mossy montane forests) (Poc's 1988 quoted in Mwangasa, 1991).

The storage capacity of catchment forests in the Southern Highlands gives rise to a number of important rivers. One example is the Great Ruaha River, which is fed by numerous streams (both seasonal and permanent) from the forests on the north facing slopes of the Poroto Mountains, the Kipengere Range, the Mbeya Range, the high country of Chunya District, and the Njombe Highlands.

This river drains the Usangu Flats in Mbeya Region. The water from the forests on the western slopes of the high country of Chunya District, Mbeya Range, and the north-west Mbozi Plateau drain into Lake Rukwa. The Songwe River, which flows into Lake Nyasa and Lake Rukwa, originates from catchment forests in south-east Mbozi, eastern Ileje and southern Mbeya. The Kiwira, Mbaka and Lufirio Rivers which flow into Lake Nyasa, drain from the highland forests in Rungwe District. It is clear therefore that the natural forests of the mountains and other highland areas have a considerable impact on water flow. The importance of catchments and natural forests are documented by Poc's (1988), Hamilton and Bensted-Smith (1989), Nsolomo and Chamshama (1990), Mgeni and Malimbwi (1990) and Mwagasa (1991), among others.

#### **Conservation of soil resources**

The soil as a resource has four characteristics that are of special interest in land use planning: a capacity to accept water, a capacity to store water, susceptibility to erosion, and fertility. The conservation of soil resources implies the maintenance of soil fertility. This involves erosion control, and the maintenance of organic matter, physical properties and nutrients, as well as the avoidance of toxic substances.

Most natural forests, especially those in highland areas (including the forests of the Southern Highlands), play a considerable role in the conservation of soil resources by providing surface cover, soil stabilization and maintenance of organic matter. Deforestation (especially in catchment areas) leads to increased erosion and hence sedimentation in reservoirs, dams and lakes downstream.

Forests are believed to be sustained by tight cycling of nutrients between vegetation and the soil. If this cycle is broken through forest destruction, nutrients are likely to be rapidly lost, resulting in an impoverished soil (Hamilton and Bensted-Smith, 1989). When a forest is destroyed, abundant nutrient reserves held in the soil and vegetation become available for utilization by crops, but are soon depleted by leaching, erosion, burning and the removal of crops. Use of the sub-montane forest soils for agriculture without measures to conserve organic matter and nutrients diminishes the resource base irreversibly (Hamilton and Bensted-Smith, 1989).

The movement of mineral elements within the forest ecosystem is governed primarily by the forest's biotic components, the various species of plant, animals and micro-organisms or particular producers, consumers and reducers. Normally, undisturbed natural forests maintain a well balanced ecosystem, which ensures efficient nutrient cycling and soil fertility. It is worth emphasizing that much of the damage caused by erosion on agricultural uplands and lowlands occurs as a result of disturbing the ecological balance of the drainage basin, destroying the protective plant cover of trees and grasses, and cultivating marginal land. Soil erosion is common in the Southern Highlands, especially in the mountainous areas of Rungwe and Ileje, and parts of Mbeya and Mbozi Districts. These are areas of high rainfall and hence of high population density.

#### **Amelioration of the micro and macro-climate**

The effect of forests on climate is a controversial subject (Hamilton and Bensted-Smith, 1989). There is no incontrovertible evidence to prove that the clearing of forests has materially altered rainfall in terms of total annual rainfall (Reynolds and Wood, 1977). However, Pereira (1973), quoted by Reynold and Wood (1977), reported that the clearing of 800 km<sup>2</sup> of tall forest in southern Tanzania for subsistence farming appeared to have halved the number of occasions on which slight rainfall was recorded. People on the East Usambara mountains have similarly reported a decrease in the of incidence of rainy days and reduced mist since extensive areas of forest have been cleared (Hamilton and Bensted-Smith, 1989). It has also been suggested that increased temperatures in the East Usambaras since the late 1970s may be due to deforestation. Decreased reliability of annual rainfall in the East Usambaras since the 1960s has been reported by Hamilton and Bensted-Smith (1989). All this points to the likelihood that the rapid depletion of forests and woodland has caused a number of environmental problems, including undesirable changes in water regimes, local climate and the biosphere as a whole.

