

Kenya Natural Disaster Profile

**United Nations Development Program
Enhanced Security Unit**

Foreword

Natural disasters disrupt people's lives through displacements, destruction of livelihoods and property, deaths and injuries. Consequently they take back years of development thus posing a major challenge to the achievement of the Millennium Development Goals especially the target of halving extreme poverty by 2015. The cyclic nature of natural disasters in Kenya have constantly eroded the recovery capacity of communities especially in the ASAL districts hence affecting their economic development year in year out. This requires more vigorous attention and planning to mitigate the effects as they have impacted greatly on the country's fight against poverty and efforts to reduce the number of people living below the poverty line. The economic cost of the impact of floods, droughts and landslides in the past have been estimated in millions of shillings.

The Kenya Natural Hazard Profile provides an overview of the past and current natural hazards that affect the country. The impact of such hazards is compounded by poverty and lack of adequate resources to develop the affected areas rendering the populations more vulnerable. The report highlights on the need to take up a proactive strategy in the management of natural disasters in Kenya, which would improve the coping capacity of communities, lessen the impact and therefore improve the lives of Kenyans in the areas prone to harsh weather conditions.

A clear vision for future actions is inevitably necessary to set the pace for development programmes aimed at mitigating the impact of natural hazards. UNDP is committed to working with the government of Kenya in improving the lives of communities in Kenya and our hope is that this report will generate a renewed interest in this critical development aspect and serve to bring together stakeholders to map out a new planning strategy and policy dialogue in the country.

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List of Acronyms

ASAL	Arid and Semi- Arid Lands
NADIMA	National Disaster Management Agency
PRSP	Poverty Reduction Strategy Paper.
DCMN	Drought Monitoring Centre Nairobi
KMD	Kenya Meteorological Department
NEMA	National Environment Management Authority
ISDR	International Strategy for Disaster Reduction
FAO	Food and Agriculture Organization
ALRMP	Arid Lands Resource Management Project
FEWSNET	Famine Early Warning System Network
DRSR	Department of Resource Survey and Remote Sensing
UNFPA	United Nations Population Fund
KFSM	Kenya Food Security Meeting
KFSSG	Kenya Food Security Steering Group
PRSP	Poverty Reduction Strategy Paper
ERS	Economic Recovery Strategy
UNDP	United Nations Development Programme

Kenya Natural Hazard Profile

Definition of key terms

Hazard

A potentially damaging physical event, human activity or phenomenon with a potential to cause loss of life or injury, property damage, social and economic disruption of life, environmental degradation among other effects¹.

Vulnerability

Vulnerability refers to a set of conditions resulting from physical, social, economic and environmental factors, which increase the susceptibility of a community to the impact of disasters. Vulnerability also refers to the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard².

Disaster

A disaster can be defined as a serious disruption of the functioning of the society causing widespread human, material or environmental damage and losses which exceed the ability of the affected community to cope using their own resources³.

Risk

Risk is the probability of harmful consequences or loss resulting from the interaction between natural hazards and vulnerable conditions of property and people⁴.

Mitigation

Short and long-term actions, programmes or policies implemented in advance of a natural hazard or in its early stages, to reduce the degree of risk to the people, property, and productivity capacity⁵.

¹ ISDR (2002); *Living with Risk, A global Review of Disaster Reduction Initiatives*, Preliminary version, pp 24-25. Geneva, Switzerland.

² Ibid

³ ibid

⁴ ibid

⁵ ibid

Preparedness⁶

Pre-disaster activities designed to increase the level of readiness or improve operational capabilities for responding to an emergency.

Response

Actions taken immediately before, during or directly after a disaster to reduce impacts and improve recovery.

Impacts

Specific effects of hazards or disasters also referred to as consequences or outcomes.

Drought⁷

Can be described as the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels causing a serious hydrological imbalance that adversely affects land resource production systems.⁸

Meteorological drought⁹

Refers to a reduction in rainfall over a specific period of time, for example a day, month, season or year. There is no agreement on what the lack of rain or the time without rain should be before it is considered a drought. Usually the area affected determines these especially in non-arid regions. Meteorological drought leads to depletion of soil moisture and this almost always has an impact on crop production.

Hydrological drought¹⁰

Occurs when there are critically low groundwater tables and reduced river and stream flow. Low wintertime snow accumulation in higher elevations can result in this type of drought in nearby lowlands. Hydrological droughts are distinguished by a reduction in water resources in reservoirs, lakes, rivers, underground aquifers and streams.

Agricultural drought¹¹

An agricultural drought is the impact of meteorological droughts and hydrological droughts on crop yields. This kind of drought is associated with extreme heat. It occurs when extended dry periods and general lack of rainfall result in a lack of moisture in the root zone of the soil. This severely damages the plants that live in the area.

⁶ ibid

⁷ Earth Observatory, Drought The Creeping Disaster November 2000, New York, USA
<http://earthobservatory.nasa.gov/Library/DroughtFacts/>

⁸ UNEP (2000) Devastating Drought , *Environmental Impacts and Responses* Nairobi, Kenya. P17

⁹ Earth Observatory, Drought The Creeping Disaster November 2000, New York, USA
<http://earthobservatory.nasa.gov/Library/DroughtFacts>

¹⁰ ibid

¹¹ Ibid

Agricultural droughts are related to the availability of water for crops although some crops can withstand the reduced soil moisture conditions for long periods for example sesame, cassavas and potatoes while others dry up immediately there is a reduction in soil moisture.

General Information

Kenya's landscape covers a total of 583 000 sq. km¹² and is grouped into geographical zones including; the Savannah Lands covering most of the arid and semi-arid areas, the Coastal Margin, the Rift Valley, the Highlands and the Lake Victoria Basin. With a growth rate of 3.1% the population stands at approximately 29 million people. The country's GNP/Capita is close to US\$330. By the year 2010 and with a slow decline, the population is expected to reach a high of 39.3 million, 37.4 million with the medium decline and 35.5 million with a fast decline. The population is predominantly rural and relies on agricultural or other related activities for daily income although only 17% of the country's territory is arable.

The next 15 or 20 years are likely to see a rapid reduction in the rate of growth of Kenya's population. Having been close to 4% per annum in the 1970's (when it was widely claimed to be the highest in the world), by the year 2010 it will be less than 2% and possibly under 1% if fertility falls as rapidly as envisaged in the "fast fertility decline" projections.

Agriculture supports up to 75%¹³ of the Kenyan population including those who reside and work in urban centres, accounts for approximately one third of the Gross Domestic Product (GDP), employs more than two thirds of the labour force and about 70% of the export earnings. It generates almost all the country's food requirements and provides a significant proportion of raw materials for the agro-based industries. Overall, the smallholder sub-sector contributes about 75% of the country's total value of agricultural output, 55% of the marketed agricultural output and just over 85% of total employment within agricultural sector. For this reason, it has a major role in the economy and consequently on the design of poverty eradication programmes.

Declining economic growth in general, coupled with a high population growth have lowered living standards and left sizeable numbers of the population poor and vulnerable to both natural and man made disasters. The country's geographical set up has also contributed much to regular if not permanent hazards in some areas. When these disasters interact with vulnerable communities they cause suffering of varying

¹² UNDP, WMO, GOK, IGAD, and DMCN, (May 2002), *Factoring Weather and Climate Information and Products into Disaster Management Policy*, A Contribution to Strategies for Disaster reduction in Kenya. Nairobi Kenya.

¹³ <http://kenyaweb.com/agriculture/> Overview of Agriculture in Kenya, 2003.

magnitudes. This has affected the economic development effectively lowering the human development of these areas.

Background on Hazards in Kenya

Natural hazards include drought, floods, earthquakes, volcanic eruptions, landslides, cyclones, storms etc. These occur all over the world and are, on their own not harmful. However when these natural hazards interact with people, they are likely to cause damage of varying magnitude resulting in a disaster. Disasters thus occur when the natural hazards interact with vulnerable people, property, and livelihoods causing varying damage depending on the level of vulnerability of the individual, group, property or livelihoods.

