

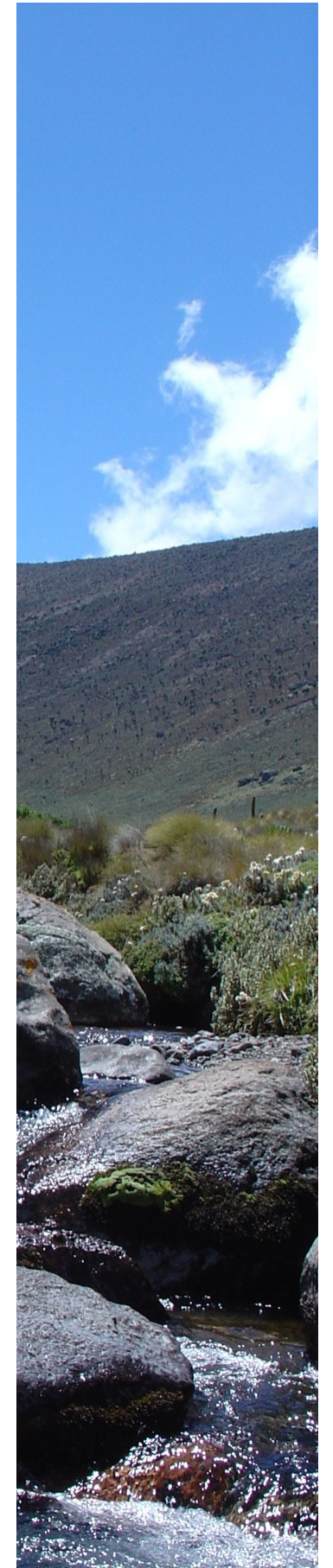
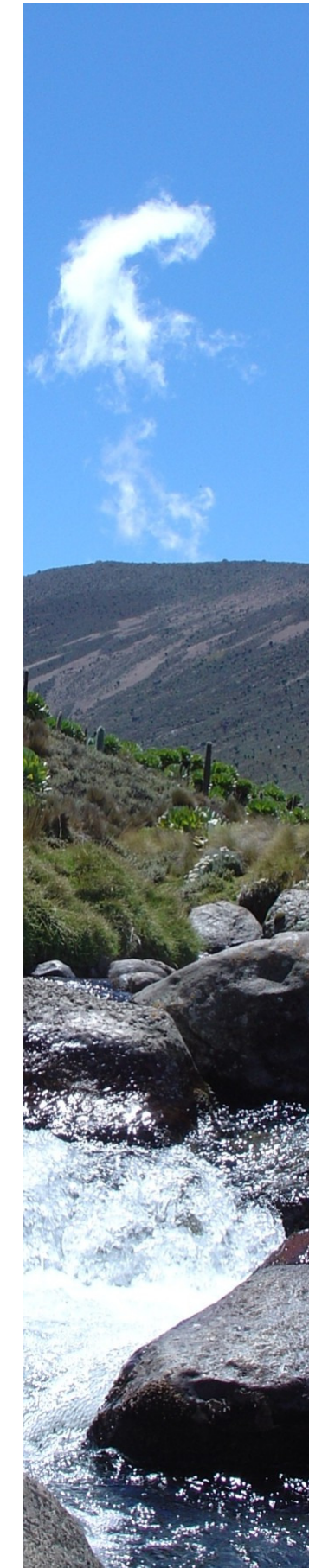
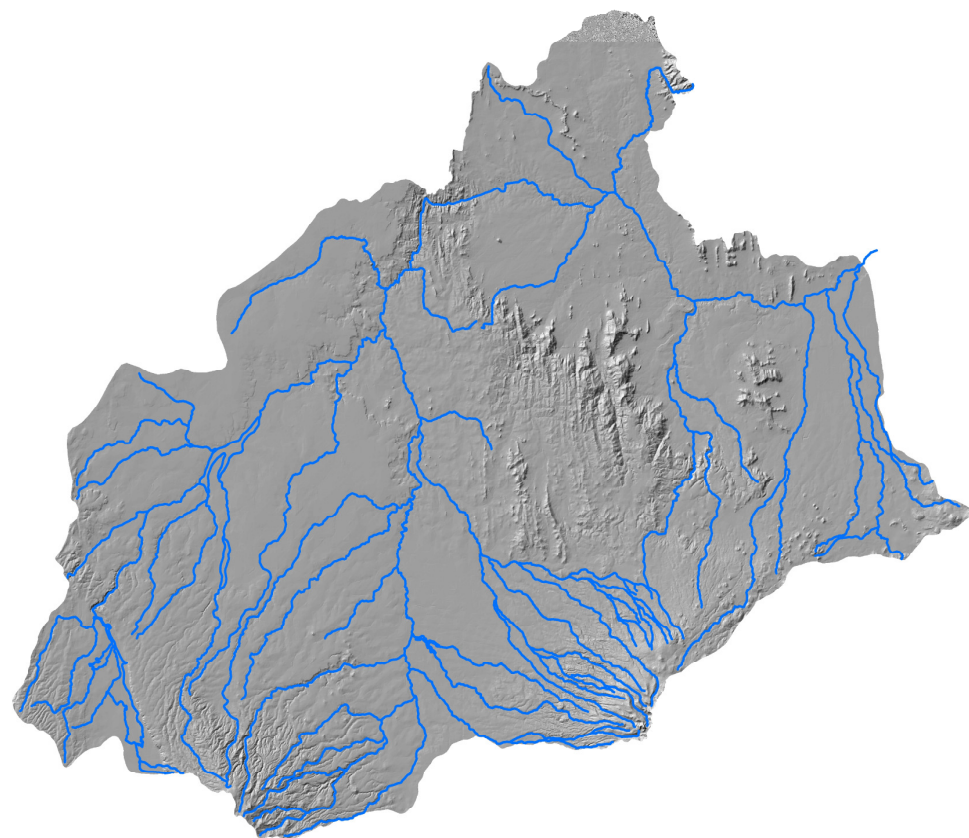
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Upper Ewaso Ngiro River Basin Sub Catchments Directory

Upper Ewaso Ngiro Basin

Foreword

This directory was elaborated by the Centre for Training and Integrated Research in ASAL Development (CETRAD) as part of a small project funded by the Swiss Agency for Development and Cooperation (SDC) under the Eastern and Southern Africa Partnership Program (ESAPP). The main objective of this project was to assess the needs of various groups of stakeholders in the Upper Ewaso Ngiro River Basin for information on water use and conservation. A survey conducted within the Basin showed that information on water use and conservation is indeed an asset many stakeholders would desire to access easily and timely. Information on technical issues linked to the use of water, information on water resources and their use and information on legal aspects of water use were severally cited as being of particular importance.

This directory is a first attempt to avail, to the concerned stakeholders, information on water related issues. It is also a way to make at least part of the vast spatial database of CETRAD available to the public. The River Water User Associations (RWUA) actively engaged in managing river water resources and solving related conflicts in the sub-catchments of the Basin are particularly welcome to use this directory as a tool for their daily activities. It might help them in their reporting activities, in inter-subcatchment situation comparison, and as a tool to inform interaction (or negotiations) with funding agencies and development partners. Furthermore, it might show their representatives some of the possibilities offered by modern information technology and spatial analysis tools and prompt them to propose the elaboration of further, even more useful products to CETRAD.

Boniface P. Kiteme
Director
CETRAD

Upper Ewaso Ngiro Basin

Acknowledgements

This directory is the result of a team work involving various persons and institutions:

The Swiss Agency for Development and Cooperation (SDC) provided funds through the Eastern and Southern Africa Partnership Program (ESAPP) of the Centre for Development and Environment (CDE). The CDE of the University of Berne in Switzerland provided logistic support and liaison with the funding agency.

The project itself was implemented by the Centre for Training and Integrated Research in ASAL Development (CETRAD) based in Nanyuki, Kenya. Part of the data used for the preparation of maps, especially hydrologic and climatic data, was availed by the Natural Resource Monitoring, Modelling and Management Trust (NRMT).

The following persons actively participated in the project:

Mrs Grace Nyaruai, research assistant at CETRAD, coordinated the work of a team of research assistants during a survey conducted in the entire Basin. This team was composed of Mrs Edith Gacheri, Mrs Jane Simon, Mrs Jane Wacuma, Mr Felix Gitari, Mr Timothy Kimathi, Mr Nicholas Mbaya, Mr Paul Kariuki and Mr Simon Ihuthia and was driven through the area by Mr Julius Wahome and Mr Edward Thega. Mr Moses Gone, GIS technician at CETRAD, assisted in the preparation of spatial data, the designing of map layouts and the final elaboration of this directory. Mr Simon Mumuli Oduori, the former head of the GIS team at CETRAD, carried out the land cover classification for the years 2000 / 2002, while the 1995 classification was carried out by Mr Peter Niederer in the frame of his MSc work conducted in collaboration with NRMT at the University of Berne in Switzerland. Finally, Mr Boniface Kiteme, the director of CETRAD, provided conceptual guidance to the project.

I wish to thank all the above for their participation and commitment.

Albrecht Ehrensperger
Project Coordinator & GIS consultant
CETRAD

Upper Ewaso Ngiro Basin

Comments on Deforestation Mapping

The following two maps provide an overview over the trends in forest cover dynamics in the Ewaso Ngiro River Basin on a catchment-by-catchment basis for the period 1995 – 2002.

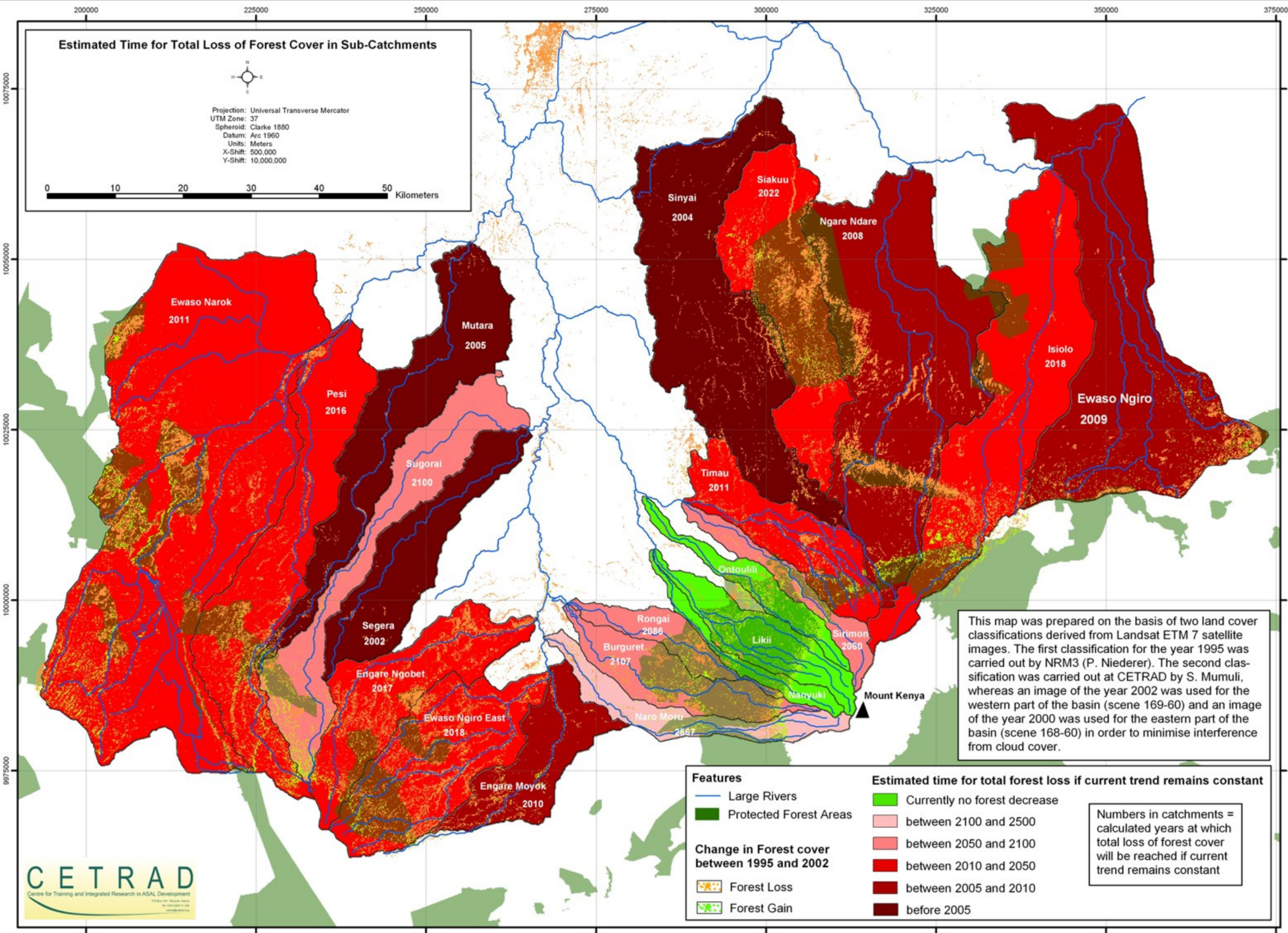
The **first map** shows, for each sub-catchment, the surface of forest (in square kilometres) that was cleared every year during the above mentioned period. It is interesting to note, that while the **Mount Kenya** and **Aberdares** Protected Forests seem to enjoy better protection from deforestation, other protected forests like Mukogodo, Ndare, Rumuruti, Marmanet and Lariak are being depleted at an alarming rate. All sub-catchments having a significant share of their area within Mt Kenya Protected Forest (Sirimon, Ontoulili, Likii, Nanyuki, Rongai, Burguret and Naro Moru) have deforestation rates below 1 km² per year, while for others, like Ewaso Narok, this rate is as high as 12 km² per year.

The **second map** shows the time remaining until each sub-catchment will be totally cleared from forests (if the current trend remains constant). Of course in this respect, catchments with larger initial forest covers, mainly in the high potential areas, have an advantage over catchments located in semi-arid regions with little initial forest cover. Still, some catchments with relatively large protected forests (Siakuu, Ngare Ndare, Ewaso Ngiro East and Ewaso Narok) seem to use these resources in a very unsustainable manner, as their forests will have disappeared before the year 2020 if the current trend remains the same. It is also interesting to note that catchments with very little or no protected forest areas (Sinyai, Mutara, Segera, Ewaso Ngiro and Engare Moyok) either have already lost all their forests, or will have lost them before the year 2010.

The two maps were prepared on the basis of two land cover classifications carried out by NRM3 (P. Niederer) and CETRAD (S. Mumuli). These classifications were both done with use of Landsat ETM 7 satellite images. It is important to note that shifts can occur between the two classifications mainly because of varying atmospheric conditions and varying perceptions of the persons conducting the visual analysis of the satellite images. In the case of forest cover, these shifts should not play a significant role, as this land cover type is relatively easy to identify with the source data used. Still, the deforestation trends were calculated by combining forest loss and gain (trend = loss – gain) in order to neutralise possible spatial discrepancies between the two source datasets.

Estimated Time for Total Loss of Forest Cover in Sub-Catchments

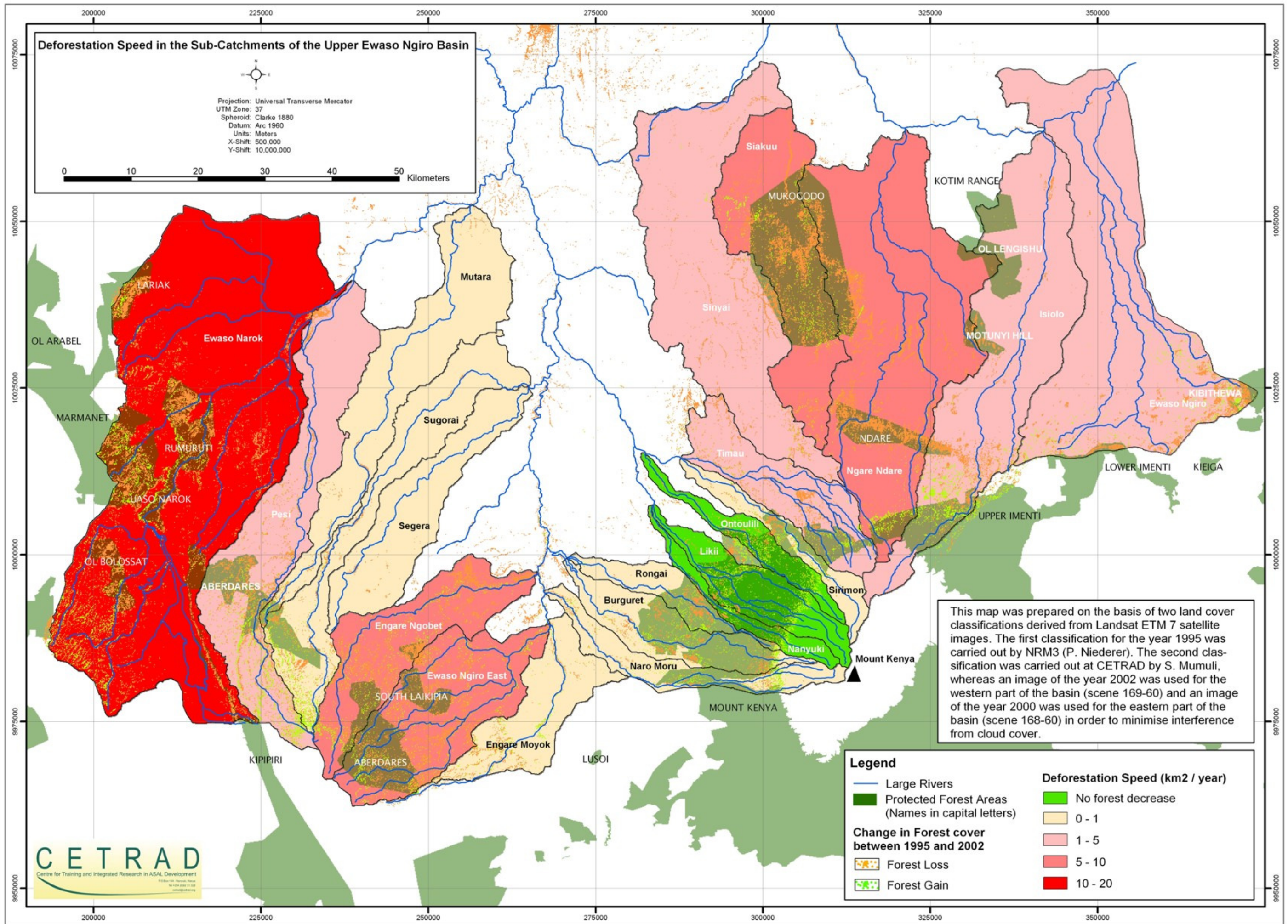
Projection: Universal Transverse Mercator
 UTM Zone: 37
 Spheroid: Clarke 1880
 Datum: Arc 1960
 Units: Meters
 X-Shift: 500,000
 Y-Shift: 10,000,000



This map was prepared on the basis of two land cover classifications derived from Landsat ETM 7 satellite images. The first classification for the year 1995 was carried out by NRM3 (P. Niederer). The second classification was carried out at CETRAD by S. Mumuli, whereas an image of the year 2002 was used for the western part of the basin (scene 169-60) and an image of the year 2000 was used for the eastern part of the basin (scene 168-60) in order to minimise interference from cloud cover.

Features		Estimated time for total forest loss if current trend remains constant	
	Large Rivers		Currently no forest decrease
	Protected Forest Areas		between 2100 and 2500
	Forest Loss		between 2050 and 2100
	Forest Gain		between 2010 and 2050
			between 2005 and 2010
			before 2005

Numbers in catchments = calculated years at which total loss of forest cover will be reached if current trend remains constant



Deforestation Speed in the Sub-Catchments of the Upper Ewaso Ngiro Basin

Projection: Universal Transverse Mercator
 UTM Zone: 37
 Spheroid: Clarke 1880
 Datum: Arc 1960
 Units: Meters
 X-Shift: 500,000
 Y-Shift: 10,000,000

0 10 20 30 40 50 Kilometers

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Legend

Large Rivers	Protected Forest Areas (Names in capital letters)
Forest Loss	No forest decrease
Forest Gain	0 - 1
	1 - 5
	5 - 10
	10 - 20

Upper Ewaso Ngiro Basin

Notes on Sub-Catchments Maps

The bulk of this directory is composed of maps and fact sheets for 21 sub-catchments of the Upper Ewaso Ngiro River Basin. The maps are composed of one main map and three secondary maps. The main map shows the land cover in the catchments for the year 1995, water abstraction points, river gauging stations, isohyets, roads, urban centres and administrative boundaries. The secondary maps feature topography (slope classes and elevation contours), soil types and population density per administrative units (sub-locations). All the map sheets have their own legends, projection information, information on the project and CETRAD, logo and copyright declaration. Therefore, they can be used either as part of the directory, or can be duplicated for separate use in reports and presentations.

The maps have been arranged and numbered in West to East order as shown in the overview on the following page. The scales of the maps vary depending on the size of the sub-catchments portrayed, but all range between 1 : 140,000 and 1 : 250,000 for the main maps and between 1 : 350,000 and 1 : 800,000 for the secondary maps.

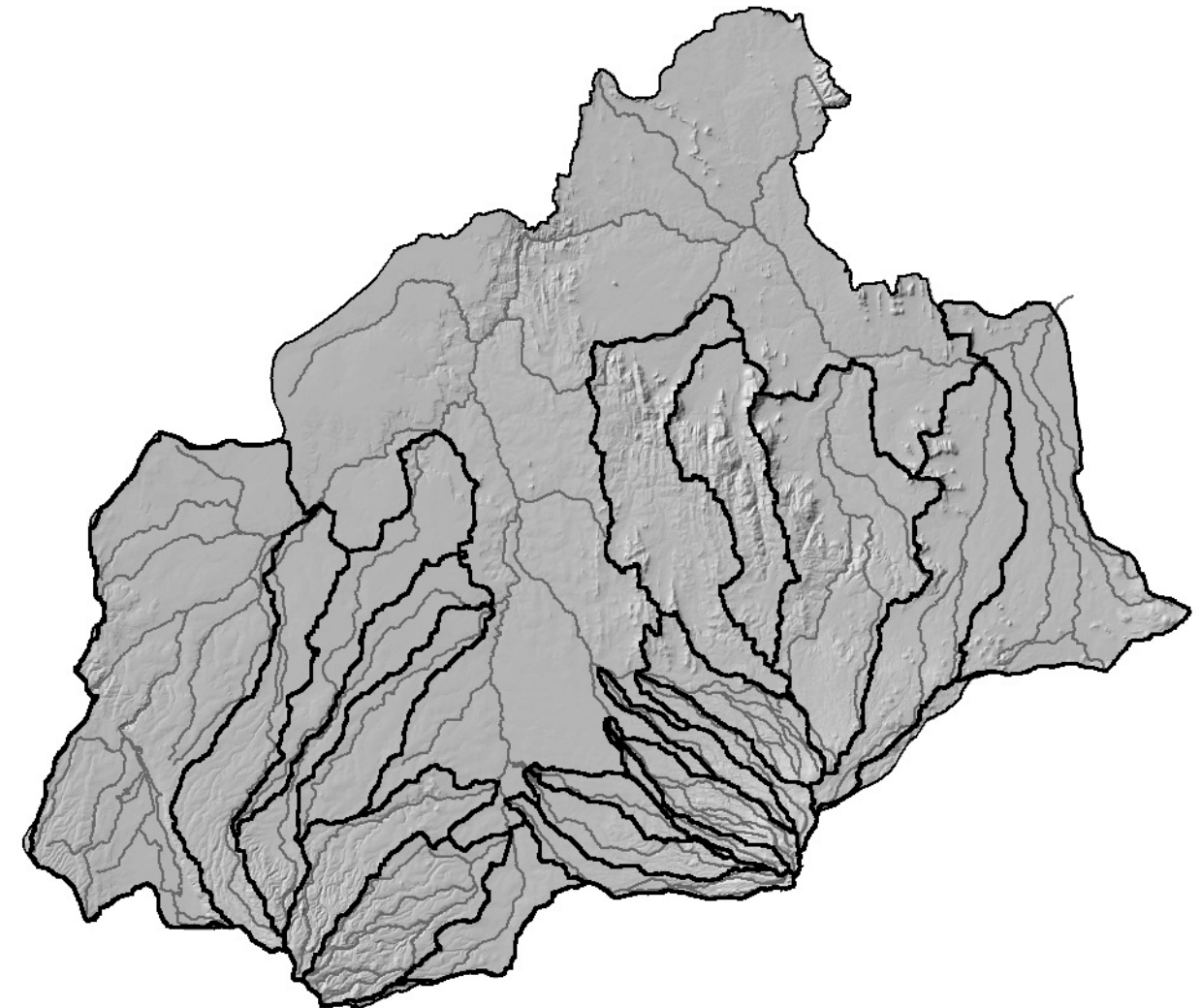
The fact sheets provided for each sub-catchment partly repeat the map information in text, or tabular format. Additionally, information on deforestation dynamics is provided together with a simple map.

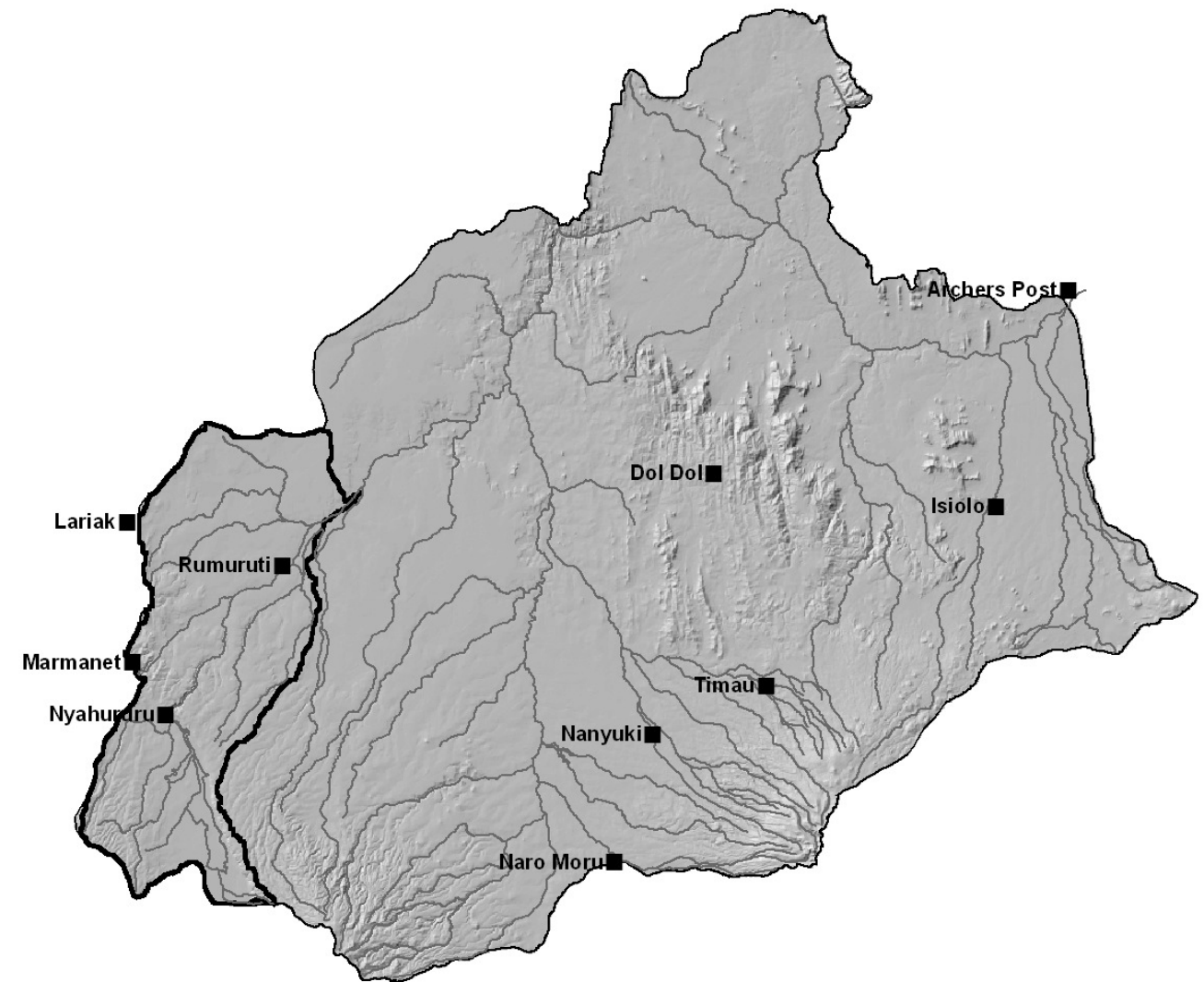
Finally, a table provides basic information on River Water User Association (WUA) for those sub-catchments in which they have been established. The information contained in these tables, reflects the opinion of the WUA representatives interviewed during a survey carried out in July – August 2003. Part of this information might be outdated and it is possible that in the meantime new WUA have been established in other sub-catchments. Nevertheless, the tables provide a good overview over the issues and conflicts that WUA are dealing with and the way in which they try to do so.

Upper Ewaso Ngiro Basin

Ewaso Narok

1. Pesi
2. Mutara
3. Suguroi
4. Segera
5. Engare Ngobit
6. Ewaso Ngiro East
7. Engare Moyok
8. Naro Moru
9. Burguret
10. Rongai
11. Nanyuki
12. Likii
13. Ontulili
14. Sirimon
15. Timau
16. Sinyai
17. Siakuu
18. Ngare Ndare
19. Isiolo
20. Ewaso Ngiro





Ewaso Narok Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	1840 km ²
Perimeter	320 km
Area to perimeter ratio	5.75
Highest point	2960 m
Lowest point	1780 m
Average altitude	2155 m
Altitude range (highest point – lowest point)	1180 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	1,545,600,000 m ³
Average annual rainfall in catchment area	840 mm
Location with highest annual rainfall	1090 mm
Location with lowest annual rainfall	650 mm

Hydrology (abstraction points and gauging stations from NRM database)

Approx. total length of main river	95 km
Total length of all rivers in catchment	1265 km
Number of gauging stations	0
Number of recorded abstraction points	114
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban centres	Chereta, Emu, Gatero, Gathuria, Gatundia, Huhoini, Karaba, Karamuton, Kinguka, Kinoiyo, Kirima, Kite, Leshau, Limunga, Lorian, Losoogwa, Machunguru, Mahianyu, Mairo Inya, Manguu, Mbogoini, Minjore, Mithuri, Muhotetu, Muruku, Ndogino, Ndurumo, Ngoru, Ngururo, Nyahururu, Ol Donyo, Ol Jabet, Rumuruti, Rwathia, Salama, Shauri, Siron, Subuko, Thiru

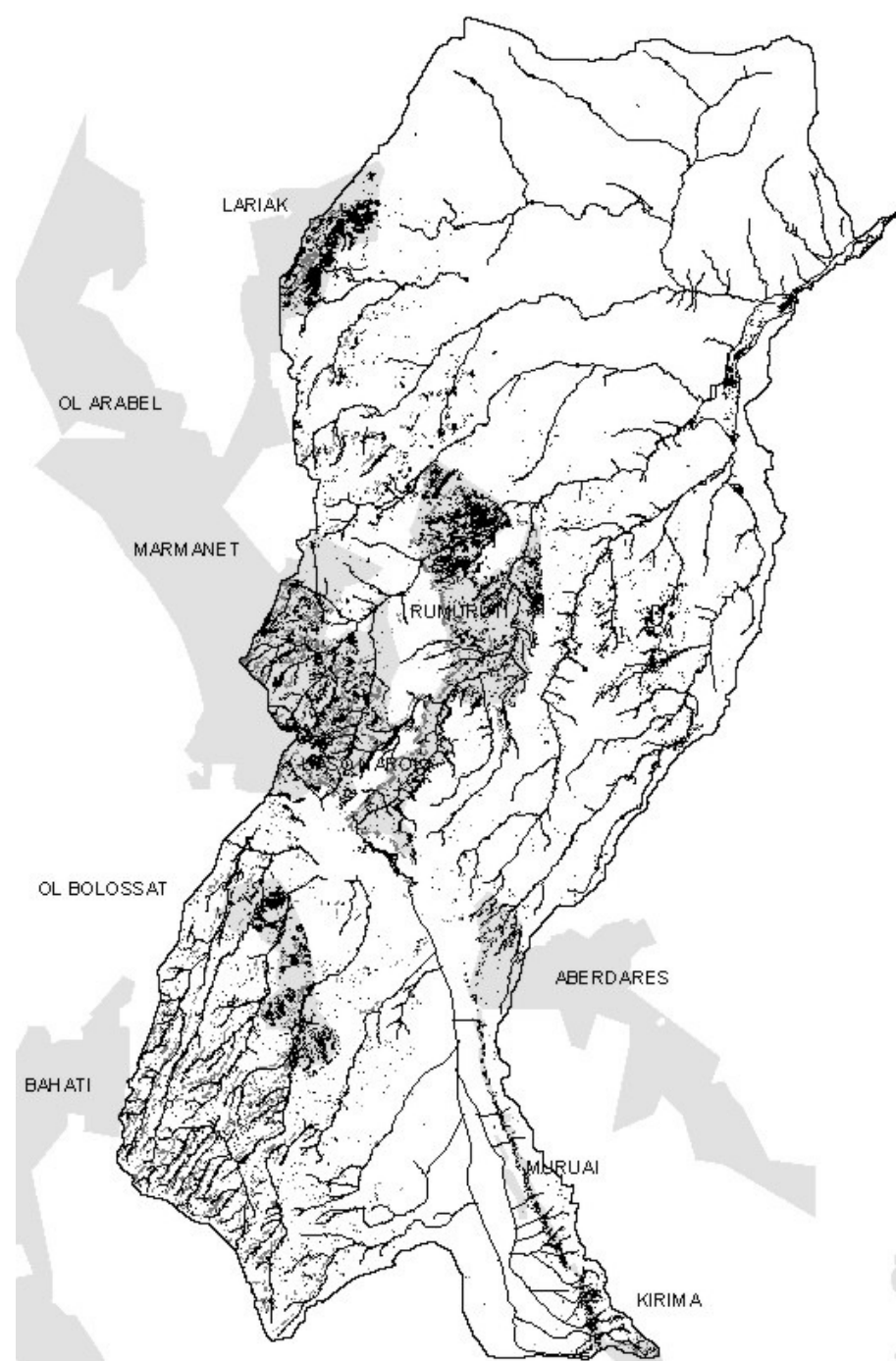
Land Cover in 1995

Grassland	11 % =	202.4 km ²
Woody grassland	34 % =	625.6 km ²
Forest	08 % =	147.2 km ²
Plantation forest	02 % =	36.8 km ²
Cropland	44 % =	809.6 km ²
Surface Water	01 % =	18.4 km ²

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations			
Laikipia	Ngarua	Muhotetu	Karaba Muhotetu			
		Sipili	Dimcom Doiyno Loip			
		Nyahururu	Igwamiti	Losogwa		
			Maina	Maina		
	Mutitu		Ngoru			
	Nyahururu		Manguo Ndunyu			
	Rumuruti	Marmanet		Melwa Oljabet Siron		
			Maundu Ni Meri	Maundu Ni Meri		
			Muthengera	Gaiti Muthengera		
		Rumuruti	Ndurumo Rumuruti			
		Salaama		Lorien Muruku Pesi Salaama		
			Sosian	Sosian		
			Nyandarua	Ndaragwa	Kanyagia	Muruai
					Kiriiti	Mairo Inya Shauri
		Leshau			Karangoini Mbuyu	
		Mathingira			Leshau Ndivai	
	Shamata				Kirima Shamata Simbara	
		Ol Joro Orok			Gatanje	Gatanje Ngawo Silibewti
Gatimu	Gatimu Gikingi Kanguo					
Ol Joro Orok				Lesirko Nyairoko Oraimutia		
	Weru				Gatumbiro Kirimangai Weru	
				Ol Kalou	Rurii	Matura Passenga Rurii

Loss of forest between 1995 and 2000



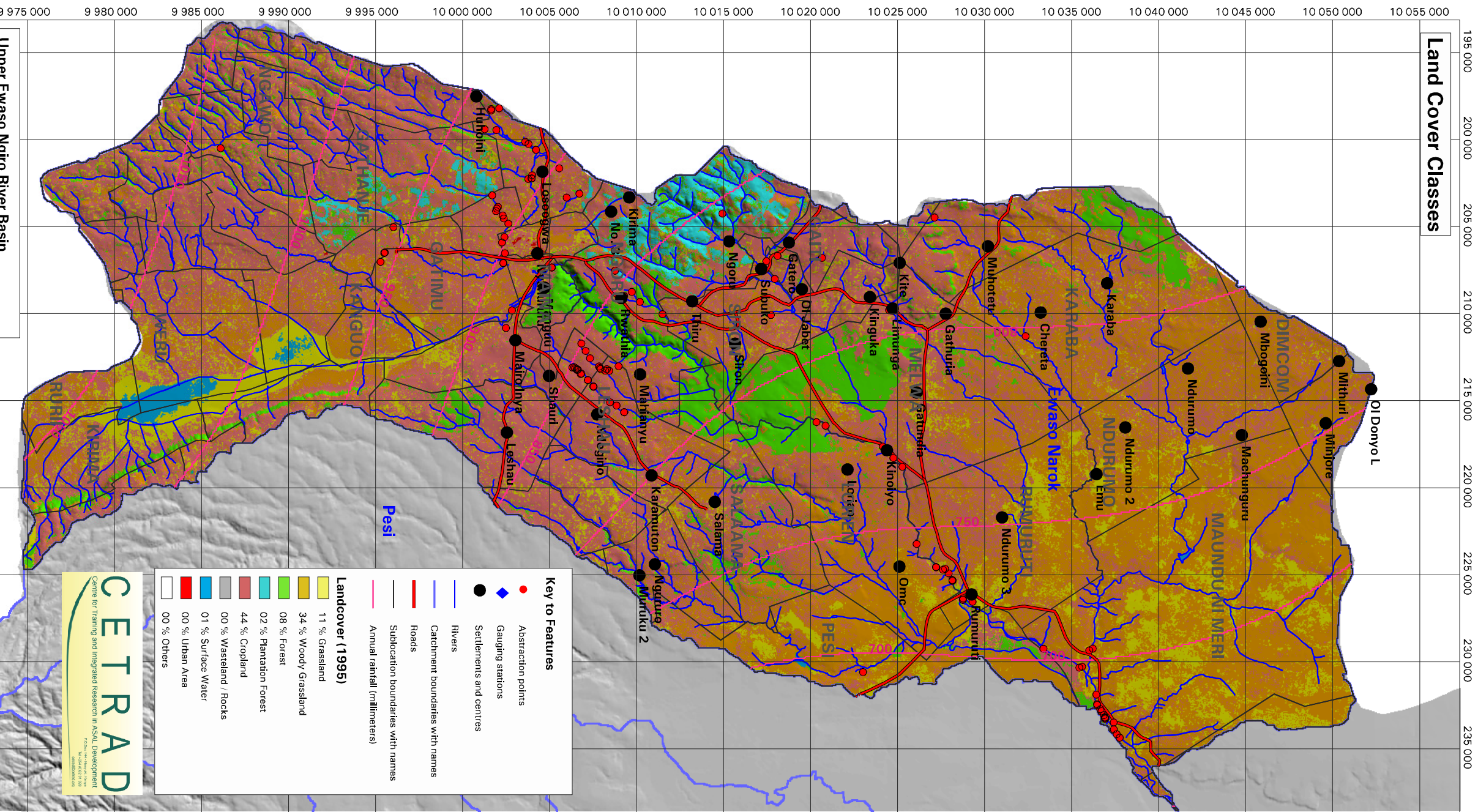
The black areas in the figure above (109 km²) show the areas of Ewaso Narok catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2000. The dark grey areas (51 km²) were classified as forests in 2000 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2000 is 58 km² (average annual forest loss = 11.6 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2011.**

The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2000 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Ewaso Narok Water User Association
Contact	The chairman is the manager of Sosian Ranch.
In existence since	2002
Registered as	Association since 2003.
Trigger of formation	Water politics, crisis on water use in the area, foreseeable crisis in future if swamp dries.
Objectives	Initially: To conserve the ecosystem, to educate people on correct water use, to improve the living standards of the people, to maintain the catchment area, to make water available to all people. Presently (additionally to the above): Water use plan, maintain ecosystem, protect swamp from drying due to farming activities, reforestation, better water utilization, preventing pollution.
Availability of sanctioning system	No paid-up members yet.
Role of horticulture farms	Only one horticultural farm in the area, not yet consulted.
Sources of conflicts	People are not following the water laws, political interference in water related issues.
Problems forwarded to the WUA	None so far
Unexpressed conflicts	None so far
Availability of conflict guidelines	None so far
Concrete way of solving conflicts	No cases so far
Cases of conflicts dealt with	None so far
Other activities the WUA is engaging in	None
Achievements	None so far
Hindrances	None so far
Advices to others	None so far

Land Cover Classes



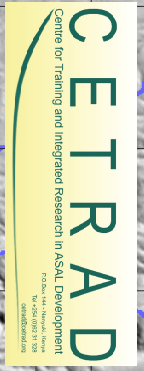
Key to Features

- Abstraction points
- ◆ Gauging stations
- Settlements and centres
- Rivers
- Catchment boundaries with names
- Roads
- Sublocation boundaries with names
- Annual rainfall (millimeters)

Landcover (1995)

- 11 % Grassland
- 34 % Woody Grassland
- 08 % Forest
- 02 % Plantation Forest
- 44 % Wasteland / Flocks
- 01 % Surface Water
- 00 % Urban Area
- 00 % Others

Pesi

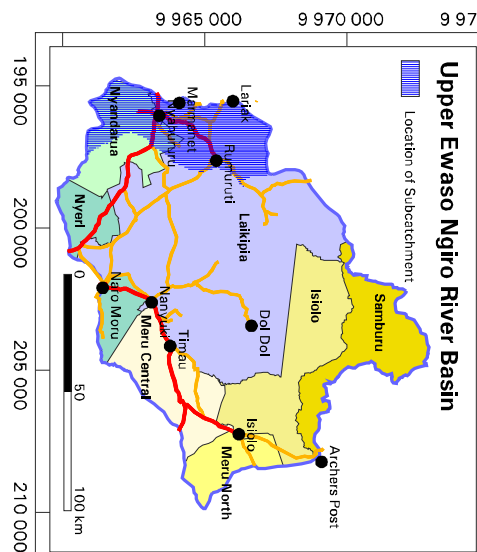


Ewaso Narok Subcatchment

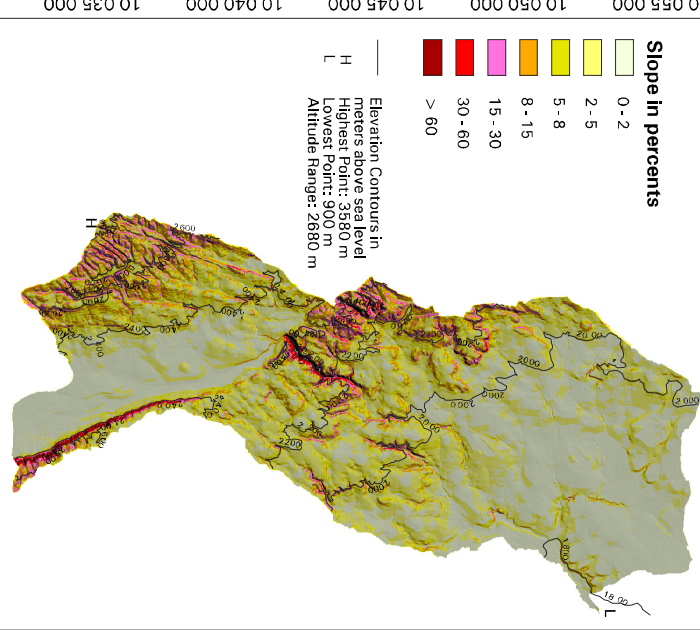
UTM Grid: 5,000 m
 Projection: Universal Transverse Mercator
 UTM Zone: UTMZ 37
 Datum: Arc 1980
 Reference Ellipsoid: Clarke 1880
 Scale: 1 : 140,000
 X-sprite: 500,000
 Y-sprite: 10,000,000