The forests of the Southern Highlands of Tanzania have a considerable influence on both the micro and macro-climate of the area. Although there is no hard data, people who have lived in the area for a long time have complained about changes in the pattern and amount of rainfall, attributing this to a decrease in forest cover (Munish, personal communication). These, among other factors, indicate the contribution of these natural forests towards environmental conservation.

#### **Conservation of the fauna and flora**

The natural forests of the Southern Highlands are habitats for many kinds of fauna and flora. All the major vegetation types that occur in this area are to varying degrees important wildlife habitats. For example, under natural forests and other types of vegetation, the biological activities of soil fauna are maintained at an optimum level. The interaction between the living (including micro and macro-fauna) and the non-living (environmental) components, results in a number of processes within the natural forest ecosystem without which the system would be unstable.

### **PROBLEMS OF ENVIRONMENTAL CONSERVATION IN THE SOUTHERN HIGHLANDS**

The major environmental conservation problems in the Southern Highlands of Tanzania include deforestation, bush fires, overgrazing, soil erosion and watershed degradation, which results in water pollution, sedimentation of dams, and floods. These problems are interrelated, so that one problem may result in another.

#### **Deforestation**

Deforestation has a number of causes. Clearing for agriculture, for example, cultivation of finger millet or ntemele, is especially prevalent in Mbozi and Chunya Districts in Mbeya Region, and also in Rukwa Region. Tobacco growing also contributes to deforestation in Chunya District, where large areas are cleared annually for this purpose. In addition, extra land is cleared to provide fuelwood for tobacco curing. In high population areas, such as the Rungwe Highlands, much of the indigenous forest cover has been cleared to make way for agriculture. This process of forest clearance for agricultural expansion is still in progress.

Population pressures have also led to encroachment into several forest reserves, including those managed for water conservation. There is, for example, the possibility of encroachment in Muipa and Lukwati Forest Reserves in Chunya by tobacco growers. Some encroachment has already been observed in the Muswina and Iyondo Forest Reserves in Ileje. About 75% of the Irungu Forest Reserve in south-east Mbeya has been encroached for settlements, cultivation and grazing, while in Rungwe some 25% of Kyejo and Kyosa Forest Reserves have been encroached for cultivation. Clearance for fuelwood and charcoal burning also contributes to deforestation in the area.

#### **Bush fires**

Bush fires may be caused by various factors, including a human activities. Fires have the effect of reducing the rate of growth of trees thus retarding forest development. Burning of the grass cover leaves the ground bare, hence increasing water run-off and susceptibility to soil erosion. In addition, fires destroy ecologically important micro and macro-fauna. It has been estimated by the Mbeya agroforestry project manager that more than 25% of the natural vegetation/forest areas in Mbeya Region has been burnt this season (1992) within a period of less than two months (Kiwalaka, personal communication). The area of natural vegetation/forest burnt in different districts within the same period has been estimated as 75% in Chunya, 50% in Mbeya and Mbozi, and 25% in Rungwe Districts. For example, the whole of Kyejo Forest Reserve in Rungwe District has been burnt.

#### **Overgrazing**

Overgrazing is prevalent in the Lake Rukwa basin and the Usangu Plains. It is caused by livestock migration from the northern regions of Singida, Tabora and Shinyanga. Most farmers in

these areas are reluctant to reduce stock numbers. The carrying capacity of these areas has been greatly exceeded in most places, as result of which there is a loss of vegetation cover (especially during the dry season) and soil erosion caused by the animals, wind and water.

### Soil erosion

Soil erosion is most serious in highland areas. It is probably caused by poor agricultural practices, overgrazing and deforestation. Both water and wind erosion are common. Other agents of erosion in the region are the alluvial gold miners in Chunya District. During the process of digging for gold in river basins and banks, they disturb and loosen the soil, causing severe erosion during the rainy season, as well as the degradation of watersheds.

### Watershed degradation

Cultivation and grazing in watersheds interfere with the hydrological balance of the catchment, intensifying soil erosion and degradation. For example, the cultivation of Irish potatoes and cattle rearing in the upper catchment of the Ruaha River around the Kitulo area in the Rungwe Highlands may have interfered with the hydrological balance of this river and other rivers originating from the same area.

