

TABLE OF CONTENT

| | |
|--|-------------------------------------|
| FOREWORD | 1 |
| ACKNOWLEDGEMENT | 2 |
| 1. EXECUTIVE SUMMARY | ERROR! BOOKMARK NOT DEFINED. |
| ENVIRONMENTAL ASSESSMENTS OF YEAR 2000 DROUGHT | 10 |
| INTRODUCTION | 10 |
| CHAPTER 1 | 11 |
| IMPACT OF DROUGHT ON LIVESTOCK AND WILDLIFE POPULATIONS IN TWO SAVANNAH ECOSYSTEMS OF KENYA | 11 |
| 1.0. INTRODUCTION..... | 11 |
| 1.2. METHODOLOGY | 12 |
| 1.3. CASE STUDY: IMPACT OF 2000 DROUGHT ON LIVESTOCK AND WILDLIFE IN NORTHERN KENYA | 12 |
| a). <i>Laikipia District</i> | 13 |
| b). <i>Samburu District</i> | 14 |
| c). <i>Isiolo District</i> | 16 |
| 1.4. CASE STUDY: IMPACT OF 2000 DROUGHT ON LIVESTOCK AND WILDLIFE IN SOUTHERN KENYA..... | 19 |
| a). <i>Narok and Trans-Mara Districts</i> | 19 |
| b). <i>Kajiado District</i> | 20 |
| 1.5. DISCUSSION..... | 23 |
| 1.5. CONCLUSION AND RECOMMENDATION | 30 |
| CHAPTER 2 | 31 |
| USE OF SATTELLITE DATA IN DROUGHT MONITORING | 31 |
| 2.0. INTRODUCTION..... | 31 |
| 2.1. EXISTING DROUGHT MONITORING AND EARLY WARNING INITIATIVES..... | 31 |
| 2.2. NEED FOR EFFICIENT AND RELIABLE EARLY WARNING SYSTEM | 32 |
| 2.3. DROUGHT INDICES | 32 |
| 2.4. ANALYSIS OF NDVI DATA | 34 |
| 2.5. OUTPUTS | 35 |
| 2.5.1 <i>Drought monitoring at a country scale</i> | 35 |
| 2.5.2 <i>NDVI Application for Estimating End of Season Primary Biomass Production</i> | 40 |
| 2.5.3 <i>Drought monitoring at district scale</i> | 40 |
| 2.6 ANALYSIS OF NDVI ANOMALIES..... | 42 |
| 2.7. DISCUSSION..... | 45 |
| 2.8. CONCLUSION | ERROR! BOOKMARK NOT DEFINED. |
| CHAPTER 3 | 46 |
| POPULATION GROWTH AND FOOD SECURITY | 46 |
| 3.1. THE IMPACTS OF 2000 DROUGHT | 47 |
| 3.2. HUMAN POPULATION | 47 |
| 3.2.1. <i>Drought and Human Population</i> | 48 |
| 3.2.2. <i>Population expansion in the ASAL areas</i> | 50 |
| 3.2.3. <i>Human activity and drought</i> | 50 |
| 3.2.4. <i>Poverty Prevalence</i> | 51 |
| 3.4. AGRICULTURE | 52 |
| 3.4.2. <i>Maize and Wheat Crop Forecasting</i> | 52 |
| 3.4.3. <i>Historical Trends in Maize Production</i> | 53 |
| 3.6. EXPANSION OF AGRICULTURE IN DROUGHT VULNERABLE AREAS..... | 56 |
| 3.5. AGRICULTURE IN NAROK DISTRICT (CASE STUDY) | 58 |
| 3.7 FOOD SECURITY | 61 |
| 3.8 CONCLUSION | 63 |
| CHAPTER 4 | 64 |
| IMPACTS ON NATURAL RESOURCES, WATER FOREST AND LAND | 64 |
| 4.0. INTRODUCTION..... | 64 |
| 4.3. IMPACTS ON SURFACE WATER SOURCES | 66 |
| 4.4. IMPACTS ON GROUNDWATER | 69 |
| 4.5. ECONOMIC IMPACTS..... | 70 |
| 4.6. SOCIAL IMPACTS | 71 |
| 4.7. DISCUSSION..... | 73 |
| 4.8 CONCLUSION | ERROR! BOOKMARK NOT DEFINED. |
| 4.8 RECOMMENDATION..... | ERROR! BOOKMARK NOT DEFINED. |
| REFERENCES | 76 |

Foreword

This report is as a result of collaboration between UNEP and the Government of Kenya through the Department of Resource Surveys and Remote Sensing (DRSRS). The problems that the government needs to tackle and some suggestions to remedy them are presented. This quantitative assessment was in response to the devastating prolonged drought countrywide in 2000. Government experts improved on an earlier qualitative report by incorporating documented literature and data from the field to assess impacts of this drought. It is hoped that the results will be used in future as a benchmark to minimize the impacts of occurring droughts and at the same time contribute to government effort to reduce poverty through mitigative measures recommended.

The drought severity was as a result of the continuous failure of rainfall between 1998 and 2000, making it the worst weather calamity to affect the country in recent memory. The drought was so bad that it affected areas usually referred to as high potential thus resulting in widespread food shortage. Low water availability had ripple effects in agricultural, industrial and environmental sectors leading to lower productivity in the industrial sector, poor harvesting, and degraded land cover. The drought worsened the poverty levels especially among the semi-arid communities.

However, regular drought in Kenya makes it necessary to learn to live with it and thus establish coping mechanisms. This report provides some mitigative measures that could be used to deal with its occurrence, which includes protection of natural resources such as forests, water resources and creation of awareness among the local communities on the importance of environmental conservation.

It is the hope of the two institutions that the recommendations of this report will be implemented in areas identified as most vulnerable to these weather phenomena. This report also provides a basis for future planning and policy formulation in the most affected areas.

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Our sincere appreciation is extended to the District Commissioners and their Officers in all the districts visited. Without their insight and availability we would never have been able to collect the necessary data. Our thanks go to the World Food Programme (WFP) and District Livestock/Agriculture Officers in Laikipia District and Centre for Training in Arid Lands Development (CETRAD).

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1. EXECUTIVE SUMMARY

1.1. Introduction

Kenya was hit by a series of droughts in 1991-92, 1996-97 and 1999-2000, and a devastating flood in 1997-98. The 1999-2000 drought occurred against a background of long-term economic recession, where water and food requirements, and security affected almost every sector. The drought and events that followed will be remembered as probably one of the worst disasters experienced in the country in over 40 years. Failure of the long rains in March 2000 was the fifth successive dry spell over a period of two years. Consequently, the soils were left with severely inadequate moisture to sustain plant growth and resulted in the destruction of crop fields, water resources, vegetation cover, severe environmental degradation and ultimately the loss of ecosystem goods and services.

The arid and semi-arid lands (ASAL) were worst hit by this drought due to the fragile nature of this ecosystem, breakdown of traditional drought coping mechanisms and rapidly changing land use. The loss of livelihoods brought incalculable suffering to over 40 millions of people in more than 22 districts. Millions of people starved and struggled to restore their homes and regain livelihoods.

Remarkable losses occurred in the livestock numbers as their conditions deteriorated rapidly and pastoralists reported a huge loss, mainly of cattle but also of camels, sheep and goats. Numerous animal carcasses were observed widely strewn in most districts and the majority of which belonged to cattle. This was a clear evidence of starvation related mortality although diseases may have taken its toll on weakened animals. The products of emaciated animals recorded the lowest market prices and a further loss to the pastoralists. Large concentrations of livestock were reported around the remaining watering points and certain location including the Mt. Kenya region and even within the residential areas in Nairobi city. This was due to rampant animal movements within the districts and from adjacent areas in search of pasture and water. Such concentration of people and animals in patchy habitats culminated in conflicts of resource use and further degradation of the environment.