Disasters disrupt people's lives through displacements, deaths and injuries. They destruct livelihoods and drain years of economic gains and development. Natural disasters for instance cause loss of lives and property, displacement of people from homes, destruction of infrastructure like roads, rails and telecommunication lines, contamination of water sources causing diseases or depletion of the same altogether.

The magnitude of a disaster depends on the characteristics, the probability and intensity of the hazard and the susceptibility of exposed elements based on the prevailing physical, social and environmental conditions.

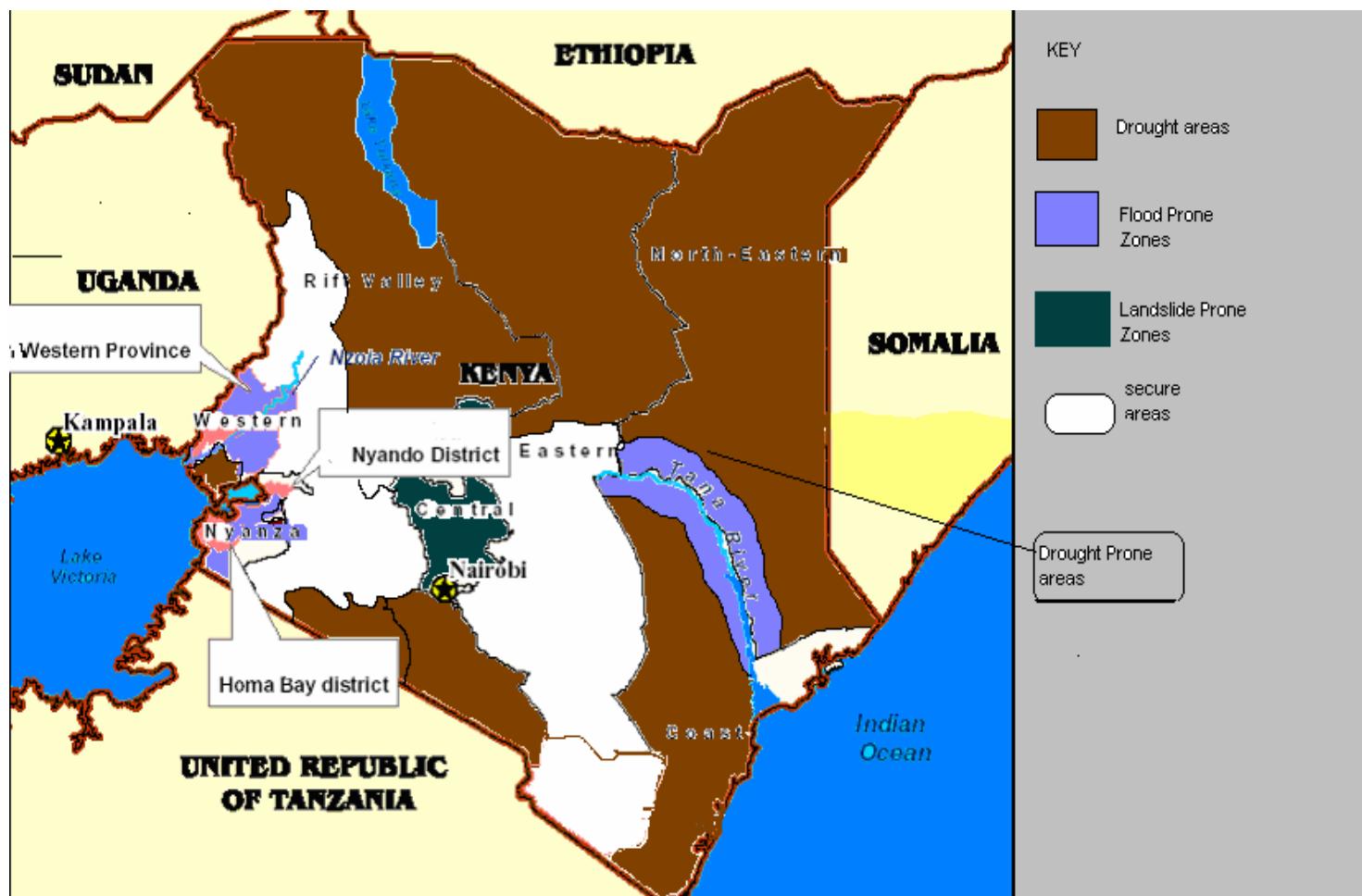
Kenya experiences a number of natural hazards, the most common being weather related, including floods, droughts, landslides, lightning/thunderstorms, wild fires, and strong winds. Other hazards experienced in Kenya include HIV/AIDS, and conflict. In the recent past these hazards have increased in number, frequency and complexity. The level of destruction has also become more severe with more deaths of people and animals, loss of livelihoods, destruction of infrastructure among other effects resulting in losses of varying magnitudes.

The Arid and semi-arid lands of Kenya make up more than 80% of Kenya's landmass, support nearly half of the livestock population of the country and over 30% of the total human population.¹⁴ The Arid and Semi-arid Lands (ASALs) are prone to harsh weather conditions rendering the communities within this region vulnerable to natural hazards, mainly droughts. The ASALS, due to their fragile ecosystems, unfavourable climate, poor infrastructure and historical marginalisation these areas represent a major development challenge for the affected populations, the Government of Kenya and its development.

¹⁴ Republic of Kenya (March 2004); National Policy for the sustainable Development of the Arid and Semi Arid Lands of Kenya, p 8-11. Nairobi, Kenya.

Drought is the most prevalent natural hazard in Kenya affecting mainly Eastern, North Eastern, parts of Rift Valley and coast Provinces. Floods seasonally affect various parts of the country especially along the flood plains in the Lake Victoria basin and in Tana river while landslides are experienced during the long rains season running from March to May especially in Murang'a district and areas surrounding the Mount Kenya region.

Kenya Hazard Map



Drought prone provinces

Eastern, North Eastern, coast, parts of Rift Valley

Flood prone areas

Budalangi, Nyando, Rachuonyo, Tana river

Landslide prone zones

Muranga district, parts of Kiambu, Thika, Maragua, Nyeri, Kirinyaga, Nyandarua and areas around mount Kenya region.

Table 1: Recent History of Natural Disasters in Kenya

Year	Type of Natural disaster	Area of Coverage	No. Of People affected
2004	Drought	Widespread	2-3 Million
2004	Landslides	Nyeri, Othaya, Kihuri	5 deaths
2002	Landslides	Meru Central, Muranga, Nandi	2,000
2002	Floods	Nyanza, Busia, Tana river basin	150,000
1999/2000	Drought	Widespread	4.4 million
1997/1998	El Nino Flood	Widespread	1.5 million
1995/96	Drought	Widespread	1.41 million
1991/92	Drought	Arid and semi-Arid districts of NE, Rift Valley, Eastern and Coast	1.5 million
1985	Floods	Nyanza and Western	10,000
1983/84	Drought	Widespread	200,000
1982	Floods	Nyanza	4,000
1980	Drought	Widespread	40,000
1977	Drought	Widespread	20,000
1975	Drought	Widespread	16,000

Source : Republic of Kenya (2004), National Policy on Disaster Management (Revised Draft) p4, Nairobi, Kenya.

Drought

Historical Background of drought in Kenya, its nature, pattern, severity, intensity and probability of threat

Almost 70 % of Kenya's land mass is affected by drought. This covers most parts of Rift Valley, North Eastern, Eastern provinces and coast province therefore classified as arid and semi-arid land. The country covers a total area of 582, 644 sq kilometers of which less than 3% of the total is forest. 75% of Kenya's population earns its living from agriculture which in turn depends on rainfall. Due to the vast areas prone to drought, Kenya's vulnerability to food insecurity is highest among the pastoralists and small-scale agriculturalists in the arid and semi-arid lands (ASALs) of the country. Extreme weather and climate events

influence the entire economy, which depends mostly on agricultural products like cash crops, food crops and animals.

