# Changes in the state of conservation of Mt. Kenya forests: 1999 - 2002











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# An Interim Report February 2003

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# FOREWORD

Forest ecosystems are critical natural assets that provide the nation with essential environmental services. As one of the five main "water towers" of Kenya, the forests of Mt. Kenya play a critical role in supporting key economic sectors, including electricity generation as well as subsistence and cash crop production.

In 1999, Kenya Wildlife Service, with support from UNEP, undertook a systematic aerial survey of the forests of Mt. Kenya. The findings of the survey revealed extensive forest destruction across the montane ecosystem. As a strategic response, Mt. Kenya forests were afforded the enhanced protection status of a National Reserve in July 2000 and placed under the management of Kenya Wildlife Service.

This report reviews the changes in the state of conservation of Mt. Kenya since 2000. I am very pleased to note that the situation in the mountain has improved significantly with drastic reduction in illegal logging, charcoal production and marijuana cultivation. The efforts made by Kenya Wildlife Service should be commended and serve as an example for other much threatened forest ecosystems.

Hon. Dr. Newton Kulundu,

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Minister for Environment, Natural Resources and Wildlife

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## 1. INTRODUCTION

Public scrutiny and outcry over forest destruction, in particular on Mt. Kenya, called for a comprehensive assessment of the status of Mt. Kenya forests. The need was highlighted by a number of concerned parties, including institutions, NGOs, conservationists and community groups. Consequently Kenya Wildlife Service (KWS), with support from the United Nations Environment Programme (UNEP), responded to the call for a comprehensive assessment by undertaking an aerial survey of the entire forest belt of Mt. Kenya in 1999. The survey was to provide factual information on the type, extent and location of destructive activities in the forests.

The result of the 1999 survey established that the whole of Mt. Kenya forests were heavily impacted by extensive illegal activities leading to serious destruction below the bamboo/bamboo-podocarpus belt. Over 6,700 Camphor (*Ocotea usambarensis*) trees had been destroyed through logging out of a total of 14,662 indigenous trees that had been cut, most of them recent. Over 75 percent of clear-felled plantations had not been replanted with tree seedlings, although all these areas were under the 'shamba system' (non-residential cultivation). Encroachment into the fringes of indigenous forests were recorded, emanating from shamba-system cultivated areas. Most of the natural forest in the Lower Imenti had been destroyed and was under crop cultivation. In the lower part of the Upper Imenti, extensive charcoal production was observed throughout the area, leading to significant destruction of the indigenous forest. Marijuana (bhangi, *Cannabis sativa*) cultivation was quite extensive, totalling 200 hectares, and was being grown in the indigenous forest from the edges to deep inside the forest. The Ngare Ndare forest was impacted by illegal logging of Cedar (*Juniperus procera*), livestock grazing and fires. However, pressure on that forest had not led to the same level of destruction as in many parts of Mt. Kenya and Imenti forests (Gathaara, 1999).

As a result of the survey report, a number of important policy measures were implemented by the Government in late 1999 and 2000. They include: the imposition of the country-wide ban on the commercial exploitation of all forest reserves in Kenya (December 1999); and the gazettement of Mt. Kenya National Reserve to provide enhanced conservation status to the entire forest belt on the mountain. The newly established National Reserve was accompanied by a shift in management from Forest Department (FD) to KWS (Letter from Minister Nyenze dated 14 July 2000; Legal Notice 93 of 24 July 2000 – see Appendix I).

Pending new cooperation arrangements between KWS and FD, KWS has concentrated its efforts in protecting and managing the indigenous forest and FD in managing the plantations.

In order to determine the forest cover changes following the shift in management, an assessment of the changes in Mt. Kenya forests between 2000 and 2002 was required. Four organizations that had gathered information and expertise on Mt. Kenya agreed to cooperate for the undertaking: Durrell Institute for Conservation and Ecology of the University of Kent, KWS, UNEP and the Kenya Forests Working Group (KFWG).

## 2. OBJECTIVES

The objectives of monitoring the changes in Mt. Kenya forests are:

- To assess changes in the state of conservation of Mt. Kenya forests since 1999;
- To assess the effectiveness of the new management practices put in place on Mt. Kenya since 2000;
- To identify emerging or prevalent threats to conservation of the forests; and,
- To recommend interventions in support of the conservation of forests.

## 3. METHODOLOGY

Evaluation of vegetation cover changes is based on three types of analyses:

- 3.1. Time-series satellite image analyses;
- 3.2. Repeated aerial surveys;
- 3.3. Repeated ground surveys.

#### 3.1. Time-series satellite image analyses

The objectives are:

- To assess changes over time in the status of forest plantation areas; and,
- To assess changes over time in location and status of degraded land, in particular encroachment, within the indigenous forest in the National Reserve.