The high crop failure prompted the World Food Programme (WFP) to appeal for US\$88 million to feed almost 3.3 million Kenyans in need of food relief. The Government declared a national disaster and in response the WFP spent US\$ 102 million on food relief alone. The Government spent more than Ksh 10.5 billion on emergency relief food during the 2000/2001 financial years. The overall damage to the country is thought to have cost at least Ksh 220 billion as compared to the 1997 El Nino floods that cost approximately Ksh 70 billion.

1.2. Key findings

This report is produced by the UNEP Division of Environment Policy Information (DEPI) in collaboration with the Department of Resource Surveys and Remote Sensing (DRSRS) in the Ministry of Environment and Natural Resources. It provides an assessment of the impact of year 2000 drought on livestock and wildlife populations in the selected districts within two savannah ecosystems in Kenya i.e. the southern rangelands with Kajiado, Narok and Transmara districts and the northern rangelands with Laikipia, Isiolo and Samburu districts. It also provides a comparative analysis of the historical trend of drought in the above districts as representatives of the arid and semi-arid region and Nakuru and Murang'a districts as representatives of the high potential areas. Furthermore, the impact of drought on food production, water resources and catchments, and economic development is examined. Finally, the trends of human population growth and agricultural encroachments into marginal areas, and deforestation as some of the factors responsible for land degradation and enhancement of drought severity is also examined.

In Kenya droughts occurs in a cyclic pattern. The vegetation indices (VI) data from NOAA AVHRR satellite provided the spatial distribution of drought conditions, intensities and duration in different ecological regions. A cyclic pattern of drought episodes with return periods of 6-10 years emerged in most districts. In the recent years, critical drought periods in the country were experienced in 1984, 1994 and 2000. For example, in Kajiado district, major droughts occurred in 1982-1984 and 1999-2000, while other less severe ones were recorded in 1992, 1994, 1996 and 1997. The local people interviewed in the district perceived the 1984 drought as the worst although that of the year 2000 appeared the severest. This was partly because the latter drought persisted over a long period with no time for recovery. In the neighbouring districts including Trans Mara and Narok, the drought pattern closely followed that of Kajiado, but in less intensity and severity. The districts occur along a rainfall gradient with the former and northern part of Narok district lying within the highlands and always the wettest, while Kajiado is always the driest.

Similarly, Laikipia, Samburu and Isiolo districts lie along a rainfall gradient with Laikipia always the wettest and Isiolo the driest. Laikipia district experienced droughts in the years 1983-84, 1986, 1991-92, 1994 and 2000. The drought pattern in Isiolo district indicated the worst period was in 1991-92, but other severe episodes were recorded in 1993, 1994, 1996, 1997 and 2000. These being a livestock production and wildlife areas, the pastoralists lost a large number of animals and wildlife was also affected.

In the high potential districts, notable drought episodes have been recorded. For example Nakuru district experienced severe droughts in 1984, 1991-92, 1993-94, but the worst occurred in the year 2000. This being an agricultural area, the drought was detrimental to the crops. Murang'a district had a prolonged drought in 1983-85, minor ones in 1986, 1992 and 1996, and the worst in the year 2000. In the latter period, rampant land degradation occasioned by increased poverty levels and breakdown of cash crop farming such as coffee led to the lack of sustainable income and aggravated the impacts of the drought.

Intrinsically linked factors aggravated drought impacts. There are several factors that aggravated the severity of the drought impacts in many areas. Change in land use activities is the single most important factor that is responsible for severe land degradation. In recent years, encroachments by agriculture especially large mechanized farms and sub-division of large communal lands into small individual parcels in the arid and semi-arid areas has led to rampant removal of vegetation cover, exposing the soils to infertility, erosion and drop in water-holding capacity. The conversion of fragile ecosystems into cultivation land has interfered with the natural balance of the systems, while loss of habitats has deprived the pastoralists, their livestock and wildlife of important dry season grazing and dispersal areas.

Rampant movement of the pastoralists with their livestock within and from outside the districts in search pasture and water was partly responsible for the severity of drought. Concentrations of large population of people and animals in patchy habitats rapidly diminished the meager resources, increased competition and led to further land degradation and conflicts. In most cases, the nature of conflicts in resource use especially for water and grazing areas degenerated into clan or tribal clashes with massive loss of life. Such incidences were reported mainly in Garissa, Ijara, Tana-River, Mandera, Isiolo, Samburu, Laikipia, Narok, Pokot and Baringo districts among others.

People's livelihoods were heavily impacted. Majority of the victims of the year 2000 drought were the rural poor people who depended on ecosystem services and natural resources for their livelihoods. When such sources of income and food were unsustainable prior to the drought, there is urgent need to find sustainable alternatives. Almost all the sectors were affected, but the worst were water resources, agriculture, livestock production and industrial. As Kenya is an agricultural based country, many victims were involved in crop cultivation, agro-pastoral

activities and pastoralists livestock keeping. Particular attention needs to be paid to sustainable land use activities including improved crop cultivation, drylands farming, livestock management and range utilization. The sustainable balance between the rangelands and livestock production in the ASAL must be re-established, small-scale agro-pastorals and mechanized commercial farmers who hire large tracks of land and abandon them for more fertile areas need to be assisted to use suitable land use methods.

High crop failure resulted in high decline of food production. Food production has steadily declined over the years. However, the high crop failure during the 2000 drought had prompted the World Food Programme (WFP) to appeal for US\$88 million to feed almost 3.3 million Kenyans in need of food relief. For instance, after the El Nino of 1997, the area under the maize crop in Narok district increased to more than 23,000 ha, but the yield fell from 3 tons/ha to 0.5 tons/ha in the year 2000, which was the lowest since 1995. The low maize yield was attributed to the drought, although grazing by livestock and wildlife damage also played a role. In many places, the maize deficit was partly supplemented by the huge donor assistance in form of relief food aid. Similarly, the area under wheat was increased significantly in anticipating rains, but the yield declined to its lowest (< 10 tons/ha). In most parts of the country, all the crops wilted and dried out, leaving bare ground exposed to soil erosion.

Pastoralists' livestock was tremendously reduced. Large number of the livestock irrespective of their range was severely affected by the 2000 drought. Majority of the animals were lost due starvation related mortality. Grazers, mainly cattle were the most affected, but camels, sheep and goats, which are either browsers or mixed feeders also suffered. For example in Kajiado district, the pastoralists lost more than 50% of the cattle and only 20% of sheep and goats. Some individual pastoralists lost their entire herds. The remaining animals were severely emaciated and the price of their meat or hides and skins declined drastically.

A total of 3,980 animal carcasses were counted in Laikipia district, almost 5,380 in Samburu district and 13,540 in Isiolo district. Laikipia depicted a lower animal carcass ratio (0.9%) as compared to Samburu (1.2%) and Isiolo (3.1%) as the three district are arrayed a long a rainfall gradient with the former always the wettest and the latter the driest. Almost 3,530 carcasses were sighted in Narok and Trans-Mara representing 0.25% of total large herbivores in two the districts. About 5,760 carcasses were also observed in Kajiado, which represented almost 0.67% of large herbivores in the district. Other un-surveyed districts also contributed a large number of dead animals and huge setback to the national economy. The recovery process was slow especially among the poor rural communities. The affected pastoralists needed assistance in restocking their lost herds. In the absence of such assistance, they might turn to stock thefts and raids among different clans or the neighbouring communities.

Wildlife was also affected. Among the wildlife species, the drought resistant species including Grant's gazelle, gerenuk, giraffe, kudu and Grevy's Zebra were less affected. However, the dependent species and mainly the grazers such as Burchell's zebra, buffalo and wildebeests were severely affected. Most of the animals migrated out of their range and dispersed widely, making them susceptible to poaching. A few wildlife carcasses were observed within the protected areas, for instance in the Masai Mara game reserve.