Arid and semi arid lands carry 30 % of the country's total human population yet they are characterized by uncertainty of rainfall, high evapo-transpiration rates, low organic matter levels and poor infrastructure.

Kenya experiences drought on a cyclic basis. The major ones coming every ten years and the minor ones happen almost every three to four years. The 2004 drought is a replica of the previous cycle of severe droughts that affect the country every decade as experienced in 1974, 1984 and 1994.

Kenya has in the past recorded deficits of food due to drought resulting from a shortfall in rainfall in 1928, 1933-34, 1937, 1939, 1942-44, 1947, 1951, 1952-55, 1957-58, 1984-85, and 1999-2000. The 1983-84 drought and the 1999-2000 ones are recorded as the most severe resulting in loss of human life and livestock, heavy government expenditure to facilitate response and general high economic losses of unprecedented levels. After the El Nino induced rains of 1997 and 1998 Kenya experienced prolonged drought in many areas leading to famine and starvation¹⁵.

There are two rainy seasons in Kenya, the long rains in April to May and the short ones in October to November. The extreme climate and weather conditions are associated with anomalies in the general circulations of the seasonal northward and southward movement of the Inter-tropical Convergence Zone (ITCZ).

Location: Areas Prone to drought in Kenya

Drought affects mostly Eastern, Coast, North Eastern and parts of Rift Valley, Provinces of Kenya. The specific districts include Baringo, Laikipia, Turkana, Samburu, Narok and Kajiado in Rift Valley, Marsabit and Isiolo in Eastern province, Mandera, Garissa and Wajir in North Eastern and Tana River, Kilifi, Kwale and Taita-Taveta in Coast Province. Most of these districts experience dry weather conditions causing pressure on the existing pastures and water resources on which the communities depend for survival.

The ASAL districts in Kenya are categorized as follows. 11 districts are classified as arid, 19 as semi arid and 6 as those with high annual rainfall but with "pockets" arid and semi-arid conditions. This gives a total of 36 districts as shown in the table below.

¹⁵ UNDP, WMO, GOK, IGAD, and DMCN, (May 2002), *Factoring Weather and Climate Information and Products into Disaster Management Policy*, A Contribution to Strategies for Disaster reduction in Kenya, P3. Nairobi Kenya.

Table 2: ASAL districts classified by extent of aridity

<u>Category</u>	<u>District</u>	<u>% Total ASAL</u>
A. 100% ASAL	Turkana, Moyale, Marsabit, Isiolo, Wajir, Mandera, Garissa, Ijara,	62%
B. 85-100% ASAL	Kitui, Makueni, Tanariver, Taita Taveta, Samburu.	25%
C. 50-85% ASAL	Machakos, Mbeere, Tharaka, Laikipia, West Pokot, Kwale, Kilifi, Baringo, Meru North	8%
D. 30-50% ASAL	Lamu, Narok, Malindi, Keiyo, Marakwet,	3%
E. 10-25% ASAL	Nyeri(Kyeni), Rachuonyo, Suba, Kuria, Thika, Koibatek.	2%

Republic of Kenya, National Policy for the Sustainable development of ASALs of Kenya. 4th Draft, p 19, Nairobi Kenya

The above table is classified on the basis of moisture availability. The arid districts are hot and dry with an evapotranspiration rate higher than twice the annual rainfall. Rainfall here is low and highly variable in space and time. These districts comprise largely of pastoralists and agro pastoralists. Large areas of the land are suitable only for livestock grazing systems

Districts commonly affected by drought in Kenya

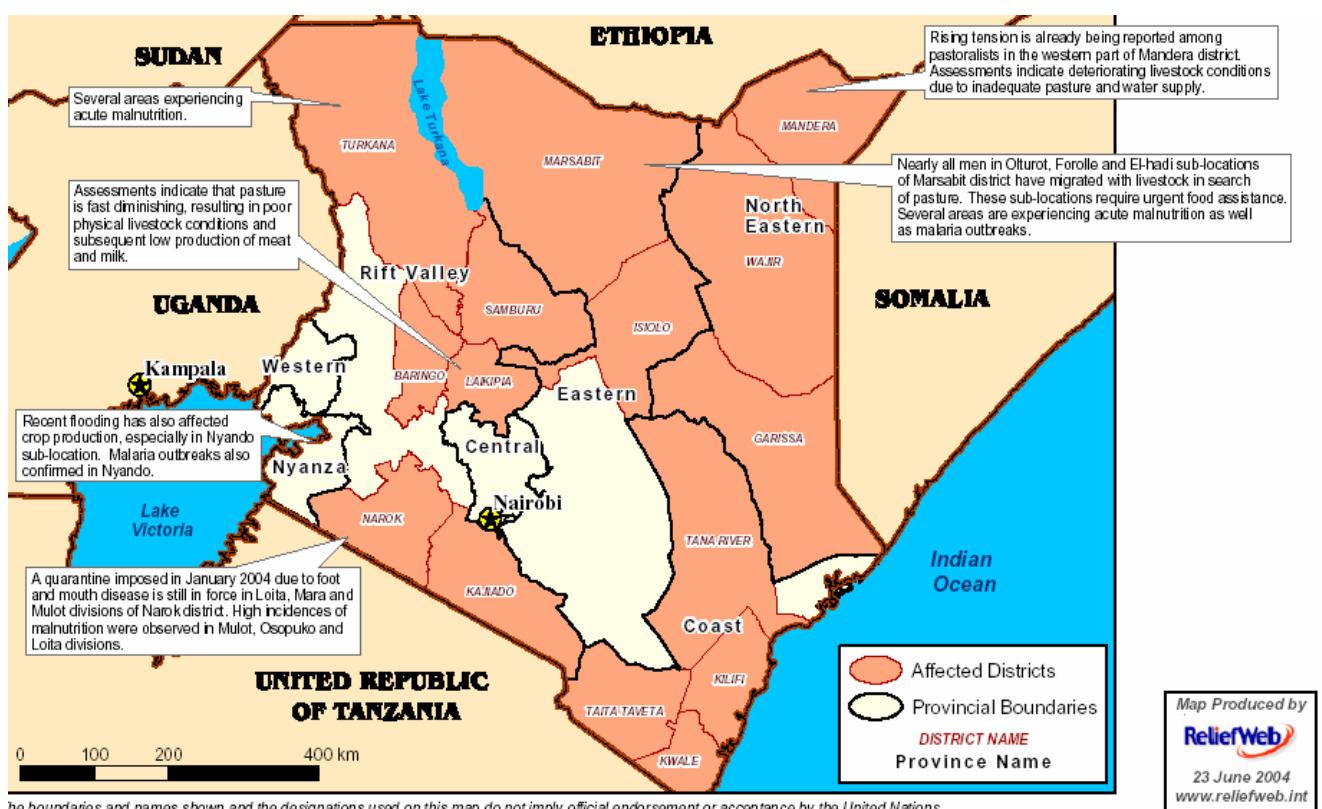
Drought affects four main provinces in Kenya mainly Northeastern, Rift Valley, Coast and Eastern. In rift valley most parts of Baringo, Laikipia, Turkana, Samburu, Narok, Kajiado; in Eastern province two districts are severely affected including Marsabit and Isiolo as the table below illustrates. The other provinces are Northeastern and Coast.

Province	District name	Economic activities	Population 1999 census
Rift Valley	Baringo	Pastoralism Agro-pastoralism	265,000
	Laikipia	Largely Pastoral, agro pastoral, marginal agriculture	322,000
	Turkana	Pastoralists Agro-pastoralism	451,000
	Samburu	Pastoralism	143,000
	Narok	Pastoralism	365,000

	Kajiado	Pastoralism	406,000
Eastern	Marsabit	Agro-pastoralism	121,000
	Isiolo	Farming Livestock production	101,000
North Eastern	Garissa	Pastoralism	392,000
	Wajir	Pastoralism Limestone mining	319,000
	Mandera	Pastoralism	250,000
Coast	Tana River	Farming Livestock production	181,000
	Kilifi	Mining (coral) Sand harvesting	544,000
	Kwale	Mining (coral) Sand harvesting	496,000

Source UNFPA, ALRMP, 2002 Population Data, Districts commonly affected by drought in Kenya.