Scale: 1 : 250,000

0 5 10 Km

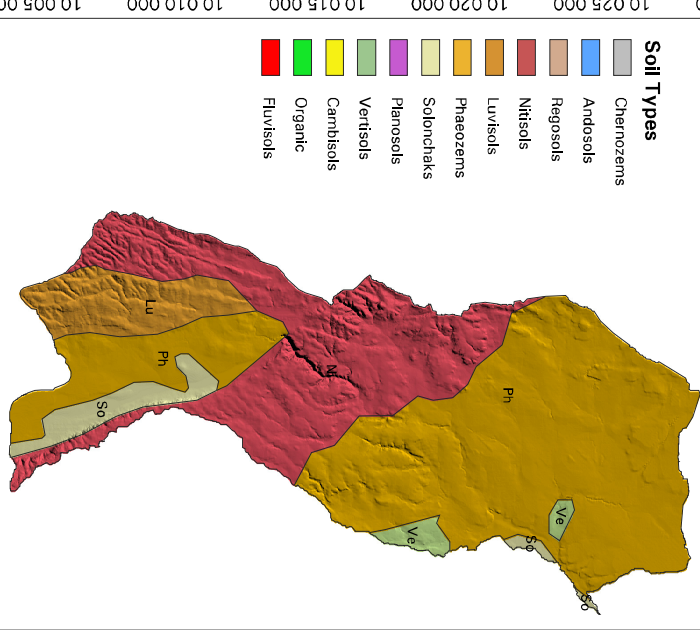


Topography

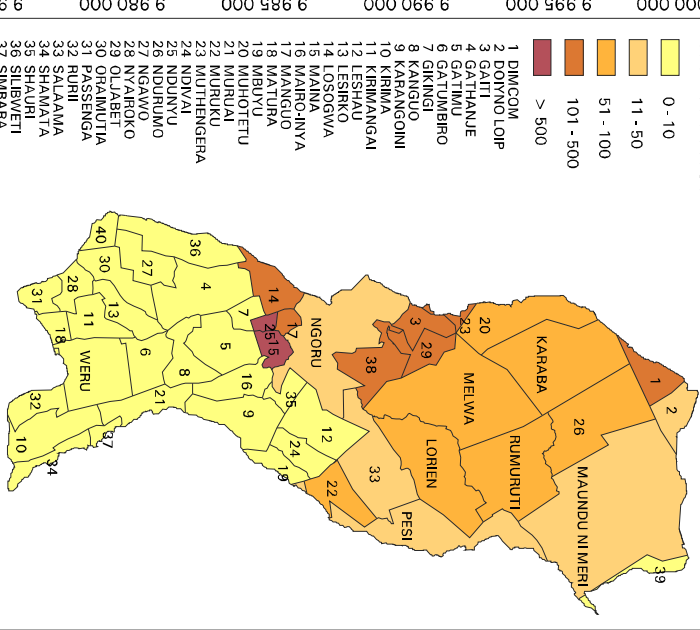


Data Source: Derived from Digital Terrain Model

Soil Types



Population Density



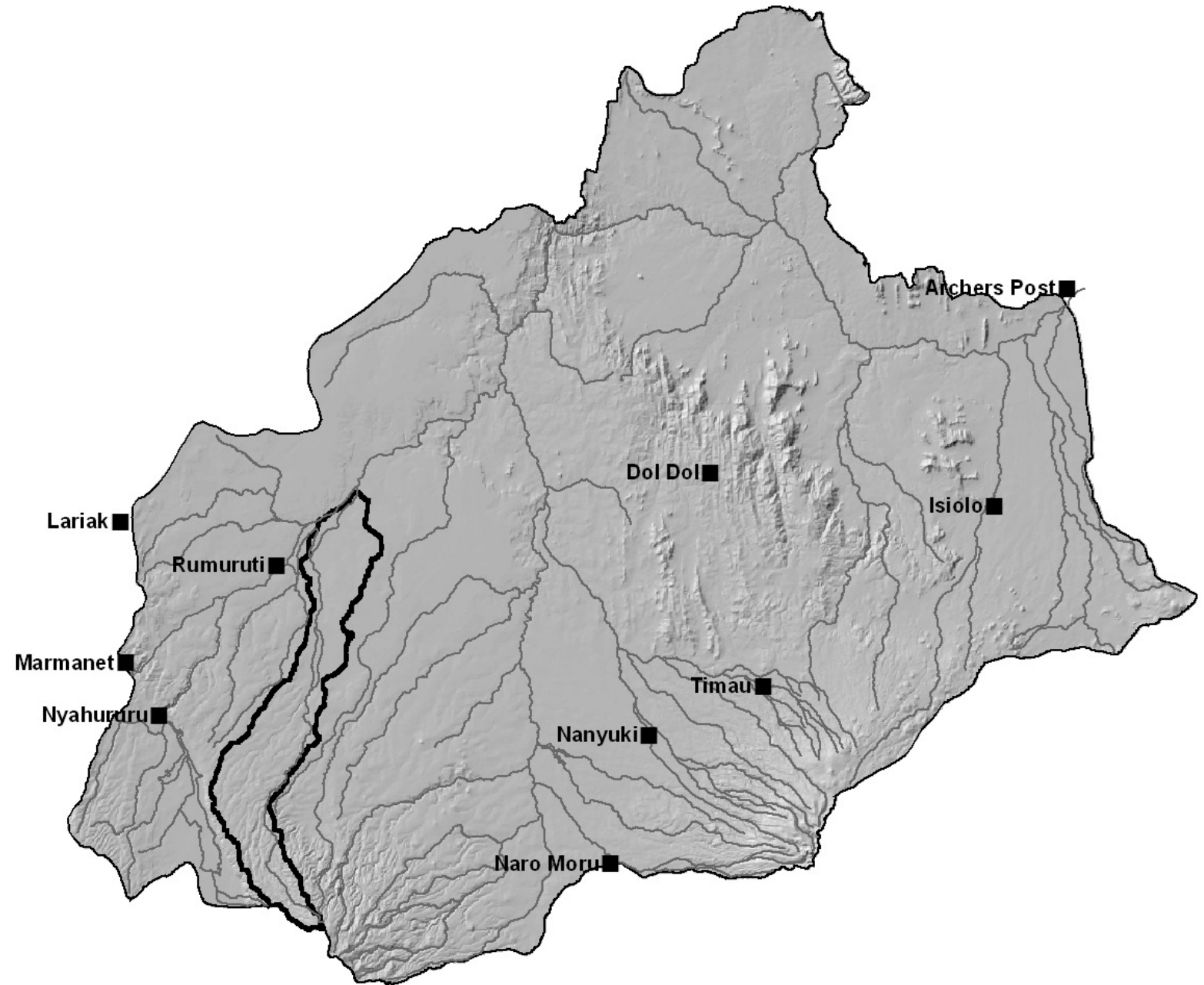
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CETRAD is based in Nanyuki, Laikipia District, Kenya. It is concerned with designing strategies for sustainable development, promoting land use planning for sustainable livelihood and optimal resource use, fostering sustainable resource use and strengthening of improved productivity and developing non-farm economy, infrastructure and services.

Linear features on this map are all part of CETRAD's comprehensive spatial database, which covers the Upper Ewaso Ng'iro Basin, Laikipia, Mwingi and Makueni Districts; Nakuru Municipality, Kenya national data sets as well as other areas. CETRAD, the Digital Terrain Model, the derived hillshade and slope map were prepared by CETRAD. All hydrologic rainfall and land cover data from NRM3. Rainfall interpolation from yearly averages in selected stations between 1991 and 2000 using Spline algorithm.

(*) Arid and Semi Arid Lands.



Pesi Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	589 km ²
Perimeter	244 km
Area to perimeter ratio	2.41
Highest point	3670 m
Lowest point	1780 m
Average altitude	2190 m
Altitude range (highest point – lowest point)	1890 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	471,200,000 m ³
Average annual rainfall in catchment area	800 mm
Location with highest annual rainfall	1020 mm
Location with lowest annual rainfall	610 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total approx. length of main river	97 km
Total approx. length of all rivers in catchment	596 km
Number of gauging stations	2
Number of recorded abstraction points	233
Water User Association	No

Socio – economy

Population	---
Urban centres	Mathira, Muruku, Ndaragwa, Pesi, Thome

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Laikipia	Rumuruti	Maundu Ni Meri	Maundu Ni Meri
		Mutara	Kiamariga
			Mutara
			Thome
		Salaama	Muruku
Sosian	Pesi		
Ndaragwa	Ndaragwa	Kahutha	Kianjogu
			Uruku
		Kanyagia	Kanyagia
			Kihara
			Muruai
		Leshau	Karangoini
			Mbuyu
		Shamata	Karandi
			Shamata
			Simbara
National Park	National Park	National Park	National Park

Land Cover in 1995

Grassland	13 %	=	76.5 km ²
Woody grassland	36 %	=	212 km ²
Forest	14 %	=	82.5 km ²
Cropland	37 %	=	218 km ²

Loss of forest between 1995 and 2000 (*)

The black areas in the figure to the right (39.8 km²) show the areas of Mutara catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2000. The dark grey areas (20.6 km²) were classified as forests in 2000 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2000 is 19.2 km² (average annual forest loss = 3.8 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2016.**

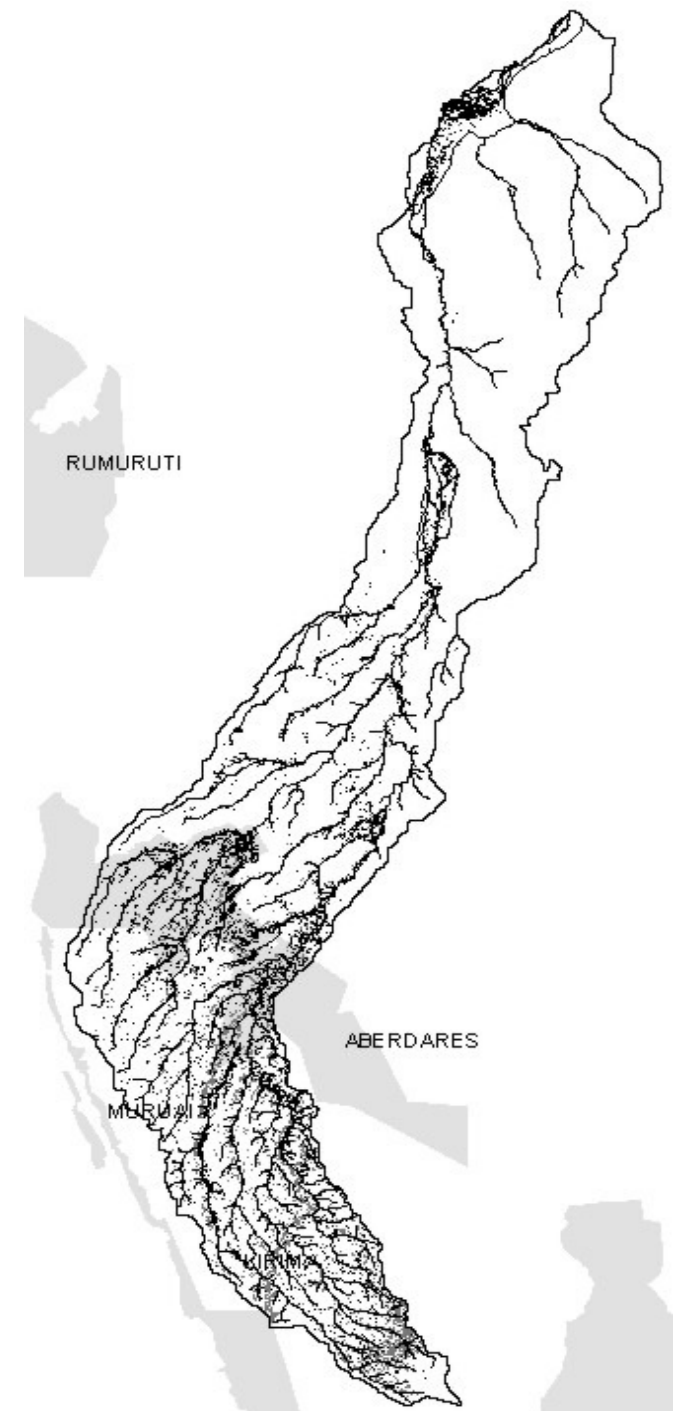
The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

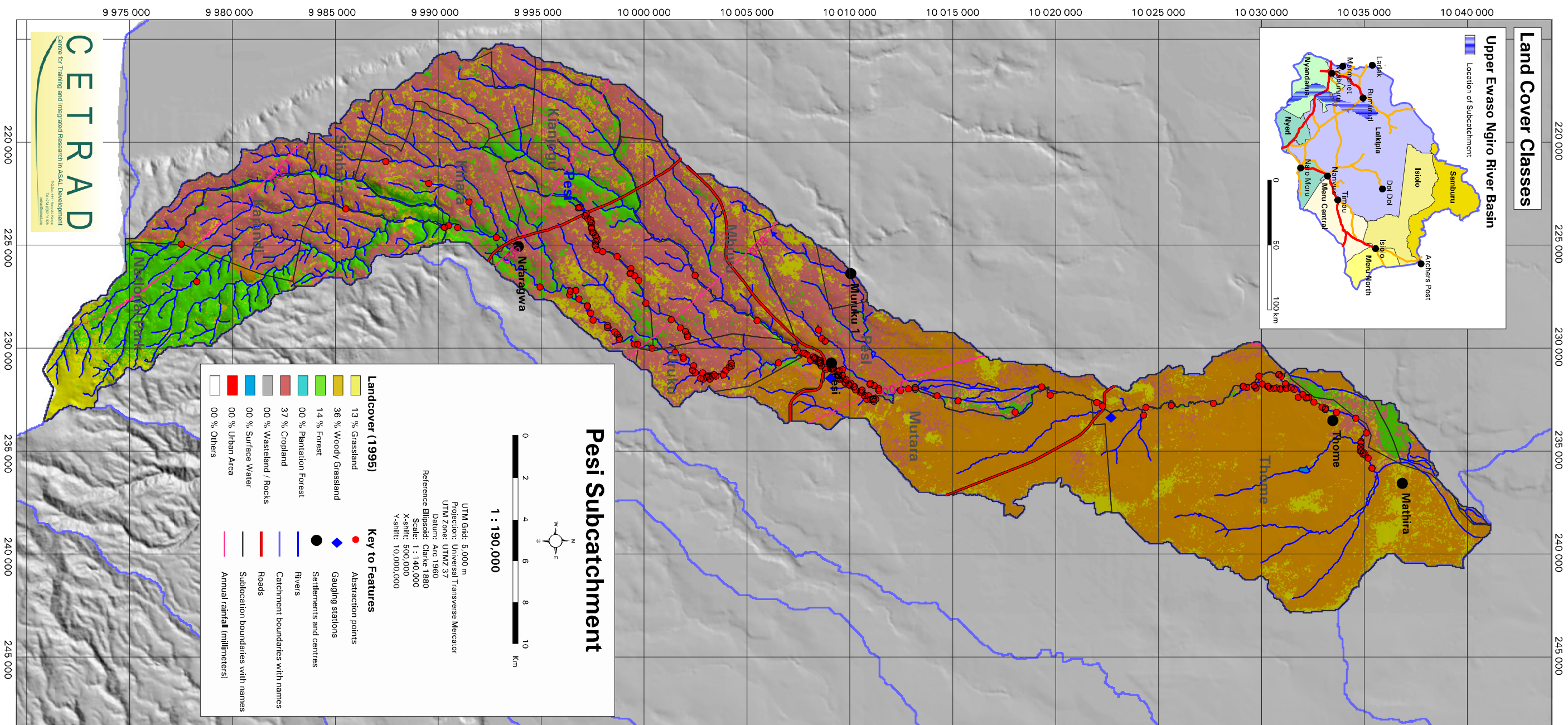
Forest classification for the year 1995 carried out by NRM3 (P. Niederer)

Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)

Both classifications on the basis of Landsat ETM satellite images

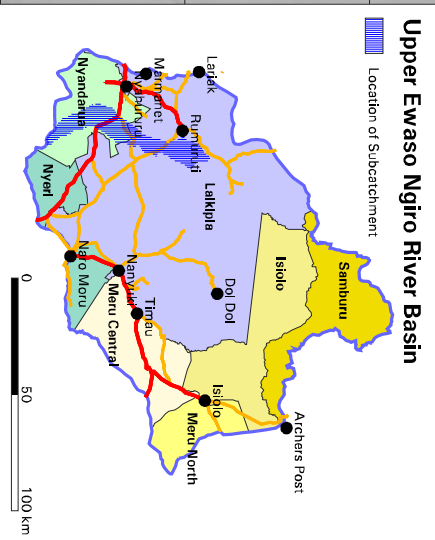
(*) This catchment is located at the boundary between two satellite images; the one to the East being of the year 2002 and the one to the West being of the year 2000. As approximately 90% of the catchment is located on the Western image, the year 2000 was taken as a temporal benchmark.





Land Cover Classes

Upper Ewaso Njiro River Basin
 Location of Subcatchment



Pesi Subcatchment

UTM Grid: 5,000 m
 Projection: Universal Transverse Mercator
 UTM Zone: UTMZ 37
 Datum: Arc 1960
 Reference Ellipsoid: Clarke 1880
 Scale: 1 : 140,000
 X-shift: 500,000
 Y-shift: 10,000,000

1 : 190,000

0 2 4 8 8 10 Km

Landcover (1995)

- 13 % Grassland
- 36 % Woody Grassland
- 14 % Forest
- 00 % Plantation Forest
- 37 % Cropland
- 00 % Wasteland / Rocks
- 00 % Surface Water
- 00 % Urban Area
- 00 % Others

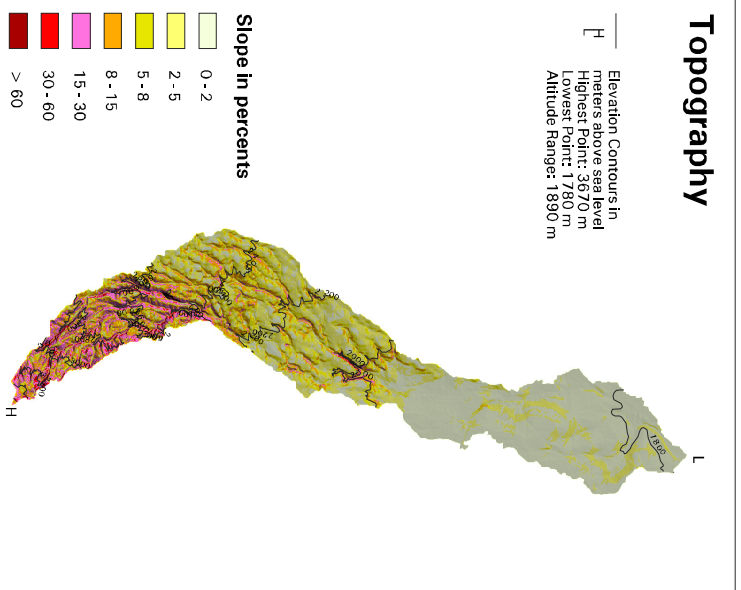
Key to Features

- Abstraction points
- Gauging stations
- Settlements and centres
- Rivers
- Catchment boundaries with names
- Roads
- Sublocation boundaries with names
- Annual rainfall (millimeters)



Topography

Elevation Contours in
 Meters above sea level
 Highest Point: 2476 m
 Lowest Point: 1780 m
 Altitude Range: 1890 m



Data Source: Derived from Digital Terrain Model

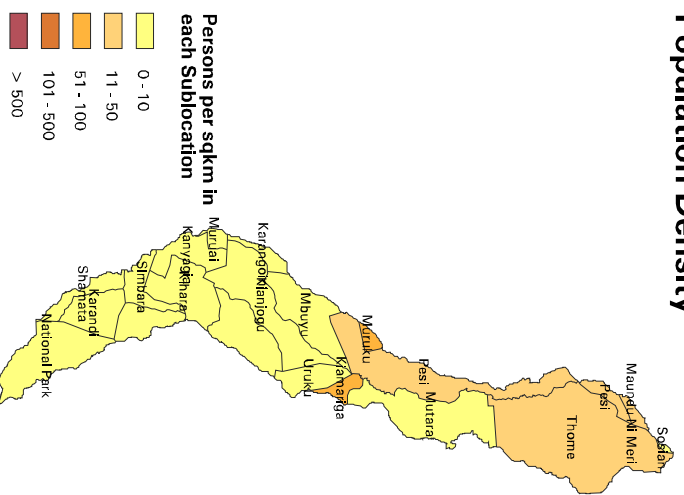
Soil Types

- Chernozemis
- Andosols
- Regosols
- Nitisols
- Luvissols
- Phaeozemis
- Solonchaks
- Planosols
- Vertisols
- Cambisols
- Organic
- Fluvisols

Data Source: National Soil Map of Kenya



Population Density



Data Source: National Census, 1999

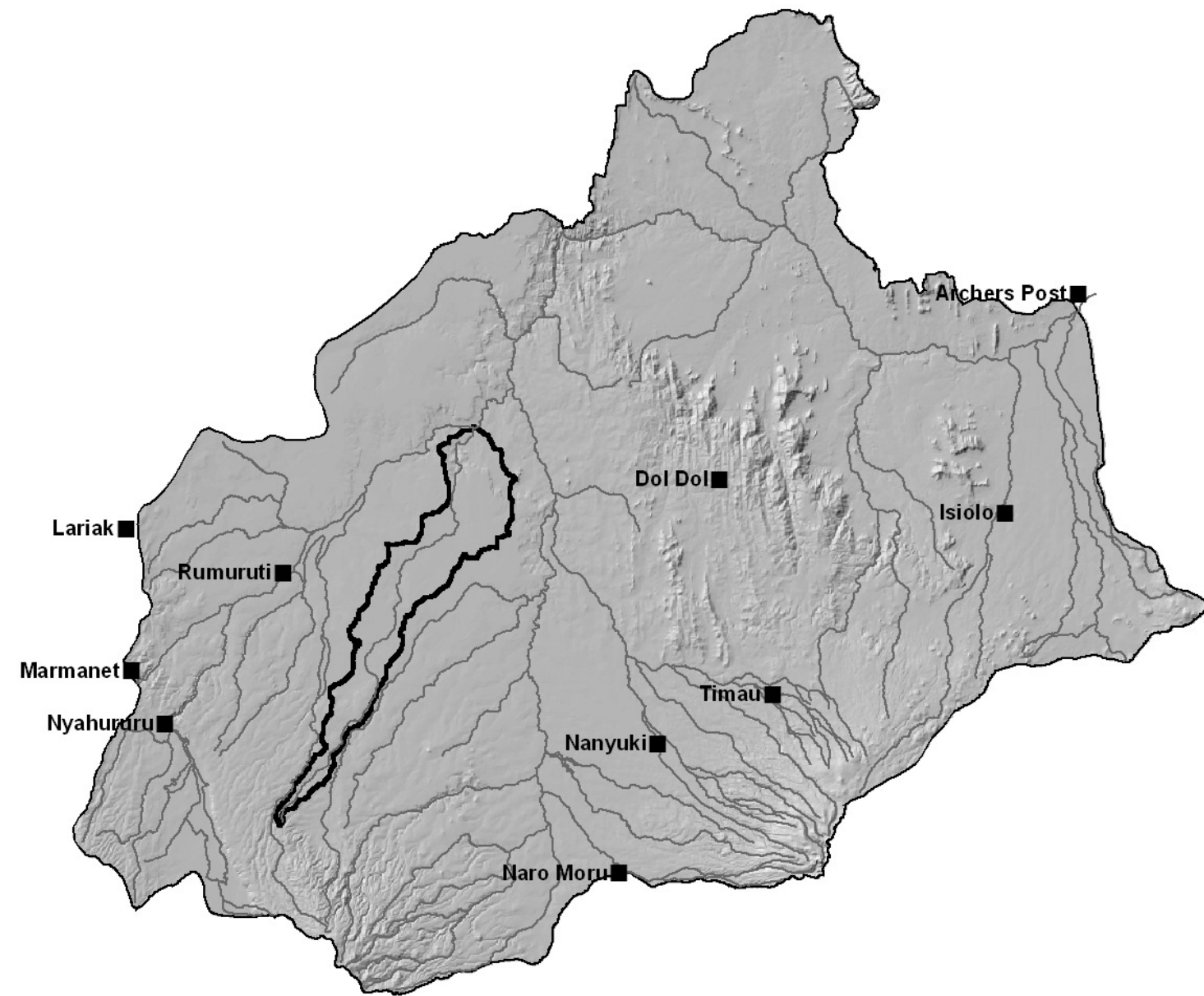
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(*) Arid and Semi Arid Lands.



Mutara Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	489 km ²
Perimeter	235 km
Area to perimeter ratio	2.08
Highest point	2500 m
Lowest point	1600 m
Average altitude	1850 m
Altitude range (highest point – lowest point)	900 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	293,400,000 m ³
Average annual rainfall in catchment area	600 mm
Location with highest annual rainfall	930 mm
Location with lowest annual rainfall	500 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total approx. length of main river	95 km
Total approx. length of all rivers in catchment	262 km
Number of gauging stations	1
Number of recorded abstraction points	76
Water User Association	No

Socio – economy

Population	---
Urban centres	Kiमारiga, Mutara

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Segera	Impala Segera
	Lamuria	Ngobit	Wiyumiririe Kiमारiga
	Rumuruti	Mutara	Mutara Thome
	Nyandarua	Ndaragwa	Kahutha Kanyagia

Land Cover in 1995

Grassland	40 % =	195.6 km ²
Woody grassland	52 % =	254.3 km ²
Forest	02 % =	9.8 km ²
Cropland	06 % =	29.3 km ²

Loss of forest between 1995 and 2002 (*)

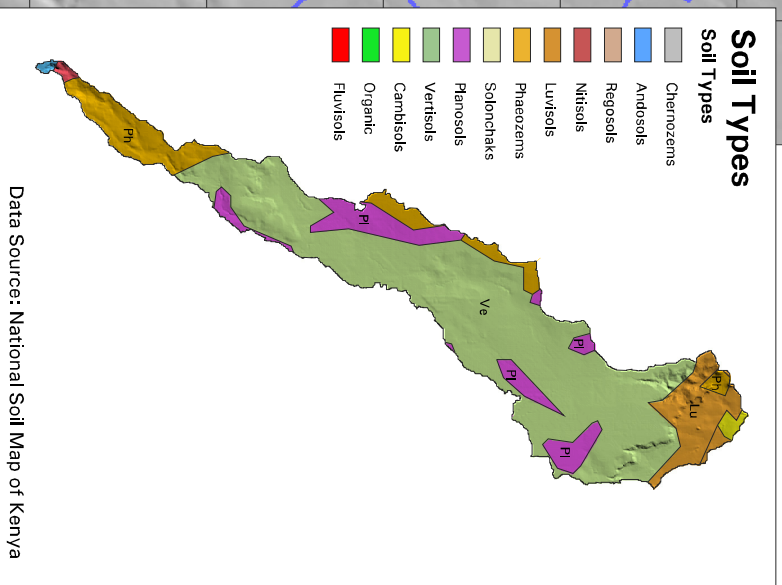
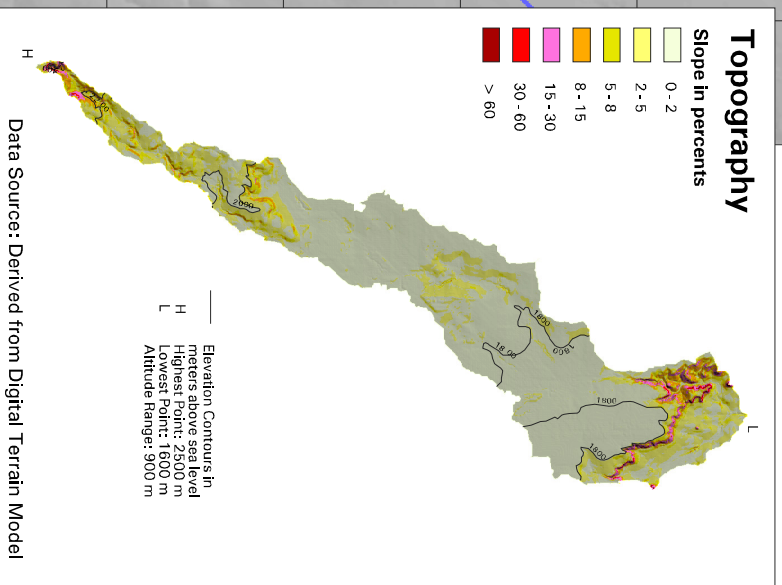
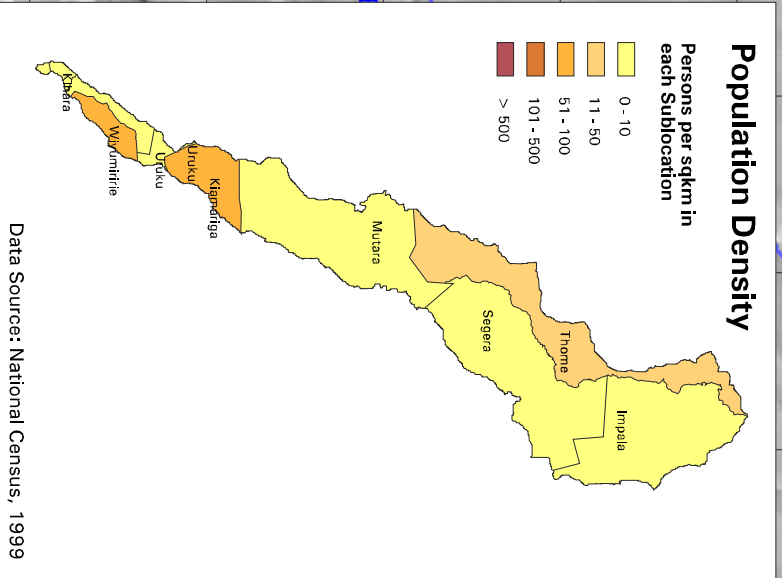
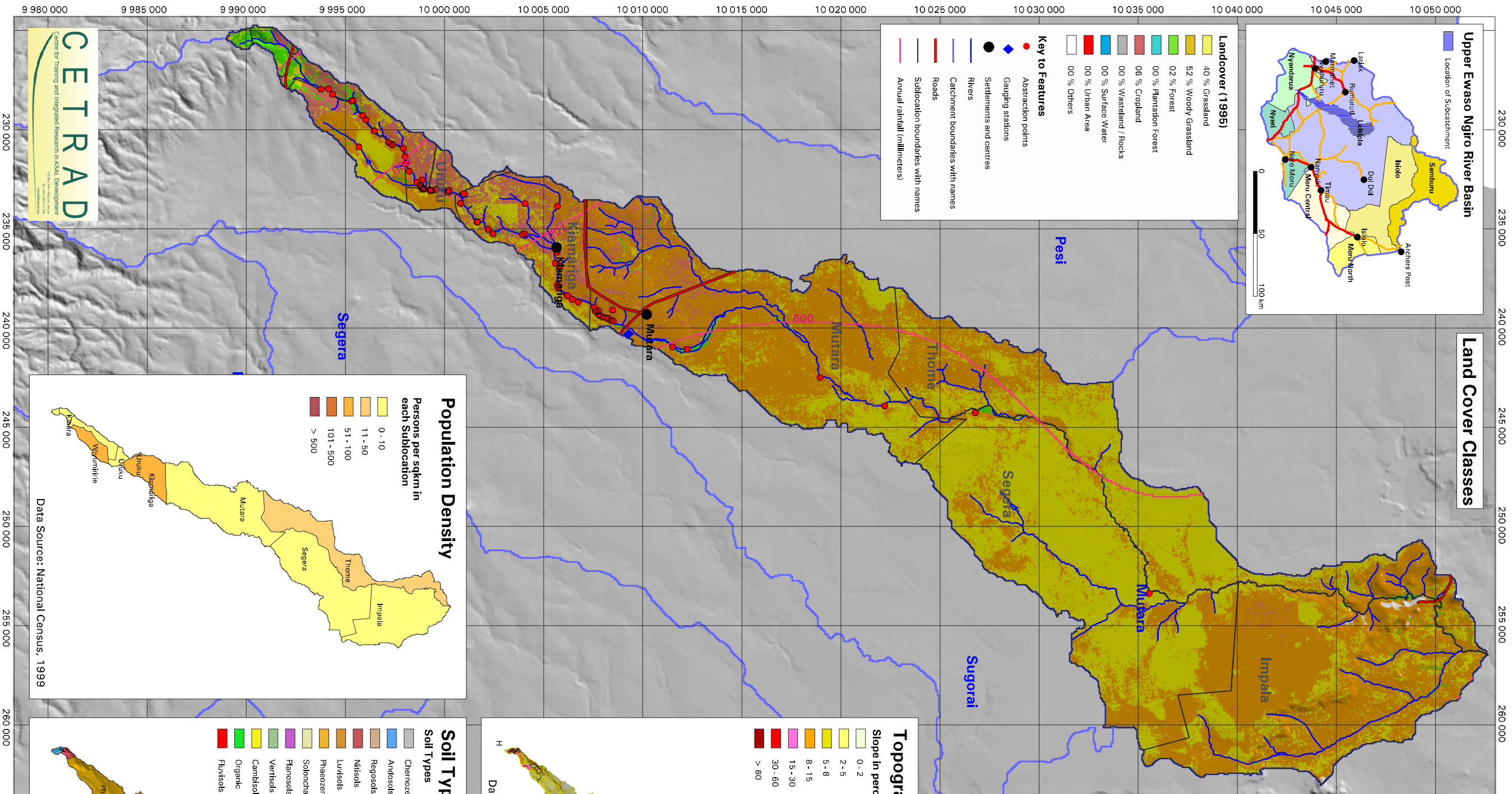
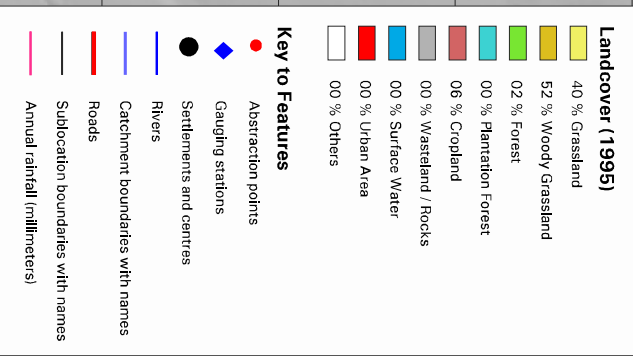
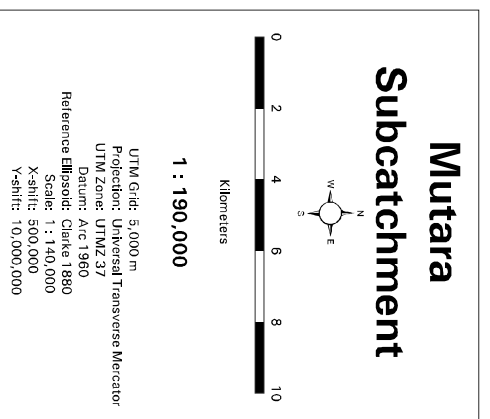
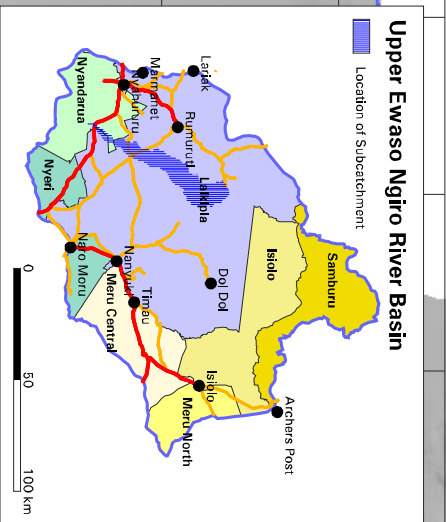
The black areas in the figure to the right (7.5 km²) show the areas of Mutara catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (1 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 6.5 km² (average annual forest loss = 0.9 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2005.**

The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
Both classifications on the basis of Landsat ETM satellite images

(*) This catchment is located at the boundary between two satellite images. The one to the East being of the year 2002 and the one to the West being of the year 2000. As approximately 80% of the catchment is located on the Eastern image, the year 2002 was taken as a temporal benchmark.





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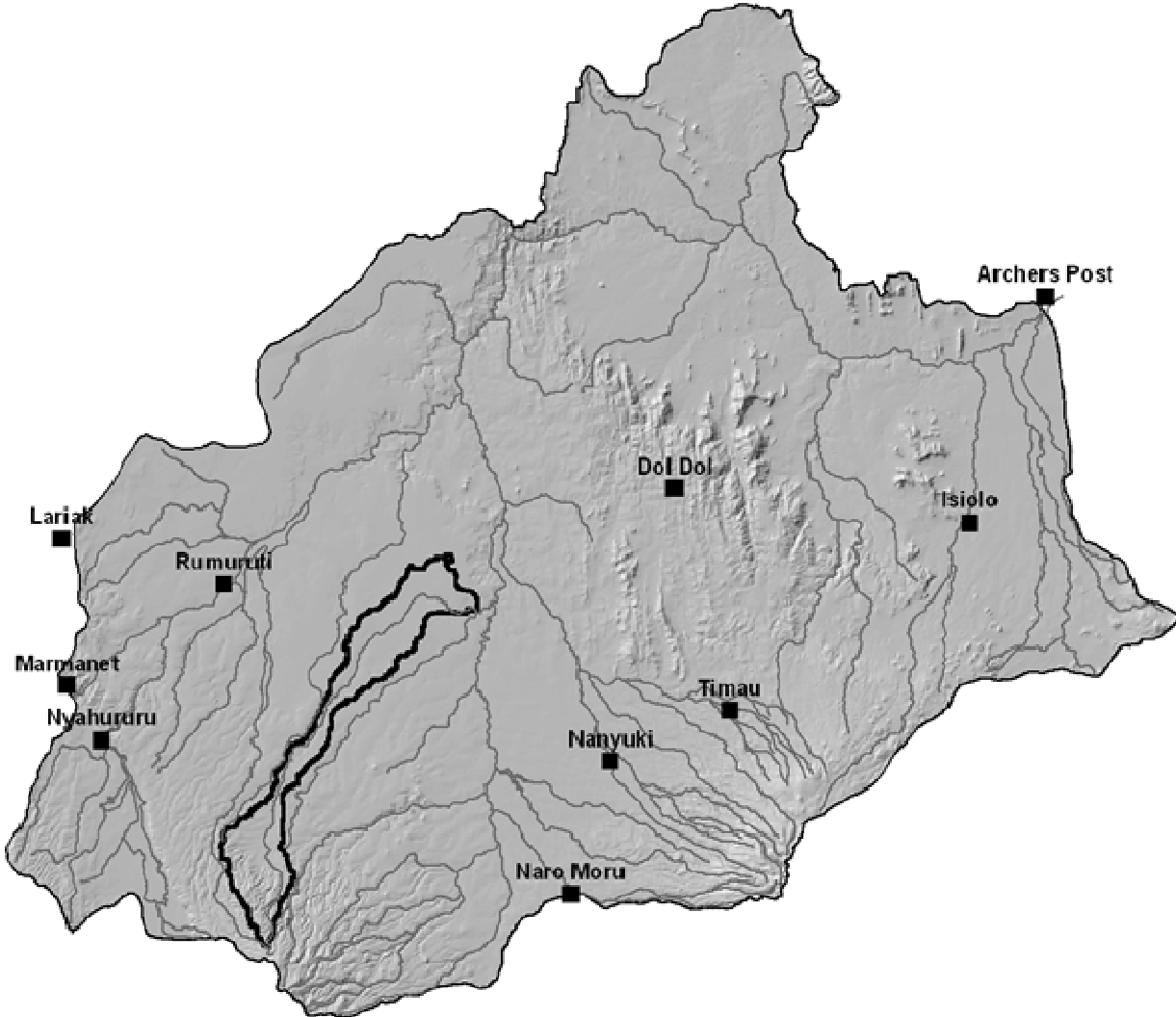
Linear features on this map are all part of CETRAD's comprehensive spatial database, which covers the Upper Ewaso Ngiro Basin, Lalkibia, Mwingi and Makueni Districts, Nakuru Municipality, Kenya national data sets as well as other areas. The Digital Terrain Model, the digital elevation and slope map were prepared by CETRAD. Annual rainfall data were derived from the Digital Terrain Model. Rainfall interpolated from yearly averages in selected stations between 1991 and 2000 using Spline algorithm.

(*) Arid and Semi Arid Lands.