Excessive demands placed on institutional capacity. The 2000 drought was declared a national disaster by the Kenya government. However, the capacity of already burdened environmental agencies was severely overstretched by added responsibilities of relief, recovery planning and assessments. In response to the Government appeal, the World Food Programme (WFP) spent almost US\$ 102 million on food relief alone. In addition, WFP required more than 15,000 tons of fortified blended foods for supplementary feeding programmes in 11 of the most affected districts in the marginal areas of Rift Valley, North Eastern, Eastern and Coast provinces. The Government spent in more than Ksh 10.5 billion on emergency relief food

during the 2000/2001 financial years. The 1999-2001 La Nino drought cost the country at least Ksh 220 billion as compared to the 1997 El Nino floods that cost approximately Ksh 70 billion.

Drought monitoring and early warnings are important aspects of drought management and food security. The government through the Arid Lands Resource Management Project (ALRMP) had an early warning programme that covered 10 marginalized districts. The programme targeted households and communities using local recruits to gather information on rural economic and environmental indicators. This was an important initiative towards the management of drought impacts, however the programme was still in its formative stage in 2000. Although the country had the necessary institutional infrastructure to help mitigate drought impacts, many environmental agencies and NGOs lacked facilities and equipment. In addition, they were poorly coordinated and had inadequate capacity to manage disasters in the affected areas, covering, for example, integrated arid land management, strategic environmental assessment, and integrated economic and environmental planning.

Deteriorated water catchments. In the recent past, a widespread deforestation has occurred in the key national water catchment's areas. Between 2000 and 2003, the major water catchments i.e. Mt. Kenya forest, Mau forest, Mt. Elgon forest and Cherangani forest were deforested by 2.2%, 2%, 1.8% and 0.2% respectively. These forests together with the Aberdares constitute 91% of the total water catchments protection forest value in the country. The breakdown of livelihood during the drought period made the communities living adjacent to forests turn to this resource for income generation.

Severe water shortage affected other sectors of the economy. Almost 70% of the country's power supply is obtained from hydroelectricity. At the peak of year 2000 drought, the capacity of hydroelectric power generation went down tremendously and resulted in the closure of some of the main hydro dams. Power rationing was frequent and sometime lasted over weeks. This impacted negatively on the manufacturing industry and domestic welfare. In total the government revenue loss was estimated at \$2 million per day.

In the urban areas, water vendors hiked the cost of water by almost 400%, which affected the low-income members of society who had no piped services or where the pipes had gone dry in the well-serviced areas. As water became scarce, tension and conflicts among various water users increased. Inadequate rainwater harvesting techniques and storage capacities in the form of pans, dams and tanks highly contributed to the general water shortage.

1.3. Recommendations

After the drought, the restoration of destroyed livelihoods that depend on the damaged environment is a demanding task. The mainstream environmental concerns were prerequisite for sustainable reconstruction. In this case, the effective drought management required more concerted effort to put in place coherent mechanisms by all the players involved in monitoring and mitigation. Rehabilitation and reconstruction of the environment should be people-centered, gender sensitive and participatory in nature. Although the recovery process especially among the poor rural communities is often slow, they are the greatest disadvantaged when it comes to adapting to change in physical environment and habitats

Major projects are needed in all affected areas to restore ecosystem goods and services, for example re-afforestation of water catchments and denuded areas, improved water harvesting, upgrade of livestock farming, sustainable drylands farming and range management. International support will likely be needed. Capacity building in techniques for rapid assessment and rehabilitation is urgently needed.

Detailed environmental assessments, including vulnerability mapping will provide critical input for drought management and mitigation. The following gaps were identified based on rapid assessment and field interviews with the affected communities:

- i. Inadequate environmental guidelines in natural disaster plans and land use policy for sustainable and management of resources;
- ii. Lack of comprehensive resource surveys, vulnerability mapping and risk assessment;
- iii. Inadequate coordination between the relief agencies and participating NGOs in disaster management;

Adequate land-use policy put in place. The government should address urgently the need for land use policy to guide the planning, utilization and management of land resources especially in the fragile ecosystems. This should include strategic environmental assessment on major land use changes and destruction of ecosystems that were traditionally used in drought coping mechanisms. The areas of concern are communal lands and pristine habitats formerly used for livestock and wildlife dry season grazing, but has since been encroached into and converted to agricultural land; the destruction of water catchments and upstream dams for horticultural activities; introduction of large mechanized farms including wheat farming in the ASAL areas; overstocking of livestock and overgrazing.

In the arid and semi-arid lands, small individual parcels of land are not viable for agro-pastoral activities due to the harsh climatic conditions. The consolidation of these land units into large communal or group ranching enterprises is a better option than the smaller land units. The large ranching enterprises in Laikipia district are success stories in terms of wildlife survival and livestock management. It is recommended that the pastoralists land tenure system be incorporated into similar land use plans in these areas.

There is need for detailed studies on the relationships of factors responsible for drought severity including demographic, land use activities, water balance, land degradation and socio-economics. This will guide appropriate policy formulation in the drought management.

Conservation of water catchments, environmental awareness and community participation will improve preparedness and sustainable resource management. The importance of watershed conservation, water resource management and implications associated with land degradation, loss of vegetation cover, alteration of hydrology and water quality cannot be overemphasized. Rural participatory and sensitization approach will encourage resource ownership and maximize the economic and social welfare benefits without compromising sustainability in resource utilization.

Rainwater harvesting strategies including those for domestic water use and agricultural activities need to be established. Affordable technology that is easily available should be encouraged. Increased damming of rivers where environmental impacts assessment has been taken into consideration is recommended. This will provide long-term sources of water for use not only domestic purposes but also for other economic benefits including hydroelectric power production and irrigation schemes. Furthermore, the rural livelihoods will be improved by the creation of employment. Both the public and private sectors must invest in water resources to avoid future water shortages as this has rippling effects in all sectors.

Environmental awareness and community participation will improve conservation activities and sustainable resource management. Basic education and environmental awareness could make a huge difference in preparedness. Ordinary people need to know climatic change indicators and mitigation measures. Indigenous people, who are closer to their natural environment, had this knowledge in their folklore. The same awareness needs to be built into the school curriculum and mass media (radio, TV and daily newspapers). The apparent sensitivity of certain animals to migrate during the dry periods or to breeds as the wet seasons approaches suggests that animal behaviour also needs to be studied and documented.

Community participation should also be used to manage catchments and rehabilitate the degraded areas. This should include sensitization on proper land use practices and conservation of forests. It will also be necessary to impress upon the people the need to undertake afforestation practices in their land explaining clearly how this is vital in the recharge of water sources.

Women being the most affected by water shortages should be fully involved in management schemes. Their involvement will lead to sustainability since improving access for them will lighten their burden and allow for their development in other areas.

Public awareness campaigns on the need to use water efficiently by avoiding wasteful use and other water saving technologies should be carried out through the newly established Water Management Authority. This will not only help in revenue savings but also guarantee supply in the time of scarcity.

Long-term sustainability:

Better land-use planning and management in ASAL will reduce vulnerability and environmental stress. The arid and semi-arid zones will remain vulnerable areas to drought due to the low and unreliable rainfall experienced, making such ecosystems very fragile. Proper land use planning backed-up by adequate land use policy, and community-based integrated arid lands management must be fundamental principles in the mitigation of drought impacts.

Environmental impact assessments are critical. Environmental impact assessment (EIA) of projects and strategic environmental assessment (SEA) of overall plans and programmes in drought vulnerable area must be undertaken. For example, there is a potential threat to natural ecosystems from increased sub-division of large pastoral lands in the ASAL into small individual parcels based on agro-pastoral activities. Encroachment by large commercial wheat farming in Narok district has deprived the Maasai pastoralists and wildlife of an important dry season grazing area. This has negatively impacted on livestock production and eco-tourism in general.