JUNE 2004: DISTRICTS AFFECTED BY DROUGHT IN KENYA



RELIEF WEB (23rd June 2004); Districts Affected by drought in Kenya; www.reliefweb.int

General Characteristics of drought in Kenya

Severe reduction of water and moisture in the soil leading to dryness that cannot sustain plant life. The people have to walk long distances to look for water and in some cases wait for relief supplies as shown in the picture below. The water shortage may go on for several months or years.

Table 3
Chronology of drought incidences in Kenya since 1893

Date	Region	Remarks
1883	Coast	Worst famine in 30 years
1889-1890	Coast	One year of drought and famine
1894-1895	Coast	Information not available
1896-1900	Countrywide	Failure of three consecutive rainy seasons, human deaths.
1907-1911	Lake Victoria, Machakos, Kitui and Coastal	Minor food shortages
1913-1919	Eastern and coastal provinces Coastal areas	Impacts exacerbated by warfare
1921	Rift valley Central and Coast	A record dry year at the coast Local food shortages, crop and livestock losses [50% in Baringo]
1925	Northern Rift Valley and central provinces	Heavy loss of livestock, Lorian swamp dried up; deaths occurred.
1938-1939	Countrywide	Food shortages, about 200 deaths.
1942-1944	Central and Coast Provinces	Very severe drought in coast province
1947-1950	Eastern, central, Coast, Nyanza, western and rift valley provinces	Mombasa reported driest, water shortages in Nairobi
1952-1955	Eastern, south/north rift Valley	Droughts followed by floods, cattle mortality at about 70-80 % in Maasai land.
1960-1961	Widespread	Rains of about 50% long-term mean, Nairobi hit by water shortage. Wildlife deaths in Nairobi national park.
1972	Most of Kenya	Human and livestock deaths in the northern districts

		Maasai cattle losses of about 80%
1973-1974	Eastern Central, northern provinces	Crop production paralyzed
1974-1976	Central, Eastern, Western, coast	Famine in eastern province Water shortages, migration of people and livestock.
1980	Eastern province	Large food deficits
1981 1983	Countrywide	Severe food shortages in Eastern province, less in central province
1984	Central, Rift Valley, Eastern and North Eastern	Moderately Severe in Eastern Province, Relief food imported.
1987	Eastern and Central	4.7 million people dependent on relief power and water rationing
1992-1994	Northern, Central, Eastern Provinces	
1999-2000	Countrywide except west and coastal belt	

Gathara (1995), as modified by UNEP and GOK (Dec 2000), *Devastating Drought in Kenya: Environmental Impacts and Responses*, p 18, Nairobi, Kenya.

Factors contributing to the severity of drought in Kenya

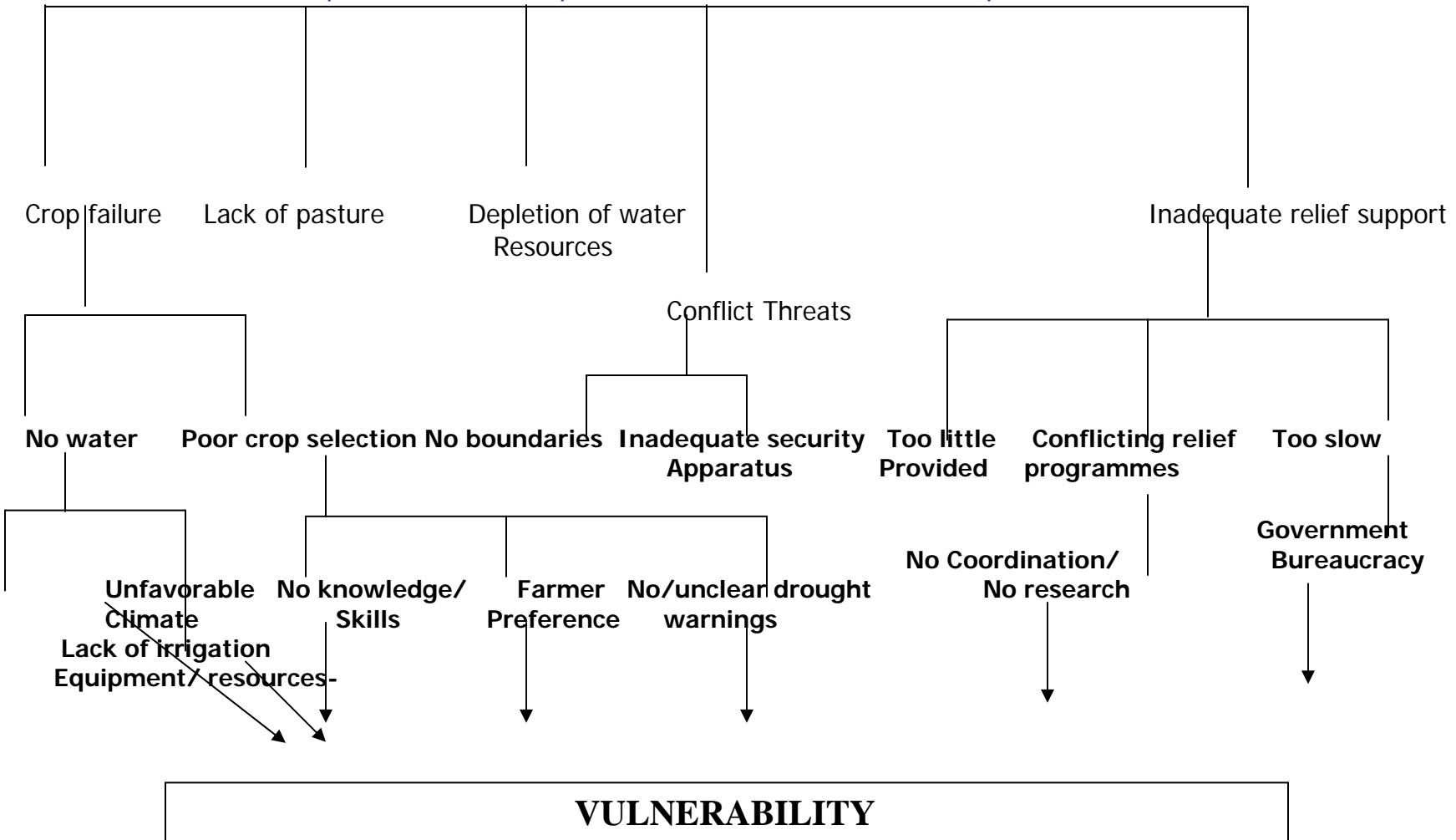
- Inadequate water storage capacity
- Increased destruction of forests due to charcoal burning, clearing forests for agriculture, logging without replacing trees, frequent forest fires
- Poor management of catchments areas, which includes destruction of forests, bushes, and plants that retain water in the soil without using appropriate soil conservation measures.
- Cultivation on stream banks and steep slopes causing erosion of the topsoil, which silts up dams and pans usually, used as dry weather water reservoirs.
- Lack of policy for managing water and drought
- Inequitable distribution of water resources

As displayed in the tree diagram below, there are root causes of the impacts apart from the climatic factors that increase the vulnerability of communities living within arid and semi arid lands in Kenya. All the underlying causes form a

complex web of events that together reduce the ability of the communities to cope in the event of a drought leading to the cyclic nature of the hazard.

Drought flow chart showing the vulnerability assessment; the blue and bolded items represent the underlying causes of the impact/ Factors contributing to vulnerability of communities.