CETRAD

Centre for Training and Integrated Research in ASAL Development

Kenya National Centre for Research and Innovation



Suguroi Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	399 km ²
Perimeter	229 km
Area to perimeter ratio	1.74
Highest point	3370 m
Lowest point	1700 m
Average altitude	2090 m
Altitude range (highest point – lowest point)	1670 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	279,300,000 m ³
Average annual rainfall in catchment area	700 mm
Location with highest annual rainfall	980 mm
Location with lowest annual rainfall	520 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total approx. length of main river	90 km
Total approx. length of all rivers in catchment	364 km
Number of gauging stations	0
Number of recorded abstraction points	45
Water User Association	No

Socio – economy

Population	---
Urban centres	Kiriogo, Laya, Mukurweini, Wiyumiririe

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Segera	Impala
			Segera
	Lamuria	Ngobit	Wiyumiririe
			Sirima
	Rumuruti	Mutara	Kiamariga
		Mutara	
Nyandarua	Ndaragwa	Kahutha	Kariki
			Kiriogo
			Uruku
	National Park	Kanyagia	Kihara
			National Park

Land Cover in 1995

Grassland	43 % = 171.5 km ²
Woody grassland	31 % = 123.7 km ²
Forest	18 % = 71.8 km ²
Cropland	08 % = 31.9 km ²

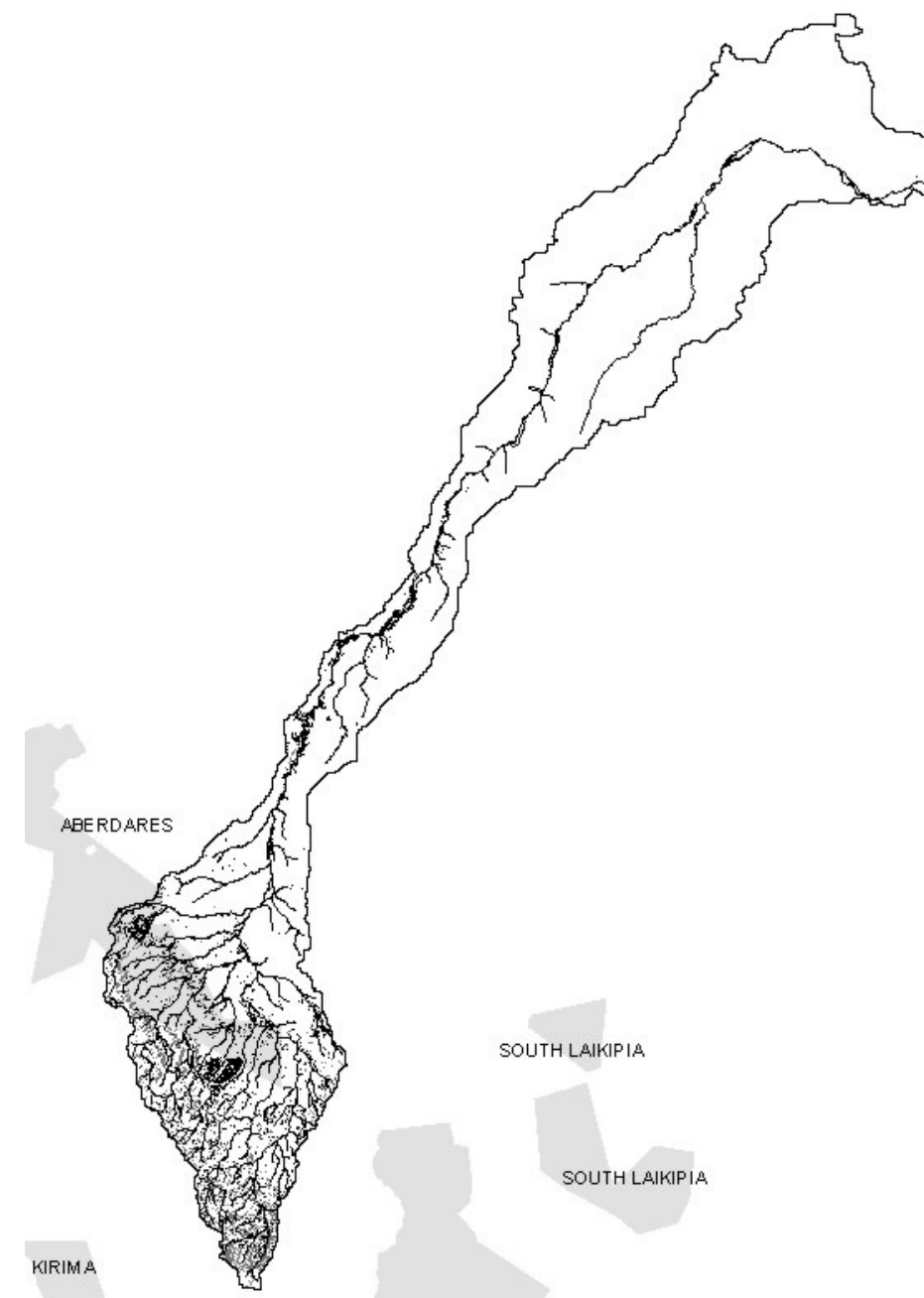
Loss of forest between 1995 and 2002 (*)

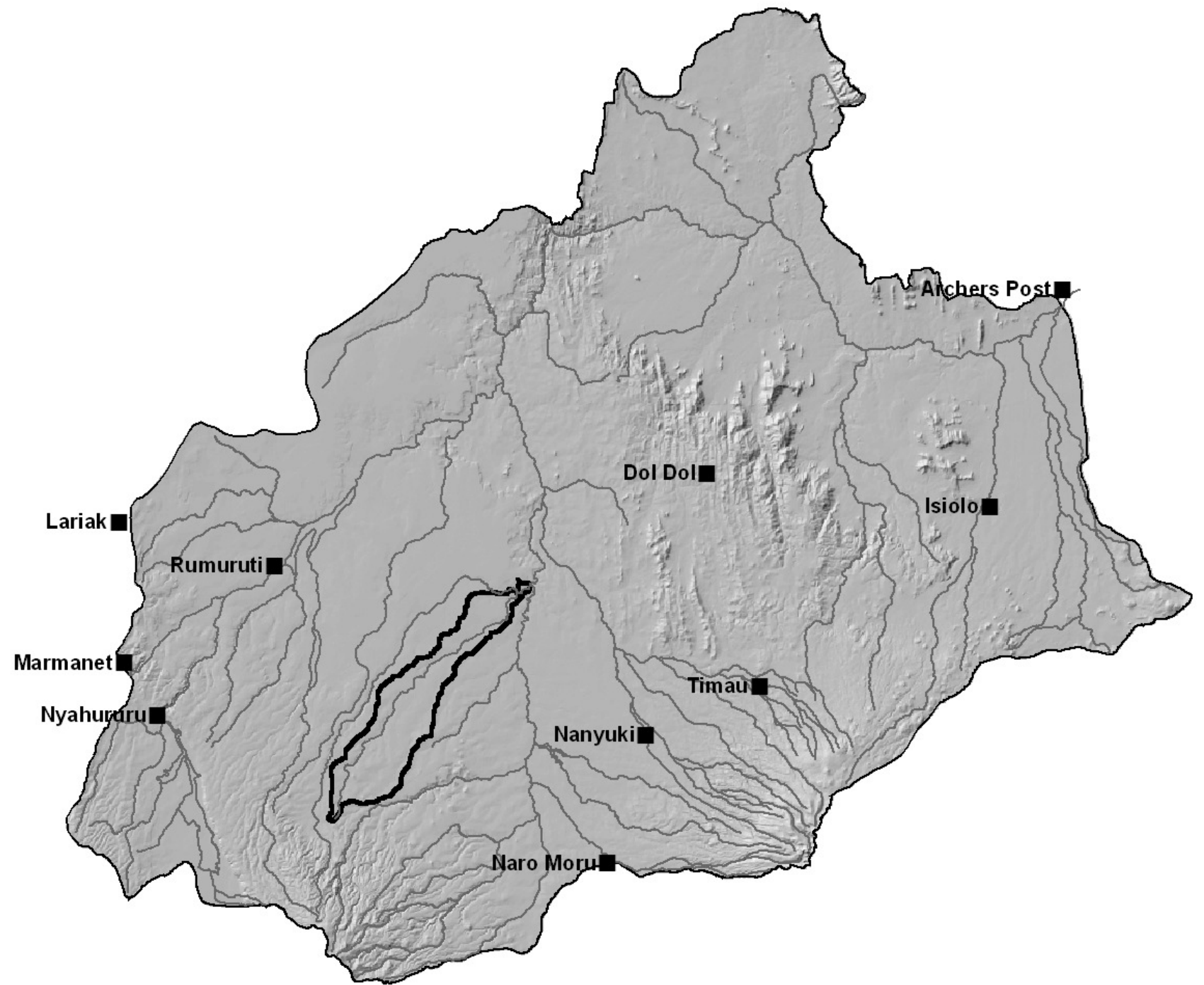
The black areas in the figure to the right (16.5 km²) show the areas of Suguroi catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (11.3 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 5.2 km² (average annual forest loss = 0.7 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2100.**

The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images

(*) This catchment is located at the boundary between two satellite images; the one to the East being of the year 2002 and the one to the West being of the year 2000. As approximately 80% of the catchment is located on the Eastern image, the year 2000 was taken as a temporal benchmark.





Segera Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	313 km ²
Perimeter	148 km
Area to perimeter ratio	2.11
Highest point	2280 m
Lowest point	1680 m
Average altitude	1940 m
Altitude range (highest point – lowest point)	600 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	187,800,000 m ³
Average annual rainfall in catchment area	600 mm
Location with highest annual rainfall	850 mm
Location with lowest annual rainfall	490 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river	68 km
Total approx. length of all rivers in catchment	220 km
Number of gauging stations	1
Number of recorded abstraction points	3
Water User Association	No

Socio – economy

Population	---
Urban centres	Makutano, Segera, Sugorai 2, Sugorai 3, Wamura

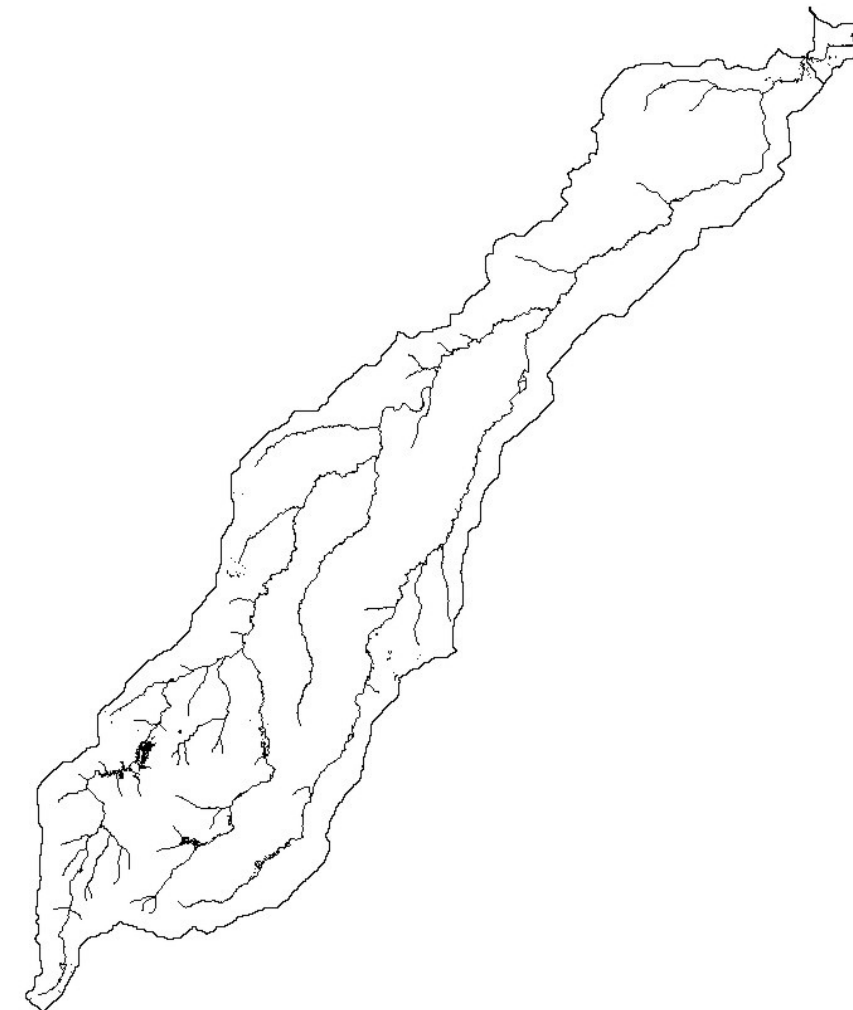
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Segera	Impala Segera
		Lamuria	Lamuria
	Lamuria	Ngobit	Kariguini Wiyumiririe
		Sirima	Withari
		Nyandarua	Ndaragwa

Land Cover in 1995

Grassland	47 % = 147.1 km ²
Woody grassland	51 % = 160 km ²
Forest	0.6 % = 1.8 km ²
Cropland	01 % = 3 km ²

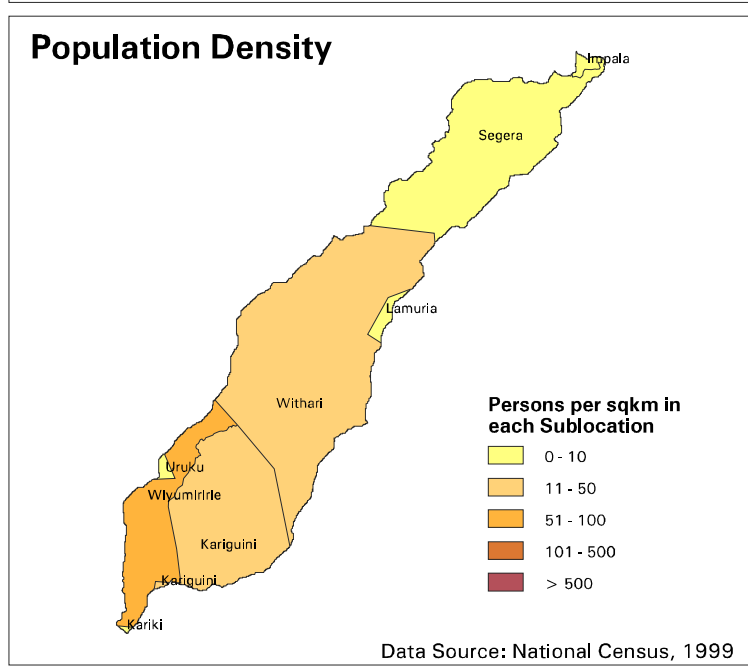
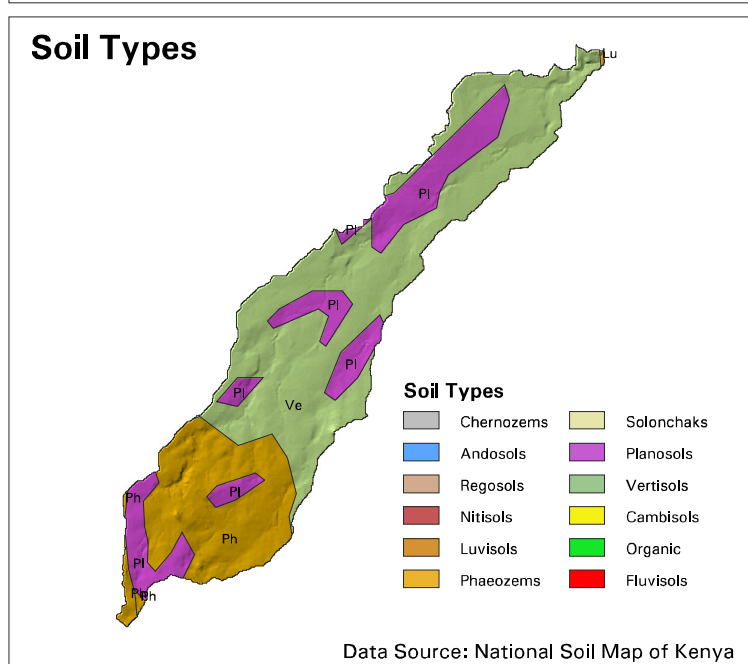
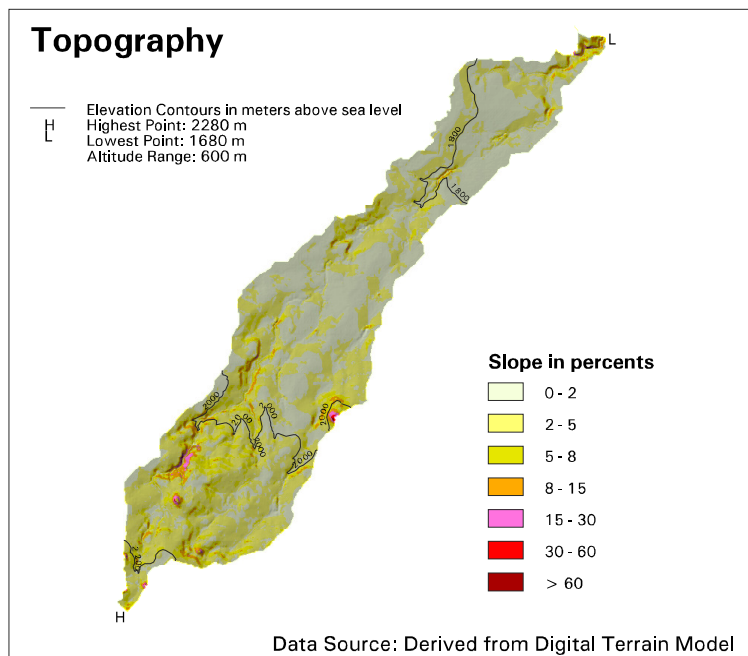
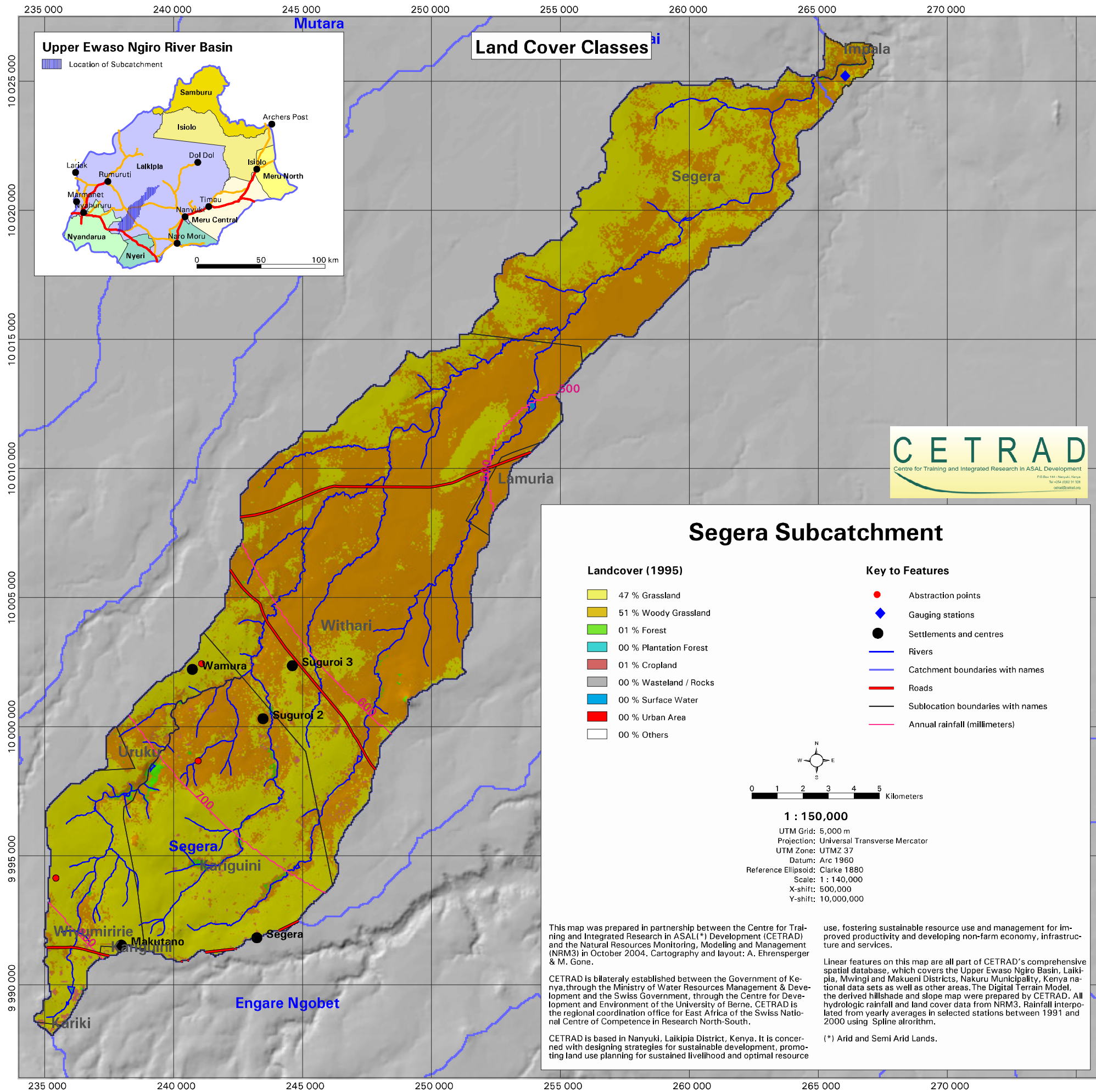
Loss of forest between 1995 and 2002

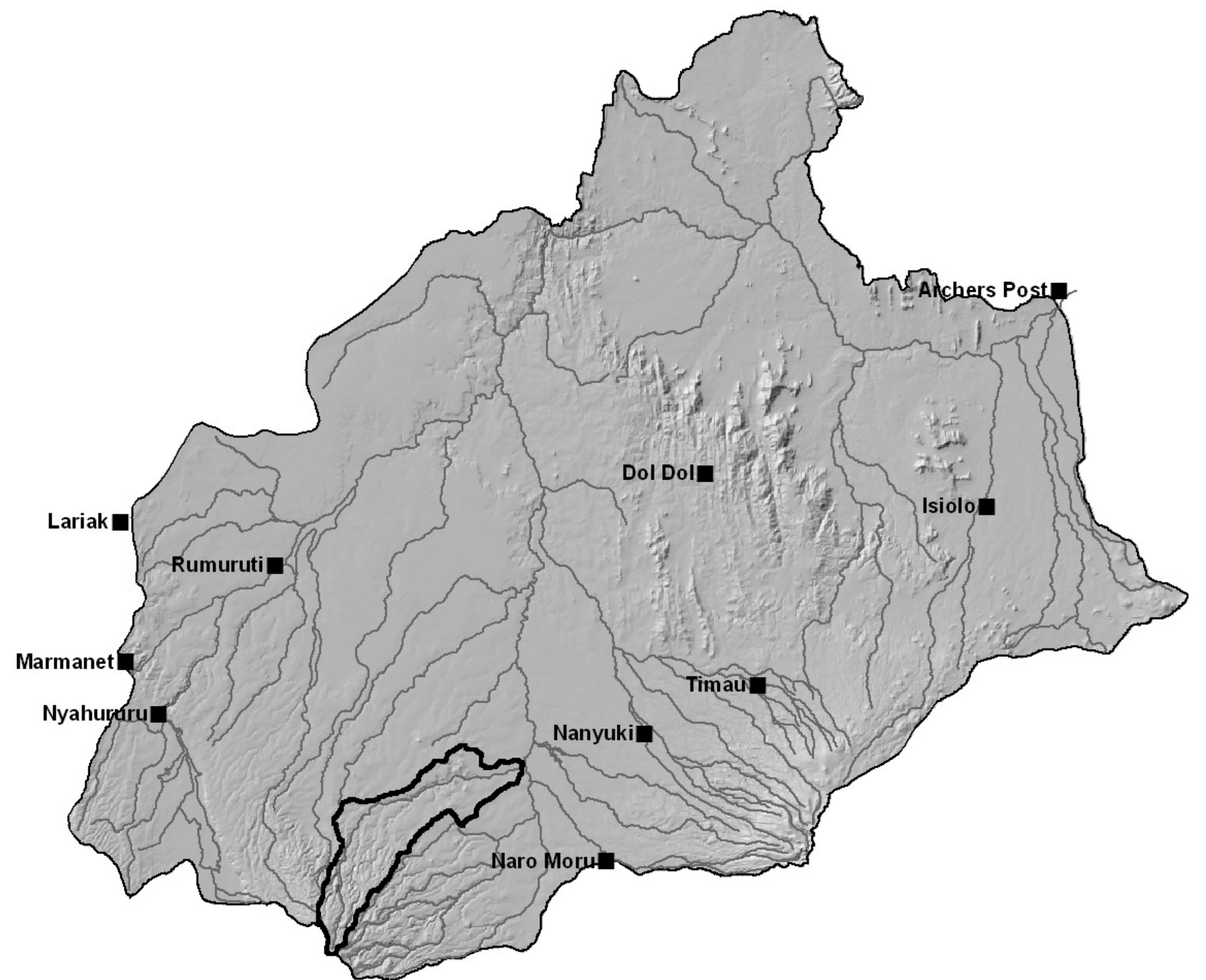


The black areas in the figure to the right (1.8 km²) show the areas of Segera catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (0 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 1.8 km² (average annual forest loss = 0.25 km²). **By 2002 the forest cover in this catchment had almost disappeared (0.07 km² remaining).**

The continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images





Engare Ngobit Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	359 km ²
Perimeter	155 km
Area to perimeter ratio	2.32
Highest point	3,970 m
Lowest point	1,780 m
Average altitude	2,300 m
Altitude range (highest point – lowest point)	2,190 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	278,616,120 m ³
Average annual rainfall in catchment area	780 mm
Location with highest annual rainfall	970 mm
Location with lowest annual rainfall	560 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Engare Ngobet River)	68 km
Total length of all rivers in catchment	478 km
Number of gauging stations	1
Number of recorded abstraction points	133
Water User Association	No

Socio – economy

Population	---
Urban centres	Gwakaniki, Mugunda, Nairutia, New Mutaro, Ngobit, Ruai, Rutunguru, Wihare

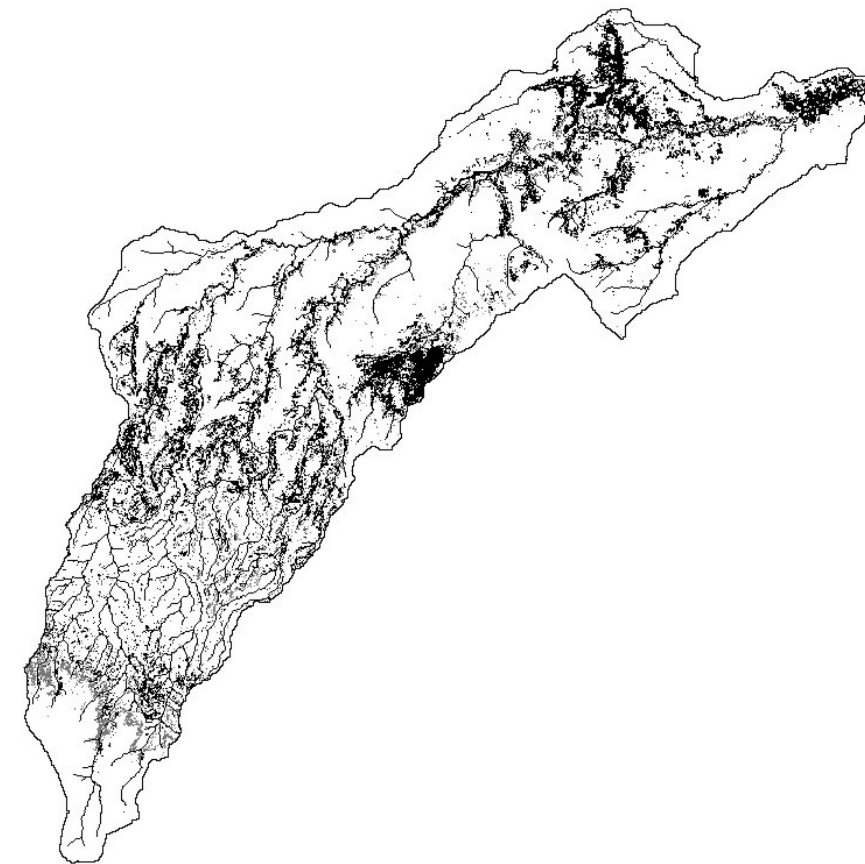
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Lamuria	Lamuria	Lamuria
		Ngobit	Kariugini
			Wiyumiririe
		Sirima	Muhonia
			Withari
Nyeri	Kieni West	Gatarakwa	Kamariki
		Mugunda	Kamiruri
			Karemeno
			Nairutia
Nyandarua	Aberdares Forest	Aberdares Forest	Aberdares Forest
	Ndaragwa	Kahutha	Kariki
	Aberdares National Park	Aberdares National Park	Aberdares National Park

Land Cover (1995)

Grassland	27 % = 97 km ²
Woody grassland	19 % = 69 km ²
Forest	33 % = 118 km ²
Cropland	21 % = 75 km ²

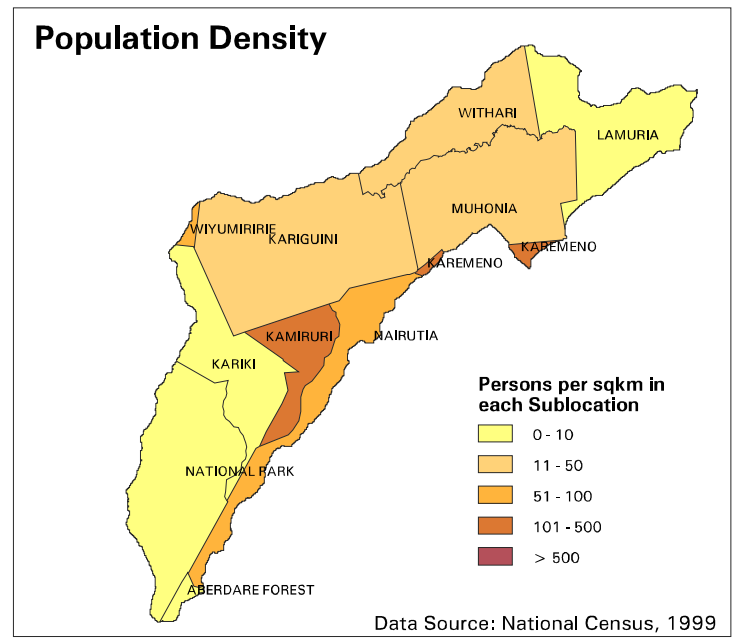
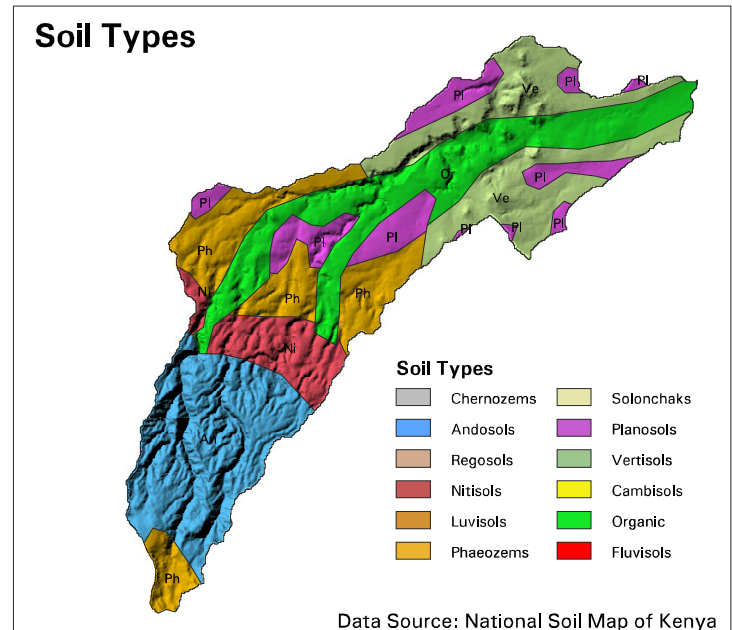
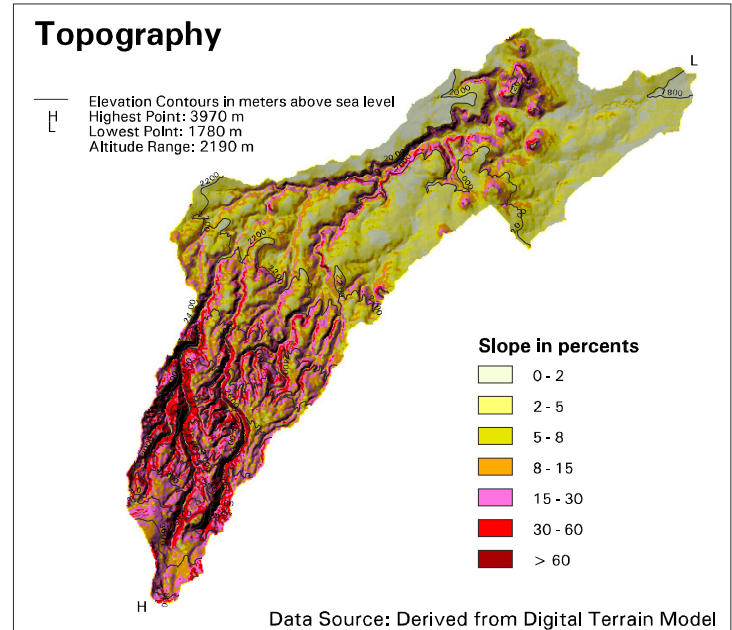
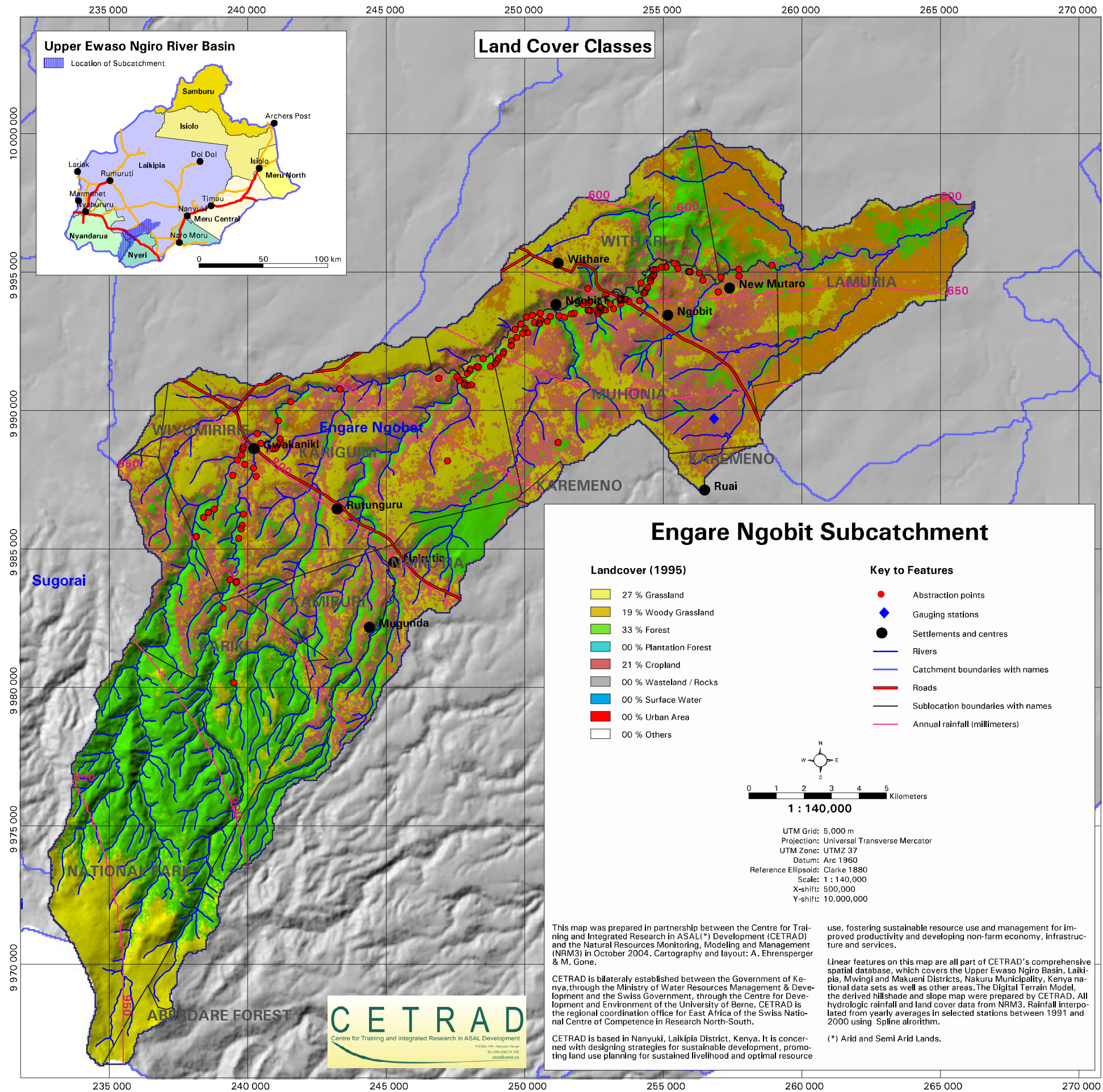
Loss of forest between 1995 and 2002



The black areas in the figure above (49.7 km²) show the areas of Engare Ngobit catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (11.2 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 38.5 km² (average annual forest loss = 5.5 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2017.**

The continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.



This map was prepared in partnership between the Centre for Training and Integrated Research in ASAL(*) Development (CETRAD) and the Natural Resources Monitoring, Modeling and Management (NRM3) in October 2004. Cartography and layout: A. Ehrensperger & M. Gone.

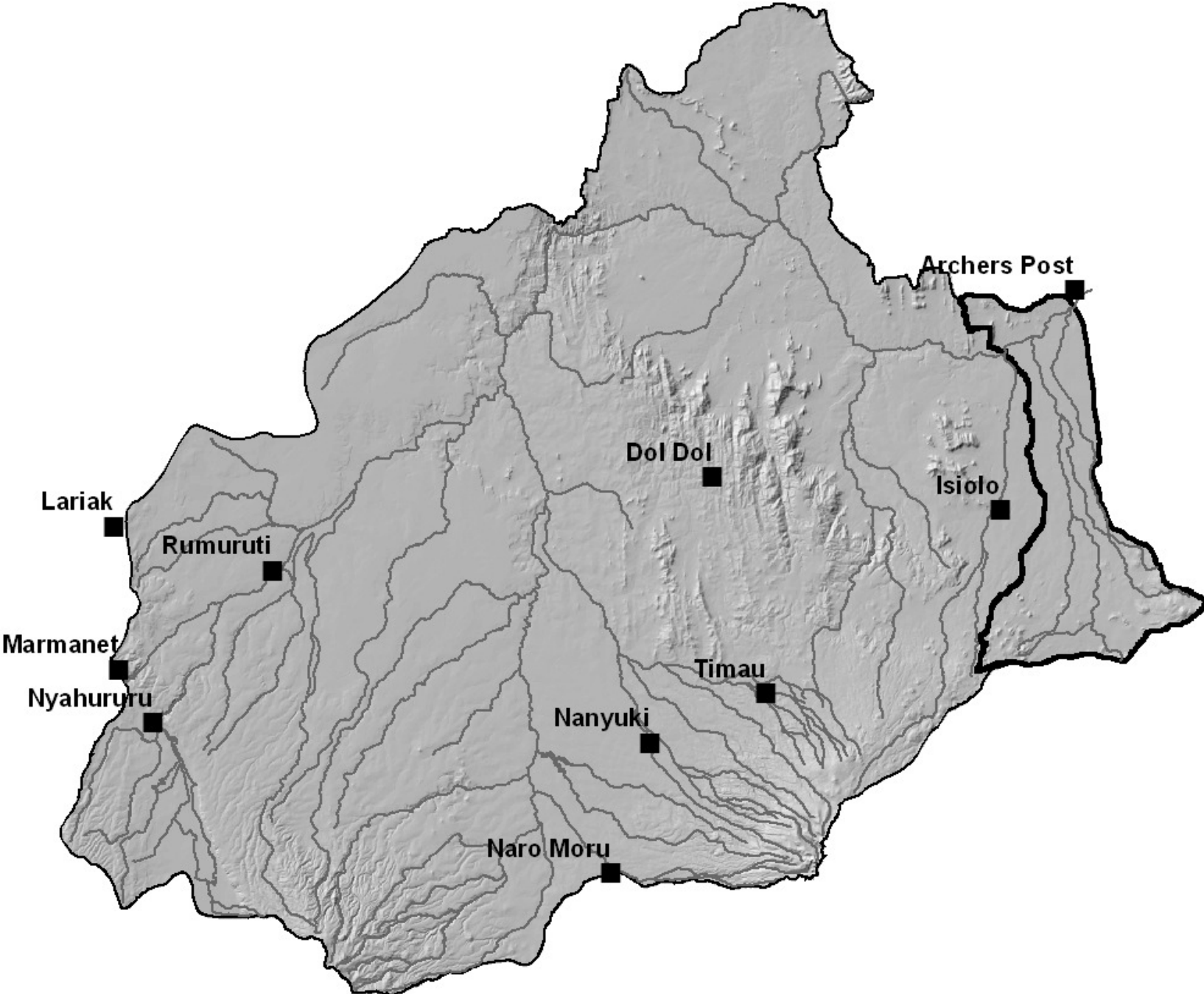
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(*) Arid and Semi Arid Lands.