Early warning systems must be put in place and capacity of environmental institutions strengthened. There was considerable concern that much loss of life, livestock and crops could have been avoided if there had been adequate early warning system in place. It was identified that improved early warning system is a priority, as it makes better sense to consider a multi-hazards warning system, as well as a network of regional and national early warning systems proposed under the Global Earth Observation Systems. The development of these systems must be well rooted at the national and local institutions. The Arid Lands Resource Management Programme (ALRMP) has early an warning programme in 10 arid and semi arid districts based on rural economy, human welfare and the environment as indicators. This programme must be fully supported as it targets households and communities.

Ongoing efforts by the government and concerned organizations to address urgent environmental challenges posed by the drought demonstrate their strong commitment to sound environmental management. This spirit should be joined and fully supported by the

international community. With continued cooperation between national and international actors, the country can establish a course towards drought mitigation and recovery, protection of its natural heritage and restoration of livelihoods.

Institutions dealing with resource survey and assessment, environmental disaster management and early warning often need direct technical assistance. However, the assistance should be combined with capacity building in priority areas. The Kenya Meteorological Department (KMD) provide daily weather forecast, seasonal weather outlook and distribution of rainfall anomalies maps; Ministry of Agriculture (MoA) provide bulletins on crop distribution and performance; and the Department of Resource Surveys and Remote Sensing (DRSRS) uses remote sensing techniques for rapid assessment and monitoring of natural resources status and environmental conditions. In addition, the linkage between early warning, crop forecasting and food security institutions and drought mitigation programmes run by the government and NGO's including the WFP should be strengthened.

Pastoralists' livestock management strategies played a greater role in sustaining livelihoods during the drought. The system is complex and involves people and livestock moving widely in search for greener pasture and the splitting of animal herds into smaller groups. It also involves switching to keeping of smaller stocks such as sheep and goats during the dry spells and turning to cattle at the onset of the rains. In the presence of adequate early warning system, the pastoralists will be advised in time to sale their large stocks when the prices are good before the drought commences. This will ensure economic stability and restocking as the dry spell ceases.

ENVIRONMENTAL ASSESSMENTS OF YEAR 2000 DROUGHT

INTRODUCTION

Kenya experienced a devastating drought between 1999-2000, which resulted from the failure of four consecutive rainy seasons. This drought caused widespread disruption of livelihoods, especially in the arid and semi-arid zones, but also in the high potential areas that are often not much affected by dry spells. The pastoralists migrated in large numbers together with their livestock in search of pasture and water. The random movement of people and animals escalated at the height of the drought and resulted in conflicts by competing for the limited resources. High migration of human beings from the rural areas to urban centers in search of employment to sustain their families was also noted. A joint collaboration effort of the United Nations Environment Programme (UNEP) and the Government of Kenya conducted a rapid qualitative assessment of the impacts of this drought on the environment. Results showed that (i) the impacts of the year 2000 drought was worsened by the effects of the 1997-98 El Nino rains, which had reduced the water holding capacity and; (ii) the drought adversely affected nearly all the sectors including livestock and wildlife, biodiversity, agriculture and water resources, industry, social and economic welfare; and (iii) there was general lack of relevant data and information on the status of natural resources, land use activities and previous droughts.

The team recommended that the impacts of the year 2000 drought on the vegetation, land use, wildlife and livestock should be studied in detail to provide baseline data for future planning and monitoring. The Department of Resource Surveys and Remote Sensing (DRSRS) was mandated to carry out this exercise with specific tasks to: acquire satellite images for the year 2000 to assess the change in vegetation cover at the height of the drought; analyze the Normalized Difference Vegetation Indices (NDVI) data between 1982 and 2004 to assess the trends of the droughts; conduct aerial surveys in pilot districts to assess the drought impacts livestock, wildlife and human settlements; integrate using Geographic Information Systems (GIS) the information acquired above and incorporating other related environmental parameters to analyze and derive the impacts of the drought.

Scientific and quantitative data on environmental parameters useful for resource monitoring, planning and management, and decision-making was generated in this exercise. Specific area assessments of the vegetation cover and food production were also undertaken. The severity of the year 2000 drought was aggravated by a number of factors including influx of human population coupled with agricultural activities into the rangelands, depletion of resource base, land use changes and environmental degradation among others. The information gathered was geared towards drought mitigation and management in the country.

CHAPTER 1

IMPACT OF DROUGHT ON LIVESTOCK AND WILDLIFE POPULATIONS IN TWO SAVANNAH ECOSYSTEMS OF KENYA

1.0. INTRODUCTION

Drought episodes are known to recur in Kenya over a cyclic pattern. Drought incidences associated with famine were recorded in the country between 1960-61, 1970-71, 1983-84, 1991-92 and 1999-2000. Over these years, the 2000 drought was probably one of the worst experienced. Failure of the long rains in March 2000 was the fifth successive dry spells over a period of two years. Consequently, the soils were left with severely inadequate moisture to sustain plant growth. The semi-arid and arid lands were the most affected and suffered massive loss of vegetation cover and severe land degradation. Over 4 million people in more than 22 districts suffered from the impacts of this drought. Severe dehydration and lack of forage led to the death of a large number of livestock and wildlife.

The status of livestock and wildlife in the year 2000 was assessed in six representative districts of two savannah ecosystems to determine the impacts of the drought on their populations. The districts covered were Laikipia, Isiolo and Samburu in northern Kenya and Narok, Trans-mara and Kajiado in the south. There was a rapid decline in the population of most animals, especially the grazers. Remarkable dispersal of species in relation to plant biomass availability was also noted. The drought had triggered extensive movement of pastoralists with their livestock and migration of wildlife along rainfall gradients. The rampant movement of people, livestock and wildlife resulted in large concentration of animals into patchy habitats. This had resulted into stringent resource use pressure, conflicts and further environmental degradation. Wildlife too migrated and the result was large concentrations of animals and people into restricted habitats, resource use conflicts and environmental degradation. The inter-ethnic clashes during this period were mainly attributed to competition over scarce resources especially for pasture and water.

In adequate preparedness and lack of mitigation measures, local capacities and coping mechanisms for drought management increased the vulnerability of people, livestock, wildlife and environment. The other factor that aggravated the impacts of the droughts was the influx of people into the semi-arid and arid lands, and subsequent introduction of agriculture and sedentary lifestyle. This has largely contributed to the drastic modification of the vegetation cover in the fragile ecosystems. The emergence of extensive farms in the ASALs has deprived the wildlife of an important dry season dispersal areas and migratory routes, while subdivisions of large communal lands into small parcels has led to habitat fragmentation and loss of ecological balance.

1.2. METHODOLOGY

a). Aerial Census of Livestock and Wildlife

Large herbivores (wildlife and livestock) were counted and other environmental parameters recorded in two savannah ecosystems at the peak of the year 2000 drought. The districts covered were Laikipia, Samburu and Isiolo that represented the northern rangelands, and Trans-mara, Narok and Kajiado representing the southern rangelands. Systematic reconnaissance flights (SRF) surveys already described by Norton-Griffith (1978) and adopted by the Department of Resource Surveys and Remote Sensing (DRSRS) was used. It involves counting of animals using light aircraft and based on sampling strategy. Animal carcasses were also recorded to assess losses due to starvation related mortality.