FAMINE/STARVATION, MALNUTRITION, DEATH OF PEOPLE & ANIMALS, INCOME LOSS



Long term economic and social impacts of drought in Kenya

- Loss of livelihoods and paralyzed economic activities
- Poor health leading to vulnerability to diseases
- Deaths especially for the children and the aged
- General poverty
- Overall dependence on relief supplies from the Government of Kenya and World Food Programme among other donors.
- Increased conflicts due to
 - Diminished water and food resources
 - Political conflicts
 - Invasion by other communities from the neighbourhood

Short term economic and social impacts of drought in Kenya

- Migration and displacement of families into areas with food supplies or relief foods.
- Malnutrition causing ill-health
- Price hikes for commodities like cereals and food products while prices of livestock go lower because they are emaciated and unhealthy.
- Lack of social amenities like water, food and sanitation services
- Livestock diseases like foot and mouth, lumpy skin disease and black quarter tend to increase during the drought seasons.
- Low yields or no yields from agricultural activities due to low moisture content in the soil.

Issues Increasing Vulnerability in Kenya's drought prone zones

1. Social issues increasing vulnerability

Social issues affect a community's access to information on natural hazards, disasters and the risks that come with it. For example cultural aspects of indigenous beliefs, traditions, insecurity and ways of coping shape a people's susceptibility to natural hazards.

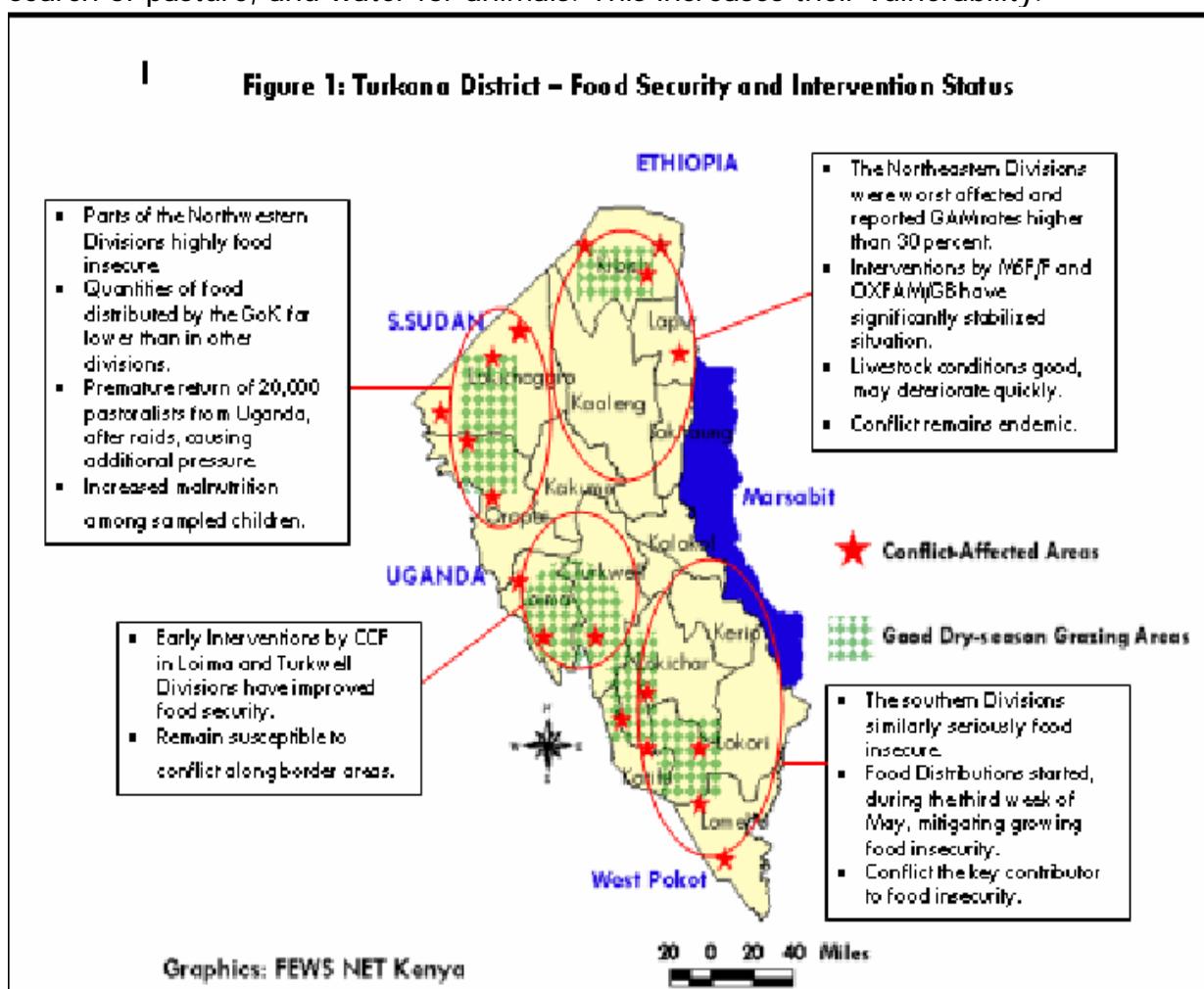
In the arid and semi-arid regions of Kenya mainly in Northeastern, Eastern and Rift Valley Provinces social issues have played a significant role increasing the vulnerability of communities to drought hazards. Insecurity is commonly mentioned in the three provinces resulting from cattle rustling, ethnic clashes and conflicts as people fight over grazing land. These issues increase their vulnerability to natural hazards specifically drought.

Conflict cases seem to increase during the drought and famine seasons as people attack their neighbours to steal animals and other livestock as shown in the map below covering Turkana District. There is also competition to access pastureland especially at the border areas with Ethiopia, Sudan and Uganda. As the

communities are threatened by their neighbours, they tend to move away to more secure zones which may not have pasture, food and water thus rendering them more vulnerable.

Other social issues include literacy levels, perception of risk emanating from natural hazards, effects of traditions and beliefs etc which affect the way the people respond to the drought hazard.

The level of literacy and understanding of hazards has been low in drought prone areas as compared to other parts of the country. The harsh weather conditions compounded by traditions and beliefs form a major setback on educational achievement. Girls and women are more disadvantaged as they are expected to play the traditional role of being housewives and homemakers rather than pursue education. They also take care of the homesteads as the men go out in search of pasture, and water for animals. This increases their vulnerability.



2. Economic issues that increase vulnerability in Kenya's drought prone zones

The impact of disasters can either push more people below the poverty line or impoverish further the existing poor people due to injuries, displacements, destruction of property and livelihoods among other effects. Most communities in the Kenyan arid and semiarid lands depend on pastoralism and agriculture for survival. These economic activities in turn depend on rainfall for water and pasture.

In Kenya the economic parameters that affect the severity of drought making the communities more susceptible to drought and famine are rise in food prices, fall in animals prices, depletion of food reserves without replacement, deterioration of health due to lack of food and clean water among other issues.

Poor infrastructure including impassable roads, poor telecommunication lines and inaccessibility of some regions hampers the transportation of food to these regions either for commercial purposes or relief aid. Poor communication also hampers action in terms of response to distress calls, poor publicity and inability to air the plight of the people.

Once the effects of the drought begin to be felt the health of animals begins to deteriorate due to inadequate pasture and water. The animals also experience Tsetse flies infestation and foot and mouth disease, which are common in drought conditions. This requires use of veterinary medicines, which are expensive and sometimes not accessible by the pastoralists.

3. Physical factors that increase vulnerability in drought prone areas

This refers to the famous phrase of " living in harms way" to mean how much of the physical assets are exposed to the hazards and are therefore vulnerable. In the arid/semiarid lands the most important physical assets are crops and livestock, which suffer the impact of severe climate conditions causing them to die. Severe malnutrition occurs in animals which risk contracting infectious diseases like foot and mouth disease, which spreads very fast incase of overcrowded conditions.

A large expanse of Kenya's land is drought prone covering up to almost 70 % of the total of land. This means it is difficult for the communities to migrate beyond the affected regions causing many of them to succumb to the impact of drought.

4. Environmental factors increasing vulnerability

Drought impact has been increasing in severity in the past four decades and this has been associated with environmental degradation that has been taking place due to urbanization, development, extension of agricultural land into forests and logging of trees to burn and sell charcoal for economic gains.