Ewaso Ngiro East Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	433 km ²
Perimeter	141 km
Area to perimeter ratio	3.07
Highest point	3,890 m
Lowest point	1,810 m
Average altitude	2,380 m
Altitude range (highest point – lowest point)	2,080 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	346,400,000 m ³
Average annual rainfall in catchment area	800 mm
Location with highest annual rainfall	950 mm
Location with lowest annual rainfall	690 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Ewaso East River)	60 km
Total length of all rivers in catchment	635 km
Number of gauging stations	0
Number of recorded abstraction points	310
Water User Association:	no

Socio – economy

Population	---
Urban centres	Karemeno, Kiawara, Lamuria 1 and 2, Muhonia, Muringa, Muthangira, New City, Ruirii, Tanyai

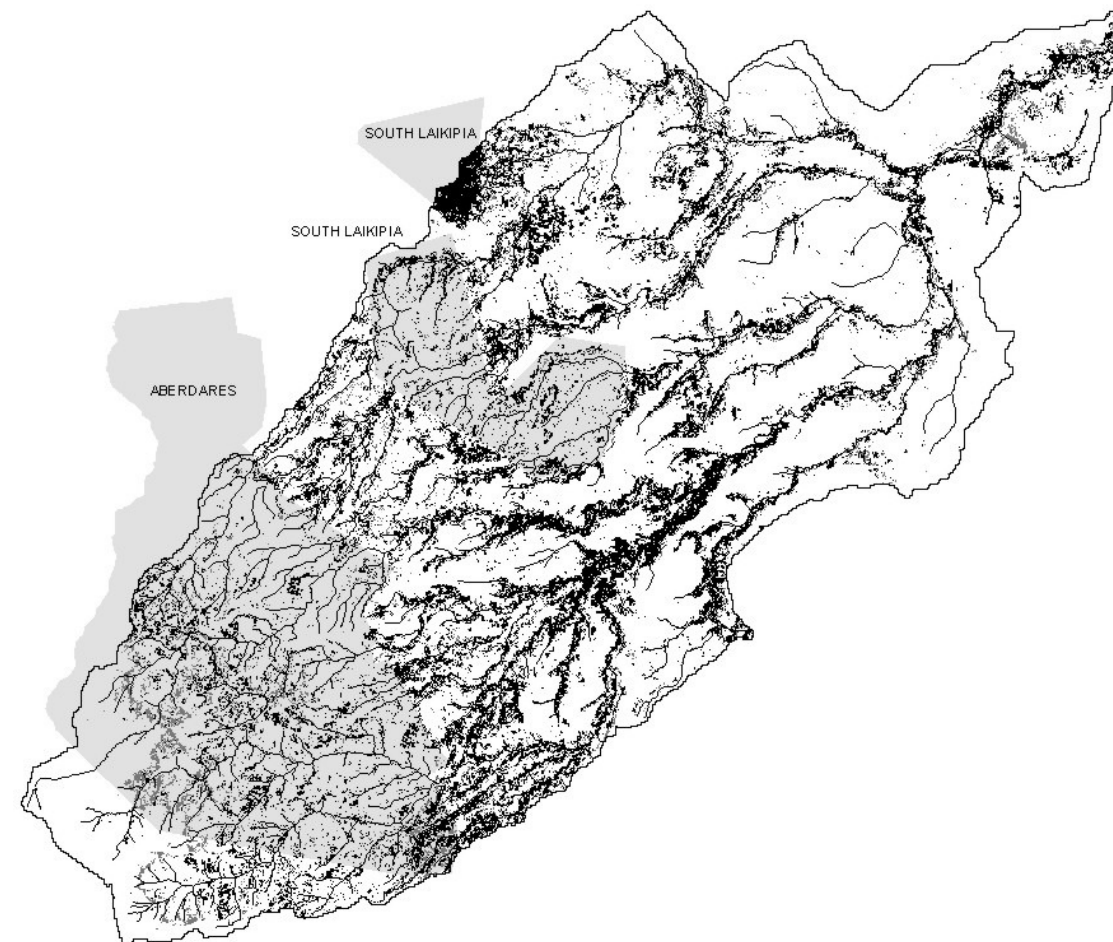
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Laikipia	Lamuria	Lamuria	Lamuria
		Sirima	Muthonia
		Tigithi	Matanya
Nyeri	Kieni West	Endarasha	Charity
			Endarasha
			Gakanga
		Gatarakwa	Embaringo
			Kamariki
			Lamuria
			Watuka
		Mugunda	Karemeno
			Nairutia
			Ruirie
		Mwiyongo	Kabati
Muthuini			
Aberdares Forest	Aberdares Forest	Aberdares Forest	

Land Cover (1995)

Grassland	21 %	=	91 km ²
Woody grassland	17 %	=	74 km ²
Forest	41 %	=	177 km ²
Cropland	21 %	=	91 km ²

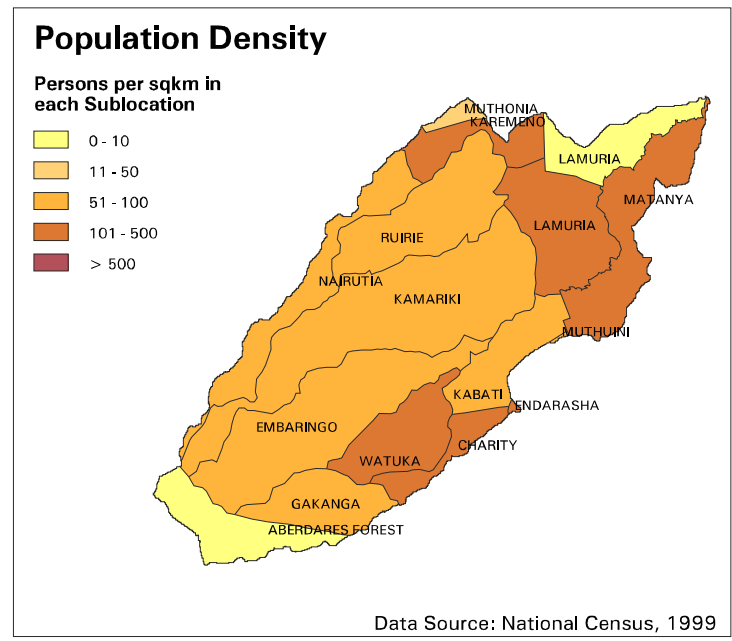
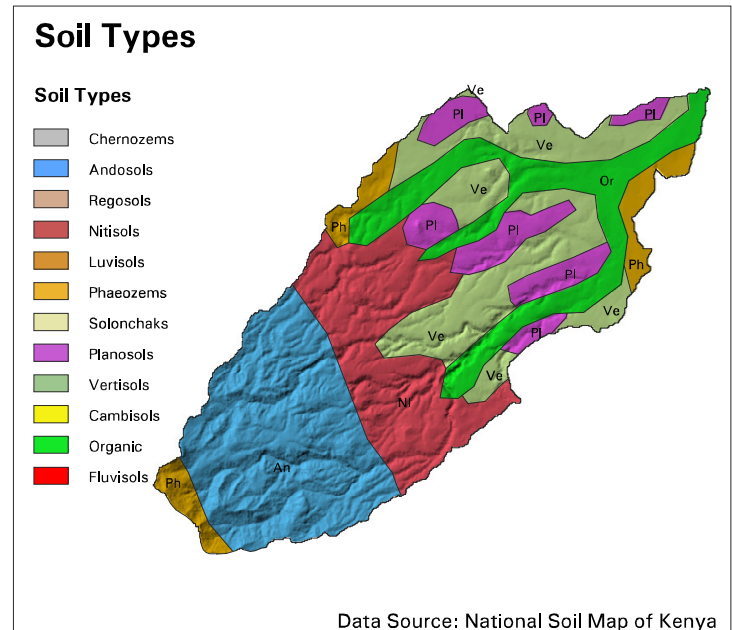
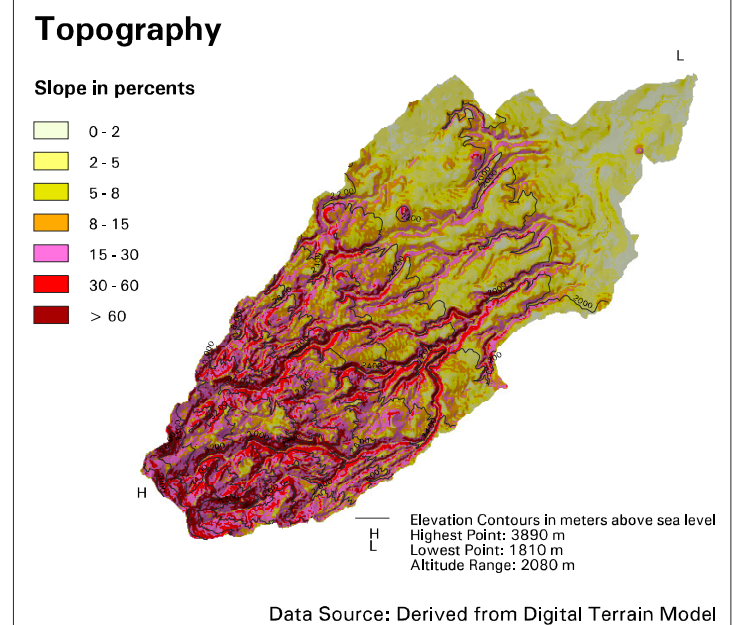
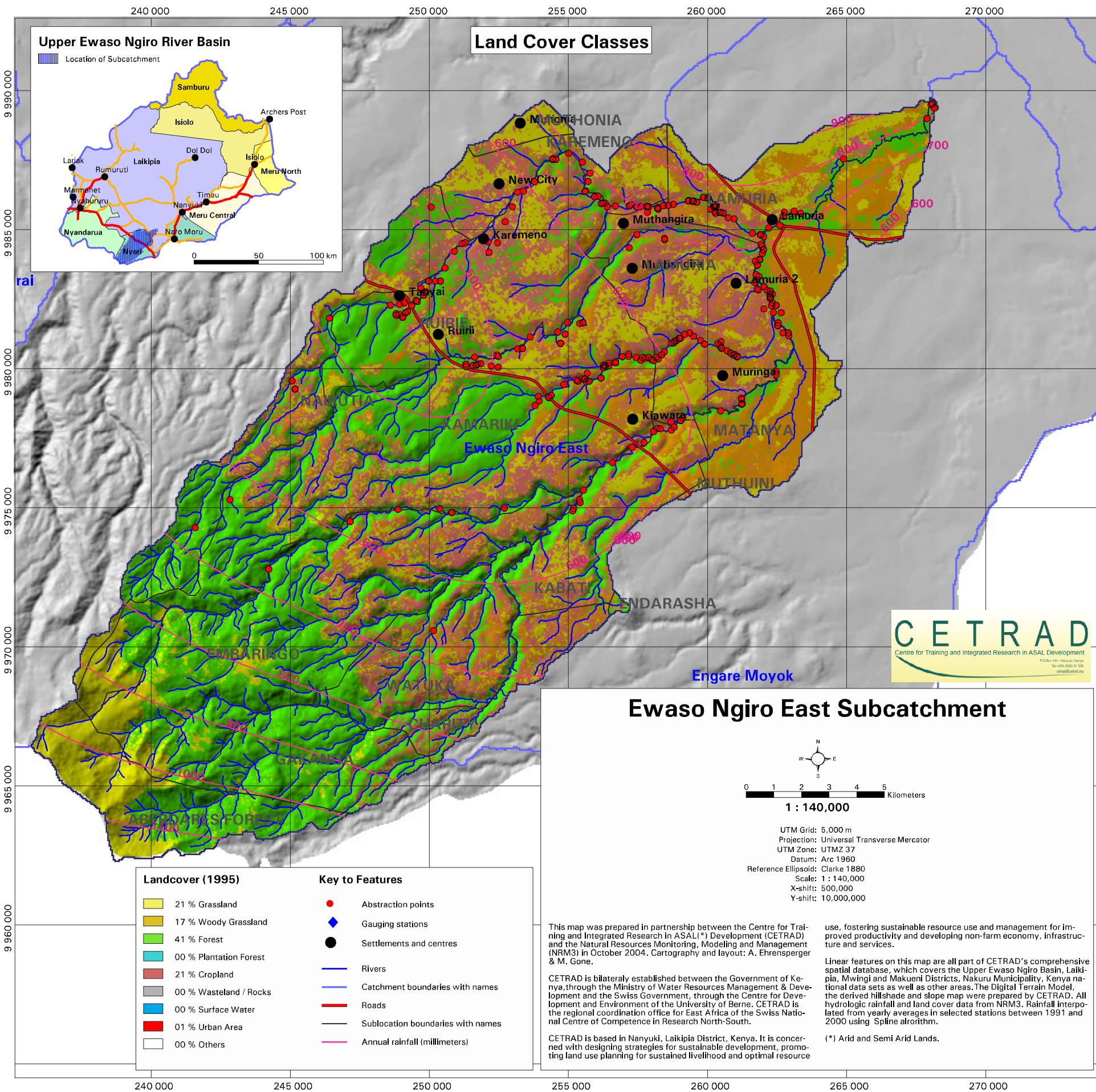
Loss of forest between 1995 and 2002



The black areas in the figure above (65 km²) show the areas of Ewaso Ngiro East catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (12 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 53 km² (average annual forest loss = 7.6 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2018.**

The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
Both classifications on the basis of Landsat ETM satellite images



Ewaso Ngiro East Subcatchment

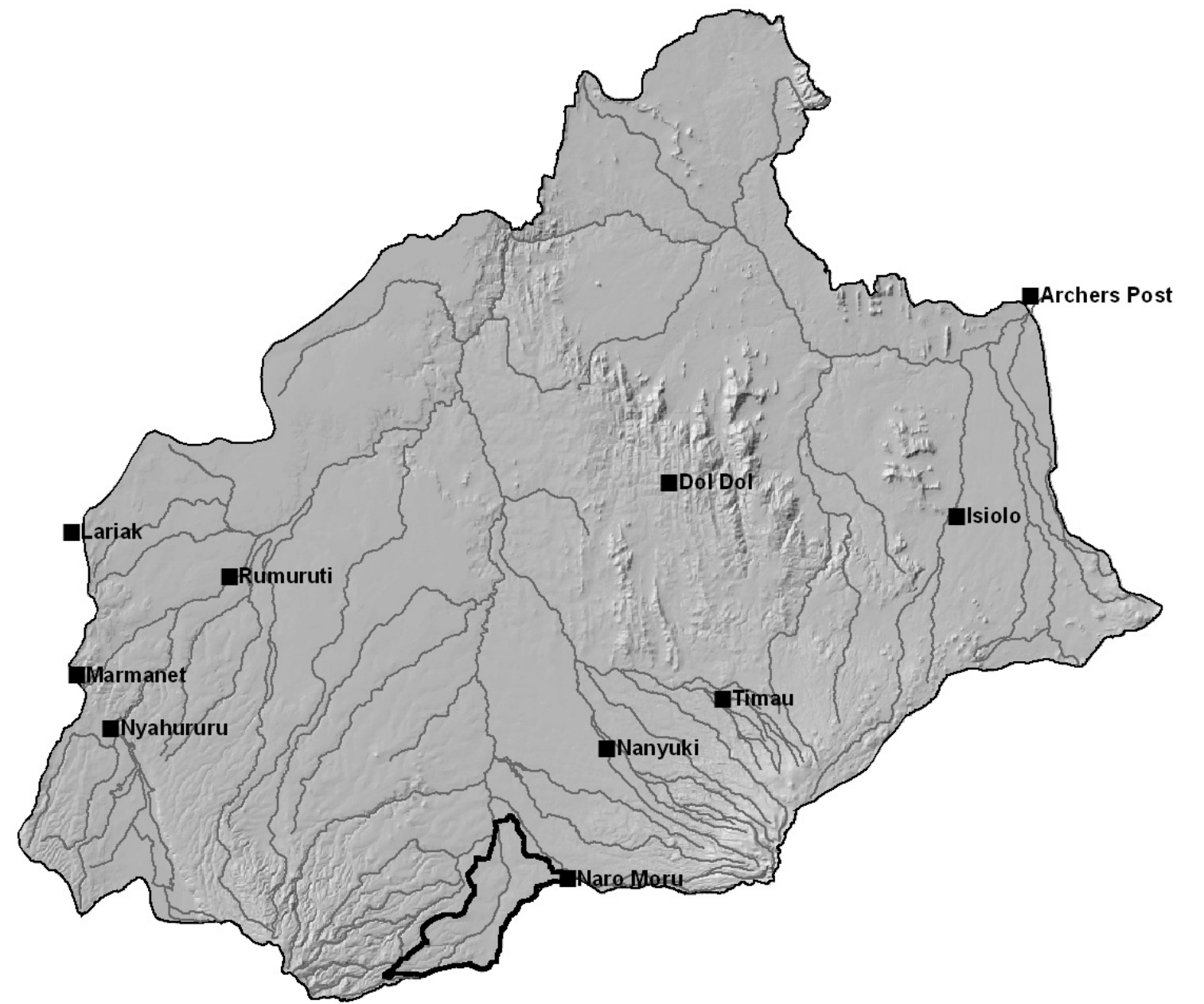
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(*) Arid and Semi Arid Lands.



Engare Moyok Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	243 km ²
Perimeter	126 km
Area to perimeter ratio	1.93
Highest point	2,620 m
Lowest point	1,810 m
Average altitude	1,970 m
Altitude range (highest point – lowest point)	810 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	172,600,000 m ³
Average annual rainfall in catchment area	715 mm
Location with highest annual rainfall	810 mm
Location with lowest annual rainfall	660 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Engare Moyok River)	41 km
Total length of all rivers in catchment	195 km
Number of gauging stations	0
Number of recorded abstraction points	2
Water User Association	No

Socio – economy

Population	---
Urban centres	Naro Moru

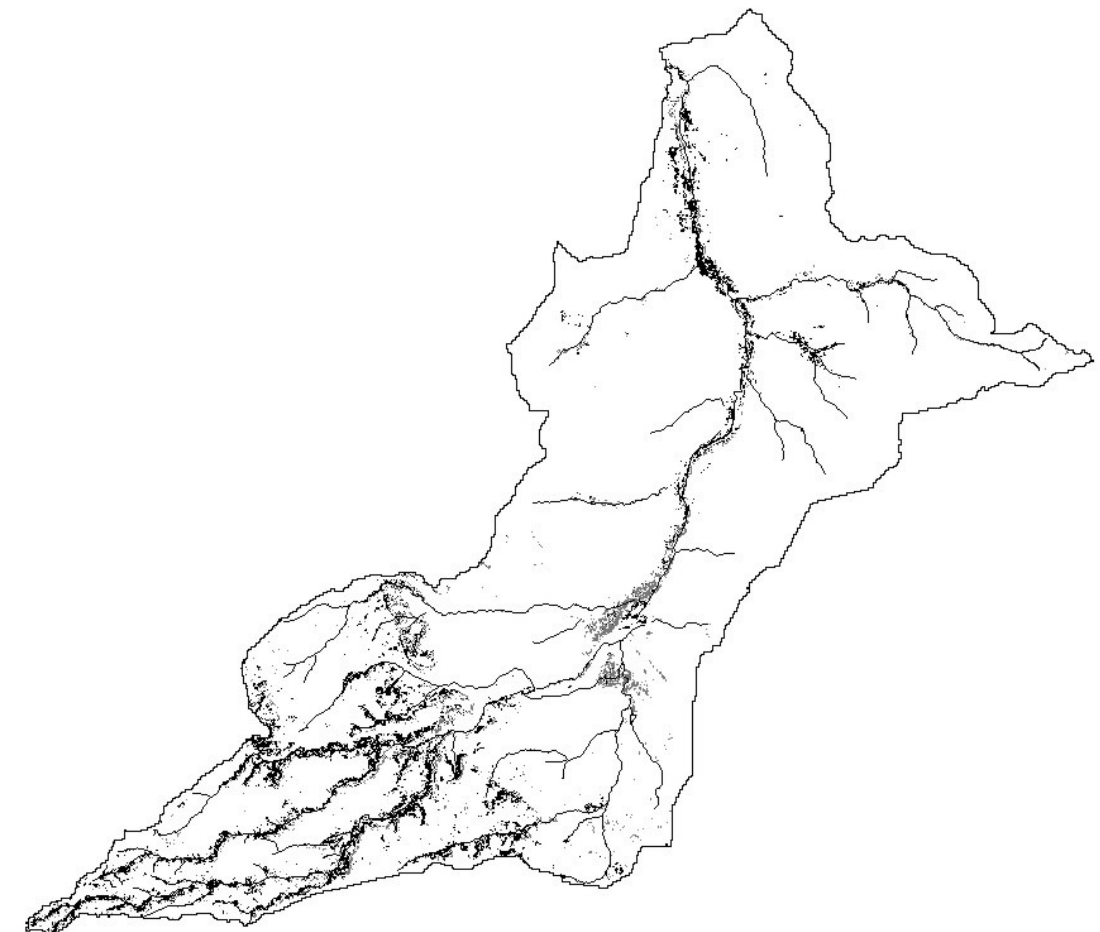
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Lamuria	Tigithi	Matanya
Nyeri	Kieni East	Naro Moru	Naro Moru
	Kieni West	Endarasha	Charity
			Endarasha
		Mitero	
		Kabati	
		Labura	
	Mwiyongo	Muthuini	
		Mwiyogo	

Land Cover in 1995

Grassland	27 % = 66 km ²
Woody grassland	53 % = 129 km ²
Forest	6 % = 14 km ²
Cropland	14 % = 33 km ²

Loss of forest between 1995 and 2002

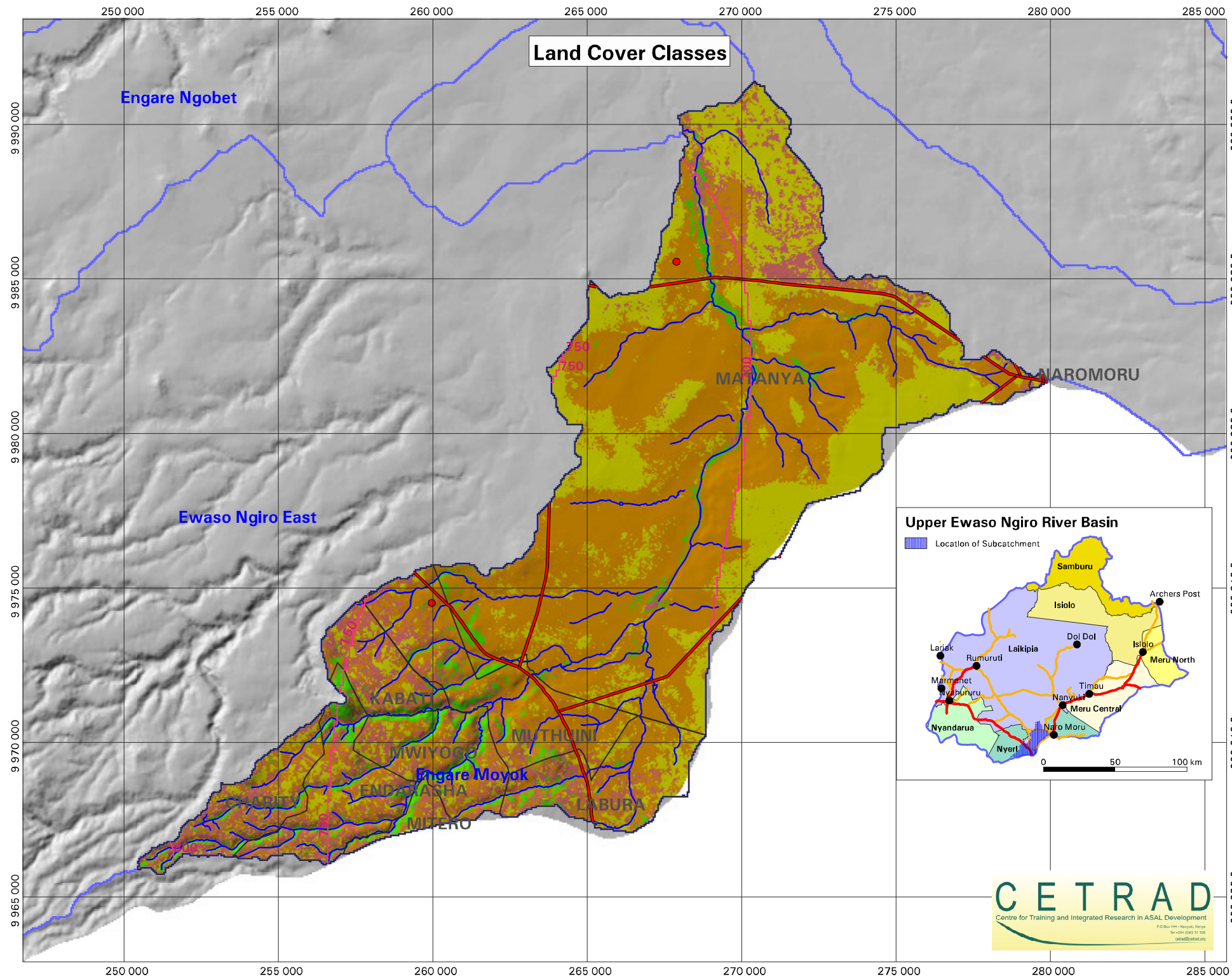


The black areas in the figure above (10.8 km²) show the areas of Engare Moyok catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (4.5 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 6.3 km² (average annual forest loss = 0.9 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2010.**

The continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)

Both classifications on the basis of Landsat ETM satellite images.



Land Cover Classes

Engare Ngobet

Ewaso Ngiro East

MATANYA

NIAROMORU

KABATI

MWIYOGO

MUTHUINI

CHARITY

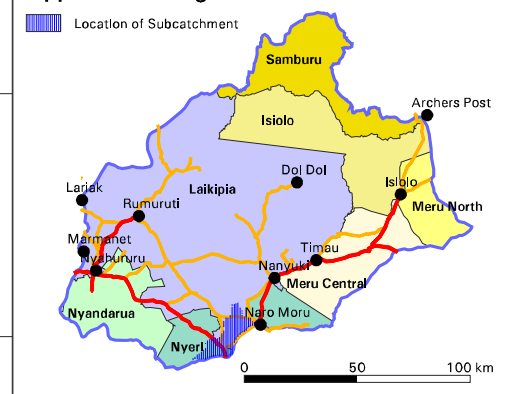
ENDARASHA

MIPERO

LABURA

Engare Moyok

Upper Ewaso Ngiro River Basin



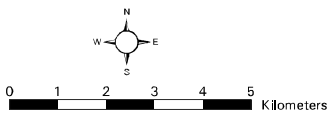
Landcover (1995)

- 27 % Grassland
- 53 % Woody Grassland
- 06 % Forest
- 00 % Plantation Forest
- 14 % Cropland
- 00 % Wasteland / Rocks
- 00 % Surface Water
- 00 % Urban Area
- 00 % Others

Key to Features

- Abstraction points
- Gauging stations
- Settlements and centres
- Rivers
- Catchment boundaries with names
- Roads
- Sublocation boundaries with names
- Annual rainfall (millimeters)

Engaremoyok Subcatchment



1 : 140,000

UTM Grid: 5,000 m
 Projection: Universal Transverse Mercator
 UTM Zone: UTMZ 37
 Datum: Arc 1960
 Reference Ellipsoid: Clarke 1880
 Scale: 1 : 140,000
 X-shift: 500,000
 Y-shift: 10,000,000

This map was prepared in partnership between the Centre for Training and Integrated Research in ASAL(*) Development (CETRAD) and the Natural Resources Monitoring, Modeling and Management (NRM3) in October 2004. Cartography and layout: A. Ehrensperger & M. Gone.

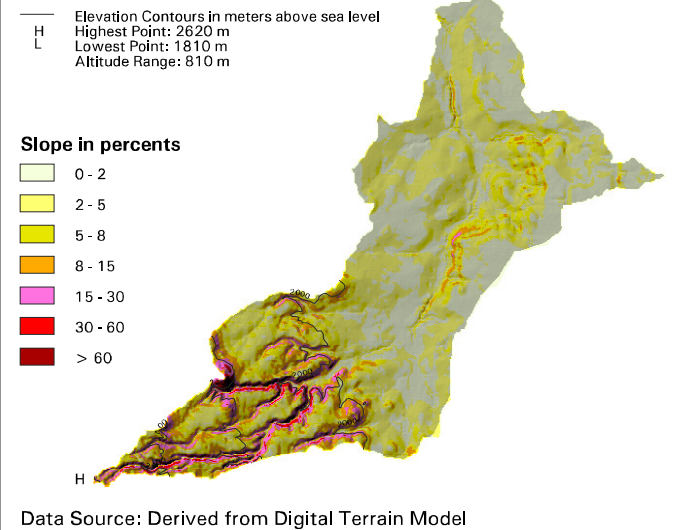
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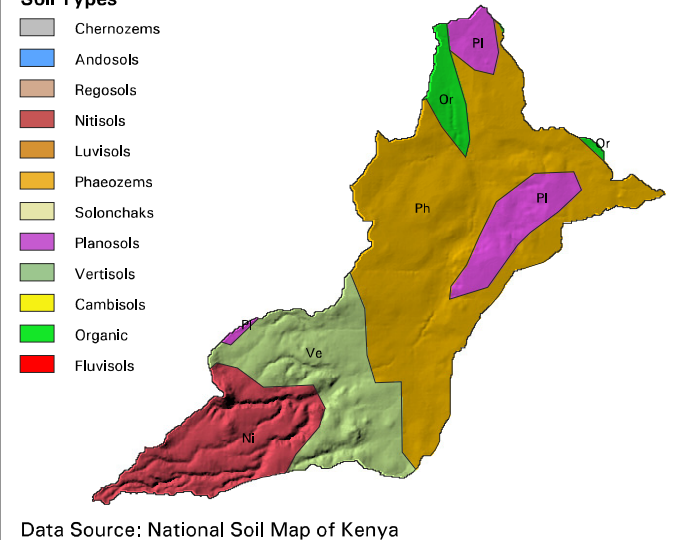
(*) Arid and Semi Arid Lands.

Topography



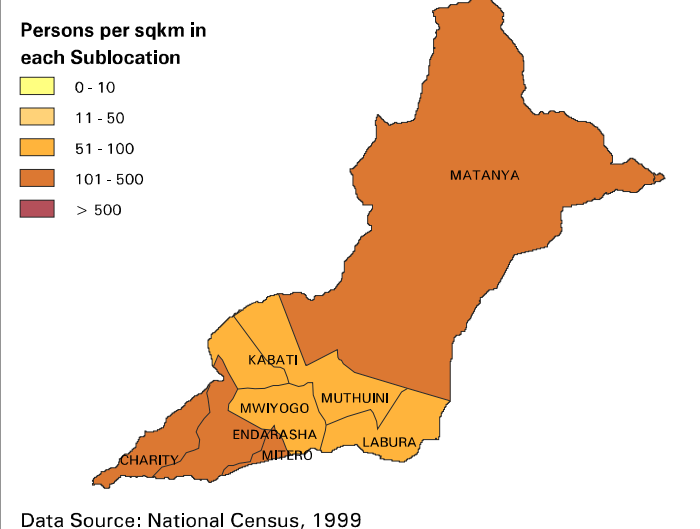
Data Source: Derived from Digital Terrain Model

Soil Types

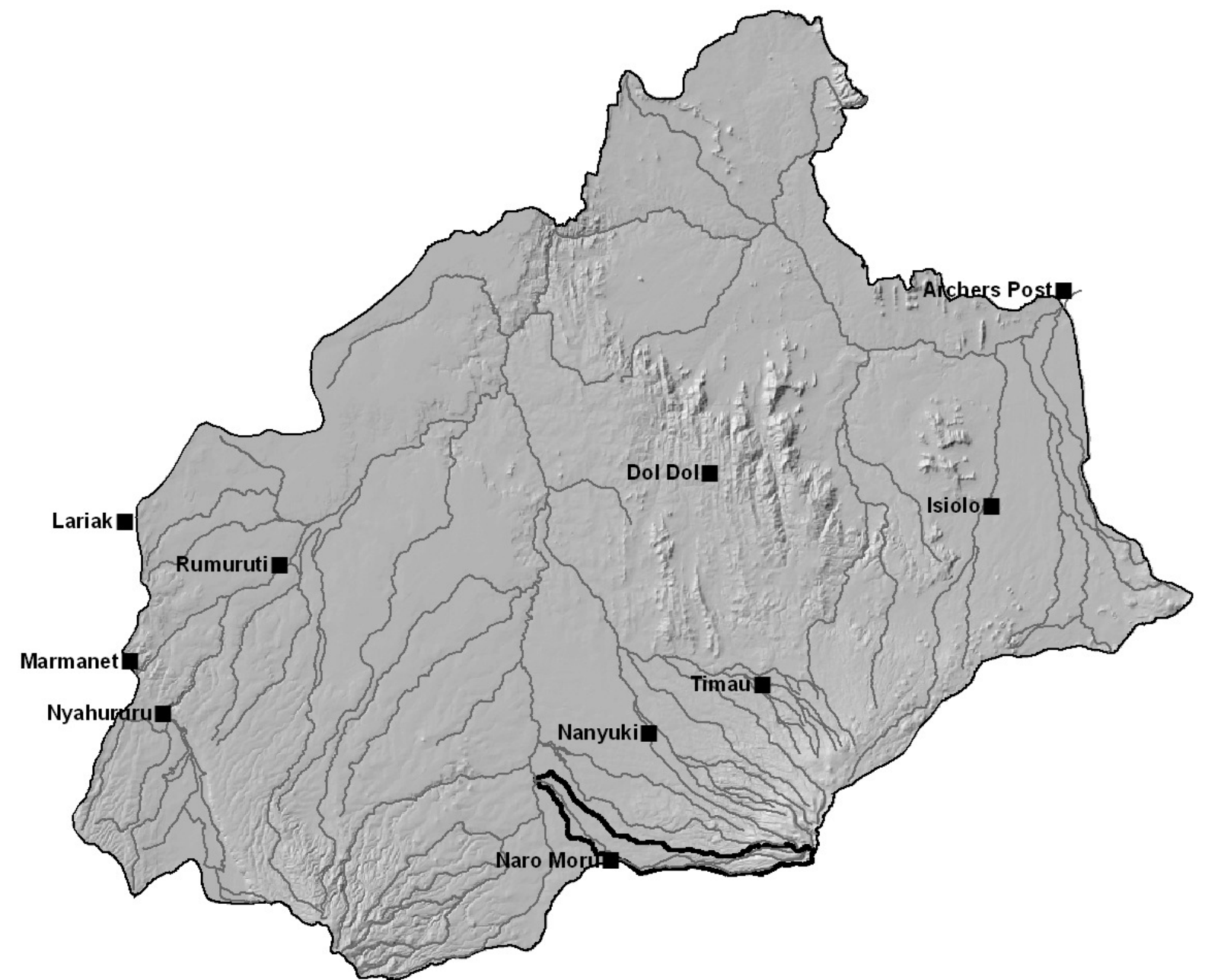


Data Source: National Soil Map of Kenya

Population Density



Data Source: National Census, 1999



Naro Moru Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	167 km ²
Perimeter	143 km
Area to perimeter ratio	1.17
Highest point	5,120 m
Lowest point	1,800 m
Average altitude	2,490 m
Altitude range (highest point – lowest point)	3,320 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	150,300,000 m ³
Average annual rainfall in catchment area	900 mm
Location with highest annual rainfall	1500 mm
Location with lowest annual rainfall	620 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river	68 km
Total length of all rivers in catchment	235 km
Number of gauging stations	6
Number of recorded abstraction points	66
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban centres	Kihato, Matanya, Olechugu, Tigithi 1

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Laikipia	Lamuria	Tigithi	Matanya
Nyeri	Kieni East	Gakawa	Githima
		Kiamathage	Gikamba
			Kabendera
			Miricho
			Tigithi
			Naro Moru
		Naromoru	
		Ndiriti	
		Rongai	
		Mount Kenya Forest	Mount Kenya Forest

Land Cover (1995)

Grassland	24 % = 40 km ²
Woody grassland	23 % = 38.4 km ²
Forest	33 % = 55.1 km ²
Plantation forest	05 % = 8.4 km ²
Cropland	15 % = 25.1 km ²

Loss of forest between 1995 and 2002

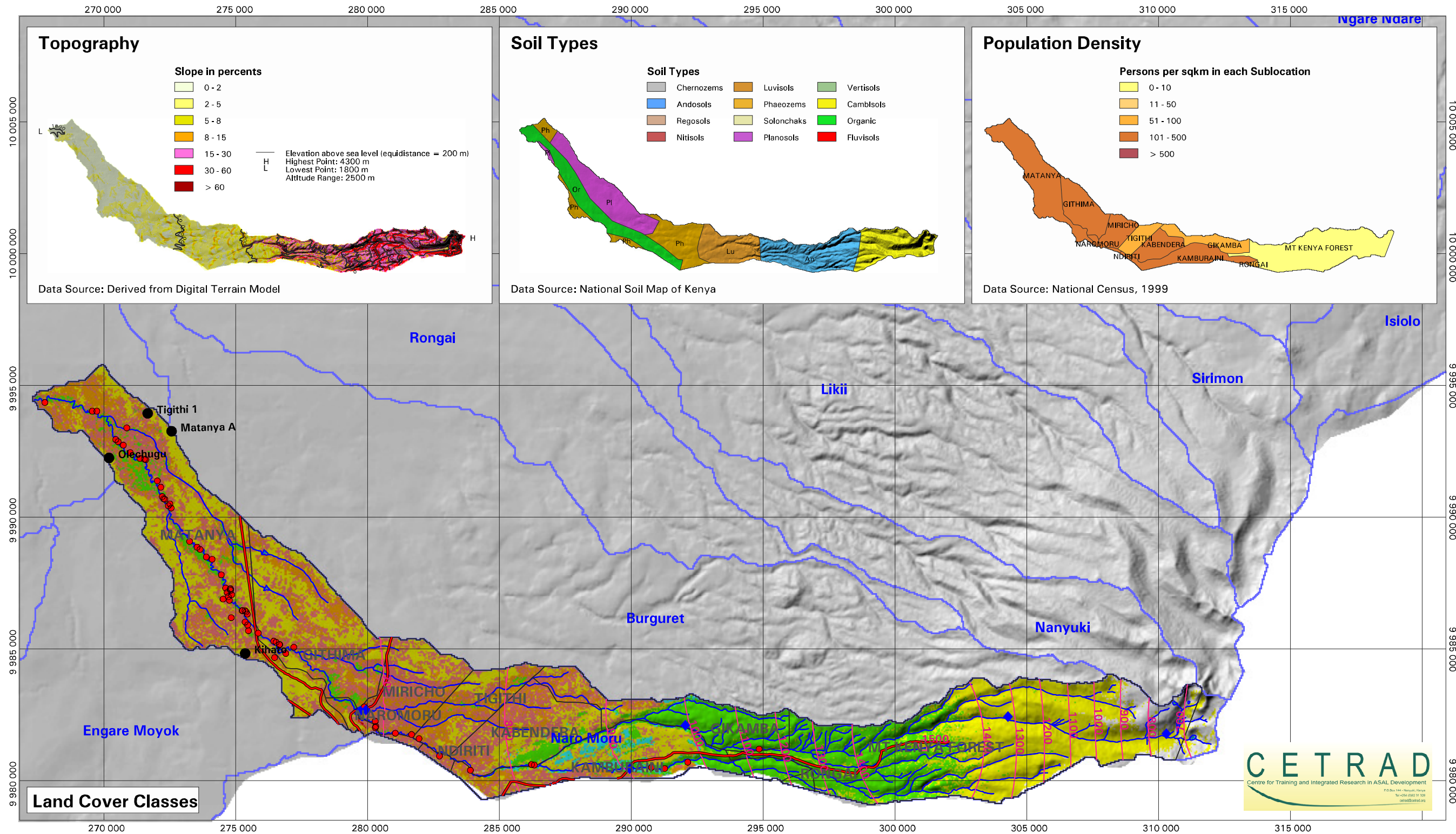


The black areas in the figure above (7.8 km²) show the areas of Naro Moru catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (7.4 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 0.4 km² (average annual forest loss = 0.06 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2567.**

The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Naro Moru River Water User Association
Contact	Mr. Robert Wahome, Chairman, Thome Mr. Julius Mwaniki, Secretary, Gathiuru, 0733 274 828
In existence since	2003
Registered as	Association. Registered in Laikipia District in the Ministry of Gender, Sports and Cultural Activities but want to register with the Attorney General's Chamber.
Trigger of formation	Constant water conflicts, water shortage problems, water catchment destruction. Want to be a forum for fund rising.
Objectives	By-laws: promote legal abstraction, efficient and proper use of water. Promote soil and water conservation. Conserve water quality. Promote situation in which available water is reasonably shared between environment, wildlife, livestock and all the communities according to following priority ranking: domestic, livestock, environment, wildlife and fishes, irrigation, recreation, manufacturing industry, others. Provide a forum to discuss, prevent and resolve conflicts. Promote dialogue in regard to water policy and enforcement of water act. New abstractions have to be approved. Transparent and fair management practices.
Availability of sanctioning system	Yes: By-laws
Role of horticulture farms	All (2) are member. They gave moral support for the founding of the WUA, but do not participate in its running. The WUA could operate without them as they have vested their interests elsewhere and do not concentrate on this venture. Their influence is therefore weak as compared to other users.
Sources of conflicts	Non-equitable distribution of water, catchment destruction, illegal abstractions, water shortage.
Problems forwarded to the WUA	Non-equitable distribution of water.
Unexpressed conflicts	River banks destruction. People feel that the trees belong to them.
Availability of conflict guidelines	Yes: Article 9 of by-laws, drafted by members, assisted by the district water officer. Consensus was achieved by voting. The guidelines are effective for water conflict resolution.
Concrete way of solving conflicts	Any conflict is channelled through the committee.
Cases of conflicts dealt with	3 cases brought to them by individual members and downstream users: Downstream water shortage; member cutting trees along the river; illegal car wash contaminating the river. The cases have been dealt with: the tree cutter was arrested and the upstream and downstream communities are now talking together.
Other activities the WUA is engaging in	Soliciting funds for patrolling, educating the community on several conservation activities. Untapped potentials include: Alleviating poverty in the community, lobbying for good markets for their products, acquiring assets (motorbikes, cars) to man the source.
Achievements	Minimising water use conflicts in the catchment
Hindrances	Lack of transport and communication facilities, poor security because of wildlife, financial constraints, ignorance on conservation issues, don't care attitude.
Advices to others	---



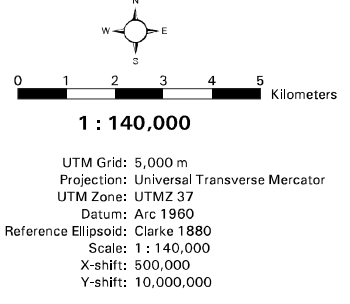
Landcover (1995)

- 24 % Grassland
- 23 % Woody Grassland
- 33 % Forest
- 05 % Plantation Forest
- 15 % Cropland
- 00 % Wasteland / Rocks
- 00 % Surface Water
- 00 % Urban Area
- 00 % Others

Key to Features

- Abstraction points
- Gauging stations
- Settlements and centres
- Rivers
- Catchment boundaries with names
- Roads
- Sublocation boundaries with names
- Annual rainfall (millimeters)

Naromoru Subcatchment



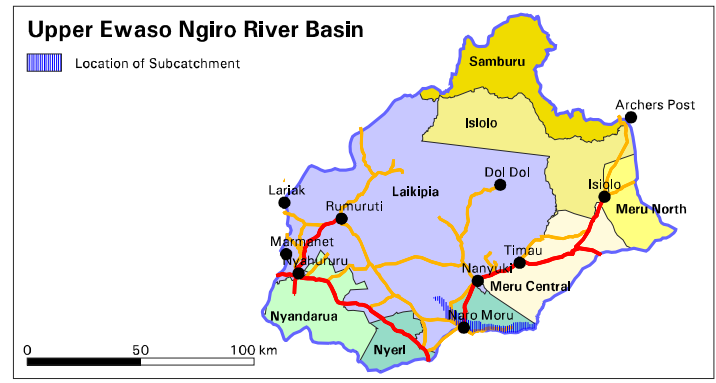
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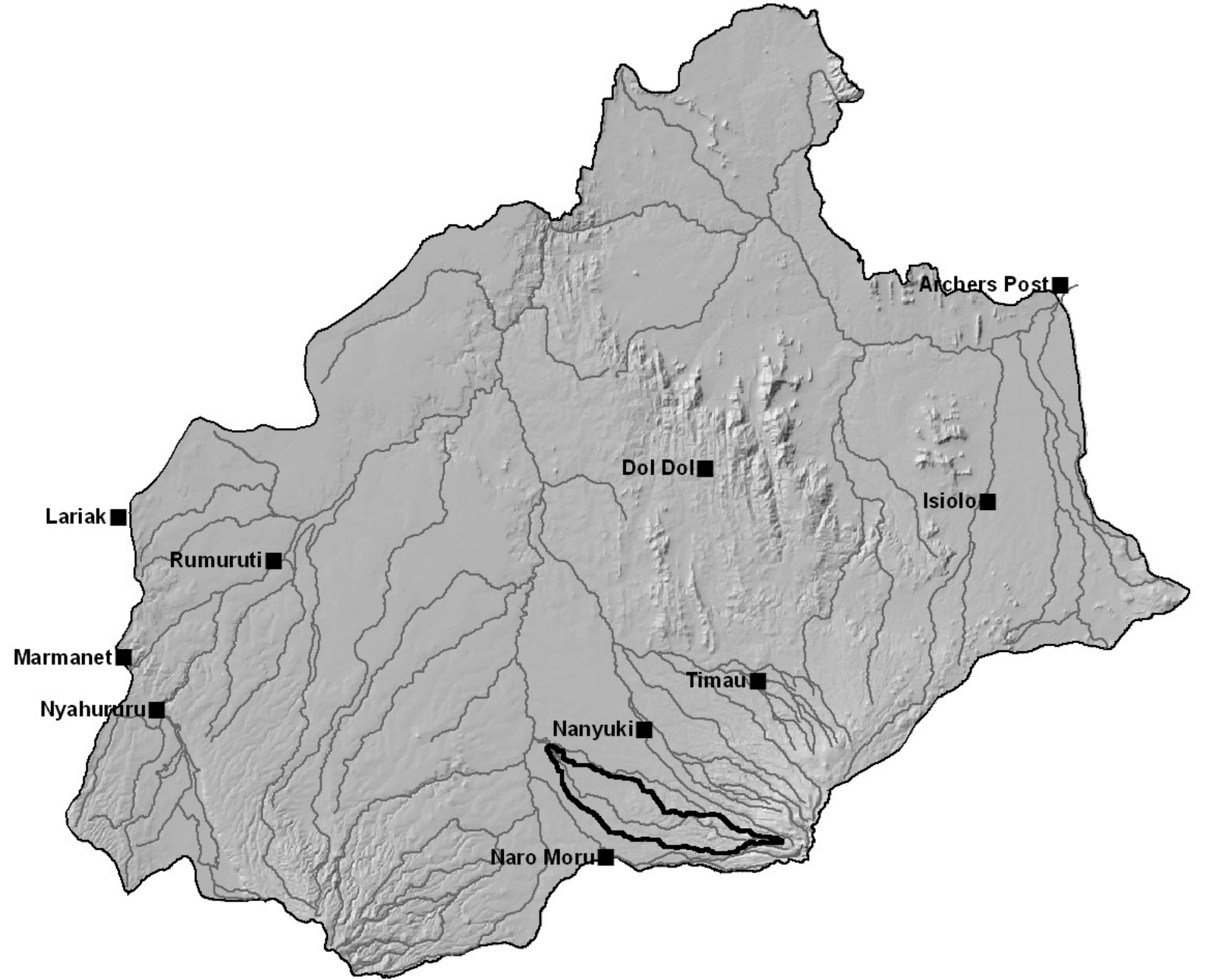
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(*) Arid and Semi Arid Lands.