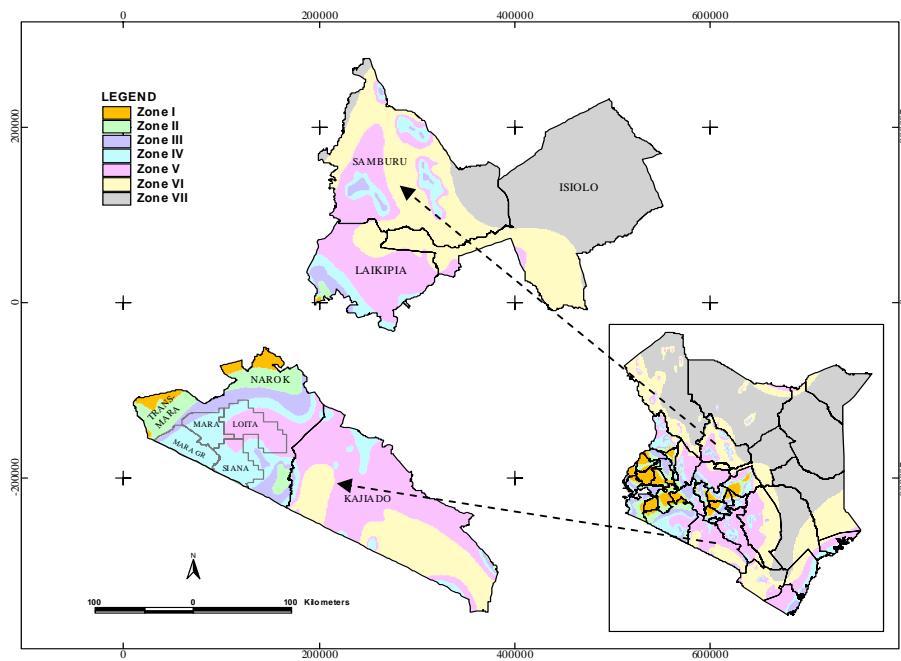


Figure 1.1. Location of Samburu, Isiolo, Laikipia districts in the north and Narok, Trans-mara and Kajiado in the south. In the background are the agro-ecological zones (I-humid, II-sub-humid, III-semi-humid, IV-semi-humid to semi-arid, V-semi-arid, VI-arid, and VII-very arid).

b). Data Analysis

The population estimates were calculated based on the Jolly (II) Method of unequal transects length (Jolly, 1969). The change in population between successive censuses was analyzed using the 'z-test' (Norton-Griffith, 1978)

1.3. Case Study: Impact of 2000 Drought on Livestock and Wildlife in Northern Kenya

The northern savannah ecosystem was represented by three districts i.e. Laikipia district occupying approximately 9,666 km², Samburu (21,095 km²) and Isiolo (25,322 km²). All the districts in this region experience unpredictable rainfall most of the year and making them only suitable for pastoralism, ranching and wildlife use. For instance, Laikipia receives rainfall of

600-850mm/yr and Isiolo receives 100-580mm/yr. Other districts such as Turkana far in the north receives rainfall far much below. Overall livestock populations in Laikipia, Samburu and Isiolo districts had increased considerably between 1994 and 2001, but the wildlife had declined by almost a similar proportion (Laikipia by 22%, Samburu by 27% and Isiolo by 24%). The increase of livestock was attributed mainly to the rampant movement of animals within and between the districts and migrations from outside areas including Marsabit, Wajir, Garissa, Turkana and Tana-River districts (Kufwafwa et al 1985, Wargute 1992).

a). Laikipia District:

The livestock numbers in Laikipia had considerably increased from 386,490 animals in 1999 to 402,870 animals in 2001. The overall rise in livestock was attributed to the increased number of sheep and goats as well as donkeys, but cattle had declined drastically (Figure 1.2). Almost 3,980 animal carcasses were observed in the district at the peak of the drought, the majority of which belonged to cattle (Figure 1.9). Drought related animal mortality was lowest in the district as compared to the adjacent Samburu and Isiolo districts.

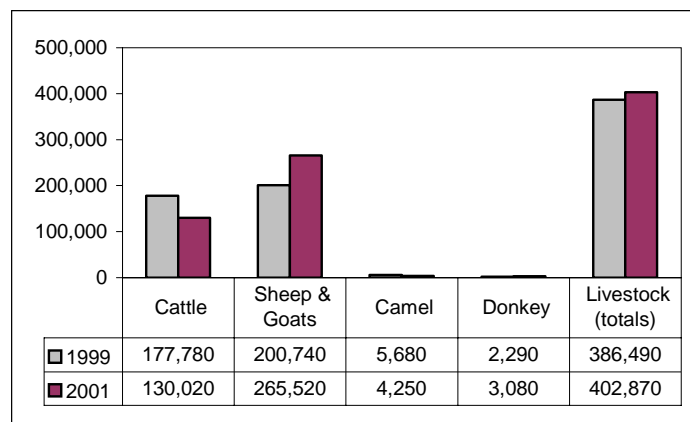


Figure 1.2. Livestock numbers in Laikipia district between 1999 and 2001

In 1999, the overall wildlife (large herbivore) numbers in the district were 62,500 animals. This number had reduced to 55,530 animals by the year 2001. Almost all the species declined in numbers. Among the species that had declined included the elephant, buffalo, hartebeest, eland, Burchell’s zebra, Grevy’s zebra, oryx and impala (Figure 1.3). However, the Grant’s gazelle, gerenuk, giraffe, ostrich and warthog had increased over the same period.

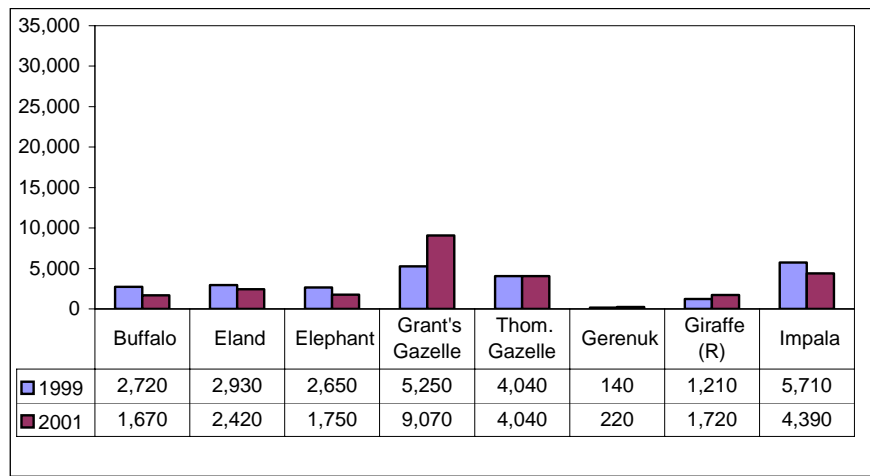


Figure 1.3. Wildlife numbers in Laikipia district between 1999 and 2001

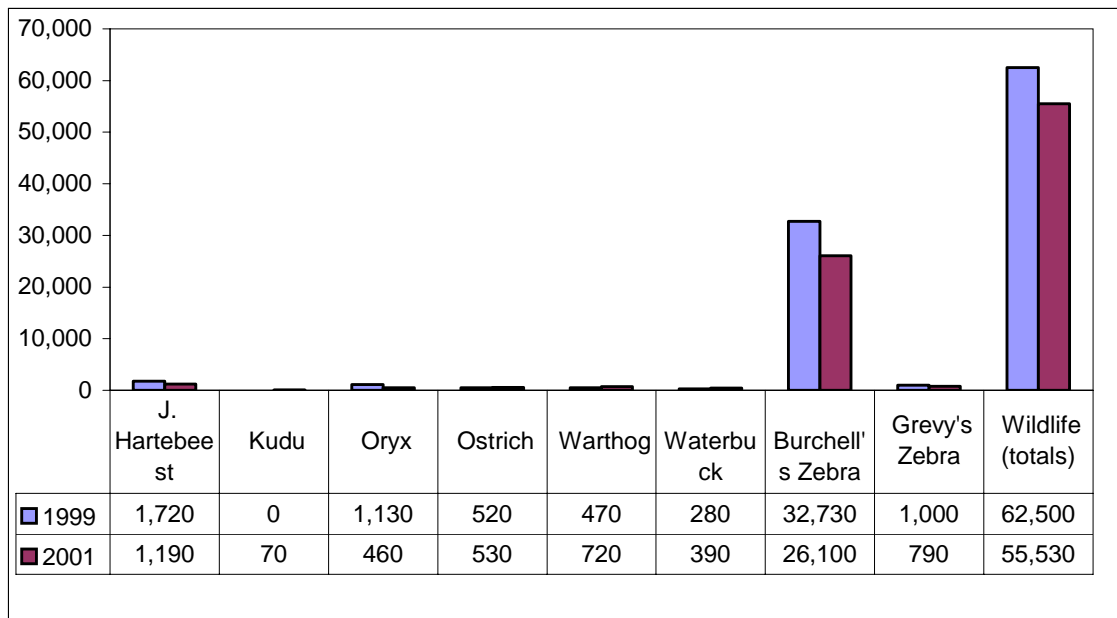


Figure 1.3. (Cont.)