Wild fires as a result are a common occurrence in the arid ASALS due to the high temperatures experienced during the drought season. They have thus played a big role in environmental degradation rendering the area even more vulnerable to drought as the vegetation is depleted. The table below illustrates the frequency of forest fires in the country.

Table 5: Forest fires occurrences from 1990 to 2000¹⁶

Year	Area burnt (Ha)			<u>Loss in Kenya Shs</u>	
	Plantation	Natural Forest	Bush & Grass	Suppression cost	Damage
1990	85	331	12,183	128,600	366,060
1991	1,705	236	6,697	456,420	2,996,340
1992	6,170	5,494	13,301	5,859,300	99,127,400
1993	1,731	515	1,718	500,820	11,901,420
1994	690	69	1,913	3,187,700	37,847,500
1995	-	-	-	-	-
1996	-	-	-	-	-
1997	4,726	2961	7,729	47,727,733	51,979,918
1998	-	-	-	-	-
1999	1,449	317	2,041	25,878,790	28,606,232
2000	861.9	1, 229	8,860.75	560,694	38,624,954

UNEP and GOK (December 2000); Devastating Drought in Kenya, Environmental Impacts and Responses. P 47 Nairobi, Kenya.

¹⁶ UNEP(2000) *Devastating Drought in Kenya*, “Environmental Impacts and Responses”. Nairobi, Kenya.
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Table 6
Drought Risk Identification Matrix for Kenya's ASALS

Impact of drought	Underlying causes	Possible actions	Mitigation (M) Response® Acceptable risk (AR)	Feasible	Effective for Impact reduction	Cost/Benefit Perspective	Sustainability	To do
Income loss from crop failure	Variable climate	Weather modification	M	No	Yes	Too expensive e.g cloud seeding	Difficult	X
		Weather monitoring	M	Yes	Yes	Feasible with external funding	Good	✓
	No irrigation	Haul water during drought for livestock	R	Yes	Yes	Positive	Good	✓
		Provide government assistance for projects	M	Yes	Yes	Positive	Good	✓
	Expensive seeds	Subsidize seed sales	M	Yes	Yes	Positive	Good	✓
	Farmer Preferences to plant specific	Conduct workshops	M	Yes	Yes	Positive	Good	✓
		Conduct research	M	Yes	Yes	Positive	Good	✓

	seeds	Enhance communication	M	Yes	Yes	Positive	Good	<input checked="" type="checkbox"/>
	Govt incentives to plant certain crops	Lobby for new incentives	M	Yes	Yes	Positive	Good	<input checked="" type="checkbox"/>
	No drought warning/ did not understand	Provide weather monitoring	M	Yes	Yes	Positive	Good	<input checked="" type="checkbox"/>
		Identify the triggers	M	Yes	Yes	Positive	Good	<input checked="" type="checkbox"/>
	Lack of research	Identify target groups and conflicting relief progs.	M	Yes	Yes	Positive	Good	<input checked="" type="checkbox"/>
	Lack of drought relief coordination	Streamline relief application and funding / coordinate relief progs.	M	Yes	Good	Positive	Good	<input checked="" type="checkbox"/>

Floods

History of floods in Kenya and severity, pattern etc

Floods occur due to natural factors like flash floods, river floods and coastal floods. They may also occur due to human manipulation of watersheds, drainage basins and flood plains. For example, in some cases floods have occurred in the river basins even with normal rains because of excess surface water run off occasioned by deforestation, land degradation upstream.

Kenya is affected by floods following torrential rainfall. These force thousands of people living in the lowlands to move to higher grounds. The people affected are mostly in western and Nyanza provinces and in Tana River district. However slum dwellers in towns like Nairobi who have erected informal structures near rivers are not spared. In Western province river Nyando is notorious bursting its banks during the rainy season.

Kenya's record of flood disasters indicates the worst floods recorded in 1961-62 and 1997-98, the latter ones being the most intense, most widespread and the most severe. During this season the flooding was associated with the El Niño phenomenon, a weather pattern that affects most parts of the world. El Niño is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe. It may cause increased rainfall in some areas and drought in others thus changing the normal weather pattern.

The problem has been perennial each time taking back years of development and costing the government millions of shillings in reconstruction and recovery. Each year several people are reported dead or injured necessitating action to curb the menace.

Location: Areas affected by floods

Most parts of the nation experience river floods which are slow onset and mostly predictable. However some parts experience more severe floods than others including most parts of Kano plains (Nyando district) and Nyatike (Migori district) in Nyanza province, Budalangi in Western province resulting from river Nzoia and the lower parts of Tana river.

The specific areas that experience floods almost annually include: -

1. Nyanza Province – Kano plains, Nyakach area, Rachuonyo and Migori
2. Western Province – Budalangi
3. Coast Province – Kilifi, Kwale and the Tana River Basin
4. North Eastern province – Garissa, Wajir, and Ijara
5. Urban Centres – Nairobi, Nakuru, Mombasa, Kisumu.
6. Tana River district (the Lower parts)

Table 7: Areas affected by floods in Kenya

Province	District	Economic Activities	Population 1999 census
Western Province	Busia district (Budalangi)	Fishing, farming	56,000
Nyanza	Kano Plains	Farming	320,000
	Tana river	Farming	

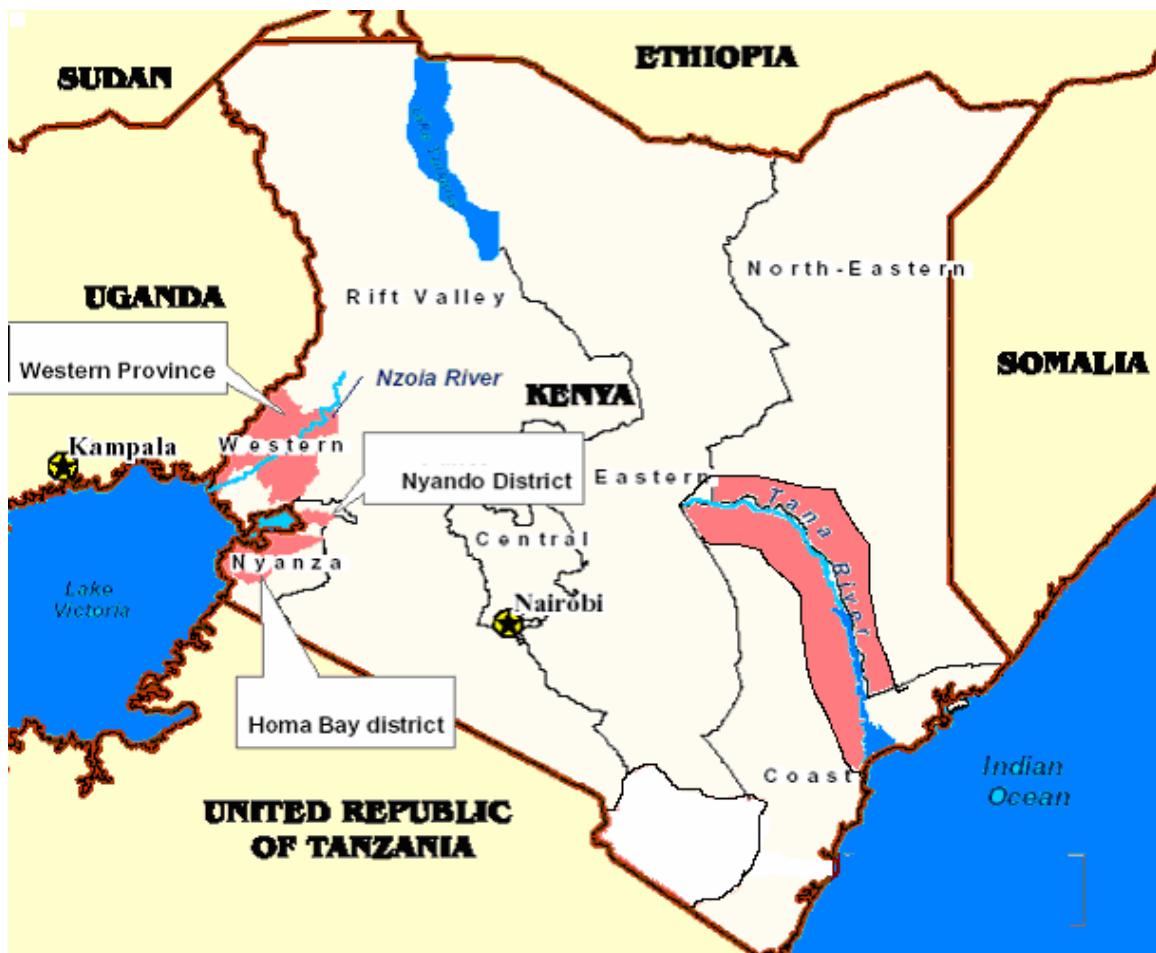
Republic of Kenya[Central Bureau of Statistics] (April 1996); *Kenya Population Census 1989, Analytical Report Vol. III; POPULATION DYNAMICS OF KENYA, Nairobi, Kenya.*