Burguret Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	206 km ²
Perimeter	122 km
Area to perimeter ratio	1.69
Highest point	4300 m
Lowest point	1800 m
Average altitude	2200 m
Altitude range (highest point – lowest point)	2500 m

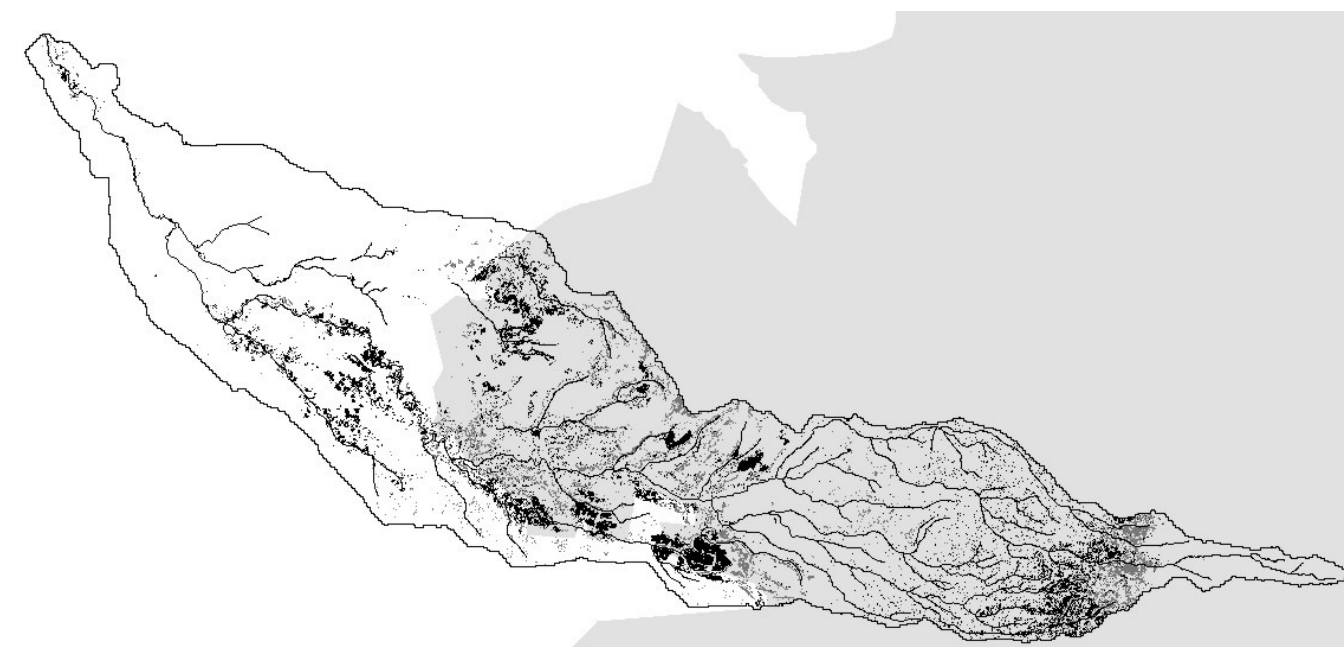
Land Cover in 1995

Grassland	24 %	=	49.5 km ²
Woody grassland	23 %	=	47.4 km ²
Forest	33 %	=	68.0 km ²
Plantation forest	05 %	=	10.3 km ²
Cropland	15 %	=	30.9 km ²

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	184,000,000 m ³
Average annual rainfall in catchment area	890 mm
Location with highest annual rainfall	1490 mm
Location with lowest annual rainfall	580 mm

Loss of forest between 1995 and 2002



The black areas in the figure above (13.7 km²) show the areas of Burguret catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (8.6 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 5.1 km² (average annual forest loss = 0.7 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2107.**

The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Burguret River)	53.3 km
Total length of all rivers in catchment	238 km
Number of gauging stations	1
Number of recorded abstraction points	63
Water User Association	Yes (see following page)

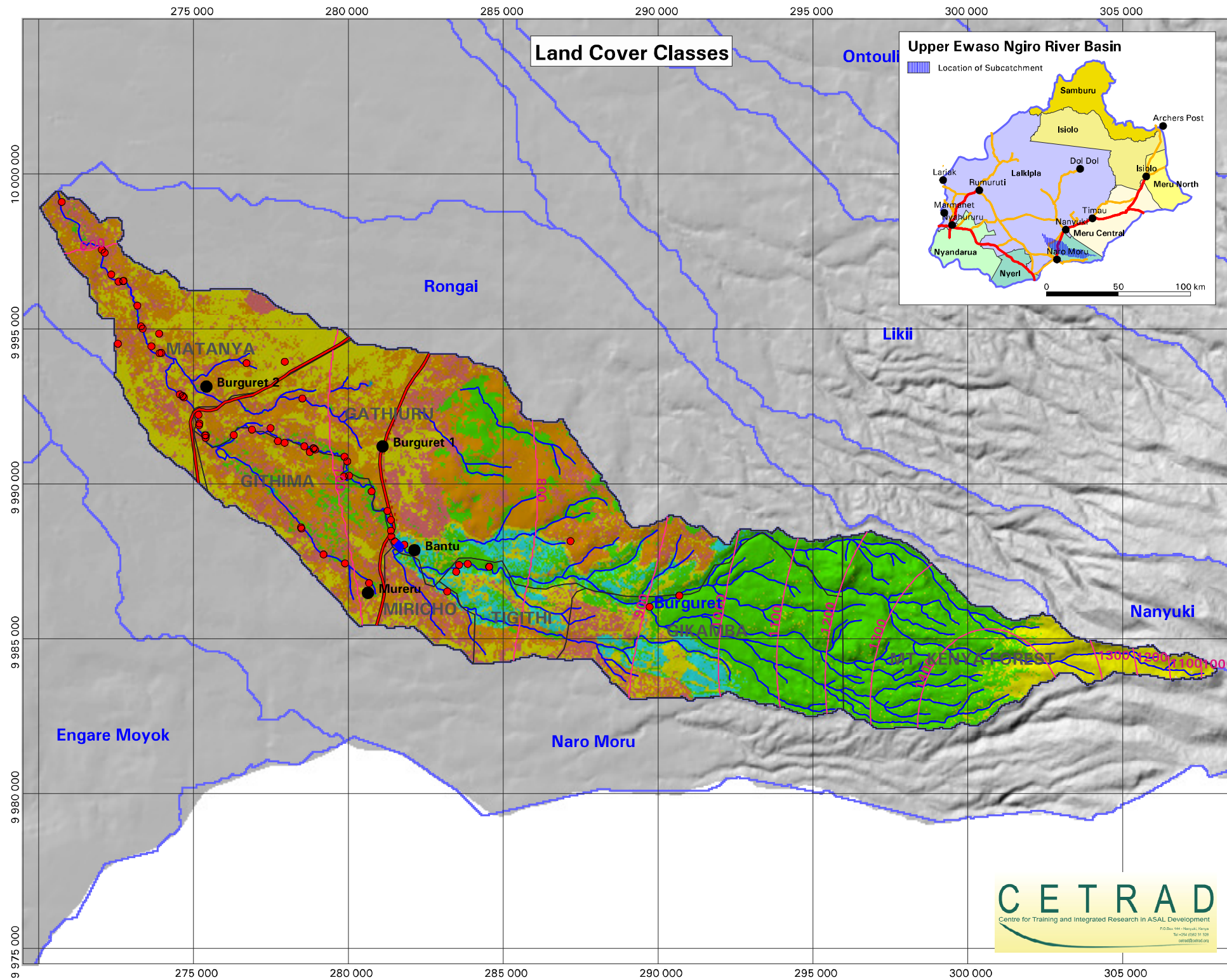
Socio – economy

Population	---
Urban centres	Bantu, Burguret 1, Burguret 2, Mureru

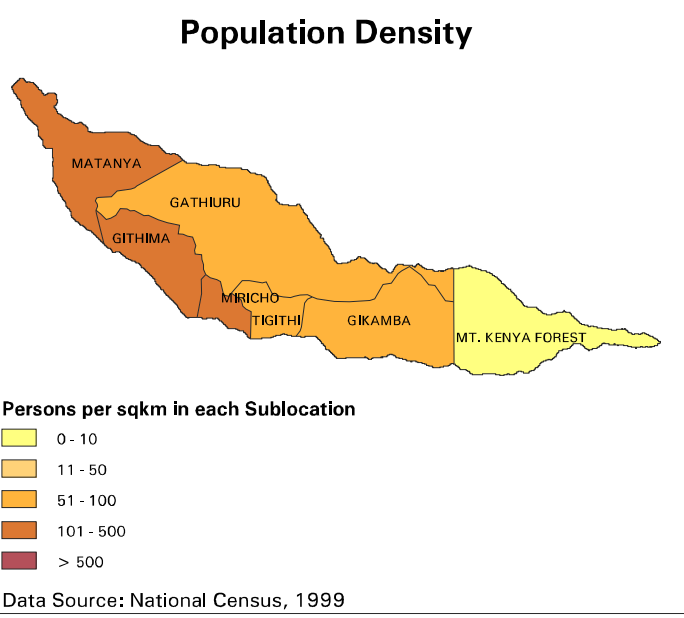
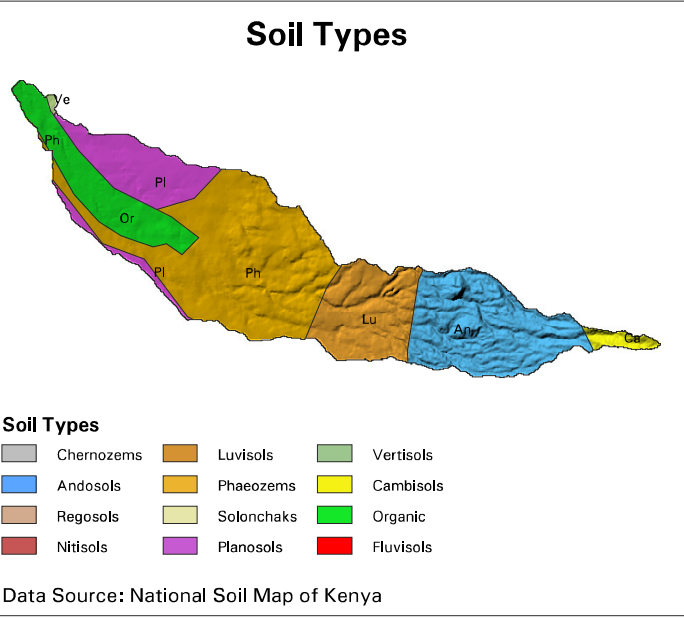
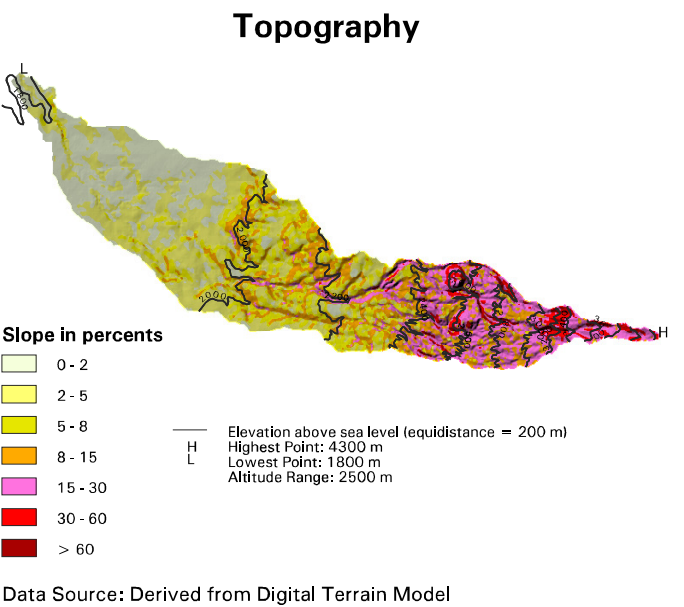
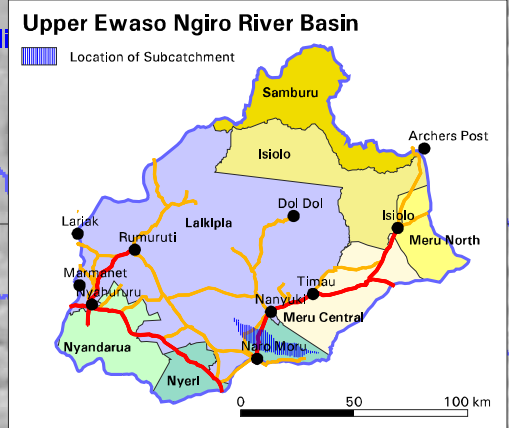
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Laikipia	Lamuria	Tigithi	Matanya
Nyeri	Kieni East	Gakawa	Gathiuru
			Githima
		Kiamathage	Gikamba
			Miricho
	Mount Kenya Forest	Mount Kenya Forest	Mount Kenya Forest

Name	Burguret River Water User Association
Contact	Mr. Mike Thomas, Chairman, Rural Focus Ltd. Mr. Njonjo, Secretary, Tamtrout
In existence since	1999
Registered as	CBO. Registered at the Ministry of Cultural and Social Services. Applied for registration at the Attorney General's Chamber
Trigger of formation	Conflicts pertaining to water use
Objectives	Promote legal water abstraction, efficient and proper water use and sustainable abstraction. Soil and water conservation. Conserve water quality. Equitable sharing of river water. Be a forum for discussion, prevention and solving of conflicts. Promoting dialogue between water users and government. Transparency and fair management practices.
Availability of sanctioning system	Yes: Elected chairmen, by their by-laws and with the authority of the WUA can enact it.
Role of horticulture farms	All (2) farms are members of the WUA (Turi Farm, Tambuzi Limited). Tambuzi was the initiator of the WUA, conveyed meetings together with the ministry of water. They help in providing resources (transport), in collecting and disseminating data and in providing office space. The WUA could not work without them because they contribute much. Their influence is comparable to the one of other users.
Sources of conflicts	Low flows in the dry season, lack of rains, abstractors blocking the whole river (breaking the law).
Problems forwarded to the WUA	Small scale farmers using pumps, illegal abstractors cutting furrows, big projects rationing water (members complain of lack of water), blocking of pipes, cutting of pipes, malice by non-members
Unexpressed conflicts	Misuse of finances, theft of material (e.g. pipes), project which contributed but is not yet established, hence complaint by members.
Availability of conflict guidelines	Yes (by-laws), drafted by members. There is consensus on them achieved through practical implementation of the guidelines. Some problems are beyond the power of the WUA (arresting, suing, getting permits). Involvement of government officers necessary.
Concrete way of solving conflicts	Through discussions between representatives (chairman, zone representative) and the committee. If they can't solve it, they involve the whole WUA. If the conflict is beyond the WUA capabilities, government officials are involved.
Cases of conflicts dealt with	Five cases brought to them by members, representatives and non-members concerning over-abstraction, cutting of furrows, pollution, destruction of abstractions, irrigation issues. Four cases were addressed, one is pending in court.
Other activities the WUA is engaging in	Educating people on catchment conservation, replanting indigenous trees, preventing farming on river banks, soil conservation and awareness creation on water pollution. Untapped potentials are: Reaching people on the ground to disseminate information, returning unused water to the river.
Achievements	Conflict solving, rationing of water during the dry season.
Hindrances	Large area, communication problems, lack of resources, bad transportation, lack of tree seedlings.
Advices to others	...



Land Cover Classes



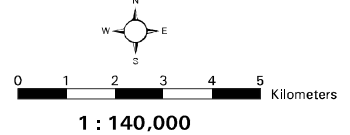
Landcover (1995)

24 % Grassland
23 % Woody Grassland
33 % Forest
05 % Plantation Forest
15 % Cropland
00 % Wasteland / Rocks
00 % Surface Water
00 % Urban Area
00 % Others

Key to Features

● Abstraction points
◆ Gauging stations
● Settlements and centres
— Rivers
— Catchment boundaries with names
— Roads
— Sublocation boundaries with names
— Annual rainfall (millimeters)

Burguret Subcatchment



1 : 140,000

UTM Grid: 5,000 m
 Projection: Universal Transverse Mercator
 UTM Zone: UTMZ 37
 Datum: Arc 1960
 Reference Ellipsoid: Clarke 1880
 Scale: 1 : 140,000
 X-shift: 500,000
 Y-shift: 10,000,000

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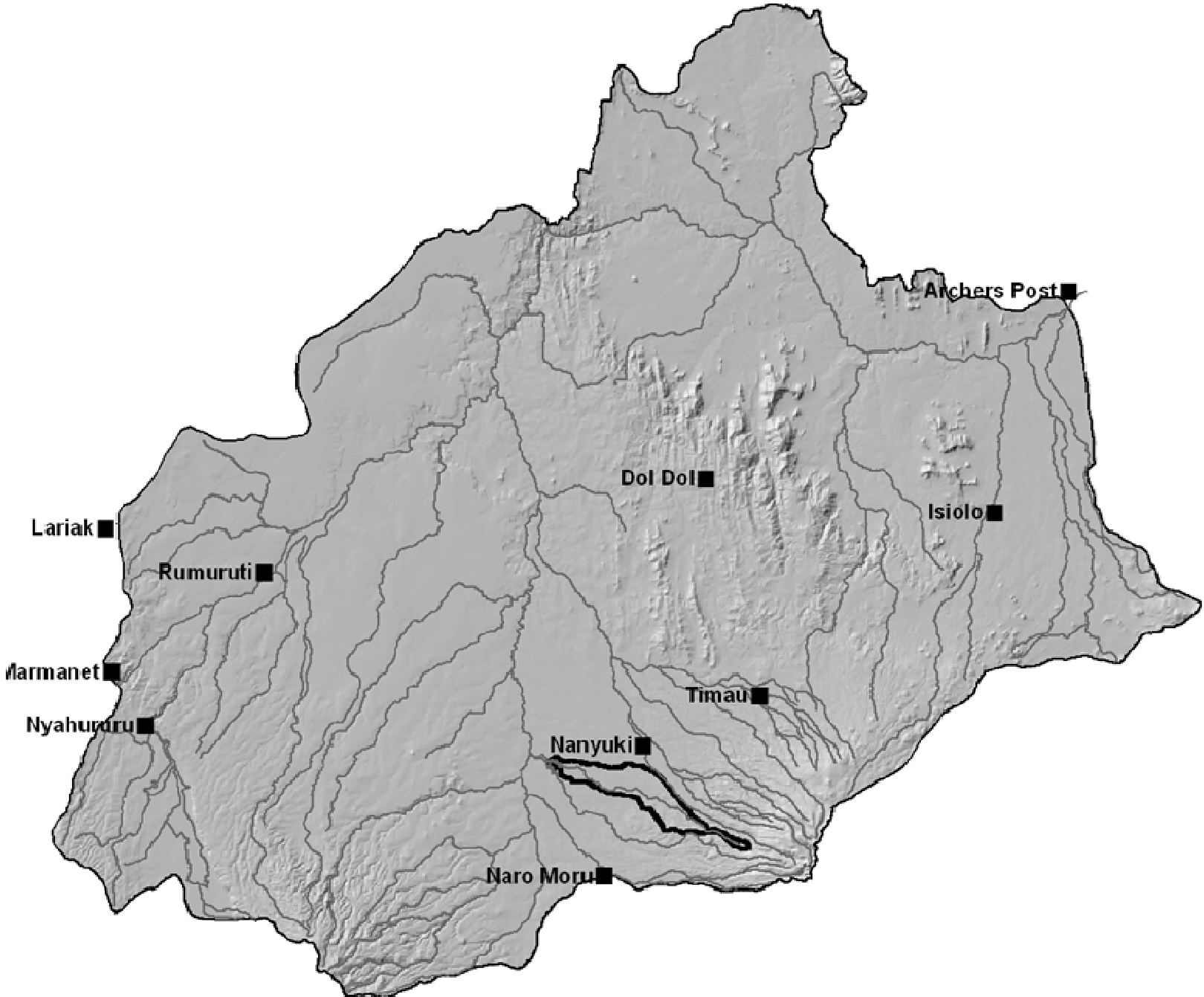
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(*) Arid and Semi Arid Lands.





Rongai Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	107 km ²
Perimeter	103 km
Area to perimeter ratio	1.04
Highest point	3,400 m
Lowest point	1,790 m
Average altitude	2,060 m
Altitude range (highest point – lowest point)	1,610 m

Land Cover (1995)

Grassland	39 %	=	42 km ²
Woody grassland	19 %	=	20 km ²
Forest	15 %	=	16 km ²
Plantation forest	11 %	=	12 km ²
Cropland	16 %	=	17 km ²

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	87,762,100 m ³
Average annual rainfall in catchment area	817 mm
Location with highest annual rainfall	570 mm
Location with lowest annual rainfall	1380 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Rongai River)	36 km (not including subterranean parts)
Total length of all rivers in catchment	86 km (not including subterranean parts)
Number of gauging stations	0
Number of recorded abstraction points	27
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban and rural centres	Chuma, Ichuga 2, Toll, Sweetwater

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Marura	Marura
		Segera	Ngarengiro
	Lamuria	Tigithi	Matanya
Nyeri	Kieni East	Gakawa	Gathiuru Kahurura
	Mt Kenya Forest	Mt Kenya Forest	Mt Kenya Forest

Loss of forest between 1995 and 2002

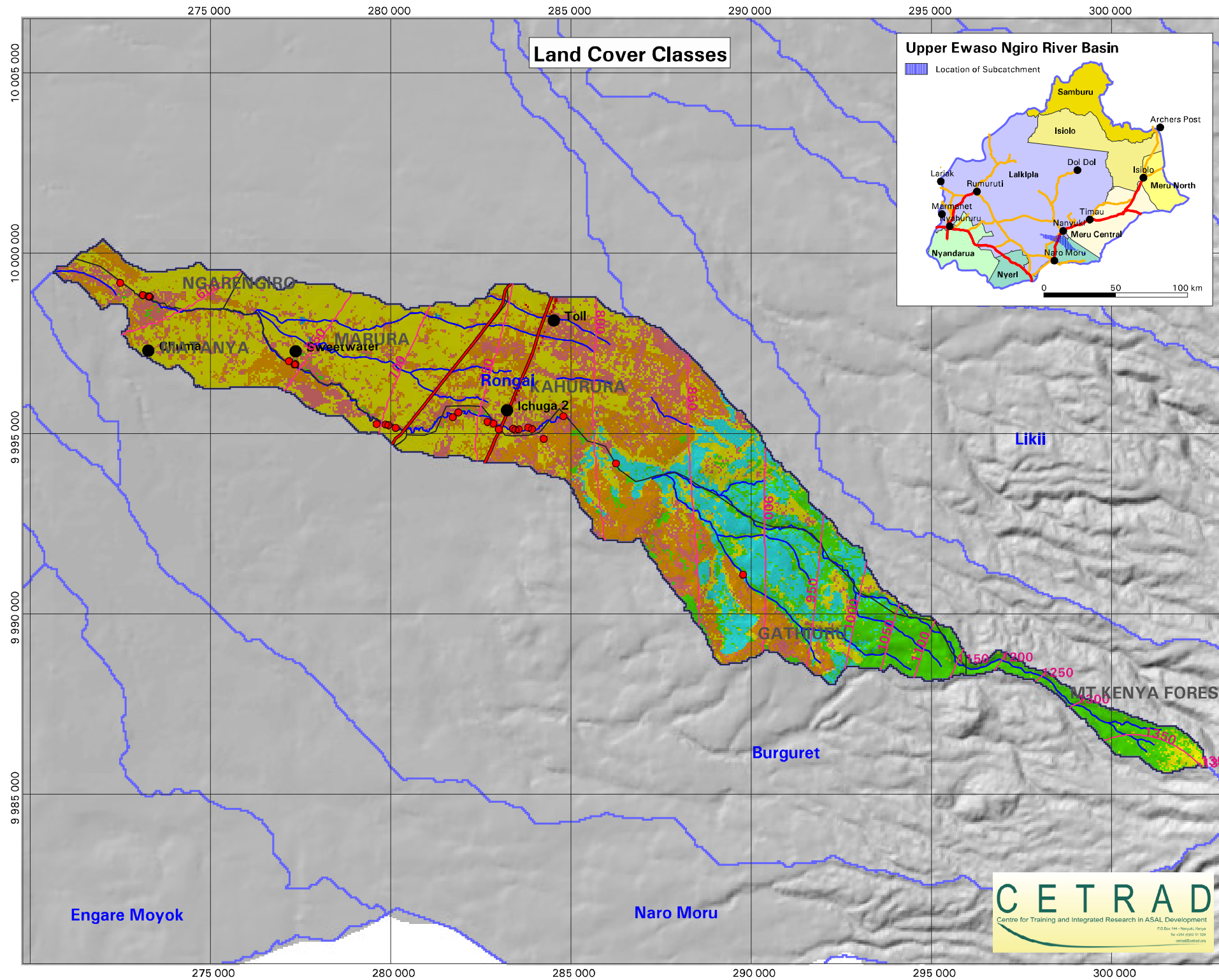


The black areas in the figure above (7.0 km²) show the areas of Rongai catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (4.6 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 2.4 km² (average annual forest loss = 0.3 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2086.**

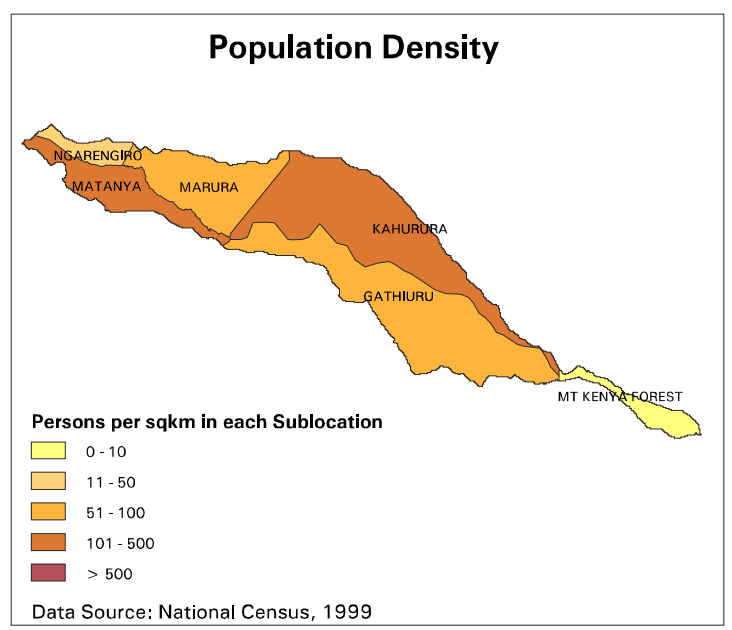
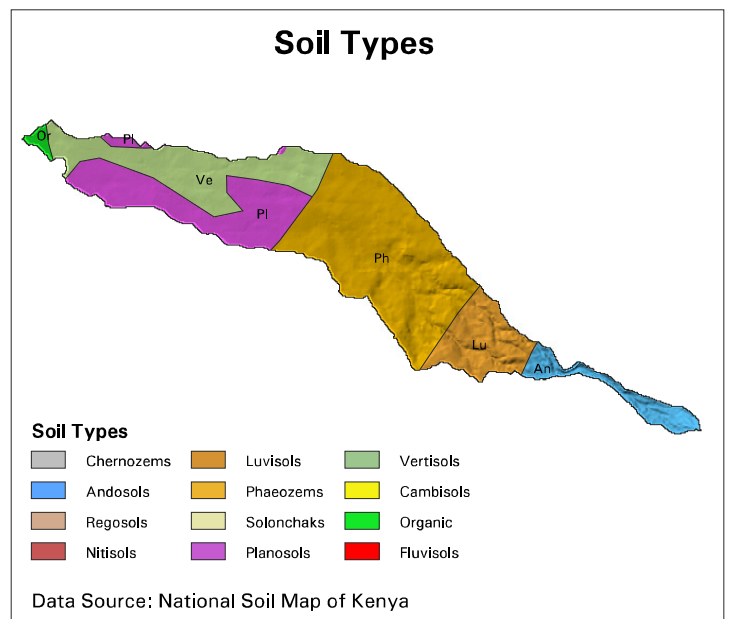
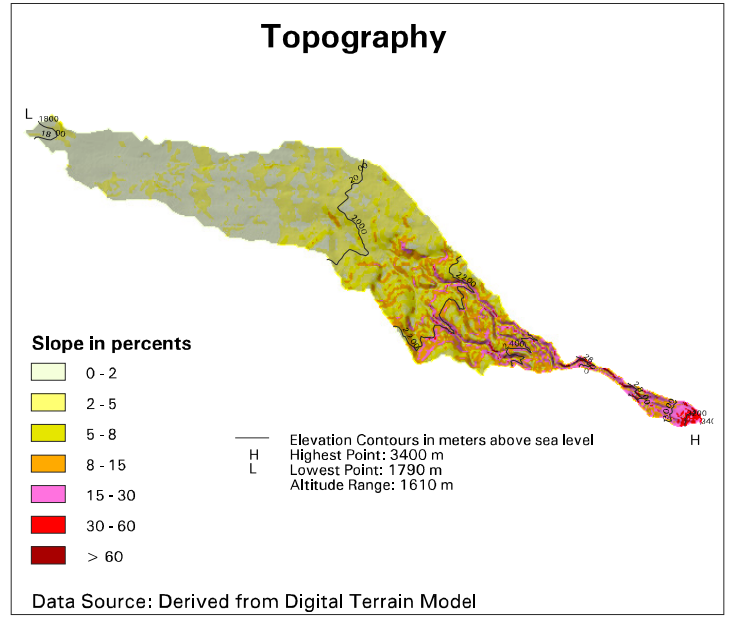
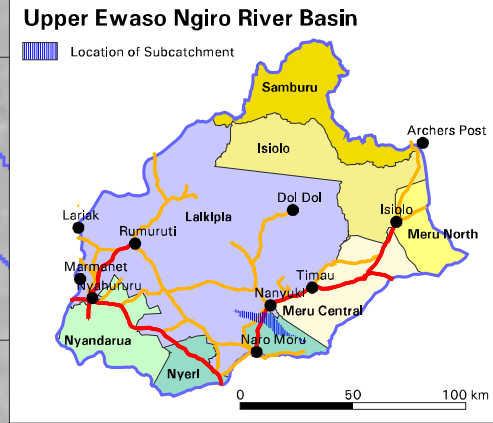
The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Rongai River Valley Development Promoters (RIVADEP)
Contact	Mr. Karuku Macheru, Patron, Mahon Shop, Nanyuki, 0721 217 409 Mr. Joseph Mathenge, Secretary, Opposite Ichuga sawing mill
In existence since	2003
Registered as	Association
Trigger of formation	Constant water related conflicts, destruction of catchment, severe water shortages.
Objectives	By-laws: Promoting legal abstraction and sustainable water use, water management and development. Promote soil and water conservation. Promote integrated development of people in the catchment. Promote self-help to reduce poverty and improve environment. Promote reasonable sharing of water. Promote water pans, roof water harvesting, dams. Provide a forum to discuss catchment protection and conflict resolution. Promote dialogue between water users. Promote biodiversity conservation. Raise, mobilise and disburse funds for promotion of the objectives. To network, collaborate or partner with other institutions. To be involved in emergencies (food distribution, etc.). Promote credit schemes.
Availability of sanctioning system	No sanctioning system
Role of horticulture farms	None
Sources of conflicts	Shortages, some users are not following the law, too many people want to use water, and people are not ready to share water.
Problems forwarded to the WUA	Downstream users think that upstream users are over-using the water. Riverine forest destruction.
Unexpressed conflicts	Catchment destruction, Illegal river water diversion
Availability of conflict guidelines	No guidelines
Concrete way of solving conflicts	Created 3 tree nurseries and planted indigenous trees. Closely relating with all users. Training members on the importance of water conservation. Encouraging people to look for alternative water sources (water pan, rain water harvesting, dam construction)
Cases of conflicts dealt with	None
Other activities the WUA is engaging in	Presently: Education, tree nurseries, water conservation, storage improvement, biodiversity conservation, (indigenous trees), food security improvement. Would like to venture into: credit facilities for members, full-time commercial farming, eliminating food related problems, poverty alleviation, improve livestock farming, purchasing movable and non-movable assets.
Achievements	Awareness creation to members on conservation. Reduction of conflicts. Establishment of tree nursery.
Hindrances	Lack of funds. Low level of literacy. Lack of skilled personnel to run the activities of the association.
Advices to others	Form the WUA directly as an association. Be conversant with new water act. Work closely with all stakeholders.



Land Cover Classes



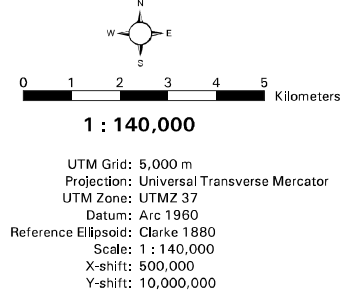
Landcover (1995)

39 % Grassland
19 % Woody Grassland
15 % Forest
11 % Plantation Forest
16 % Cropland
00 % Wasteland / Rocks
00 % Surface Water
00 % Urban Area
00 % Others

Key to Features

●	Abstraction points
◆	Gauging stations
●	Settlements and centres
—	Rivers
—	Catchment boundaries with names
—	Roads
—	Sublocation boundaries with names
—	Annual rainfall (millimeters)

Rongai Subcatchment



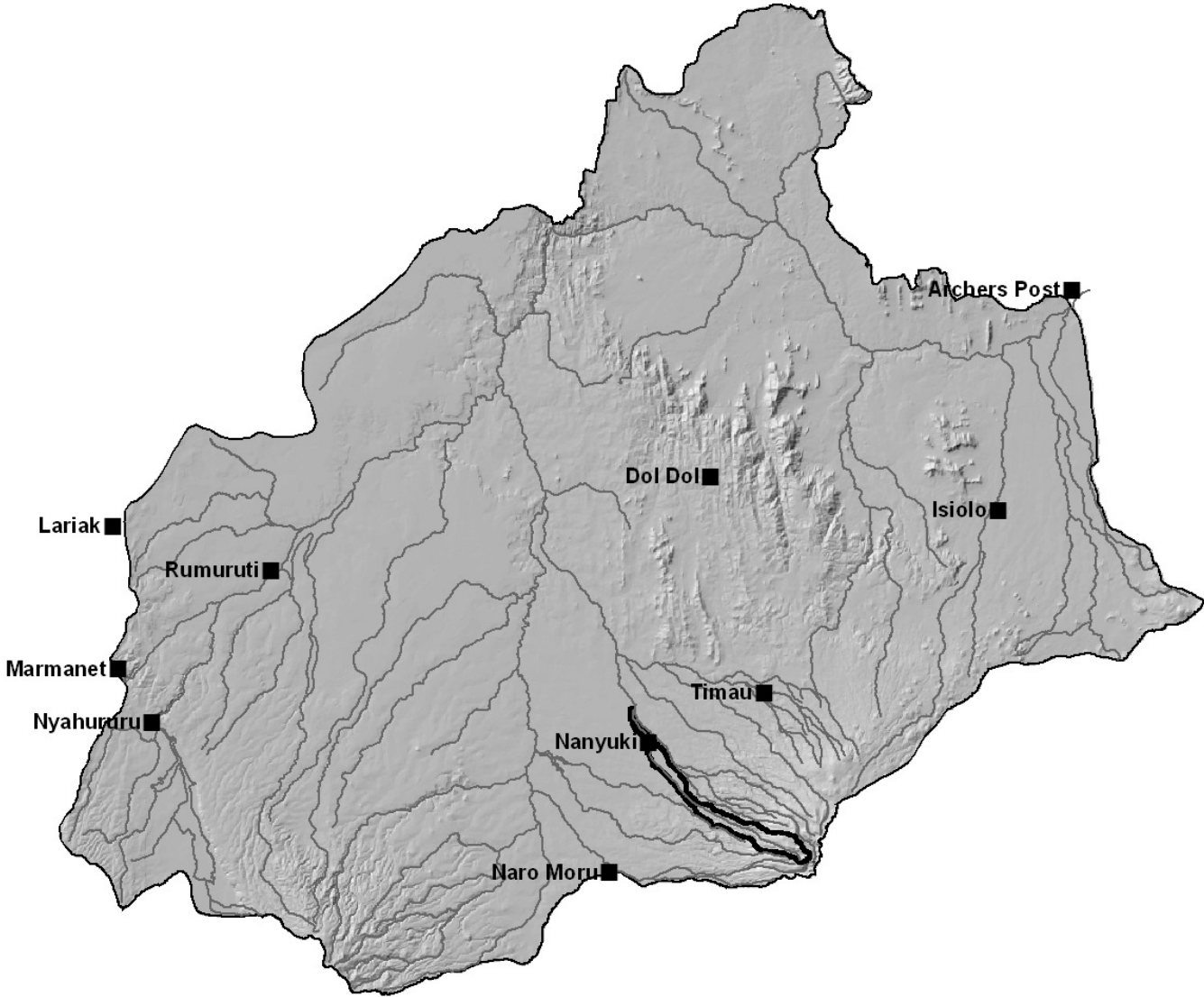
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(*) Arid and Semi Arid Lands.