Time-series analyses of four Landsat satellite images were carried out to establish vegetation cover changes, using the software ArcGIS 8.2. The results of the interpretation of the satellite images were validated by flying at very low elevation above the areas to be checked. Such "aerial truthing", to compare with traditional "ground truthing", proved to be very efficient as a large number of areas, some very remote, could be reached in a short period of time. The dates of the satellite images are February 1987, October 1995, February 2000 and February 2002. The 1987 image was acquired from Tropical Rainforest Information Centre. The 1995, 2000, and 2002 images were provided by United States Geological Survey/United Nations Environment Programme-Global Resource Information Database at Sioux-Falls. The four images have a resolution of 30 metres, meaning that each pixel represents 30 x 30 metres on the ground. The interpretation of the satellite images was made based on "true colour" compositions of bands 1 (blue), 2 (green) and 3 (red).

Two separate analyses were carried out: one for the forest plantations currently managed by FD, and the other for the indigenous forests under the management of KWS.

The boundaries of the forest plantations were obtained from the plantation sheets at scale 1/10,000 provided by FD. These boundaries were overlaid on the satellite images to locate accurately the forest plantations. The total forest plantation area derived from the plantation sheets amounts to 18,617.6 ha.<sup>1</sup>

The status of forest plantations was identified from the interpretation of the satellite images.

The location and extent of degraded land within the indigenous forests in the National Reserve were also derived from the interpretation of the satellite images. Degraded land is understood in this report as forest land impacted by fire or illegal settlement or cultivation. Aerial truthing was undertaken to distinguish open areas that are naturally devoid of trees (i.e. grasslands) from degraded land.

<sup>&</sup>lt;sup>1</sup> There is a discrepancy between the total forest plantation area derived from the plantation sheets (18,617.6 ha) and the total acreage under forest plantation suggested by Matiru (2000) based on written records (21,450 ha). It is possible that some smaller plantation blocks had not been reflected on the plantation sheets, which could explain the difference.

#### 3.2. Aerial surveys

The objective of using aerial survey data is:

• To assess the changes in type, extent and location of the damage or threats to the forests between 1999 and 2002.

The methodology for the stratified sampling aerial survey of the forests was derived from the long experience gained by East African wildlife departments in counting animals from aircraft following set transects, further adapted as a result of the first ever forest survey of its kind on Mt. Kenya in 1999 followed by Mt. Kilimanjaro in 2001 and the Aberdare Range in 2002.

To compare the current situation with the results of the 1999 aerial survey of destruction in Mt. Kenya, Imenti and Ngare Ndare forests, a sampling aerial survey was conducted in 2002. Using a stratified random sampling technique, 30 squares of 3 x 3 kilometres were selected and over-flown.

The stratification was based on the number of observations made in 1999 in each survey block. For example, if 10 percent of the total number of observations were found in block 'B' in 1999, the sampling effort in block 'B' in 2002 would be 10 percent out of the 30 squares. The squares in each block were then selected randomly.

During the selection, squares that partially covered areas above the tree line were rejected and redrawn since no damage or threat was observed at such a high altitude in 1999. The type of damage or threats recorded include:

- Logging of indigenous trees;
- Charcoal production;
- Cultivation of marijuana (bhangi, *Cannabis sativa*);
- Fire occurrences;
- Landslides;
- Grazing of livestock.

The sampling survey required over seven hours of count time, with an average of 14 minutes per survey square (see Map 1 at Appendix III) and covered some 18 percent of the area surveyed in 1999.

#### 3.3. Ground surveys

The objective of using data from ground surveys is:

• To make a comparison of the intensity of illegal logging activities between 1999 and 2002.

Ground survey data is derived from the Mount Kenya Elephant Project, a research project conducted under KWS with funding from the United States Fish and Wildlife Service. The research aims to estimate elephant distribution and movement across the Mt. Kenya ecosystem, as well as to identify factors affecting them. As part of the project, a total of 150 kilometres of line-transects that run from the moorlands (3,500 metres) to the lower slopes and across all forest types, were walked in 1999 and 2001. Along the transects, data were recorded with regard to elephant presence (dung), forest type, altitude, slope, ground cover, and human activities. The latter include: logging and charcoal burning sites, marijuana cultivation, logging and/or poaching camps, campfires, snares and animal traps, injured animals and poached carcasses.

Logging sites remain visible for several years on the ground. As such all logging sites recorded in 1999 were still visible in 2001. The intensity of logging was assessed through recording the number of active sites vis-a-vis non-active sites. Non-active sites were categorized into 'abandoned recently' (no human activity and not yet overgrown with vegetation) or 'abandoned old' (no human activity and overgrown with vegetation). To evaluate the impact of new management practices put in place in 2000 on logging on M. Kenya, the data gathered in February 1999 were compared with those of February 2001.

The transects of the 2001 ground survey were not exactly at the same position as the 1999 transects. Both surveys therefore comprise a random sampled set of logging sites along transects that are located approximately at the same location. The similarity of proportional distribution of recorded sites between the two years (Fig 3.1) suggests that the survey data between years can be used for comparative analyses.





### 4. RESULTS

#### 4.1. Time series analysis of satellite images

Satellite imagery is an excellent remote sensing tool to study land-cover changes. Satellite images of Mt. Kenya area were obtained for 1987, 1995, 2000, and 2002.

#### 4.1.1. Forest plantations

Forest plantations on Mt. Kenya constitute approximately 20 percent of the forest area in the north and west as opposed to only four percent in the south and 0.1 percent in the east (Kohler, 1986). Changes in the forest

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