Table 8: Recent history of floods in Kenya

Year	Area affected	No of people affected
2003	Nyanza, Busia, Tana River	170,000
2002	Nyanza, Busia, Tana River	150,000
1997/98	Widespread	1.5 million
1985	Nyanza, Western Province, Tana River	10,000
1982	Nyanza	4,000

Source : Republic of Kenya (2004), National Policy on Disaster Management (Revised Draft) p4, Nairobi, Kenya.

KENYA'S FLOOD-PRONE AREAS



SOURCE: RELIEF WEB : www.reliefweb.int; maps- Kenya

General Characteristics of floods

- Flash floods- usually occur in a flash without much warning as a result of an accelerated runoff, dam failure etc
- River floods –are slow onset as they build up slowly, usually occur over a long period when a river breaks its banks and are seasonal.
- Coastal floods- occur along the coast due to wave activity resulting from tropical cyclones, Tsunamis and storm surges

Factors contributing to vulnerability to floods and causing flood disasters in Kenya

- a. Location of settlement in the flood plains
- b. Cultivation of crops along slopes adjacent to the floodplains, causing massive erosion and destruction of trees in the catchments.
- c. Lack of awareness of the flood hazard by the local communities
- d. Where the capacity of the soil to absorb water is reduced due to erosion or existence of concrete.
- e. Poor building materials leading to non-resistant structures and foundations that cannot withstand the running waters
- f. High risk infrastructure

Economic and social impacts of floods on the regions affected

- a. Structural damage to buildings, roads, rails, communication lines, and land in general causing massive erosion resulting in wide gullies that cannot be cultivated anymore.
- b. Deaths of people and animals from drowning and injuries from displaced boulders, falling buildings, trees and others.
- c. Possible outbreaks of diseases like malaria, cholera, dysentery etc due to presence of mosquitoes and contamination of water sources by the floodwaters.
- d. Contamination of wells and ground water which is the major source of drinking water by most rural communities
- e. Loss of harvests and crops in farms, loss of food stocks, supplies and produce from farms.

El Nino induced floods [1961/62 and 1997/98]

Kenya experiences two seasons of long and short rains. The long rains occur during the months of April to May while the short rains occur between October to December. However in 1997 and 1988 the short rains anticipated in October-December were more than expected and caught all Kenyans by surprise resulting in economic, social and other losses running into millions of shillings. The resultant floods were attributed to El Nino, a weather pattern that affects many parts of the world.

Drainage Basins

The country has a total of 5 drainage basins¹⁷.

Drainage area 1 of the national surface water resources

This area covers mostly the Lake Victoria basin, with the highest amount of mean annual rainfall of about 1245mm. It has the highest runoff. It also has the highest river flow potential(49%).

Drainage area 2 of the national surface water resources

This covers mostly the Rift Valley province. The geographical setting of the Great Rift Valley cutting through Kenya makes it susceptible to weather patterns that vary greatly with the rest of Kenya. It covers an area of 126,910 square kilometers and is characterized by a rugged terrain. Being classified under area 2 of the national surface water resources, this means the area is predominantly characterized by lakes with no outflows.

The rift valley river system has the lowest relative annual runoff of about 1% of the mean annual rainfall. It has an annual river flow potential of 4%, which is the lowest in the country giving it a climate of semi-arid nature with well-drained soils. Lake Turkana found in this area has a depth of 120 meters deep, a surface area of 6,405 square kilometers, with brackish water.

Drainage area 3

This drainage area defines the Athi/Galana/Sabaki river systems. Has a low national river flow potential of below 7% of the total national flow. The climate is predominantly semi-arid.

Drainage area 4

Under this system is the Tana river system, which has the highest national river flow potential amounting to 33%.¹⁸

Drainage area 5

Represents the North Ewaso Ngiro basin. Has a low national river flow potential of below 7% of the total national flow. The climate is predominantly semi-arid.

¹⁷ UNDP, WMO, GOK, IGAD, and DMCN, (May 2002), *Factoring Weather and Climate Information and Products into Disaster Management Policy*, A Contribution to Strategies for Disaster reduction in Kenya. Pp 35-40 Nairobi Kenya

¹⁸ Ibid

Vulnerability assessment for area 2, 3, and 5

Generally dry most of the year causing severe drought. This area has a low national river flow potential of no more than 7% of the total national river flow and experiences severe dry weather conditions for the most part of the year making the area highly vulnerable to drought and therefore famine.

Vulnerability assessment for area 1 and 4

The two areas have the highest national river potential. Area 1 covering the lake Victoria basin is has the highest national river flow potential of 49% while area 2 covering the Tanariver system has the second highest national river flow potential of 33 %. This makes the areas highly vulnerable to floods.

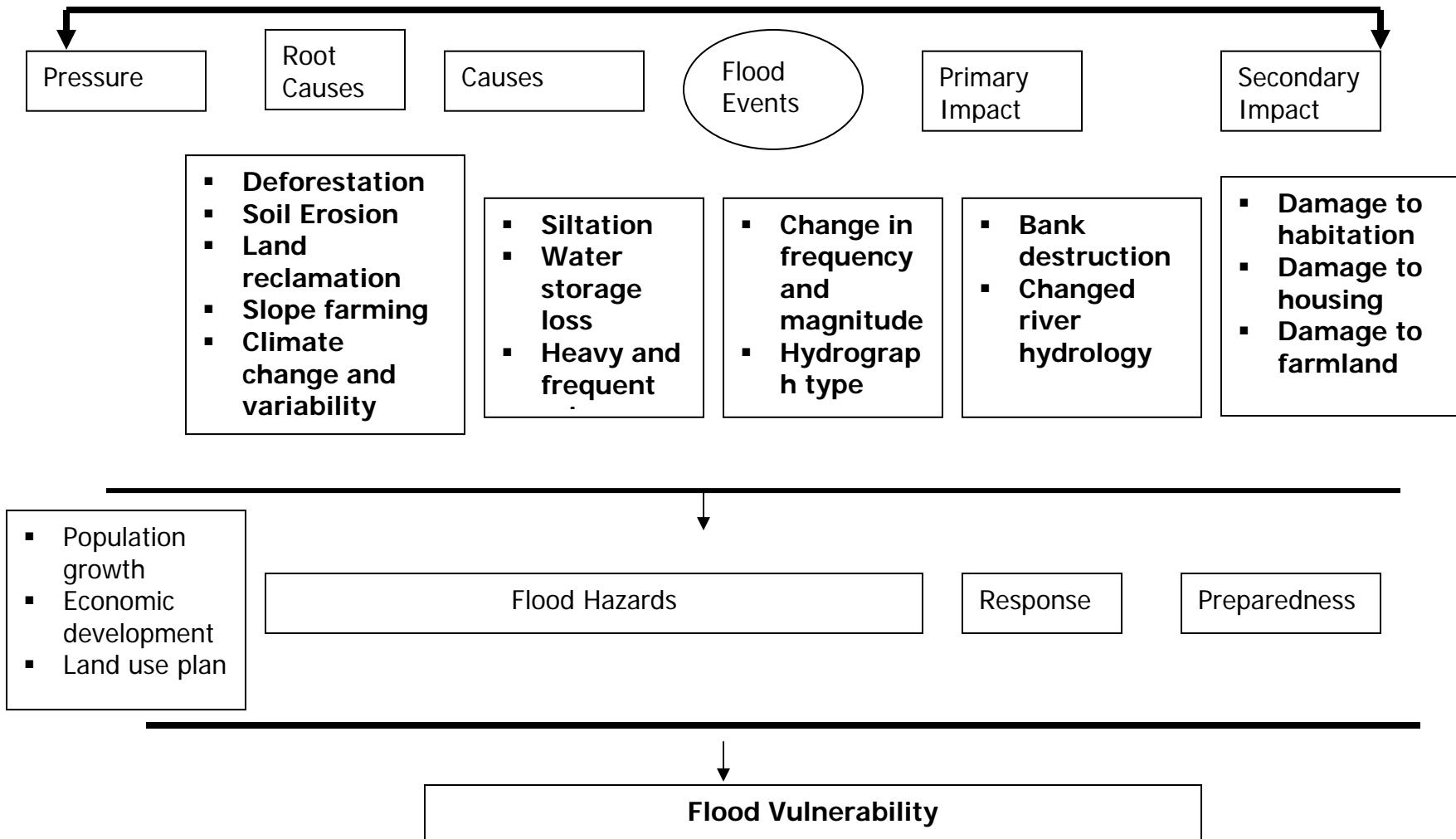
Table 9: Summary table of the hydrological characteristics of the main drainage basins in Kenya