b). Samburu District

The overall livestock population in Samburu district was 545,070 animals in 1996 and 446,070 animals in 2000. This provided a decline of almost 18.2% in nearly four years (Figure 1.4). Cattle population had fell by 18.5%, sheep and goats by 10.7% and camel by 18.8%, but donkeys had increased by 12.9%. At the peak of year 2000 drought, almost 5,380 animal carcasses observed, of which the majority consisted of cattle (Figure 1.9).

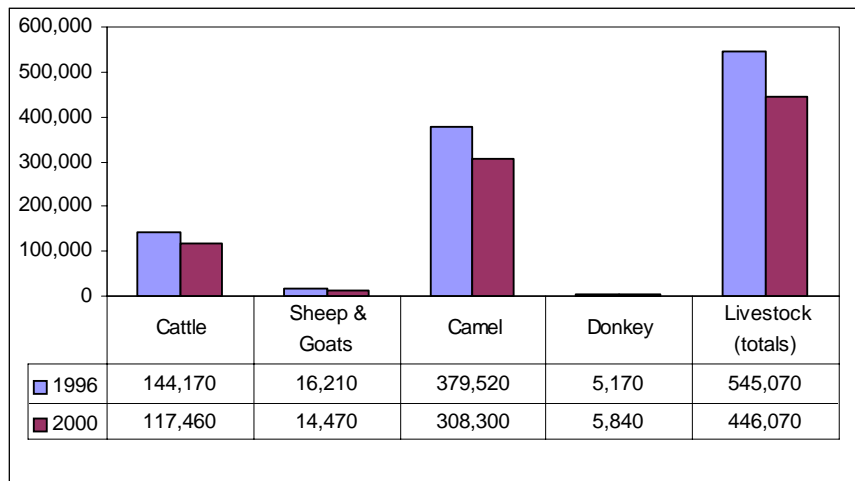


Figure 1.4. Livestock numbers in Samburu District between 1996 and 2000

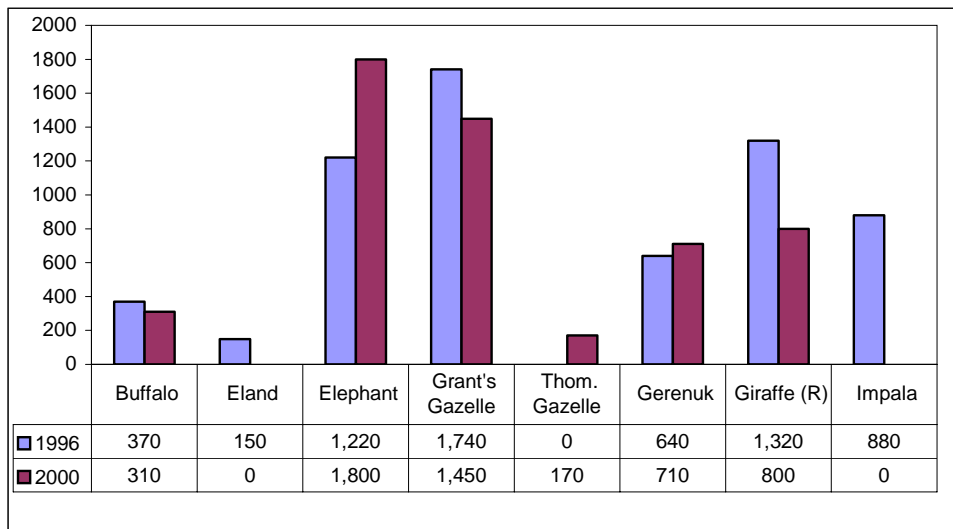


Figure 1.5. Wildlife numbers in Samburu District between 1999 and 2000

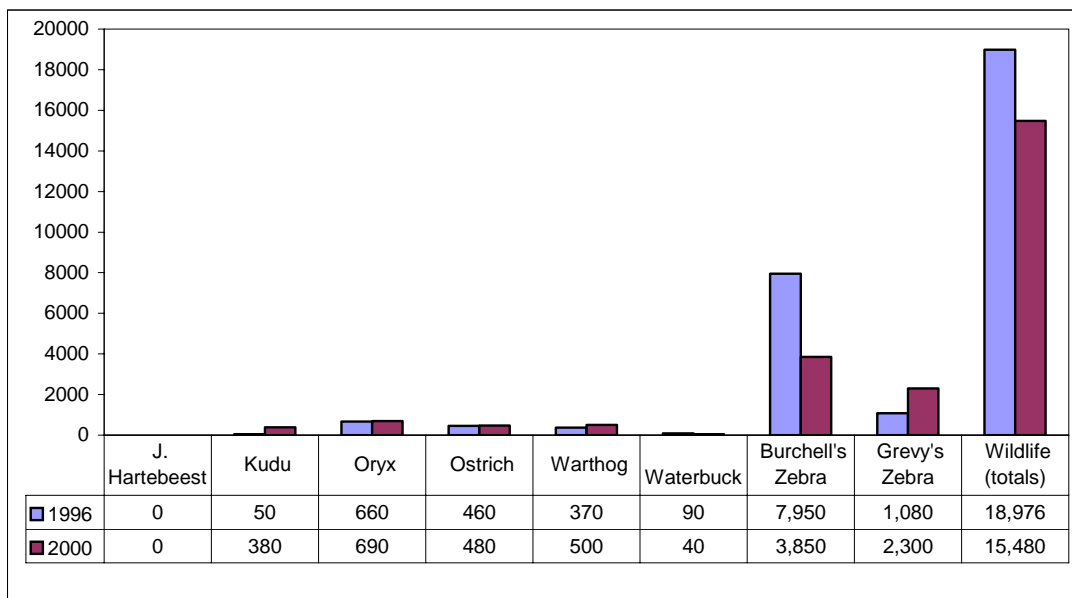


Figure 1.5. (Cont.)

The overall wildlife (large herbivore) population was 18,976 animals in 1996 and 15,480 animals in 2000. Unlike the livestock species, most of the wildlife species had increased in the district, including elephant, Thomson’s gazelle, gerenuk, kudu, oryx, ostrich, warthog and Grevy’s zebra (Figure 1.5). Exceptions to this trend were the buffalo, Grant’s gazelle, waterbuck and Burchell’s zebra, whose numbers had declined.

c). Isiolo District

The overall livestock population in Isiolo district was 454,440 animals in 1994 and 402,430 animals in 2001. This showed a decline of 11.4% over the period. Sheep and goats population had declined significantly by almost 70.3%, donkeys by 24% and camels by 10.9%, but cattle had increased by 39% (Figure 1.6). At the peak of 2000 drought, a large number of animals was lost with almost 13,540 carcasses observed. The increase in cattle over the period was attributed to animal migrations from adjacent districts.