Nanyuki Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	74 km ²
Perimeter	111 km
Area to perimeter ratio	0.66
Highest point	4,870 m
Lowest point	1,850 m
Average altitude	2,860 m
Altitude range (highest point – lowest point)	3,020 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	76,600,000 m ³
Average annual rainfall in catchment area	1,020 mm
Location with highest annual rainfall	680 mm
Location with lowest annual rainfall	1,350 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Nanyuki River)	42 km
Total length of all rivers in catchment	107 km
Number of gauging stations	1
Number of recorded abstraction points	34
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban centres	Nanyuki

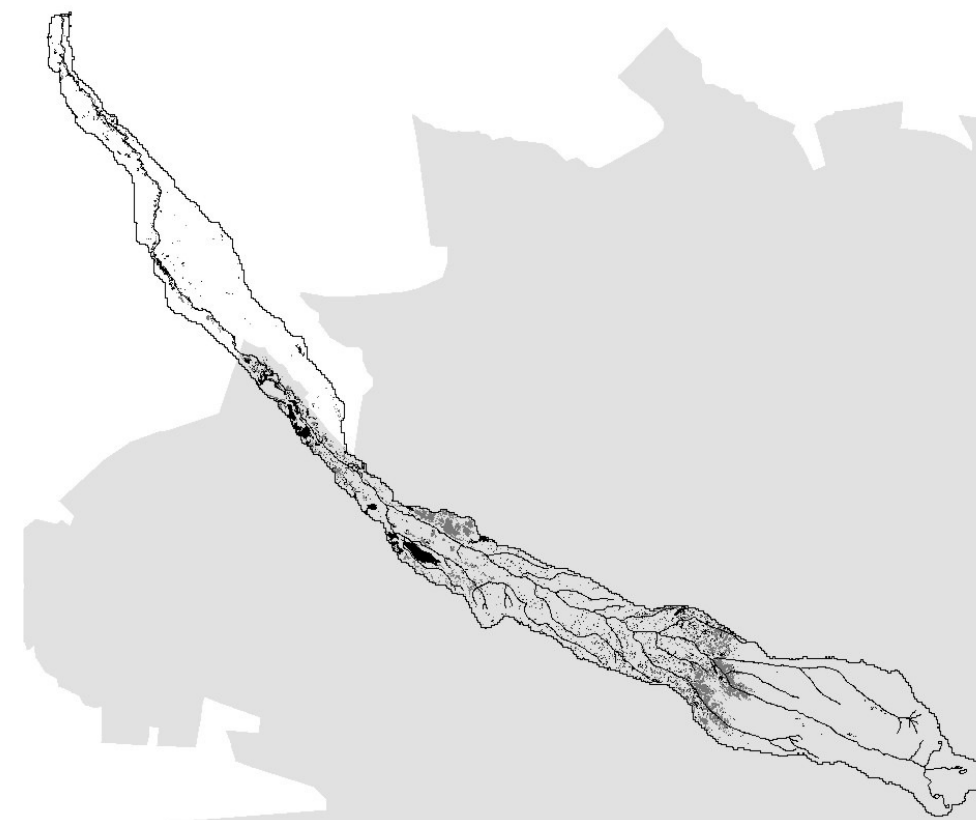
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Daiga	Naibor
		Marura	Marura
		Nanyuki	Majengo Thingithu
		Nturukuma	Likii Nturukuma
Meru Central	Mt Kenya National Park	Mt Kenya National Park	Mt Kenya National Park
Nyeri	Kieni East	Gakawa	Kahurura
	Mt Kenya Forest	Mt Kenya Forest	Mt Kenya Forest

Land Cover (1995)

Grassland	45 % = 33 km ²
Woody grassland	05 % = 4 km ²
Forest	30 % = 22 km ²
Plantation forest	04 % = 3 km ²
Cropland	11 % = 8 km ²
Wasteland / rocks	04 % = 3 km ²
Urban areas	01 % = 1 km ²

Loss of forest between 1995 and 2002

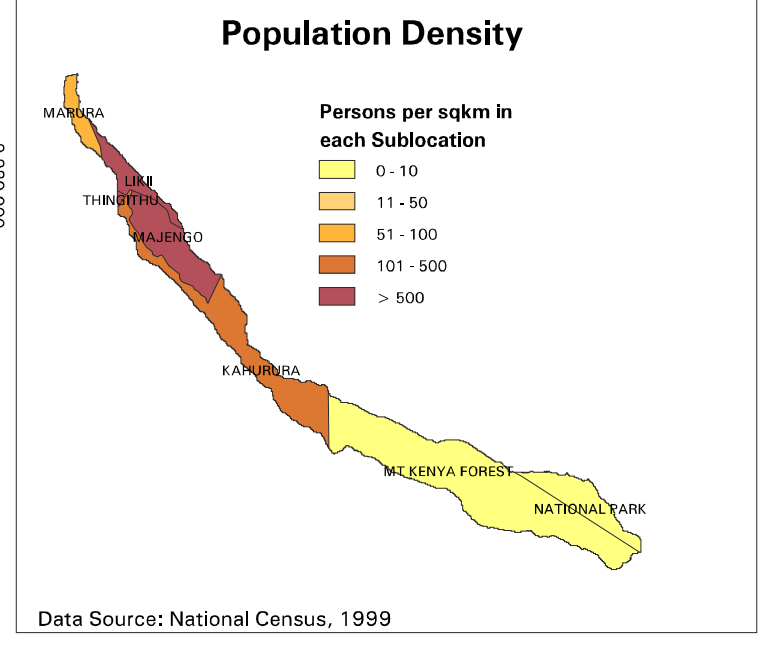
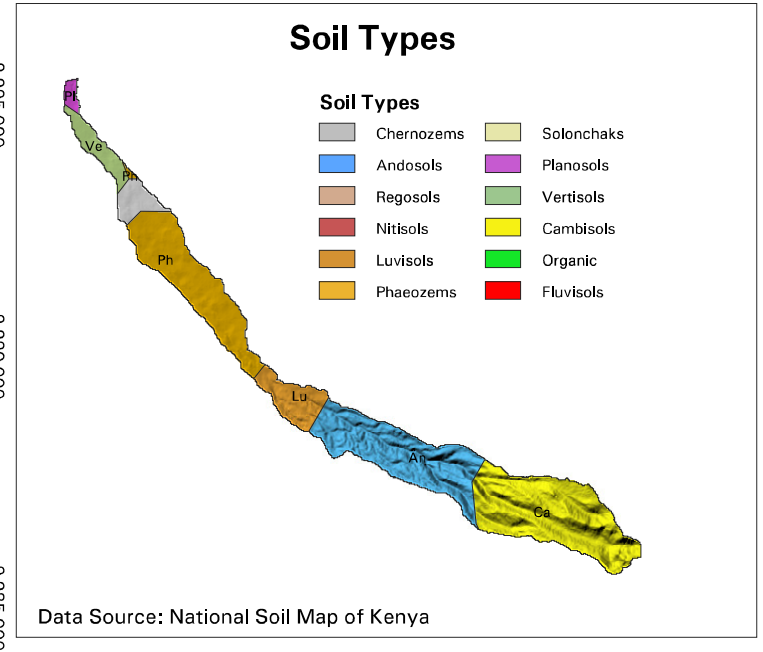
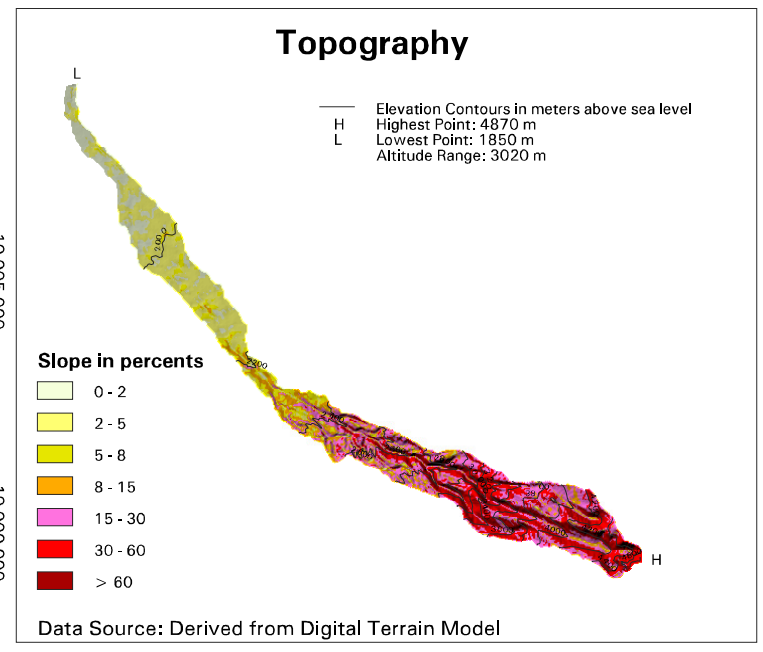
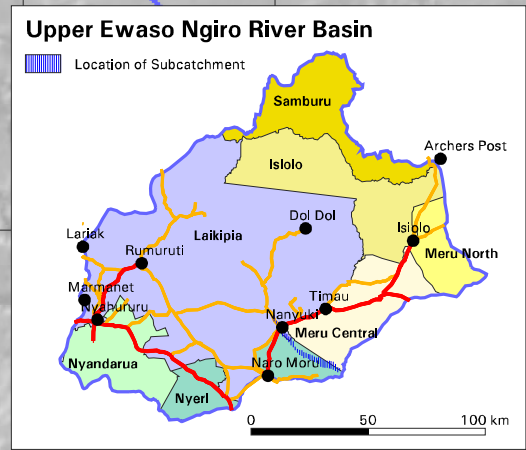
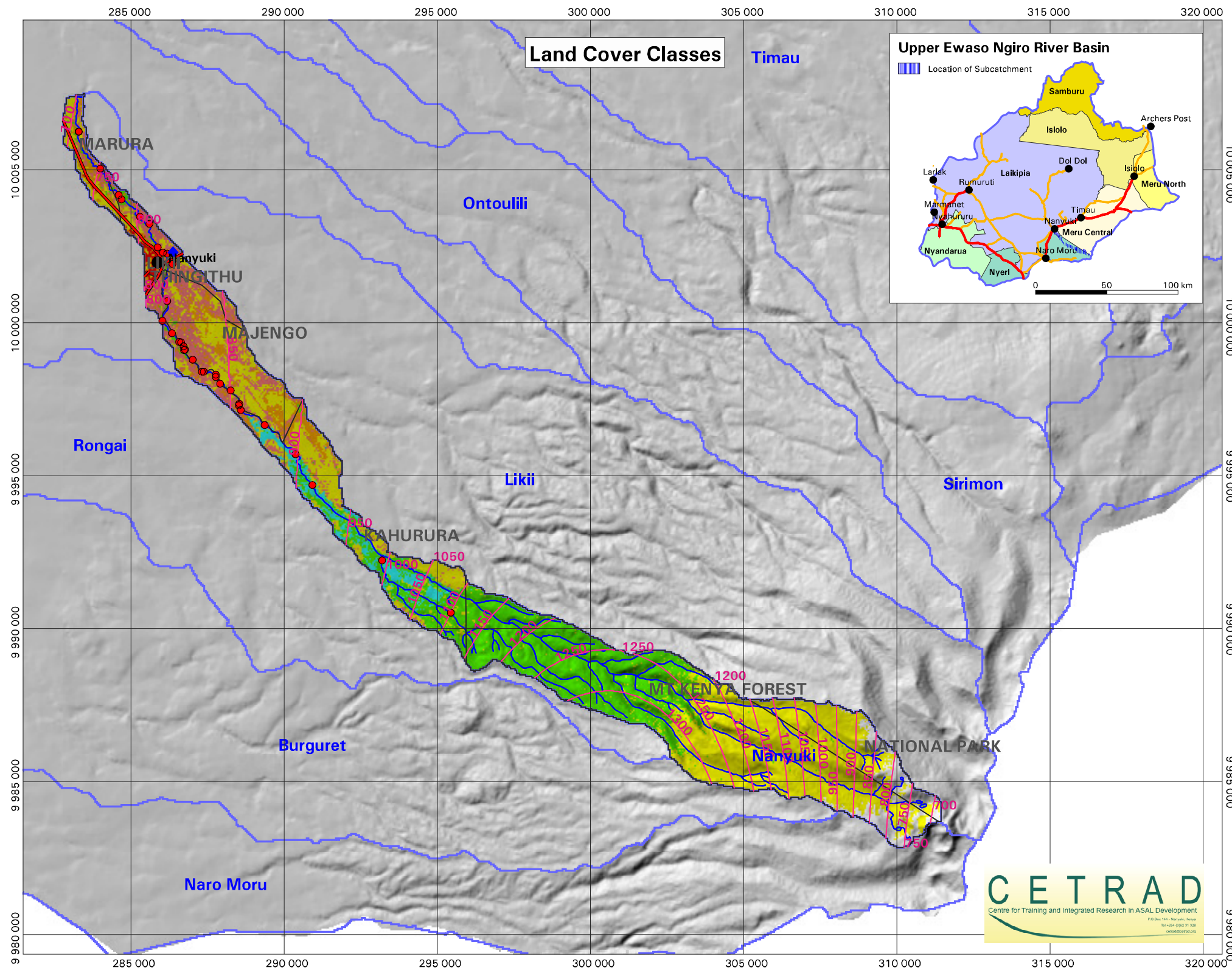


The black areas in the figure above (3.5 km²) show the areas of Nanyuki catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (3.8 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest gain for the period 1995 – 2002 is 0.3 km² (average annual forest gain = 0.04 km²). **This is one of the few analyzed catchment with a net forest increase according to the two classifications.**

The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Nanyuki River Water User Association (NRWUA)
Contact	Kassim Hammed, Chairman
In existence since	2001
Registered as	Association (registered at Attorney General's Office)
Trigger of formation	Everybody was handling on their own. People in the middle and lower stretches were not getting water.
Objectives	Share water equitably, minimise conflicts, protect environment along the river, minimise pollution, soil erosion control, management of water matters.
Availability of sanctioning system	Yes: Officials summon culprit, or report him to the relevant authority.
Role of horticulture farms	None
Sources of conflicts	Water shortages, low water quality, lack of adhering to water laws by some users
Problems forwarded to the WUA	Excessive abstraction by upper users, water pollution upstream, cutting of trees along the river, quarrying activities along the river
Unexpressed conflicts	None
Availability of conflict guidelines	Yes: In the by-laws. Drafted by officials and members. Approval by all members. There was a consensus on them through general meeting of all members. Guidelines are effective in solving conflicts.
Concrete way of solving conflicts	Visiting affected sites. Issuance of directives on how and when to use water. Big conflicts are forwarded to relevant government authorities.
Cases of conflicts dealt with	Essentially water shortage and scarcity problems during the dry spell brought to them by individual members. Cases dealt with successfully (timing abstraction between upstream and downstream areas, e.g. day – night, or half-day – half-night). No case pending.
Other activities the WUA is engaging in	None so far but plan to start tree nurseries and plant trees along river banks. Have potential to engage in environmental protection, construction of dams, etc.
Achievements	Creation of awareness among users on water use and conservation
Hindrances	Financial limitations, shortage of trained manpower, communication media between different projects and individual users.
Advices to others	Approach relevant authorities for guidance on procedures. There needs to be cooperation, understanding and consensus building. Self-sacrifice. Seek advice from experts. Exercise transparency.



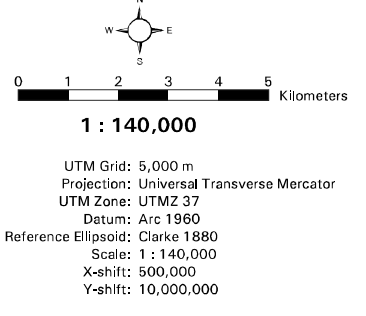
Landcover (1995)

45 % Grassland
05 % Woody Grassland
30 % Forest
04 % Plantation Forest
11 % Cropland
04 % Wasteland / Rocks
00 % Surface Water
01 % Urban Area
00 % Others

Key to Features

●	Abstraction points
◆	Gauging stations
●	Settlements and centres
—	Rivers
—	Catchment boundaries with names
—	Roads
—	Sublocation boundaries with names
—	Annual rainfall (millimeters)

Nanyuki Subcatchment



This map was prepared in partnership between the Centre for Training and Integrated Research in ASAL(*) Development (CETRAD) and the Natural Resources Monitoring, Modeling and Management (NRM3) in October 2004. Cartography and layout: A. Ehrensperger & M. Gone.

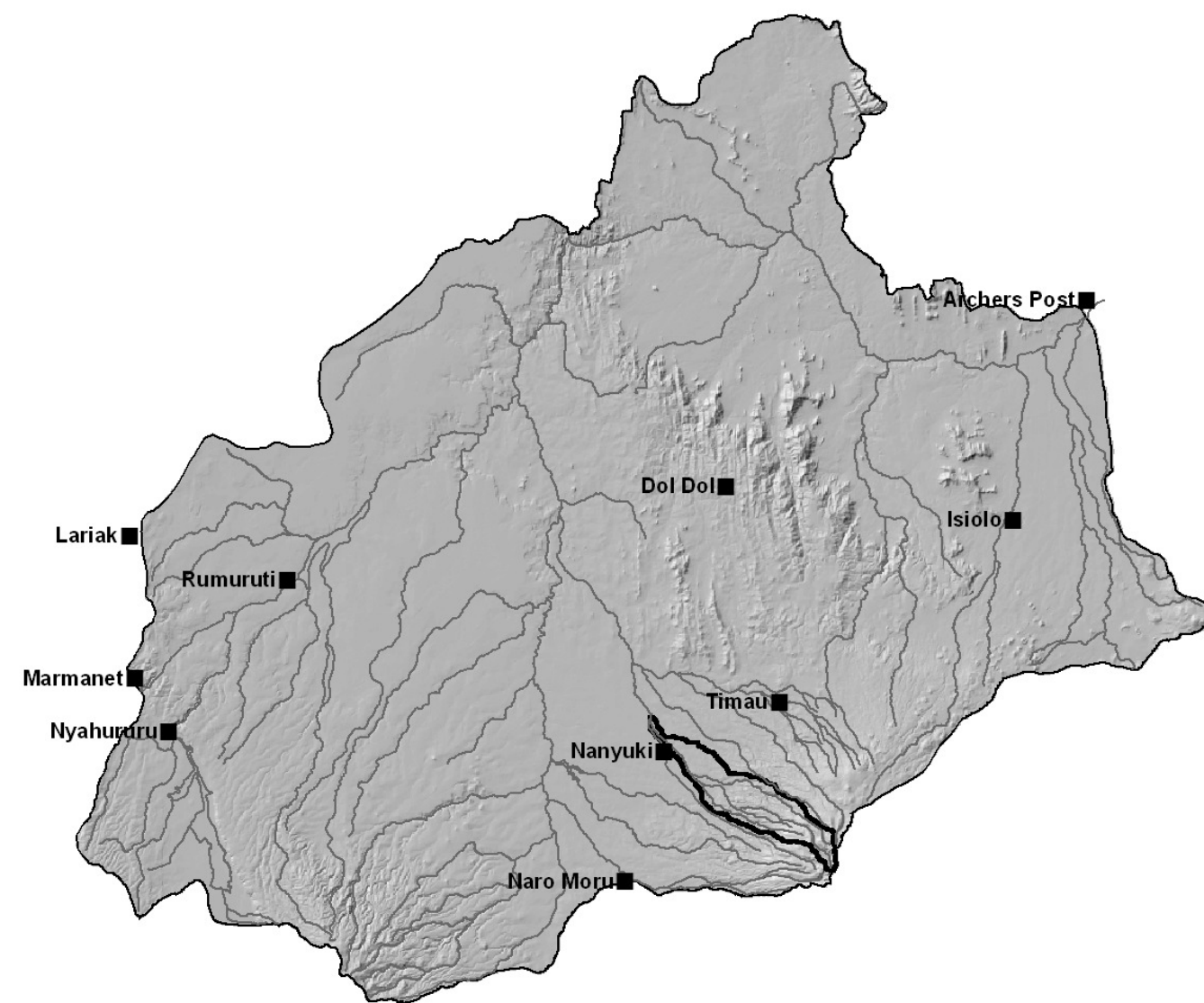
CETRAD is bilaterally established between the Government of Kenya, through the Ministry of Water Resources Management & Development and the Swiss Government, through the Centre for Development and Environment of the University of Berne. CETRAD is the regional coordination office for East Africa of the Swiss National Centre of Competence in Research North-South.

CETRAD is based in Nanyuki, Laikipia District, Kenya. It is concerned with designing strategies for sustainable development, promoting land use planning for sustained livelihood and optimal resource use, fostering sustainable resource use and management for improved productivity and developing non-farm economy, infrastructure and services.

Linear features on this map are all part of CETRAD's comprehensive spatial database, which covers the Upper Ewaso Ngiro Basin, Laikipia, Mwingi and Makueni Districts, Nakuru Municipality, Kenya national data sets as well as other areas. The Digital Terrain Model, the derived hill-shade and slope map were prepared by CETRAD. All hydrologic rainfall and land cover data from NRM3. Rainfall interpolated from yearly averages in selected stations between 1991 and 2000 using Spline algorithm.

(*) Arid and Semi Arid Lands.





Likii Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	184 km ²
Perimeter	114 km
Area to perimeter ratio	1.61
Highest point	5,120 m
Lowest point	1,850 m
Average altitude	2,740 m
Altitude range (highest point – lowest point)	3,270 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	178,234,360 m ³
Average annual rainfall in catchment area	975 mm
Location with highest annual rainfall	1,250 mm
Location with lowest annual rainfall	620 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Likii Central River)	46 km
Total length of all rivers in catchment	256 km
Number of gauging stations	1
Number of recorded abstraction points	43
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban and rural centres	Nturukuma

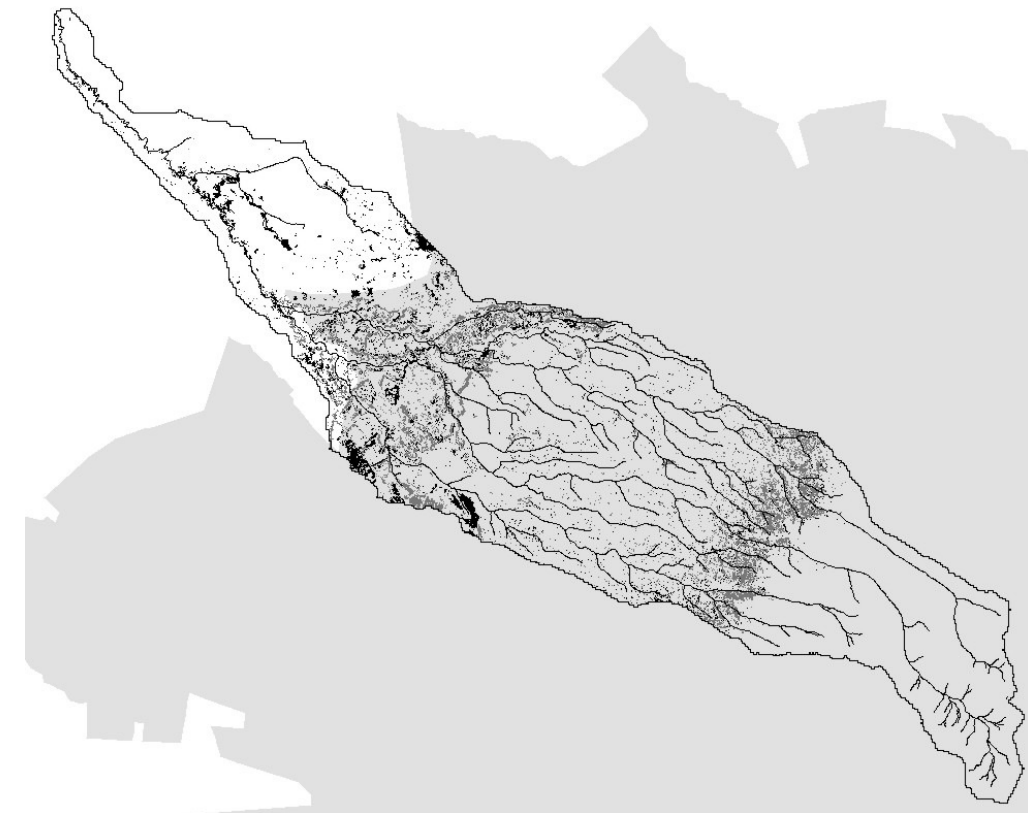
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Daiga	Naibor
		Marura	Marura
		Nanyuki	Majengo
		Nturukuma	Likii Nturukuma
Meru Central	Timau	Ontulili	Kangaita Katheri
	Mt Kenya Forest	Mt Kenya Forest	Mt Kenya Forest
	Mt Kenya National Park	Mt Kenya National Park	Mt Kenya National Park

Land Cover (1995)

Grassland	34 %	=	63 km ²
Woody grassland	4 %	=	7 km ²
Forest	40 %	=	74 km ²
Plantation forest	5 %	=	9 km ²
Cropland	14 %	=	26 km ²
Wasteland / rocks	3 %	=	5 km ²

Loss of forest between 1995 and 2002

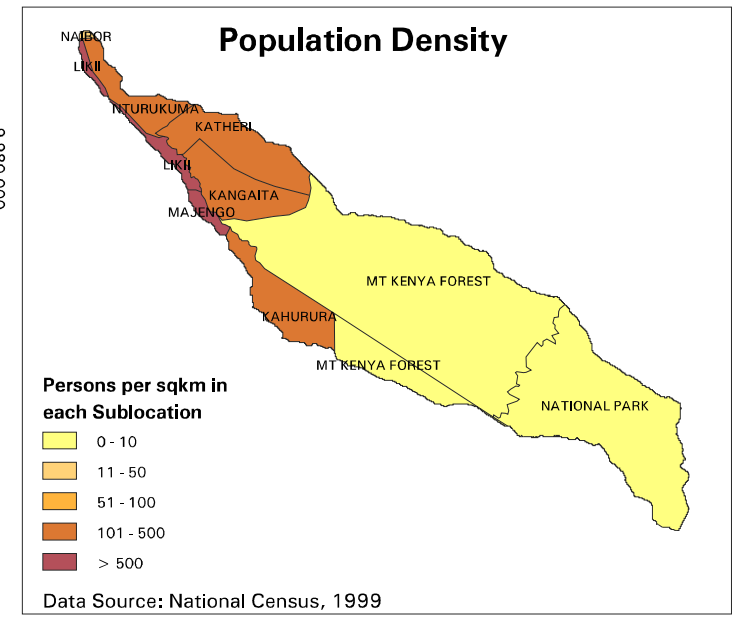
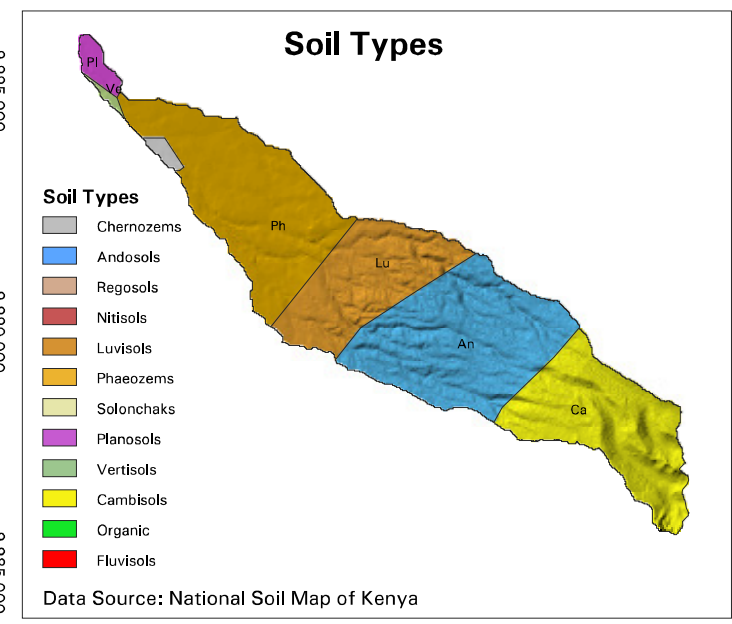
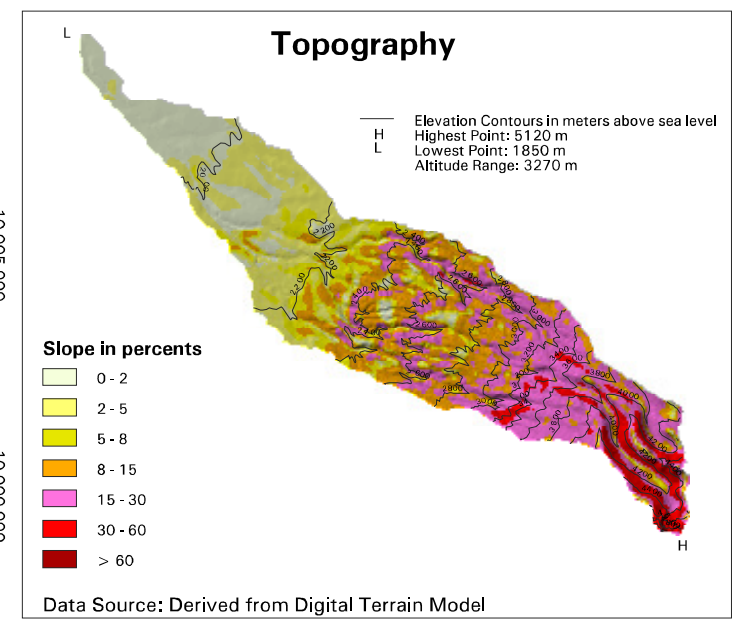
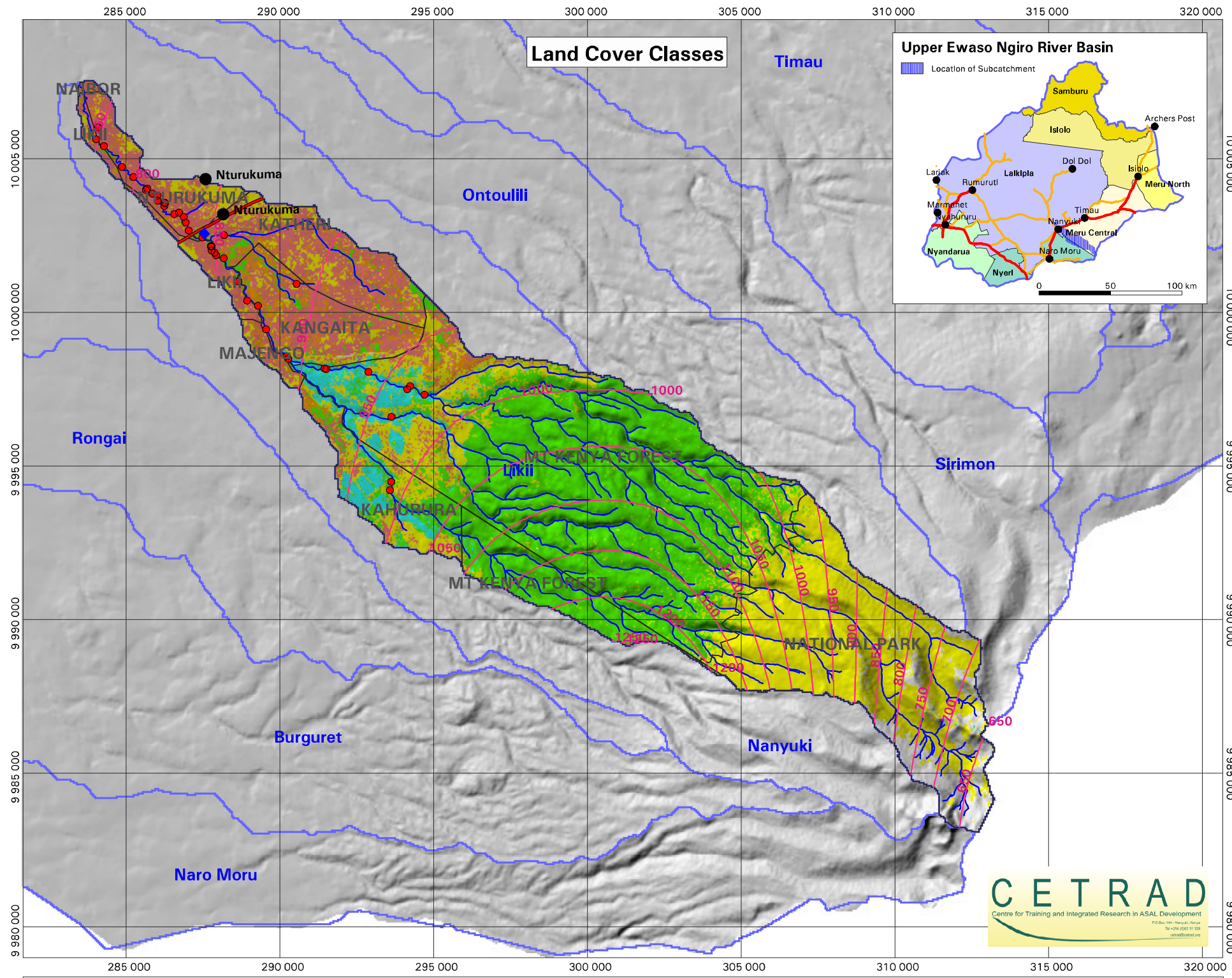


The black areas in the figure above (7.2 km²) show the areas of Likii catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (11.2 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest gain for the period 1995 – 2002 is 4 km² (average annual forest gain = 0.6 km²). **This is one of the few analyzed catchment with a net forest increase according to the two classifications.**

The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Likii River Water User Association
Contact	Mr. Fernandez – Chairman – Kangaita Flower Farm.
In existence since	2002
Registered as	Association
Trigger of formation	Result of private activities, e.g. irrigation projects.
Objectives	(not yet availed)
Availability of sanctioning system	No case of failure to adhere to the by-laws was ever reported
Role of horticulture farms	All (2) farms are member of the WUA. They were involved in the formation through financial help, fixing of legal protocols, soliciting support from all stakeholders and users, arranging for initial meetings prior to registration. Help in running WUA both financially and at the management level. WUA could not work without them because of financial hindrances, lack of qualified manpower for managing the WUA, coordination and communication hindrances. The role of the horticultural farms is therefore very dominant.
Sources of conflicts	Water shortages
Problems forwarded to the WUA	No conflicts have been reported to the WUA so far
Unexpressed conflicts	Water shortage related conflicts, bans by the ministry. Who, when and how should stop abstracting water?
Availability of conflict guidelines	No
Concrete way of solving conflicts	None has arisen so far
Cases of conflicts dealt with	None so far
Other activities the WUA is engaging in	Promoting drip irrigation, educating masses, improving water storage Untapped potentials include: Improved water storage, widespread promotion of drip irrigation, training and educating users.
Achievements	Forming of the association in its own, i.e. succeeding in bringing users together.
Hindrances	Financial hindrances, ill-equipped personnel to run WUA, time constraints.
Advices to others	To be willing to form the WUA, get support (financially and logistics) from e.g. ministry. Make stakeholders aware of existing problems.



Landcover (1995)

- 34 % Grassland
- 04 % Woody Grassland
- 40 % Forest
- 05 % Plantation Forest
- 14 % Cropland
- 03 % Wasteland / Rocks
- 00 % Surface Water
- 00 % Urban Area
- 00 % Others

Key to Features

- Abstraction points
- Gauging stations
- Settlements and centres
- Rivers
- Catchment boundaries with names
- Roads
- Sublocation boundaries with names
- Annual rainfall (millimeters)

Likii Subcatchment

Scale: 1 : 140,000

UTM Grid: 5,000 m
 Projection: Universal Transverse Mercator
 UTM Zone: UTMZ 37
 Datum: Arc 1960
 Reference Ellipsoid: Clarke 1880
 Scale: 1 : 140,000
 X-shift: 500,000
 Y-shift: 10,000,000

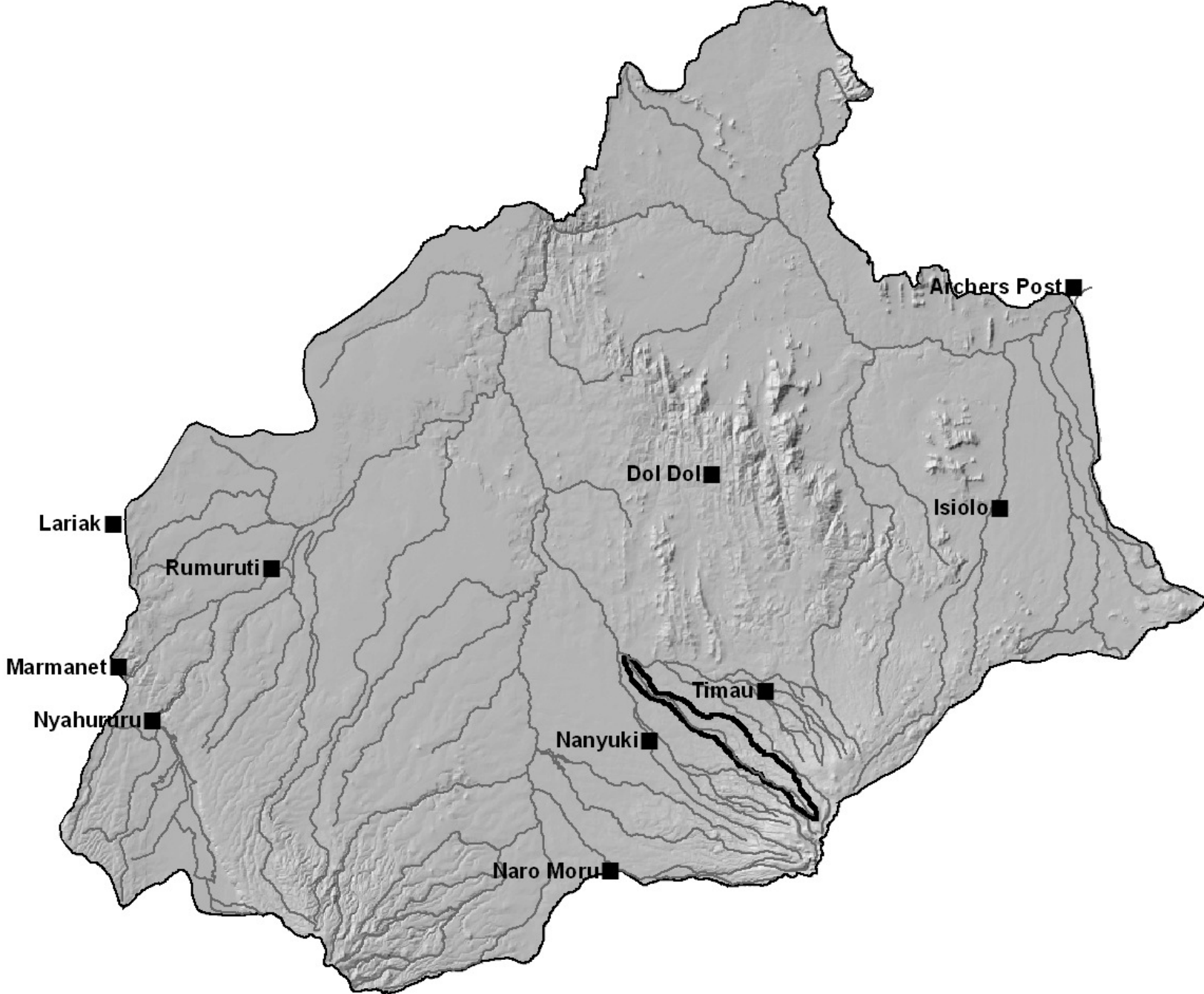
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(*) Arid and Semi Arid Lands.



Ontulili Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	107 km ²
Perimeter	116 km
Area to perimeter ratio	0.92
Highest point	4,250 m
Lowest point	1,770 m
Average altitude	2,450 m
Altitude range (highest point – lowest point)	2,480 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	94,800,000 m ³
Average annual rainfall in catchment area	875 mm
Location with highest annual rainfall	1020 mm
Location with lowest annual rainfall	640 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Ontulili River)	44 km
Total length of all rivers in catchment	124 km
Number of gauging stations	1
Number of recorded abstraction points	15
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban centres	Githuchi, Mathagi, Nyariginu

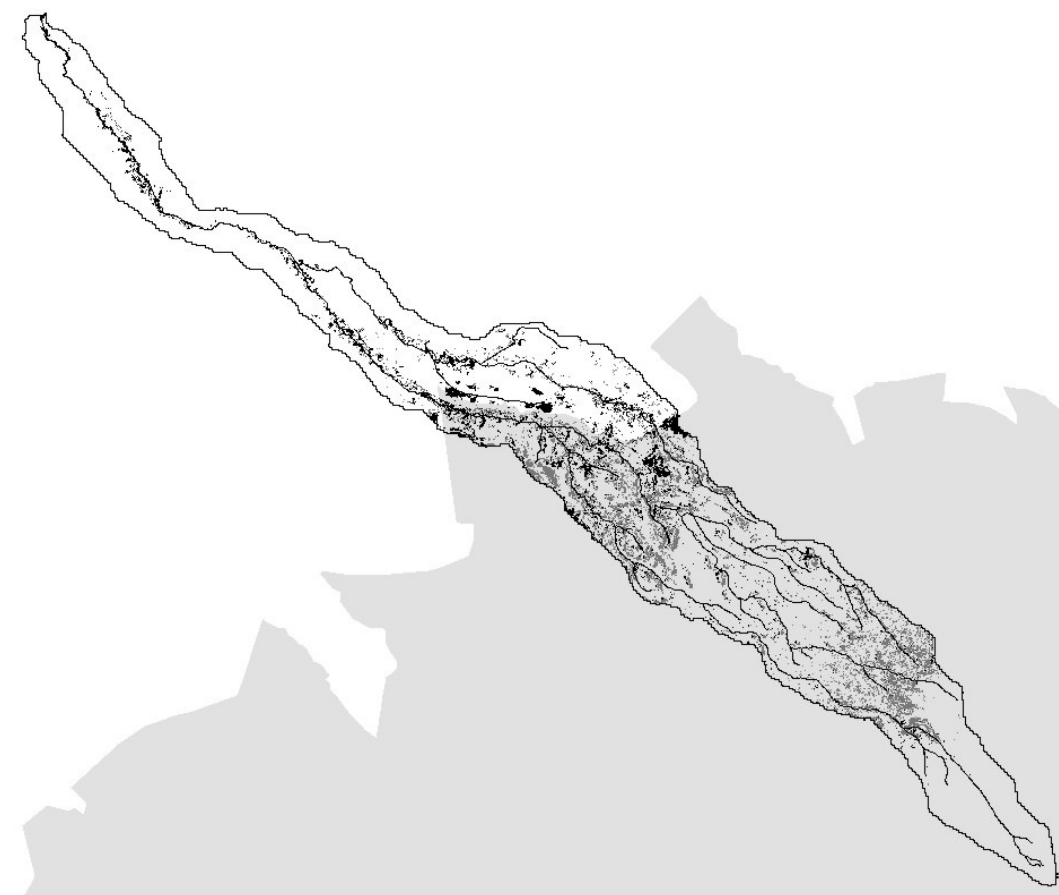
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Daiga	Naibor
			Umande
		Nturukuma	Nturukuma
Meru Central	Timau	Ontulili	Antubamwitu
	Mt Kenya Forest	Mt Kenya Forest	Mt Kenya Forest
	Mt Kenya National Park	Mt Kenya National Park	Mt Kenya National Park

Land Cover (1995)

Grassland	33 % = 35 km ²
Woody grassland	12 % = 13 km ²
Forest	30 % = 32 km ²
Plantation forest	05 % = 05 km ²
Cropland	19 % = 20 km ²
Wasteland / rocks	01 % = 01 km ²

Loss of forest between 1995 and 2002

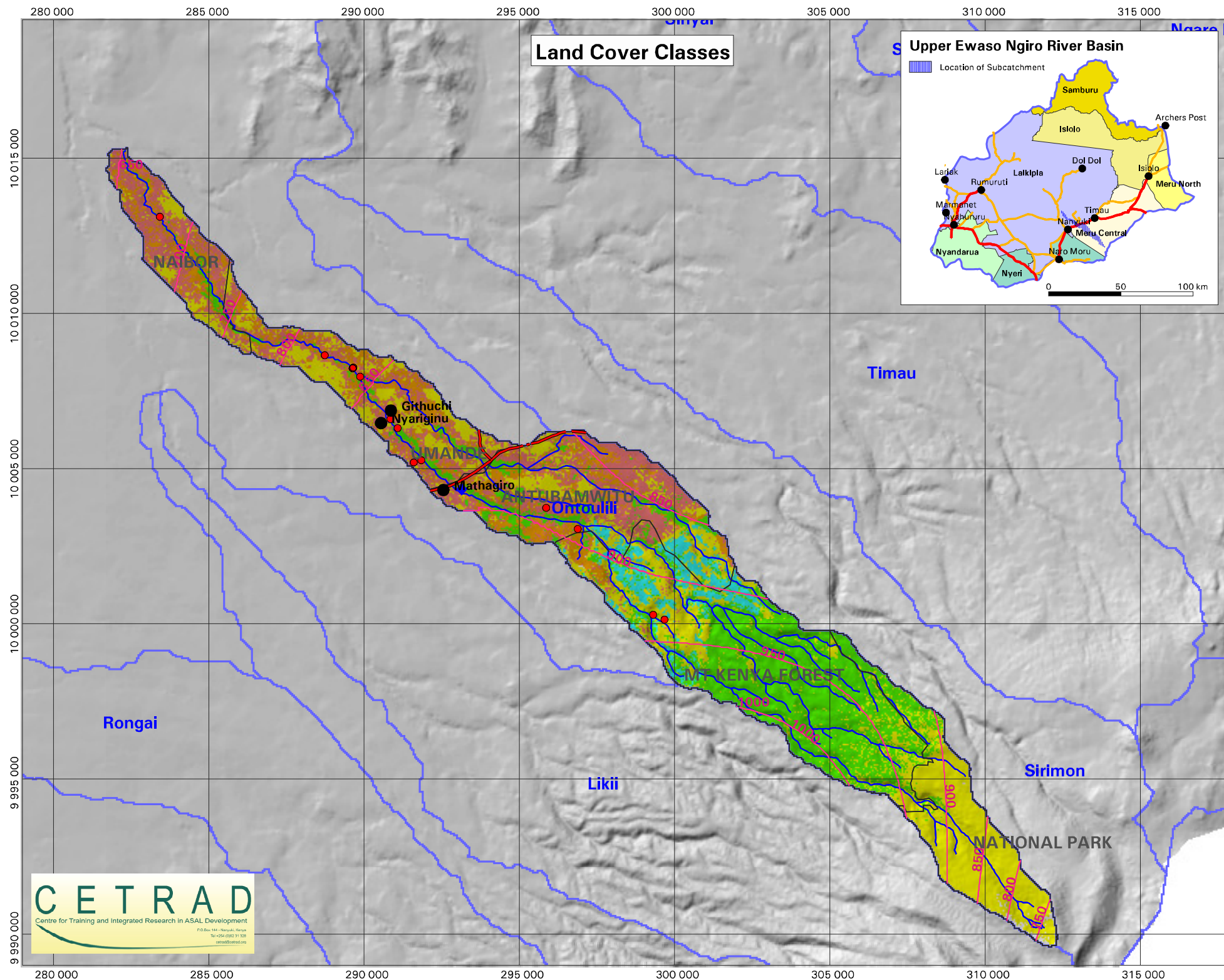


The black areas in the figure above (5.9 km²) show the areas of Ontulili catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (9.3 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest gain for the period 1995 – 2002 is 3.4 km² (average annual forest gain = 0.5 km²). **This is one of the few analyzed catchment with a net forest increase according to the two classifications.**