The present reduction of water levels at Mtera dam may have been partly caused by human activities and degradation of the upper catchment of the Ruaha River. Moreover, the clearing of land for rice in Usangu (Madibira, Mbarali, Kapunga, Kimani and Igurusi) and the redirection of water for irrigation, may have been responsible for a reduced water flow into Mtera dam. Although no quantitative data on this is available, there is a need to take this issue seriously in order to avoid or eliminate any irreversible effects which might occur in the future.

Other agricultural activities that can lead to the degradation of watersheds include the practice of dry season farming, whereby people traditionally cultivate alongside water sources and river and stream banks (commonly known as 'virimbika' in Mbozi and Mbeya, and as 'vinyungu' in Njombe and Iringa). This practice is detrimental to the catchment of many rivers as it involves the clearing of vegetation near the rivers, resulting in both erosion and the drying up of streams.

### Floods

Floods occur as a result of peak run-off because of poor conservation of water in a catchment. Floods can cause a number of serious problems, including the destruction of crops and property, and even whole settlements, and the sedimentation or siltation of dams and Lakes. In the Southern Highlands floods are common in the plains of Kyela, Usangu and Lake Rukwa. Floods have caused siltation of Lakes Rukwa and Nyasa, reducing their depths and causing water to flood onto the land, threatening human settlements. For example, between 1975 and 1992 some villages around Lake Rukwa (Mbangala and Maleza in Chunya) had to be resettled three times because of the overflow of the lake onto the land caused by siltation. The same threat exists in Mbozi District.

## REMEDIAL MEASURES

A good knowledge of the management of natural forests for sustainable agricultural production and environmental conservation is important. Integration of decisions and activities among different land use sectors is essential in order to avoid detrimental opposing efforts. In this respect, knowledge of the interrelations between the factors involved in environmental degradation is important for planning the future management of the region. As an example, de-stocking and reduced grazing could reduce soil erosion and help eliminate the extreme peak flows and thus increase the amount of water available for downstream irrigation, power supply and domestic use.

Several measures have already been undertaken by the Government and regional authorities to reduce the problems of natural forest and environmental degradation. In Mbeya Region, for example, these measures include the prevention of deforestation by education and law enforcement and tree

planting (about seven million tree seedlings were raised in 1991 and distributed for planting by different agencies including the Forest Department, the European Economic Community (EEC) Agroforestry Project, the Water Department-DANIDA, and non-governmental organisations). Furthermore, new Forest Reserves have been created, which will benefit the environment.

Other measures include education through seminars in order to create public awareness, for example, on the problems caused by fire on pasture development so as to reduce overgrazing, on soil erosion control by contouring, on the planting of grass and fruit trees to increase vegetation cover and conserve water resources.

However, despite all these measures, very little has so far been achieved. More efforts are required. The response from target groups has not been promising. For example, the proposal to implement soil erosion control measures in places has been taken to indicate a colonial mentality on the part of the proposers, and gold miners in Chunya are reluctant to consider the issue of soil conservation.

## CONCLUSION AND RECOMMENDATIONS

There is growing concern about the status of the natural forest resources of the Southern Highlands of Tanzania (especially those in mountainous areas) and the apparent trend towards increasing deforestation. The environmental problems observed in this area require greater attention in order to reduce their effects. Planned and intensive management of these natural forests is essential to maintain their important role in environmental conservation. In this respect, there needs to be greater awareness of the complexity of the interrelationship between such matters as forest conservation and development, population growth, agricultural production, micro and macro-climate change and biological diversity. More emphasis should be put on measures to conserve the natural forests and the environment of the Southern Highlands. Such measures might include the prevention of shifting cultivation where it still exists, the use of coal instead of fuelwood, enrichment planting in encroached areas using indigenous tree species, education on the rational use of fire, improved agricultural practices and the adoption of more balanced agricultural practices such as agroforestry, especially in areas where the ecosystem is fragile, such as water sources and steep slopes, and agro-silvi-pasture (combining agriculture, pasture and fuelwood production). The support of the extension services, the involvement of local people and the integration of technologies among different sectors will be of prime importance. In some cases, law enforcement will be necessary to ensure the remaining natural forests of the Southern Highlands are conserved.

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