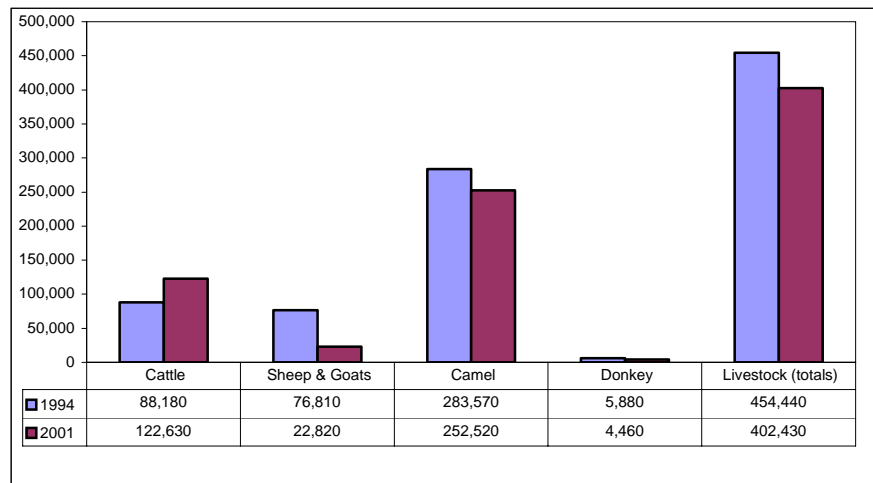


Figure 1.6. Livestock numbers in Isiolo district between 1994 and 2001

The overall wildlife (large herbivore) population was 23,184 animals in 1994 and 18,221 animals in 2001. The population of most wildlife species had declined including Grant’s gazelle, Thomson’s gazelle, gerenuk, giraffe, impala, ostrich, warthog, Burchell’s zebra and Grevy’s zebra. However, the populations of elephant, kudu and oryx had increased, probably due to migrations into the district (Figure 1.9). In the March 2000 census, the buffalo, eland and waterbuck were not observed in the district, probably due to movements out of their range.

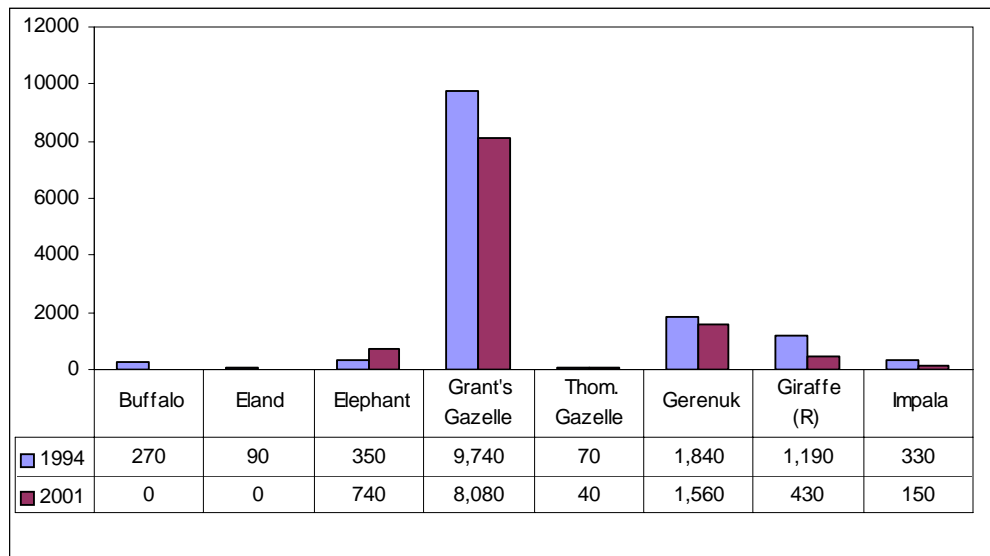


Figure 1.7. Wildlife numbers in Isiolo district between 1994 and 2001

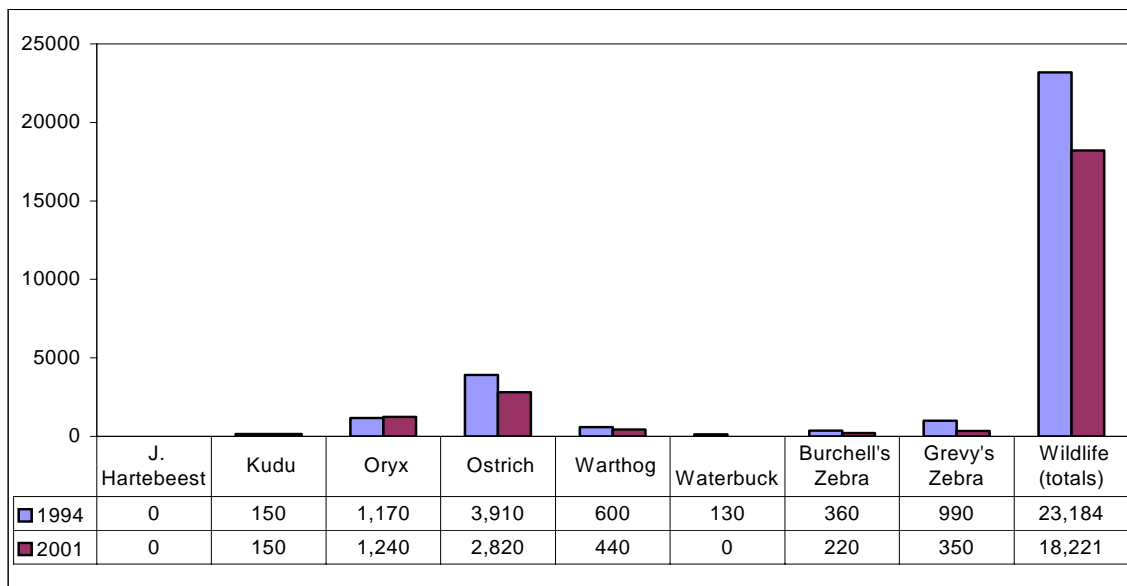


Figure 1.7. (Cont.)

d). Spatial Distribution of Livestock and Wildlife in Northern Kenya

At the peak of year 2000 drought, most of the livestock and wildlife species were located within large ranches in the northern, central and southern parts of Laikipia district (Fig 1.8). Exceptions were a few species, which were observed within the drier Mukogodo area in the northeast and western, southeast and southern parts. In Samburu district, a large concentration of wildlife was observed in the eastern part and within the highlands including the Nyiru, Ndoto and Mathews Mountains. Animal mortality was high with carcasses strewn within the highlands and around Maralal town (Fig 1.9). This suggested the rampant animal movements along the rainfall gradient, as a large portion of the district had remained dry but green patches occurred in the upland bushes and mountainous areas. Finally, livestock were widely distributed in Isiolo district with large concentration in the western arm (Fig 1.8). Most of the wildlife was also widely dispersed, but in small herds within proximity of permanent water

source. Large concentrations of animal carcasses were observed along the Ewaso Ng'iro River swamps, Kiboko camp, Modugashu and Benane area (Figure 1.10).