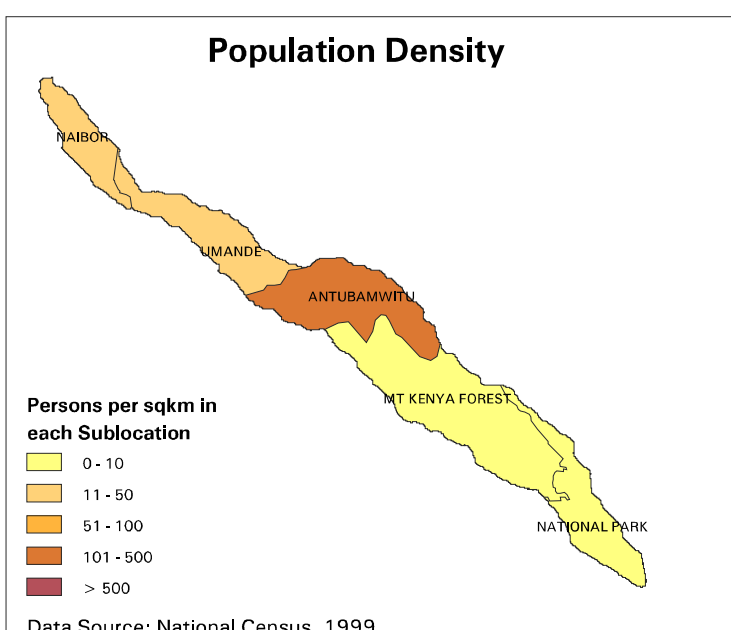
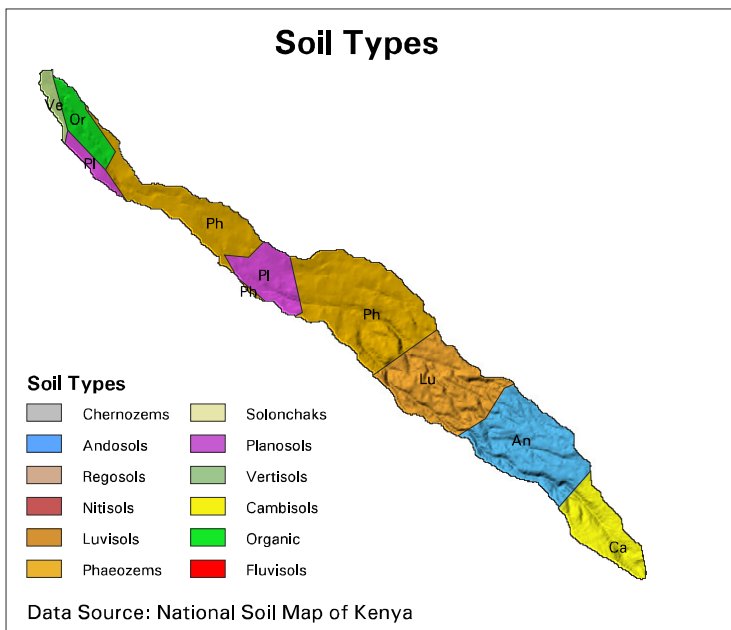
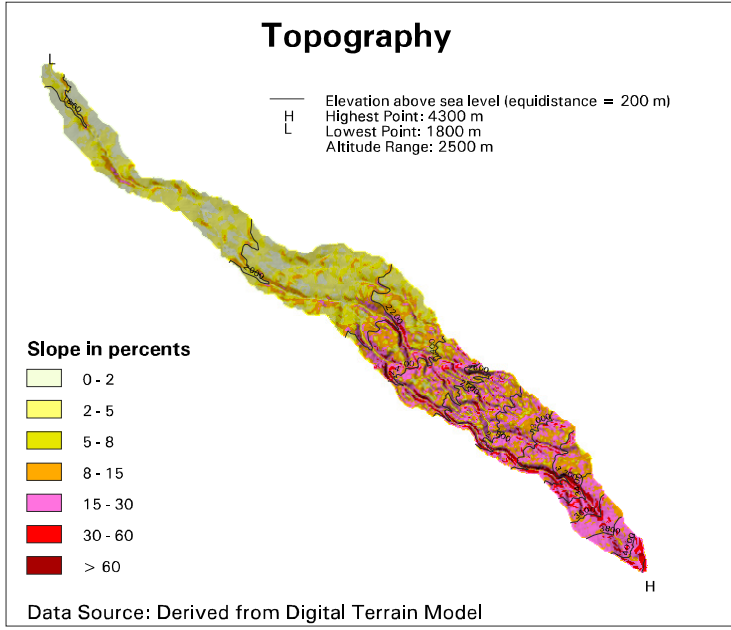
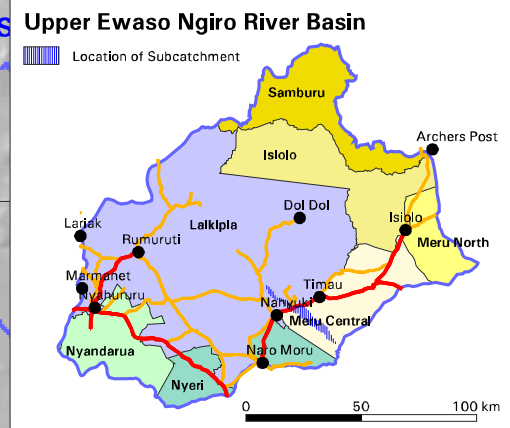
The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Ontulili River Water User Association
Contact	Mr. Mwangi Mahindu, Committee member, Turaco Farm, 0734 751 196 Mr. Mathagirot, Committee member, Mathagirot Centre, 0721 559 921
In existence since	2003
Registered as	Not yet. Intend to register it as an association
Trigger of formation	The new water act stating that each river should have a WUA
Objectives	Reforestation of catchment, especially along the river. Water conservation through dams. Secure water for domestic and irrigation use. Maintenance of rivers and watershed management. Promote economic use of water.
Availability of sanctioning system	No sanctioning system.
Role of horticulture farms	All (3) are members. Homegrown participated in the formation by arranging meetings and offering management personnel. The WUA can not work without them, as they assist in the coordination. Their influence is comparable to other members
Sources of conflicts	Shortages, catchment destruction, people do not share water, or do not follow the law.
Problems forwarded to the WUA	Catchment destruction, artificial shortages caused by over-abstraction upstream.
Unexpressed conflicts	Population pressure, leading to higher demand, while resource dwindles.
Availability of conflict guidelines	None.
Concrete way of solving conflicts	Talk with upstream users to reduce abstraction. Talk with inhabitants to curb catchment destruction. Create awareness on the need for good water management
Cases of conflicts dealt with	Two cases on over-abstraction and on catchment destruction. Cases brought to them from users through the district water office. Cases were successfully addressed.
Other activities the WUA is engaging in	None. They would like to help enhancing the economic status of the people in the catchment.
Achievements	Reduction of water conflicts.
Hindrances	Registration, lack of legal backing as stipulated in the water act.
Advices to others	---



Land Cover Classes



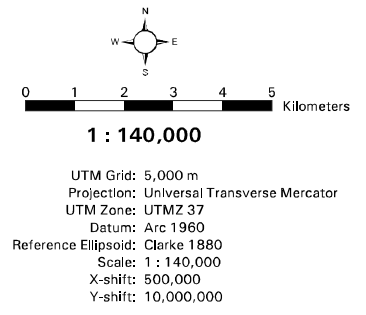
Landcover (1995)

33 % Grassland
12 % Woody Grassland
30 % Forest
05 % Plantation Forest
19 % Cropland
01 % Wasteland / Rocks
00 % Surface Water
00 % Urban Area
00 % Others

Key to Features

●	Abstraction points
◆	Gauging stations
●	Settlements and centres
—	Rivers
—	Catchment boundaries with names
—	Roads
—	Sublocation boundaries with names
—	Annual rainfall (millimeters)

Ontulili Subcatchment



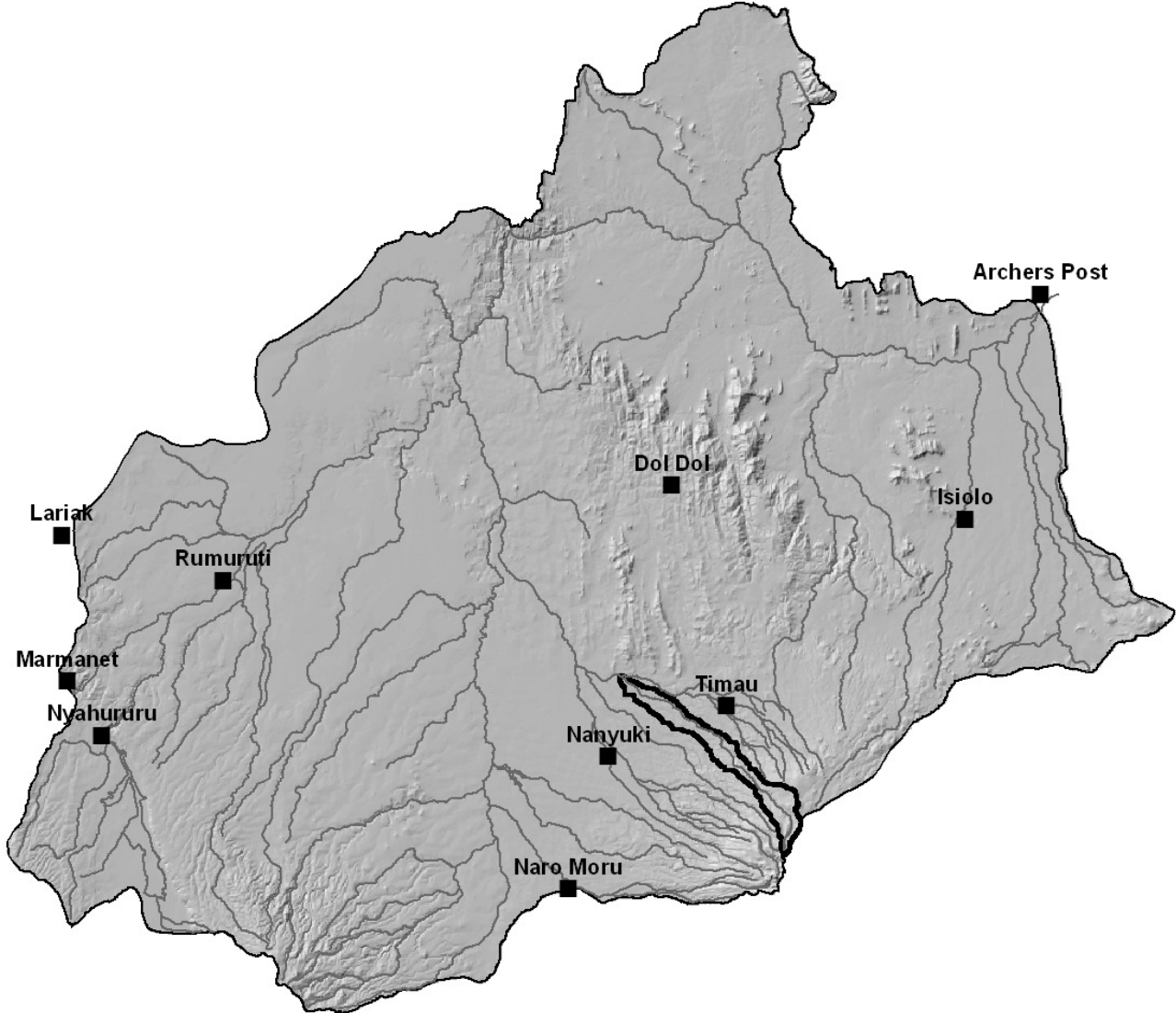
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(*) Arid and Semi Arid Lands.



Sirimon Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	116 km ²
Perimeter	117 km
Area to perimeter ratio	0.99
Highest point	4,520 m
Lowest point	1,830 m
Average altitude	2,770 m
Altitude range (highest point – lowest point)	2,690 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	94,400,000 m ³
Average annual rainfall in catchment area	809 mm
Location with highest annual rainfall	640 mm
Location with lowest annual rainfall	920 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Sirimon River)	46 km
Total length of all rivers in catchment	112 km
Number of gauging stations	1
Number of recorded abstraction points	19
Water User Association	No

Socio – economy

Population	---
Urban centres	Kalalu, Maili Tisa, Gitugi, Kwa George, Umande

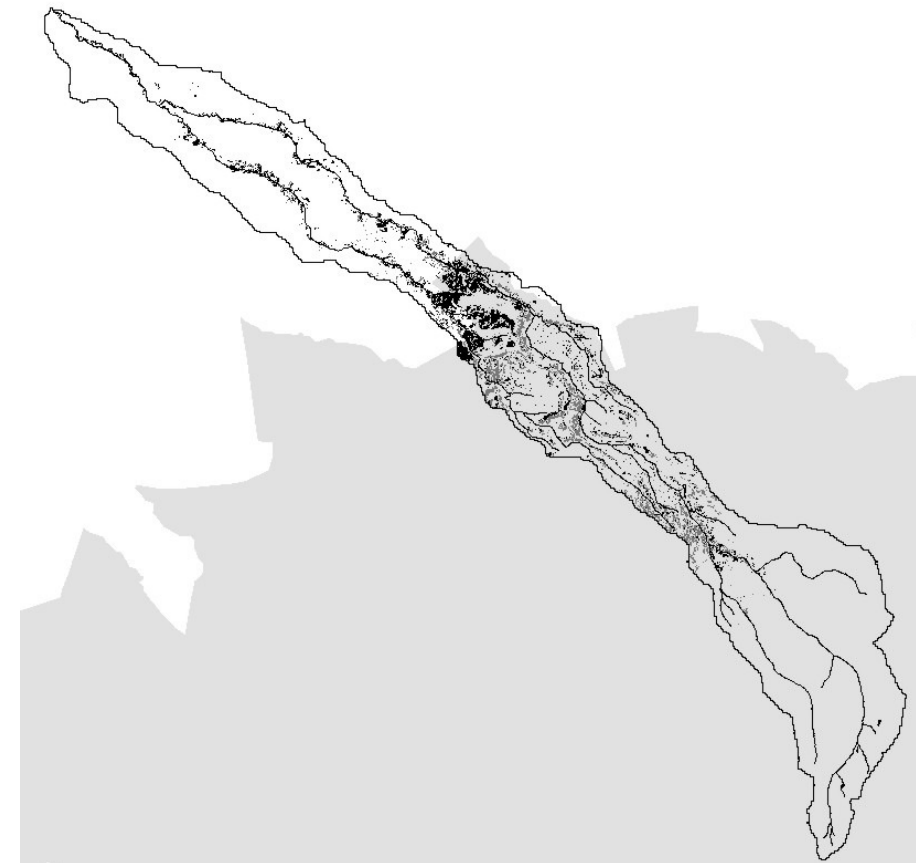
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Daiga	Ethi
			Umande
Meru Central	Timau	Kirimara	Kithithina
		Ontulili	Antubamwitu
	Mt Kenya Forest	Mt Kenya Forest	Mt Kenya Forest
	Mt Kenya National Park	Mt Kenya National Park	Mt Kenya National Park

Land Cover (1995)

Grassland	49 % = 57 km ²
Woody grassland	9 % = 10 km ²
Forest	22 % = 26 km ²
Cropland	17 % = 20 km ²
Wasteland / rocks	3 % = 3 km ²

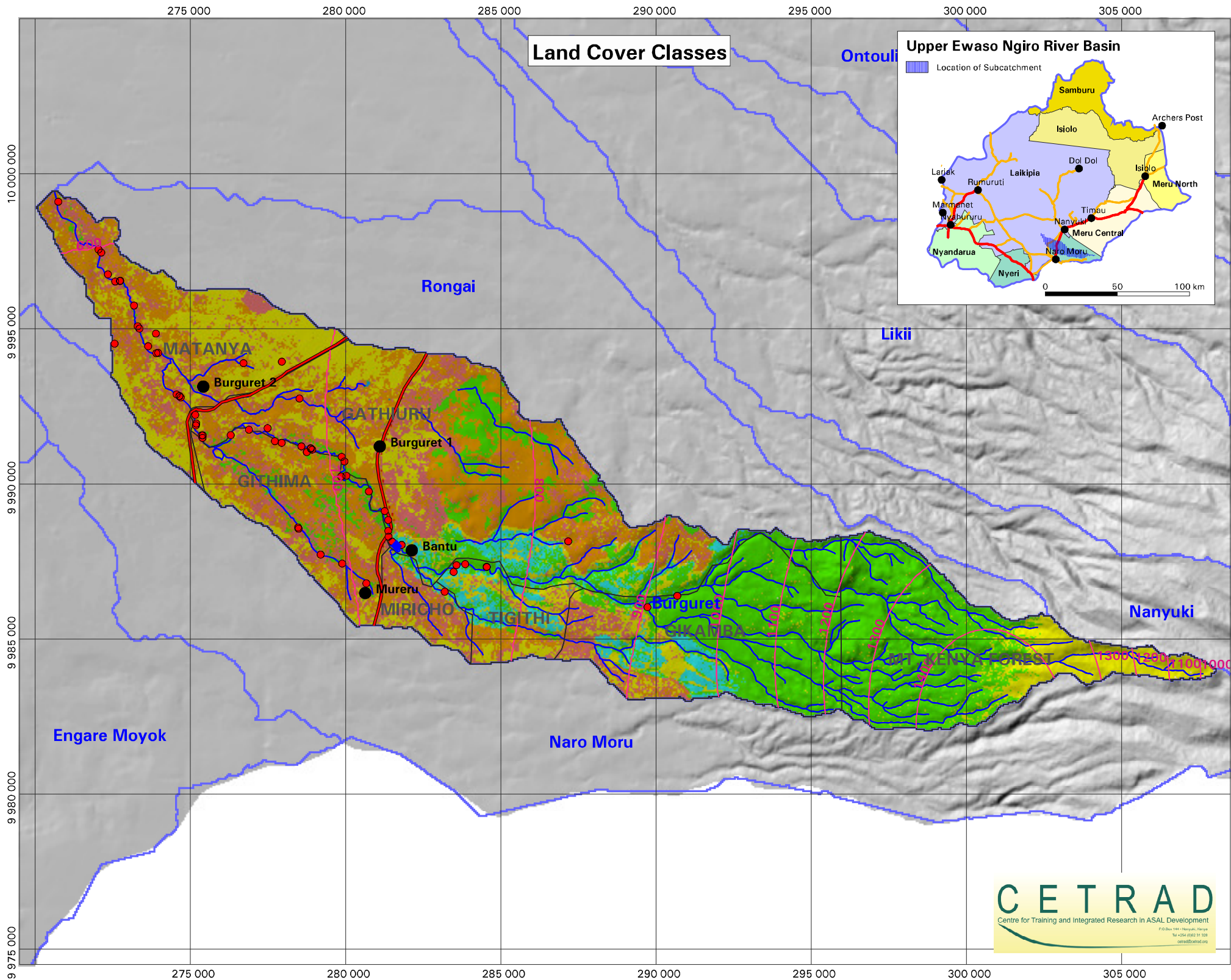
Loss of forest between 1995 and 2002



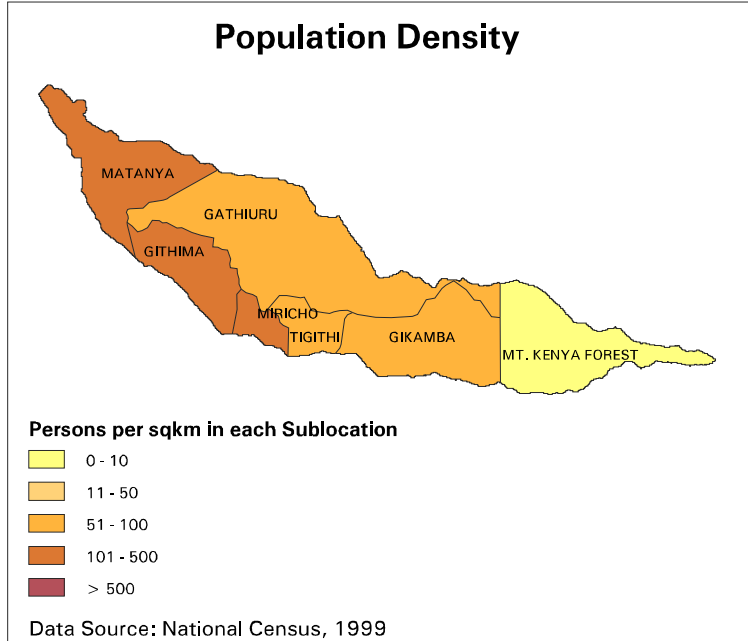
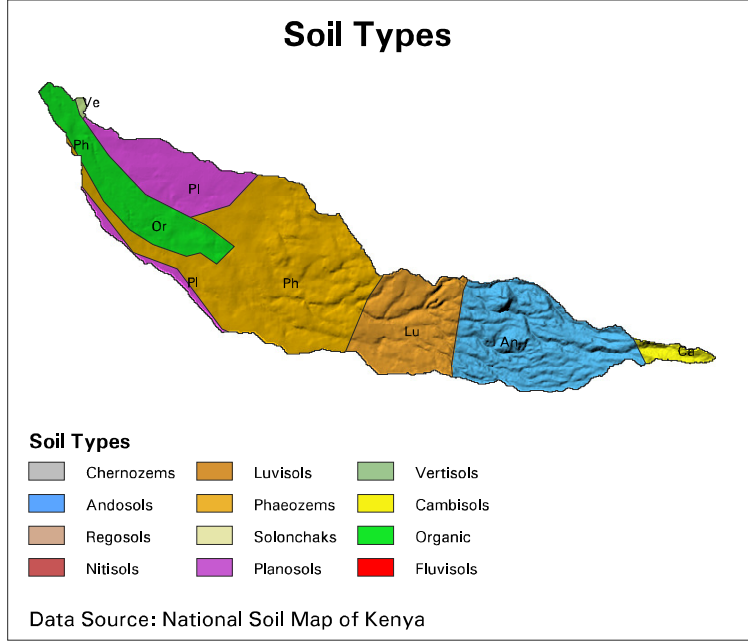
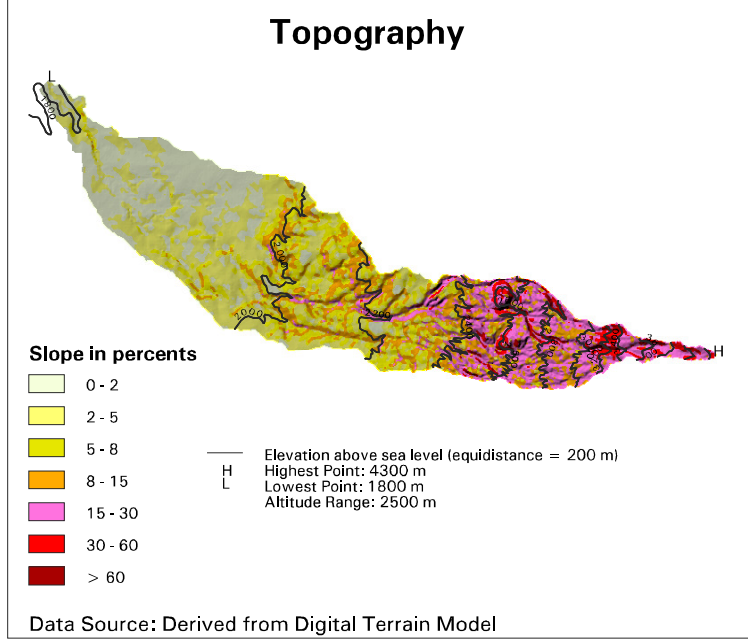
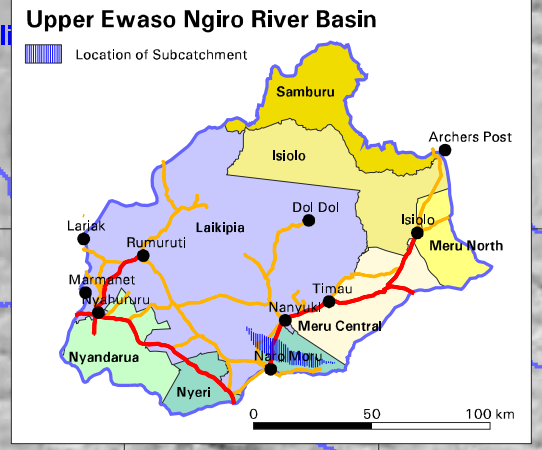
The black areas in the figure above (6.2 km²) show the areas of Sirimon catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (4 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 2.2 km² (average annual forest loss = 0.4 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2060.**

The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.



Land Cover Classes



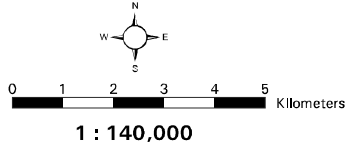
Landcover (1995)

- 24 % Grassland
- 23 % Woody Grassland
- 33 % Forest
- 05 % Plantation Forest
- 15 % Cropland
- 00 % Wasteland / Rocks
- 00 % Surface Water
- 00 % Urban Area
- 00 % Others

Key to Features

- Abstraction points
- Gauging stations
- Settlements and centres
- Rivers
- Catchment boundaries with names
- Roads
- Sublocation boundaries with names
- Annual rainfall (millimeters)

Burguret Subcatchment



1 : 140,000
 UTM Grid: 5,000 m
 Projection: Universal Transverse Mercator
 UTM Zone: UTMZ 37
 Datum: Arc 1960
 Reference Ellipsoid: Clarke 1880
 Scale: 1 : 140,000
 X-shift: 500,000
 Y-shift: 10,000,000

This map was prepared in partnership between the Centre for Training and Integrated Research in ASAL(*) Development (CETRAD) and the Natural Resources Monitoring, Modeling and Management (NRM3) in October 2004. Cartography and layout: A. Ehrensperger & M. Gone.

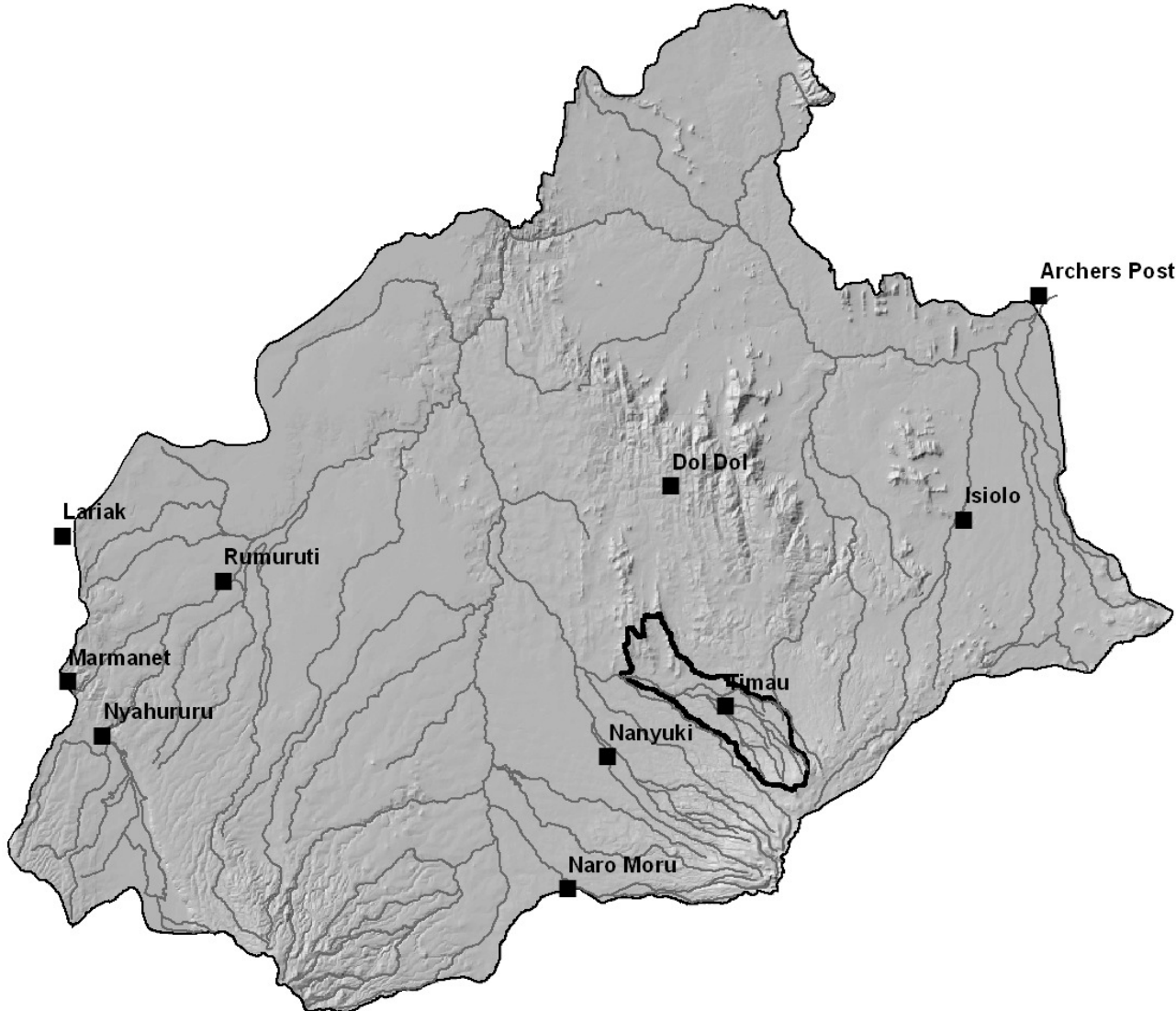
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(*) Arid and Semi Arid Lands.





Timau Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	268 km ²
Perimeter	128 km
Area to perimeter ratio	2.09
Highest point	3,850 m
Lowest point	1,830 m
Average altitude	2,370 m
Altitude range (highest point – lowest point)	2,020 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	199,000,000 m ³
Average annual rainfall in catchment area	738 mm
Location with highest annual rainfall	600 mm
Location with lowest annual rainfall	880 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river (Timau River)	38 km
Total length of all rivers in catchment	246 km
Number of gauging stations	8
Number of recorded abstraction points	77
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban and rural centres	Kwa Mumbero, Mia Moja 1, Mia Moja 2, New Ngenia, Ngusishi, Old Ngenia, Timau

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to)

Districts	Divisions	Locations	Sublocations
Laikipia	Central	Daiga	Ethi Umande
Meru Central	Timau	Kirimara	Kiambogo Kithithina
		Ngusishi	Maritati Mutarakwa
	Mt Kenya Forest	Mt Kenya Forest	Mt Kenya Forest
	Mt Kenya National Park	Mt Kenya National Park	Mt Kenya National Park

Land Cover in 1995

Grassland	35 % = 94 km ²
Woody grassland	24 % = 64 km ²
Forest	14 % = 38 km ²
Cropland	26 % = 69 km ²
Wasteland / rocks	1 % = 3 km ²

Loss of forest between 1995 and 2002

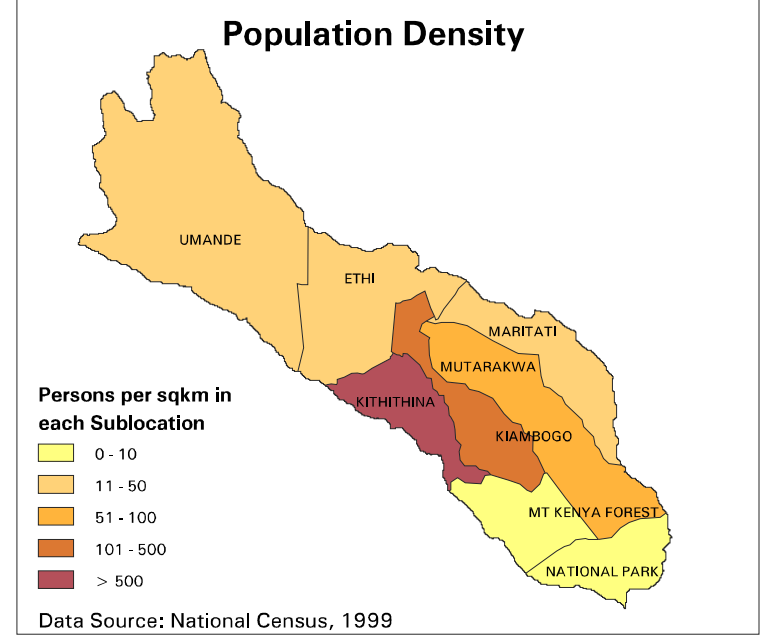
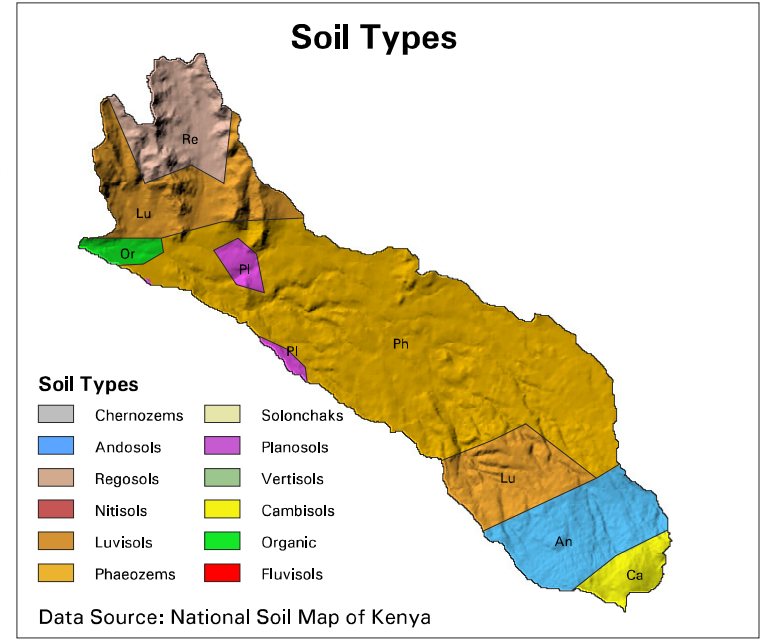
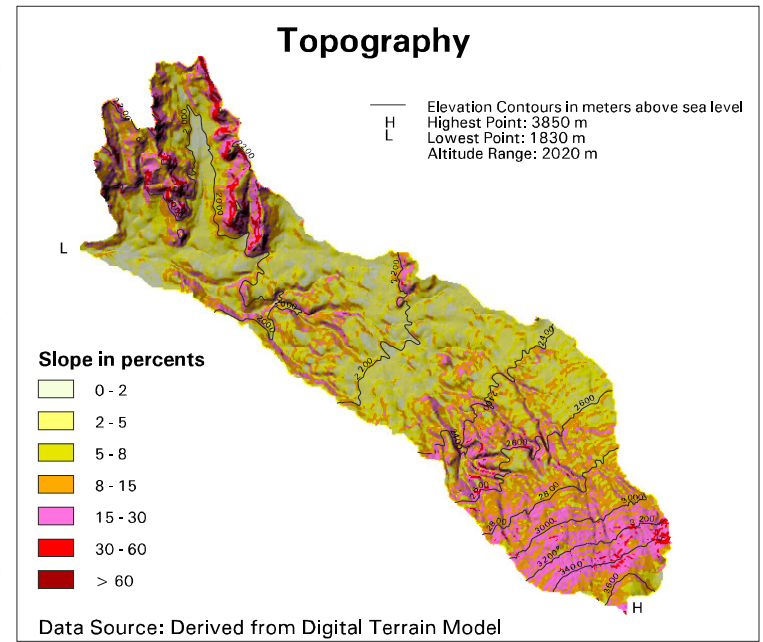
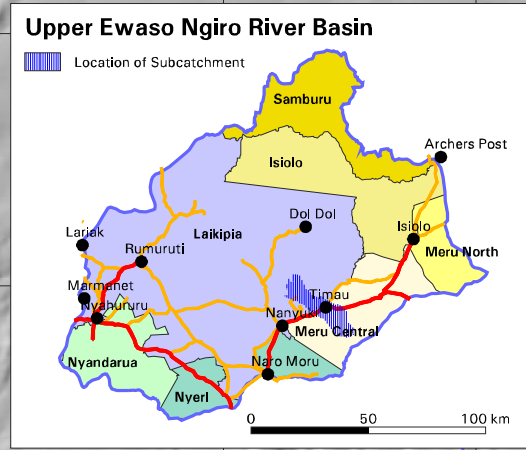
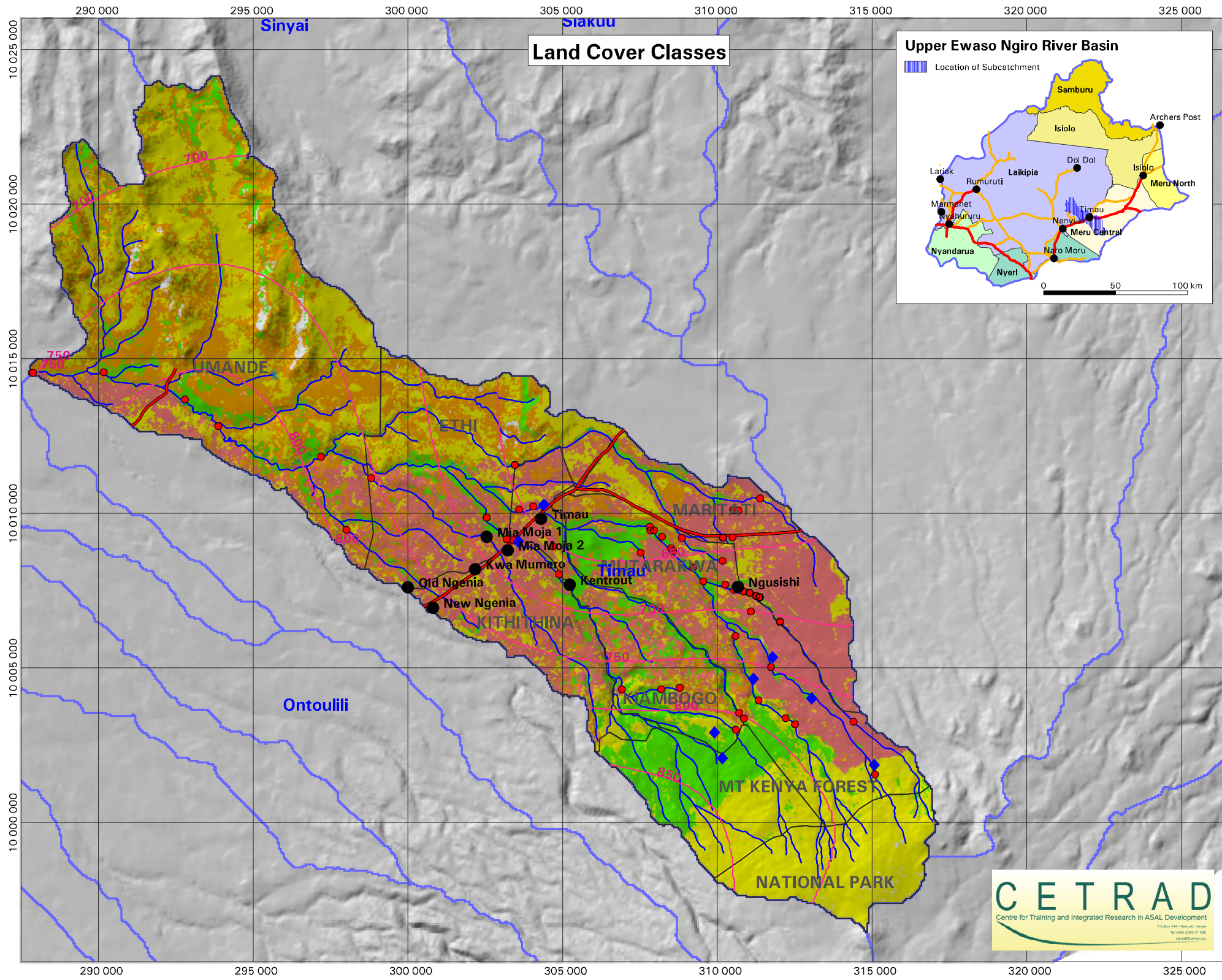


The black areas in the figure above (22 km²) show the areas of Timau catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (5.2 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 16.8 km² (average annual forest loss = 2.4 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2011.**

The light grey area represents the Mt Kenya protected forest as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Mount Kenya East Water User Association (Timau)
Contact	Mr. Daniel, Chairman, Ngusishi
In existence since	2002
Registered as	Community Based Organisation and Association. Registered at the Attorney General's Office and at the Ministry of Culture and Social Services.
Trigger of formation	By the community because of conflicts between a big farm and the community. The farm did not want the community to lay their pipes through that farm. Destruction of the catchment.
Objectives	Conservation of the catchment, manage river by issuing permits, construction of dams to increase water reserves, development of the catchment area.
Availability of sanctioning system	Yes
Role of horticulture farms	Some (4) are members (Daisa Farm, Timau Gardens, Homegrown, Batian Flowers). They did not participate in founding the WUA and do not help in the running of the WUA (just pay membership fees). The WUA could run without them, as their influence is comparable to the one of other users. But the WUA would run better if they would involve themselves fully, as they have resources, which the others don't have.
Sources of conflicts	Too many people want to use water, water shortages in some months and during extended drought.
Problems forwarded to the WUA	Between projects, concerning sharing of water. Problems on where to get water: Some get authorizations, while other intakes have dried up. Non members abstracting more water than required. Illegal abstraction.
Unexpressed conflicts	Harassment of members by management. Favouritism in distribution (officials favour their relatives and friends).
Availability of conflict guidelines	Yes, in the by-laws and the constitution, drafted by members and approved by district authorities.
Concrete way of solving conflicts	Weigh the magnitude of the problem when it is brought to them; call a full management committee under chairmanship of the DO. If they can't solve it, they call for a general meeting.
Cases of conflicts dealt with	4 cases brought to them by members of the projects: Between two projects; case of well serving 3000 families and being grabbed by an individual; Mirimani Junior Water Project versus Mirimani B; Timau Garden versus Mirimani B. The well grabbing was solved well: They communicated with the district water engineer and the well was returned to the community within less than 7 days. Two cases still persist (splinter groups, person denying the WUA to lay water pipes), due to lack of information and poor community involvement. One case is still in court.
Other activities the WUA is engaging in	Want to start a tree nursery. Untapped potentials include: Tapping other water sources, rehabilitation of catchment area.
Achievements	Solving conflicts, contributed funds to start a tree nursery
Hindrances	Lack of office space for meetings and plots for nurseries, lack of guidance on catchment rehabilitation, lack of funds.
Advices to others	Wildlife should be given first priority. Get legal advice from the relevant authorities.