Drainage basin	Area in km	Mean annual rainfall mm	Mean annual runoff mm	National river flow potential	Climate and soils
Lake Victoria (area 1)	49,210	1,245	149	49	Humid to sub-humid poorly drained soils
Rift Valley (area 2)	126,910	535	6	4	Arid to semi-arid well drained soils
Athi-river (area 3)	69,930	585	19	7	Semi-arid well drained soils
Tana River (area 4)	130,090	535	36	33	Upper semi-humid Lower: semi-arid to arid. Impeded drainage soils
Ewaso Ngiro (area 5)	204,610	255	4	7	Arid to semi-arid, well drained soils

Source: UNDP, WMO, GOK, IGAD, and DMCN, (May 2002), Factoring Weather and Climate Information and Products into Disaster Management Policy, A Contribution to Strategies for Disaster reduction in Kenya pp36. Nairobi, Kenya.

The department of water development is charged with the monitoring the quality and quantity of both surface and ground water throughout the country. It is also charged with maintaining an updated water quality database for all water resources in the country.

Schematic illustration of the progression of vulnerability to floods; [the bolded items represent the underlying causes of the impact/ Factors contributing to vulnerability of communities to floods.]



- **Effects of floods**

1. **Economic effects of floods on people, assets, livelihoods etc**

Floods cause a lot of losses in Kenya especially because they have become perennial and seem to weaken the communities' ability to cope each time they hit. This has been evident especially in parts of western province, Nyanza province and Tanariver area. Among the impacts are: -

- Loss of livelihoods including destruction of crops, death of farm animals, loss of fishing equipment, loss of other working equipment.
- Destruction of settlements and houses
- Destruction of infrastructure mainly roads, telecommunication lines, power lines etc
- Erosion of productive layers of the soil rendering the soil less productive.
- Loss of food reserves

2. **Social impacts of floods in Kenya**

- Death and injury of both people and animals
- Mental and physical stress (e.g. anxiety, depression, loss of security, domestic problems)
- Health –related problems (contamination of water resources, sewerage problems etc)
- Nutrition problems- lack of food as the floods destroy food reserves
- Increased diseases and epidemics especially water related ones like diarrhoea, dysentery, typhoid, and cholera due to contamination of water resources.
- Increased conflicts over water resources

3. **Landslides**

Landslides are described as the downward movement of soil and rocks resulting from naturally occurring vibrations, changes in water content, removal of lateral support, loading with weight and weathering or human manipulation of water courses and the composition of the slope.

In Kenya landslides and mudslides occur mostly during the rainy season and are accelerated by flooding. Usually they affect parts of the country like western, Nyanza and north Rift Valley provinces, however the most vulnerable areas have been the following: - Murang'a district in central province, Kirinyaga, Nyeri, parts of Meru, which are areas around the mount Kenya region, Kisii and Mombasa Island. These are areas with annual rainfall of over 1200 mm and steep slopes.

Landslides are triggered by rapid saturation of the soil, which in turn reduces cohesion, surface tension and friction. The El Niño rains experienced between October 1997 to February 1998 have exacerbated the landslide hazards, thus calling for an urgent need to set up early warning systems in Kenya.

According to Bonventure Wendo, the director of the National Disaster Operations Centre, which is mandated by the Kenya government to coordinate all activities, related to disaster management, "Mudslides have become more common in Kenya because so many forests have been cleared to make way for farmland. People have cut trees to cultivate, and the soil gets loose." ¹⁹

Location: Areas affected by landslides

Central province being mountainous and with permeable soils is affected seriously and experiences landslides during most rainy seasons. The districts affected include Muranga, Kiambu, Thika, Maragua, Nyeri, Kirinyaga, Nyandarua and areas around mount Kenya region.

Table 10: Areas affected by landslides in Kenya

Areas affected	Economic activities	Population 1999	Population 2000
Murang'a	Agriculture, Horticulture, Livestock	348,000	354,000
Kiambu	Agriculture, Horticulture, Livestock	743,000	801, 000
Thika	Agriculture, Horticulture, Livestock	645,000	676,000
Maragua	Agriculture,	388,000	405,000
Nyeri	Agriculture,	660,000	692,000

¹⁹ Daily Nation (May 2002), Mudslides in Kenya.

	Cashcrop farming		
Kirinyaga	Agriculture,	457,000	489,000
Nyandarua	Agriculture,	480,000	537,000

Source UNFPA, ALRMP(2002), Areas affected by Landslides in Kenya

Characteristics of landslides

Landslides may be presented in many forms including: -

Slides, falls, topples, lateral spreads and mud flows etc. They can also result as effects of heavy storms, earthquakes and volcanic activities.

Factors contributing to vulnerability to landslides in central province and other landslide prone areas.

In many parts of the mount Kenya region people have expanded their agricultural land to create room for their farm crops. This deforestation means that trees can no longer stop the earth from sliding down hillsides. When this happens many people are buried with the sliding mud. In Murang'a district there are reports of whole families being buried in the long rains of April and May in 2002 and 2003. In addition to the influence of topography, landslides are aggravated by human activities, such as deforestation, cultivation and construction, which destabilize the already fragile slopes. Among the factors that increase vulnerability are: -

- a. Population pressure and settlements built on steep slopes of the Aberdares and Mt. Kenya, softer soils and cliff tops which then succumb to gravity when the soil becomes too wet to hold together.
- b. Settlements built at the base of steep slopes, on mouths of streams from mountain valleys.
- c. Exploitation of the environment for economic reasons.
- d. Construction of roads, communication lines in mountain areas.
- e. Environmental degradation
- f. Buildings with weak foundations
- g. Buried pipelines and brittle pipes
- h. Lack of enforcement of the physical planning act allowing people to build in high-risk areas of the province.
- i. Ignorance resulting from lack of understanding of the hazard itself.

Economic and social impacts of landslides in the regions affected

Landslides in Kenya have been on the increase in the recent past. This has both social and economic impacts mainly loss of life, agricultural land and crops as well as destruction of infrastructure. Landslides tend to bury all that is their way

resulting in destruction of life and property. They may bury or sink buildings, rubble and boulders moved to block roads, railways, and lines of communication or waterways. They may destroy all property along their way and render agricultural land unproductive.

The casualties of mudflows, massive boulders, rocks and all that can be moved by the landslides may be thousands of people and animals.

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