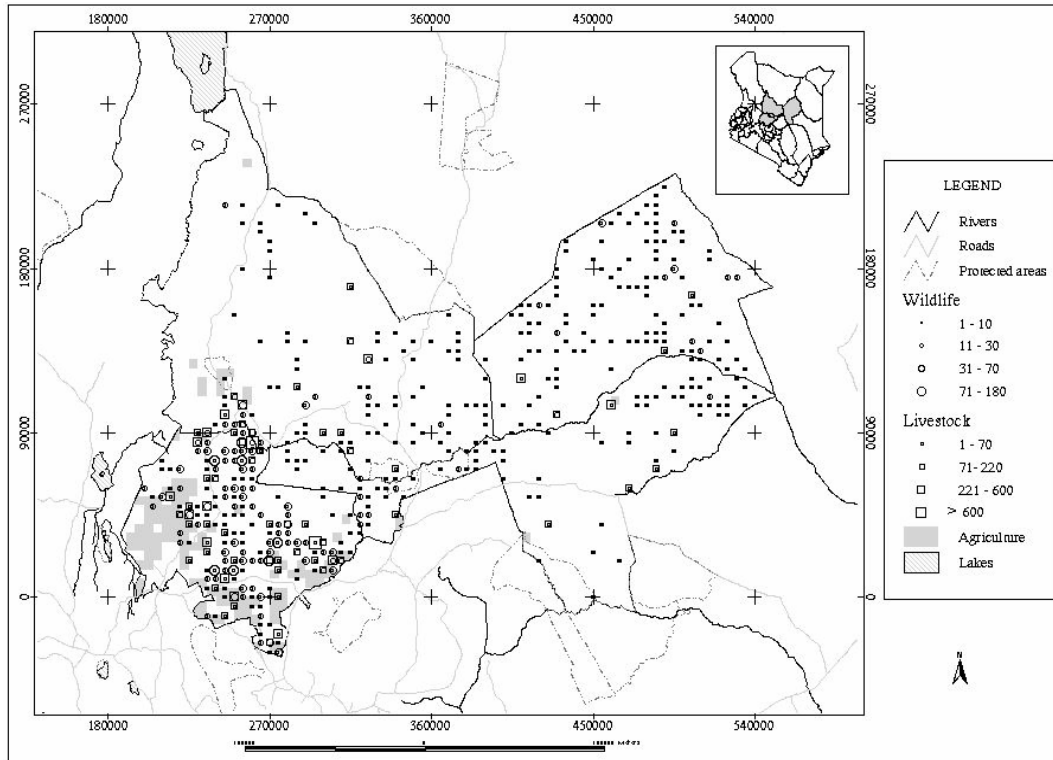


Figure 1.8. Spatial distribution of wildlife and livestock in Laikipia, Samburu and Isiolo districts (Feb - Mar 2001).

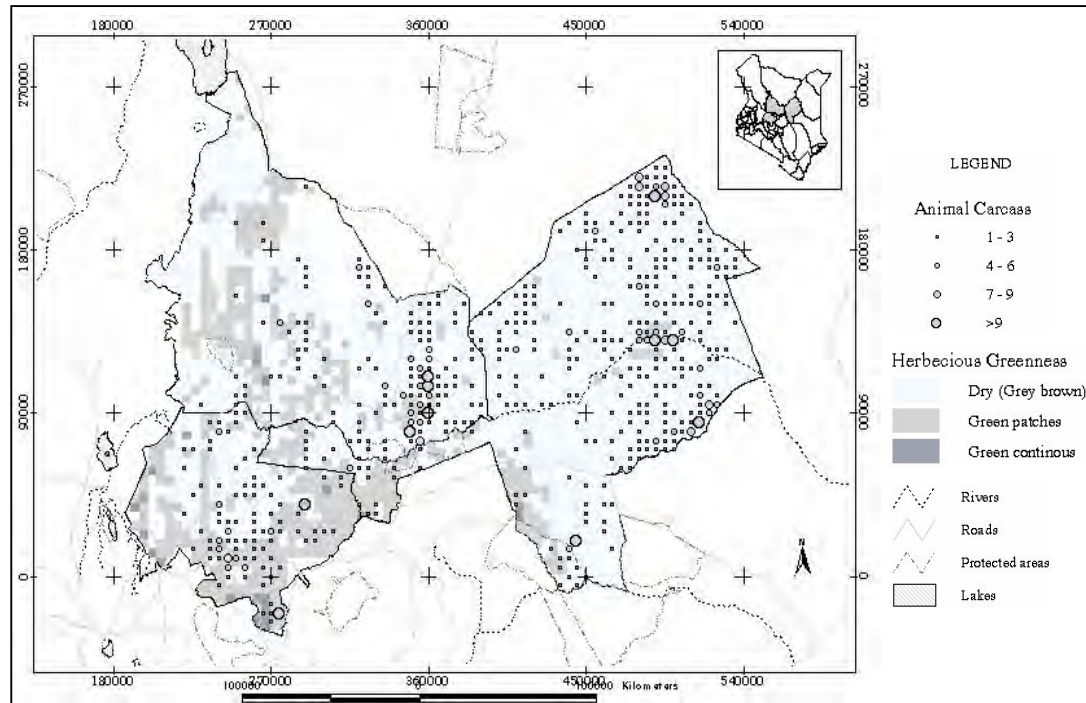


Figure 1.9. Spatial distribution of animal carcasses in relation to cultivated areas of Laikipia, Samburu and Isiolo districts (Feb - Mar 2001).

1.4. Case Study: Impact of 2000 Drought on Livestock and Wildlife in Southern Kenya

The selected southern rangeland districts consisted of Narok and Trans-mara, which covers approximately 18,573 km² and Kajiado covering approximately 21,852 km². The region is composed of highlands in the northwest and rolling plains covered by grasslands, shrubs and bushes in the larger portions of Narok and Kajiado districts. The Inter-Tropical Convergence Zone (ITCZ) generally influences rainfall in the region, but local variations in topography also play a major role in its distribution (Brown and Cocheme, 1973). A rainfall gradient runs from the drier southwest plains of Kajiado (500mm/yr) to the wetter highlands of Narok and Trans-Mara districts (1200mm/yr). Sharp increase in rainfall also occurs with altitude within the hills and escarpments (Sinclair, 1995).

Narok and Trans-Mara (formerly the Narok district boundary as used in this report combine the two areas) and Kajiado districts host a large population of livestock (cattle, donkeys, sheep and goats). Camels were also observed in Kajiado, having been introduced into the area in the recent years. The region also supports a diversity of wildlife species, which are found in high densities within the Mara Ecosystem in Narok and widely dispersed across the Amboseli, Ewaso Ng'iro and Athi-Kapiti Ecosystems in Kajiado.

a). Narok and Trans-Mara Districts

In the two districts combined, the overall livestock population was estimated at 953,234 animals in 1996 and 1,169,741 animals in 2000. This was an increase of almost 22.7%, however the highest increase occurred in sheep and goats by 43.2% and donkeys by 19.8%. Cattle only increased by 6.5% over the same period (Figure 1.10).

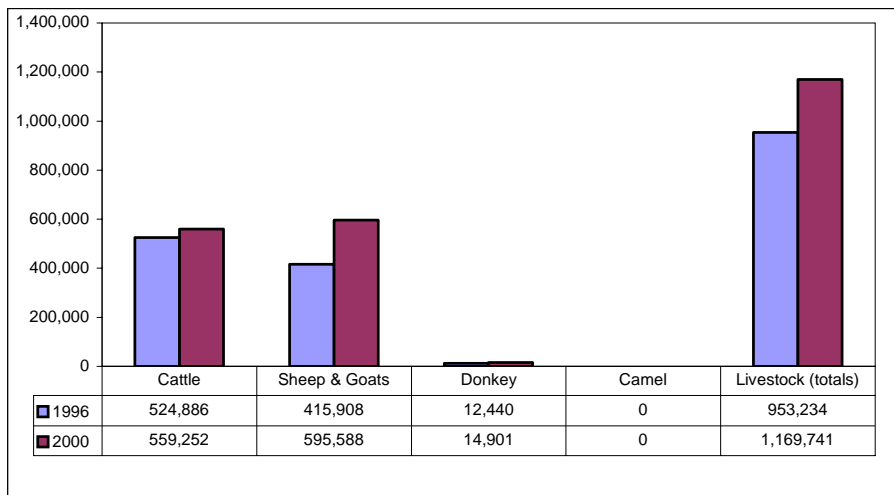


Figure 1.10. Livestock numbers in Narok and Trans-Mara districts between 1996 and 2000

A large number of dead animals were also observed (about 3,530 carcasses) in the district at peak of year the 2000 drought, the majority of which belonged to cattle.