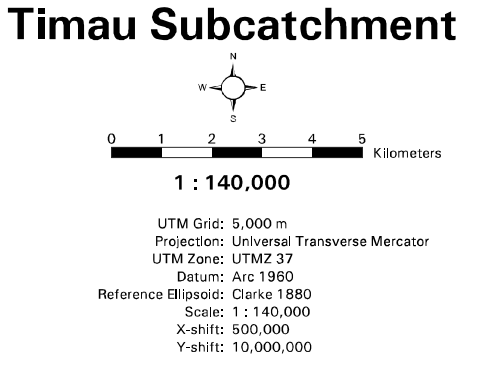


Landcover (1995)

35 % Grassland
24 % Woody Grassland
14 % Forest
00 % Plantation Forest
26 % Cropland
01 % Wasteland / Rocks
00 % Surface Water
00 % Urban Area
00 % Others

Key to Features

●	Abstraction points
◆	Gauging stations
●	Settlements and centres
—	Rivers
—	Catchment boundaries with names
—	Roads
—	Sublocation boundaries with names
—	Annual rainfall (millimeters)



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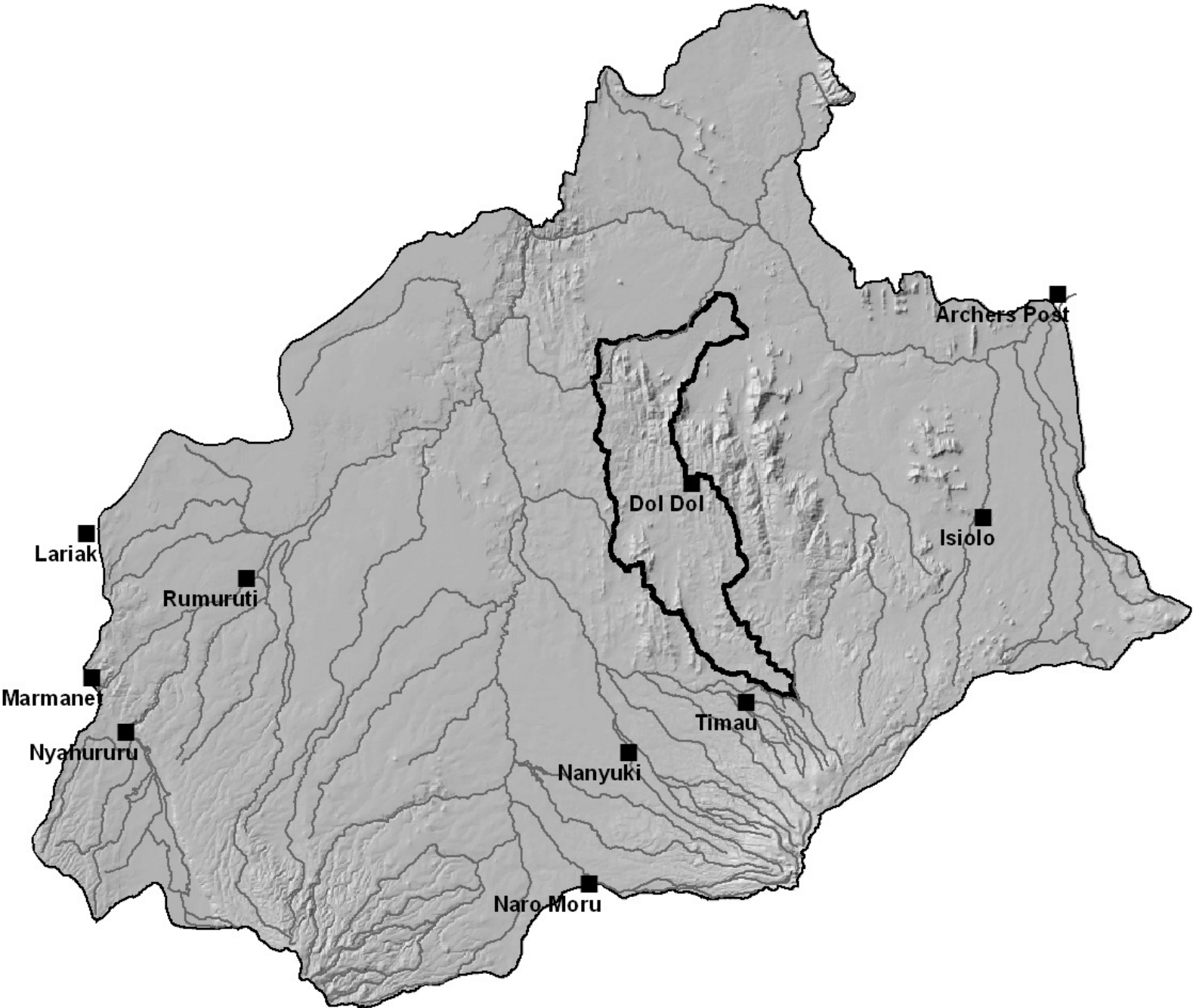
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(*) Arid and Semi Arid Lands.





Sinyai Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	793 km ²
Perimeter	264 km
Area to perimeter ratio	3.00
Highest point	2440 m
Lowest point	1020 m
Average altitude	1750 m
Altitude range (highest point – lowest point)	1420 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	467,870,000 m ³
Average annual rainfall in catchment area	590 mm
Location with highest annual rainfall	740 mm
Location with lowest annual rainfall	490 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total approx. length of main river	93 km
Total approx. length of all rivers in catchment	1009 km
Number of gauging stations	0
Number of recorded abstraction points	0
Water User Association	No

Socio – economy

Population	---
Urban centres	---

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Isiolo	Oldonyiro	Kipsing	Kipsing
			Lenguruma
Laikipia	Central	Oldonyiro	Lonkopito
		Daiga	Ethi
			Naibor
	Mukogodo		Umande
		Ildigiri	Tura
		Ilpolei	Ilpolei
		Makurian	Aljojo
			Makurian

		Mukogodo	Kurikuri
		Mumonyot	Mumonyot
		Oloibosoit	Seek
Meru Central	Timau	Ngusishi	Ewaso
			Maritati

Land Cover in 1995

Grassland	32 %	=	253.8 km ²
Woody grassland	60 %	=	475.8 km ²
Forest	04 %	=	31.7 km ²
Cropland	01 %	=	7.9 km ²
Wasteland / Rocks	03 %	=	23.8 km ²

Loss of forest between 1995 and 2002

The black areas in the figure to the right 1995 and not in 2002. The dark grey the period 1995 – 2002 is 22.6 km² forest cover around the year 2004.

The light grey area represents various catchment.

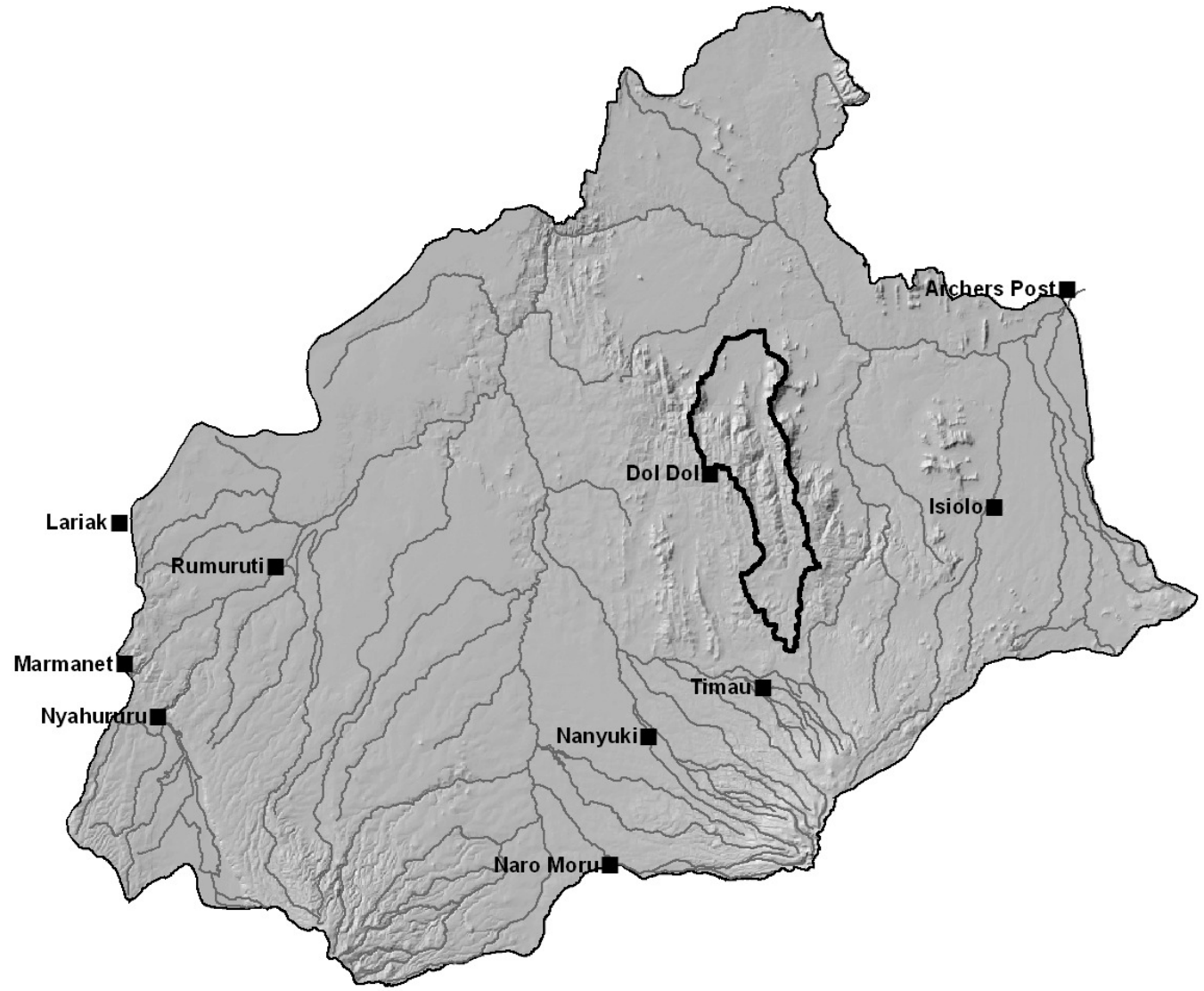
Forest classification for the year 1995
 Forest classification for the year 2002
 Both classifications on the basis of



(23.9 km²) show the areas of Sinyai catchment, which were classified as forests (natural and plantation forest combined) in areas (1.3 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for (average annual forest loss = 3.2 km²). **Should this deforestation rate remain constant, the catchment will be without**

protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the

carried out by NRM3 (P. Niederer)
 carried out by CETRAD (S. Mumuli)
 Landsat ETM satellite images



Siakuu Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	477 km ²
Perimeter	184 km
Area to perimeter ratio	2.6
Highest point	2,300 m
Lowest point	1,020 m
Average altitude	1,650 m
Altitude range (highest point – lowest point)	1,280 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	300,000,000 m ³
Average annual rainfall in catchment area	630 mm
Location with highest annual rainfall	710 mm
Location with lowest annual rainfall	550 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river	67 km
Total length of all rivers in catchment	550 km
Number of gauging stations	0
Number of recorded abstraction points	0
Water User Association	no

Socio – economy

Population	---
Urban centres	Aljiju

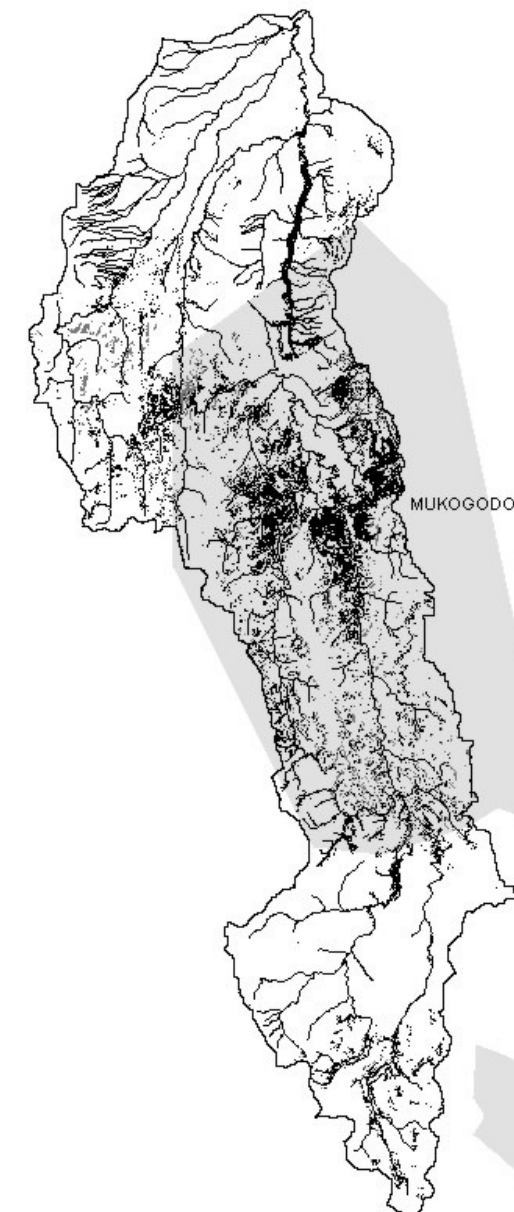
Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations
Isiolo	Oldonyiro	Kipsing	Kipsing
Laikipia	Mukogodo	Ilgwesi	Ngarendare
		Makurian	Aljojo
		Mukogodo	Kurikuri
		Mumonyot	Mumonyot
		Seek	Seek
	Sieku	Sieku	
	Central	Daiga	Ethi
			Umande
Meru Central	Timau	Ngusishi	Maritati

Land Cover (1995)

Grassland	20 %	=	95 km ²
Woody grassland	45 %	=	215 km ²
Forest	29 %	=	138 km ²
Cropland	1 %	=	5 km ²
Wasteland / rocks	5 %	=	24 km ²

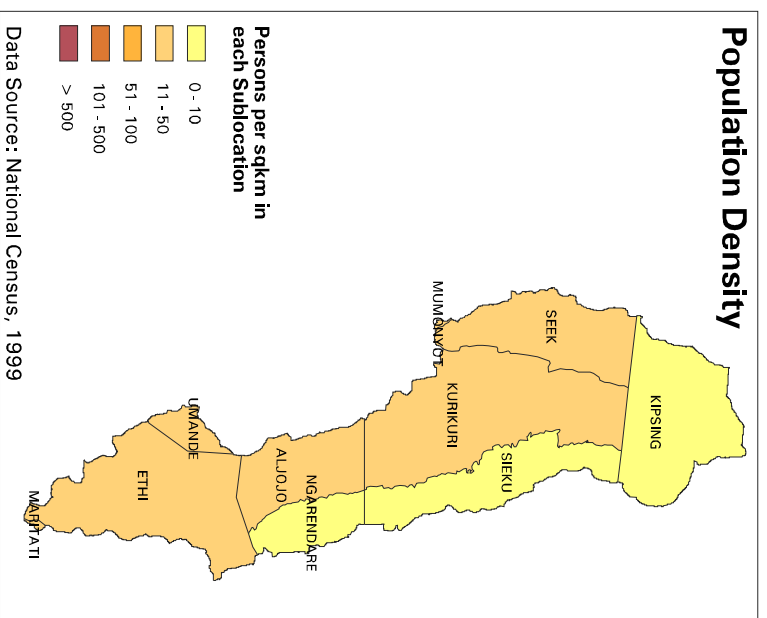
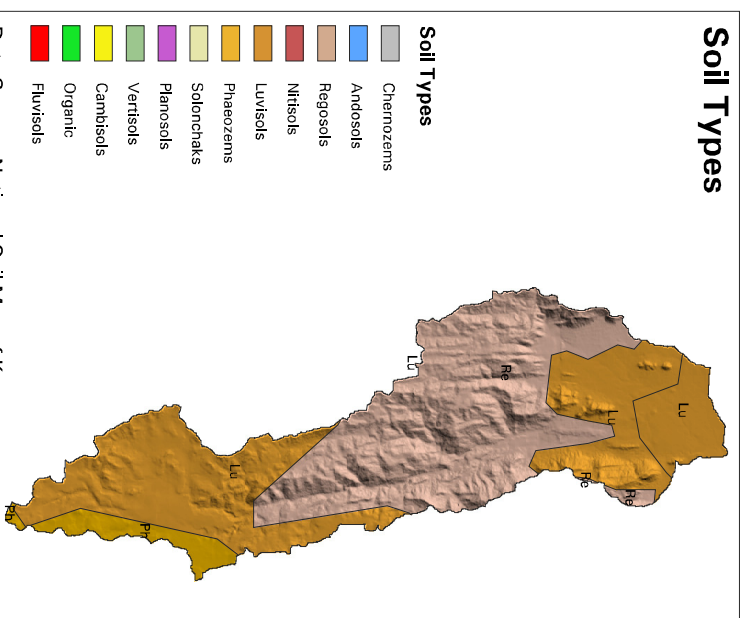
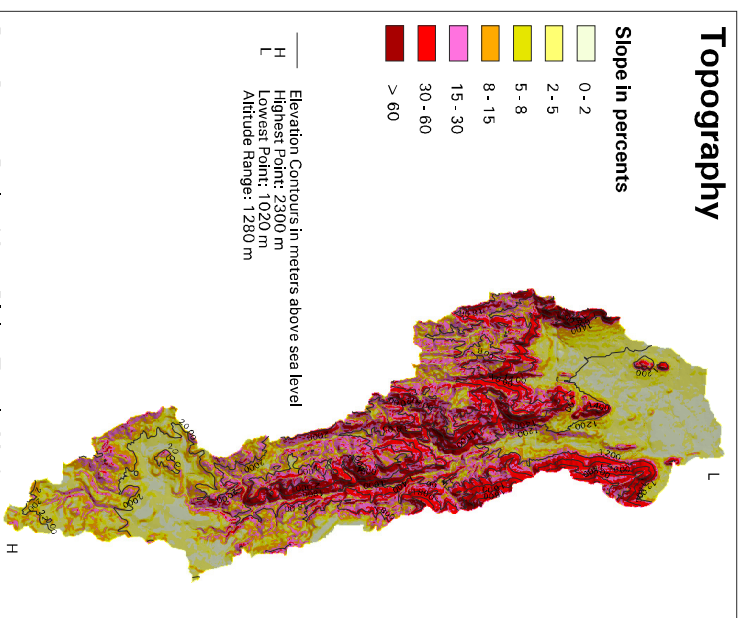
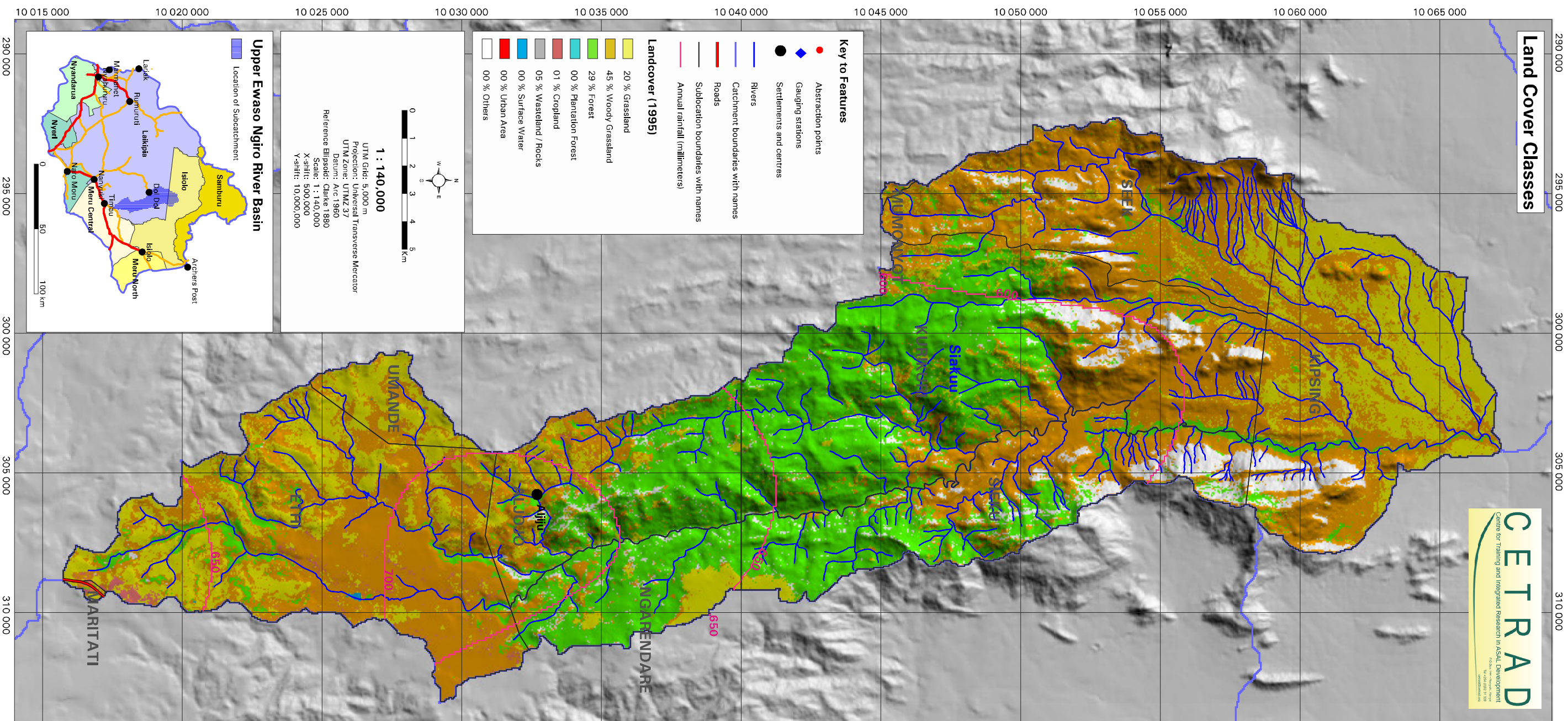
Loss of forest between 1995 and 2002



The black areas in the figure above (48 km²) show the areas of Siakuu catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (11.5 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 36.5 km² (average annual forest loss = 5.2 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2022.**

The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by Forest classification for the year 2002 carried out by CETRAD (S. Mumuli) Both classifications on the basis of Landsat ETM satellite images.



Siakuu Subcatchment

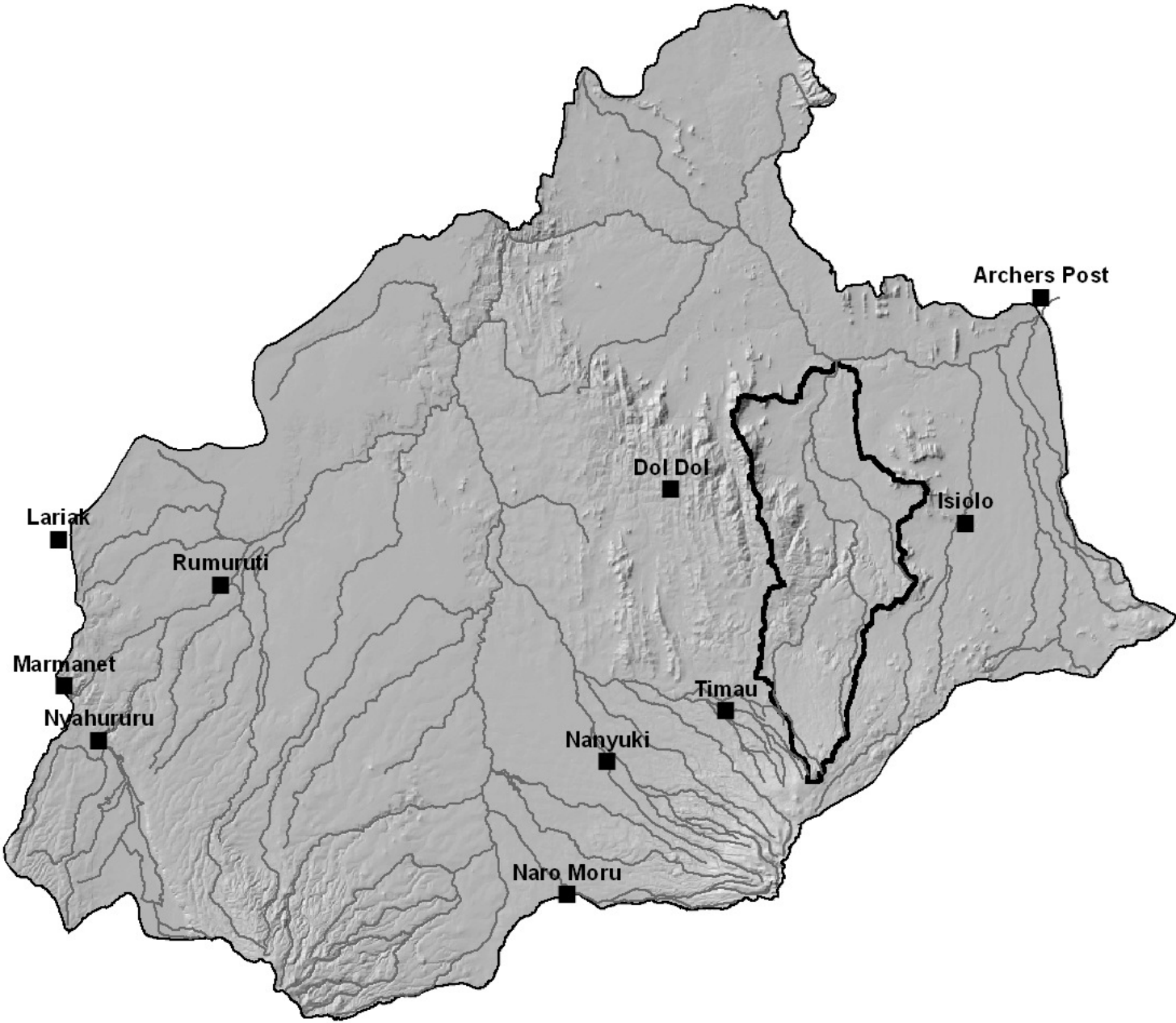
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(*) Aid and Semi Aid Lands.



Ngarendare Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	1012 km ²
Perimeter	243 km
Area to perimeter ratio	4.16
Highest point	3580 m
Lowest point	900 m
Average altitude	1600 m
Altitude range (highest point – lowest point)	2680 m

Land Cover (1995)

Grassland	15 % = 149.3 km ²
Woody grassland	60 % = 602.6 km ²
Forest	12 % = 122.3 km ²
Cropland	13 % = 135.0 km ²

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	66,426,559,000 m ³
Average annual rainfall in catchment area	655 mm
Location with highest annual rainfall	1000 mm
Location with lowest annual rainfall	470 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river	82.5 km
Total length of all rivers in catchment	1057 km
Number of gauging stations	0
Number of recorded abstraction points	10
Water User Association	Yes (see following page)

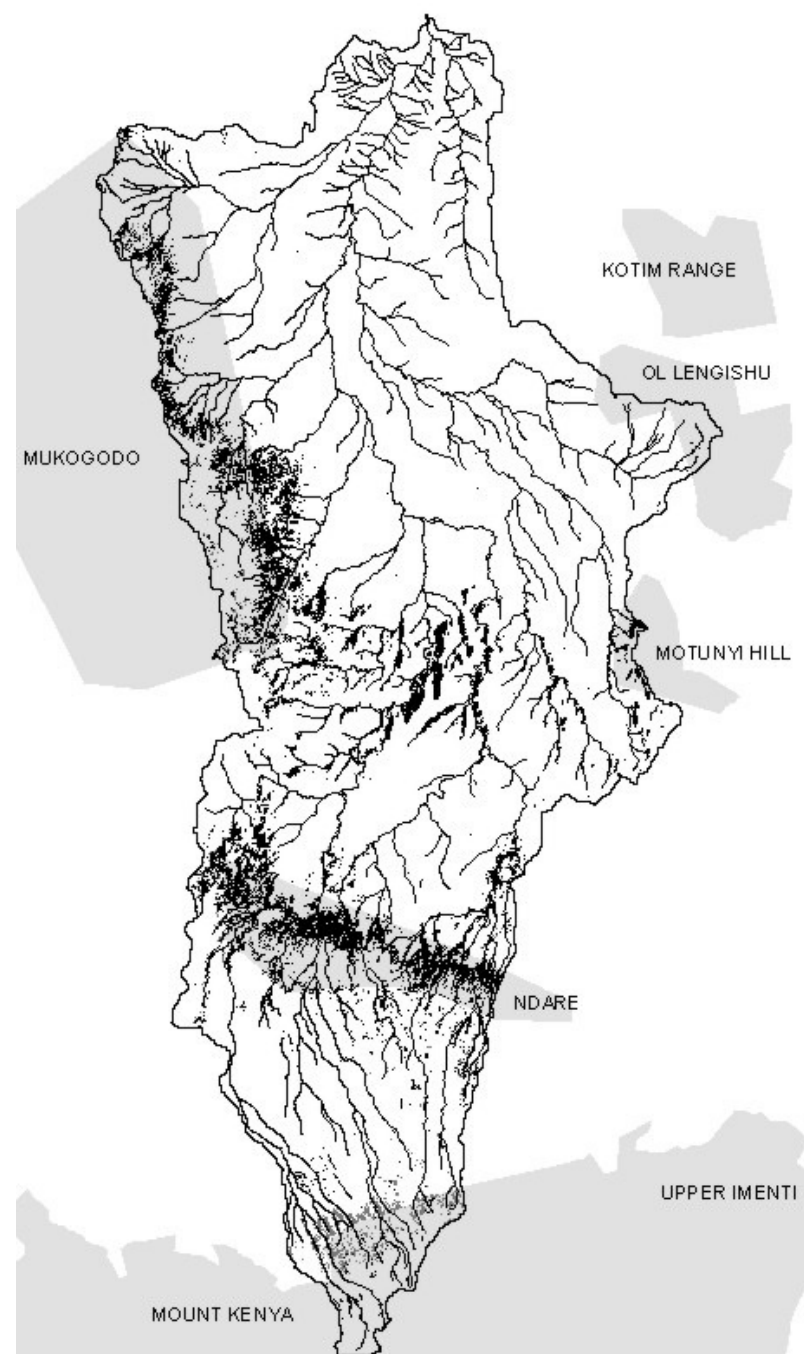
Socio – economy

Population	---
Urban centres	Anandaguru, Ethi, Kisima, Lorangai, Ngare Ndare

Administration (bold administrative units are located completely within the catchment)

Districts	Divisions	Locations	Sublocations
Isiolo	Central	Isiolo West	Burat
			Isiolo West
Laikipia	Mukogodo	Ilgwesi	Ngarendare
			Sangaa
Meru Central	Timau	Kisima	Buuri
			Mutonyi
			Ngare Ndare
			Maritati
	Ngusishi	Mutarakwa	
National Park	National Park	National Park	National Park

Loss of forest between 1995 and 2002



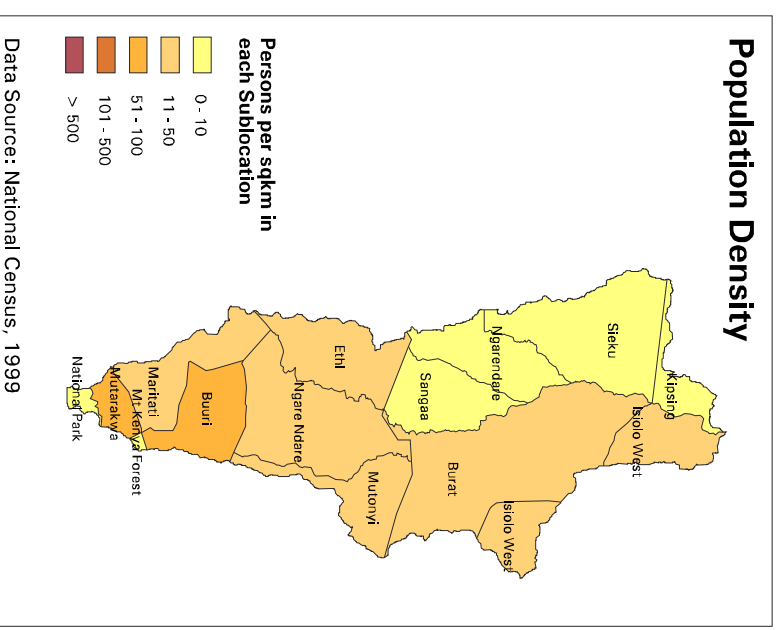
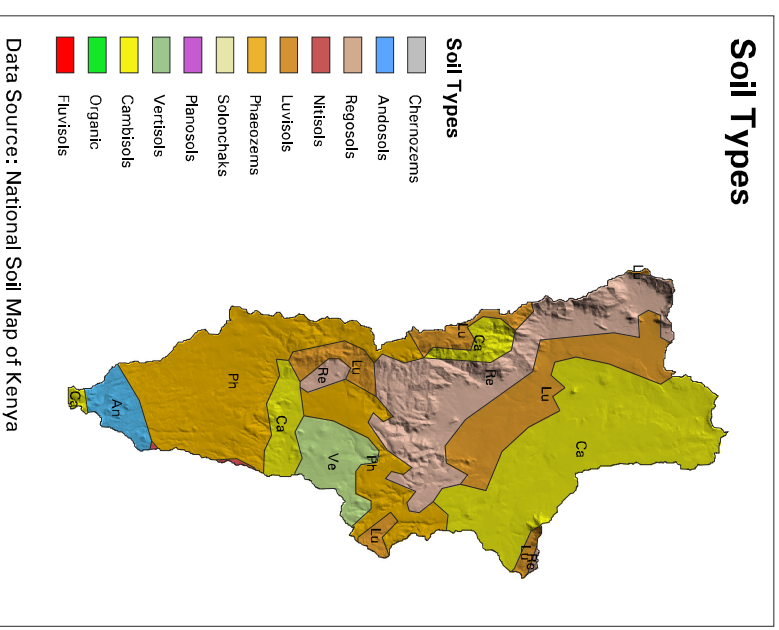
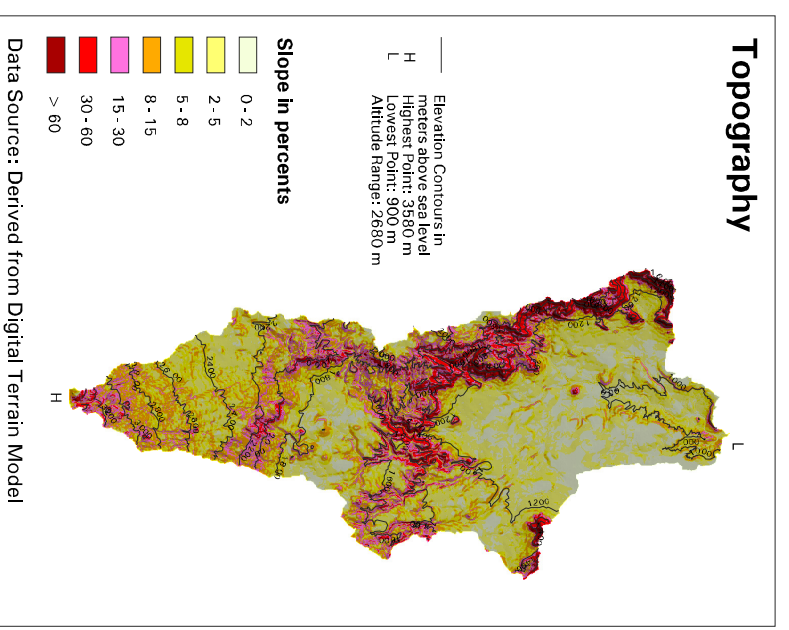
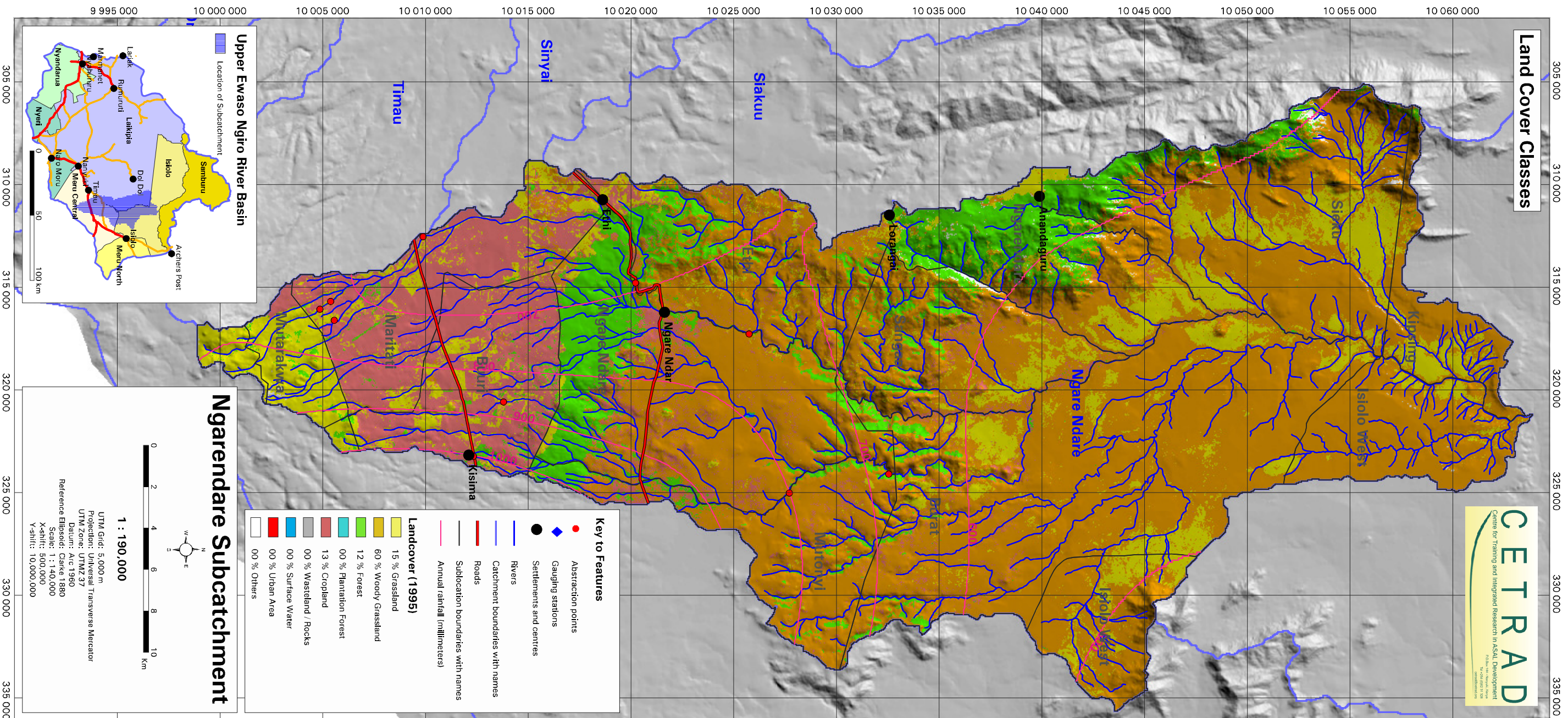
The black areas in the figure above (75.5 km²) show the areas of Burguret catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (8.5 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 67 km² (average annual forest loss =9.6 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2008.**

The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

	Mr. Mugambi, Secretary, Ngare Ndare Centre
In existence since	2001
Registered as	As a self help project. A registration problem arose, such that they decided to register it as an association but they got a self help project certificate. They intend to change the registration documents.
Trigger of formation	The current chairman, because of constant water use conflicts, water shortages and dwindling water levels.
Objectives	Safeguard the river, raise awareness in the community.
Availability of sanctioning system	No sanctioning system. There has never been any defaulting.
Role of horticulture farms	All (4) are members (Cinnabar Green Farm, Kintari Farm, Borana Ranch, Ill-Ngwesi Ranch). Were also involved in the forming of the WUA (fixing financial problems, logistic support, organising seminars with experts, paying for registration fees), keeping documentation, and organising meetings. WUA could not work without them as the local community does not have the necessary funds to work out logistics. Their influence is comparable to the one of others.
Sources of conflicts	Competition and rivalry because of water shortages in some months, cutting of trees in the catchment and along river banks.
Problems forwarded to the WUA	None has been reported so far.
Unexpressed conflicts	By-passing of association's decisions by some users who go directly to the ministry to seek permits for water abstraction.
Availability of conflict guidelines	No guidelines. Want to finalise such guidelines in a meeting on August 19 th 2003.
Concrete way of solving conflicts	Strictly enforced water rationing programme. All abstraction must be permitted by the WUA. Ensuring that members do not cut trees in the catchment and along the river banks.
Cases of conflicts dealt with	None so far.
Other activities the WUA is engaging in	Educating community on the need to manage water resources. Untapped potentials include: Planting of trees, building of livestock watering points, developing a profile water supply line to all member farms. Building big water storage facilities that can last the community longer.
Achievements	All conflicts have ceased since the formation of the WUA.
Hindrances	Lack of finances, lack of skilled manpower, lack of information related to proper water management and conservation.
Advices to others	Build consensus first. Be ready to protect the catchment area. No one will help the community apart from themselves. Seek more information and knowledge from the ministry of water resources management and development.

Name	Ngare Ndare River Water Users Self Help Project
Contact	Mr. John Horsey, Chairman, Borana Farm



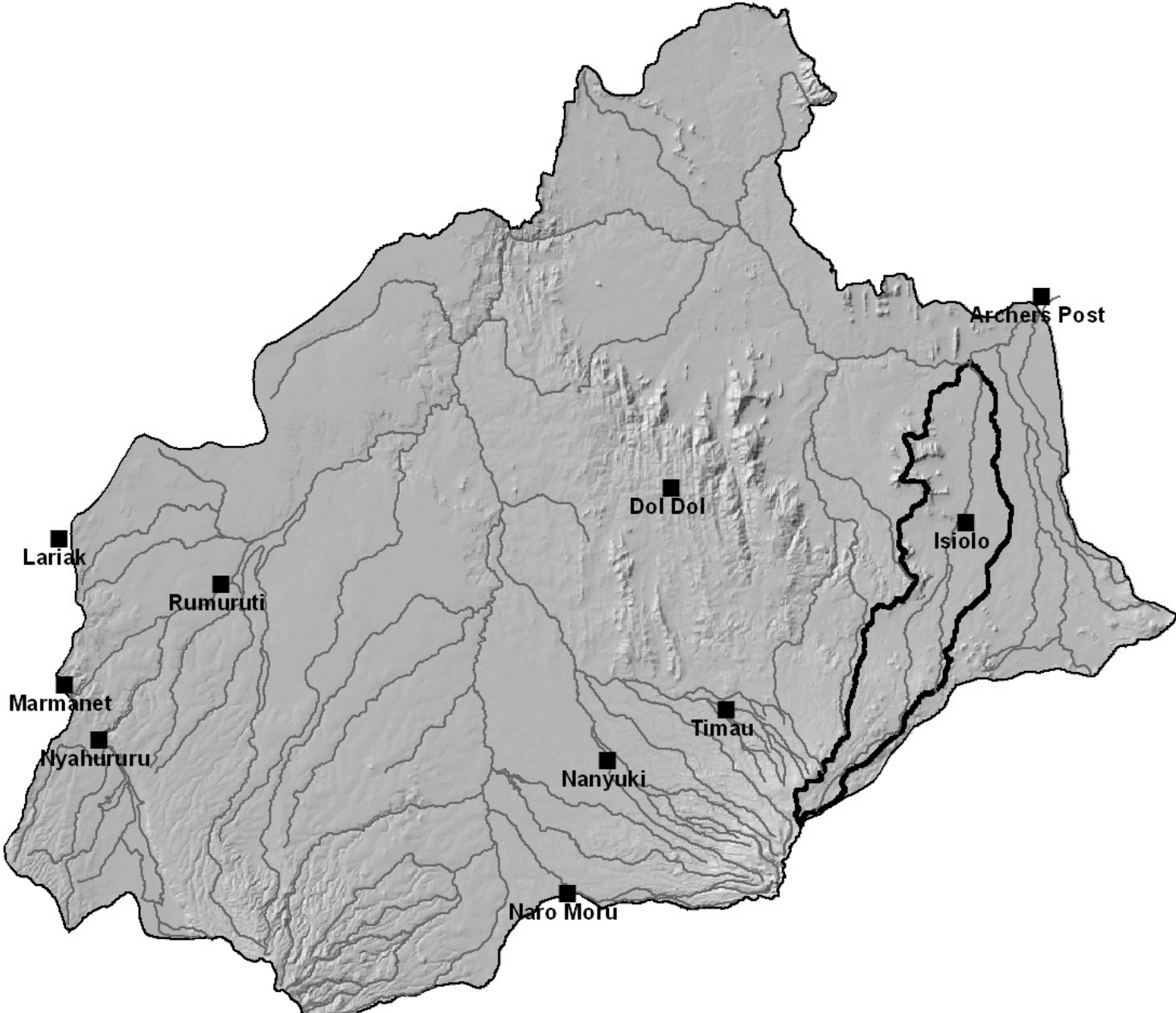
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(*) Aid and Semi Aid Lands.



Isiolo Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	770 km ²
Perimeter	256 km
Area to perimeter ratio	3.00
Highest point	3960 m
Lowest point	850 m
Average altitude	1630 m
Altitude range (highest point – lowest point)	3110 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	577,500,000 m ³
Average annual rainfall in catchment area	750 mm
Location with highest annual rainfall	1360 mm
Location with lowest annual rainfall	400 mm

Hydrology (abstraction points and gauging stations from NRM database)

Total length of main river	95 km
Total length of all rivers in catchment	670 km
Number of gauging stations	0
Number of recorded abstraction points	12
Water User Association	Yes (see following page)

Socio – economy

Population	---
Urban centres	Isiolo

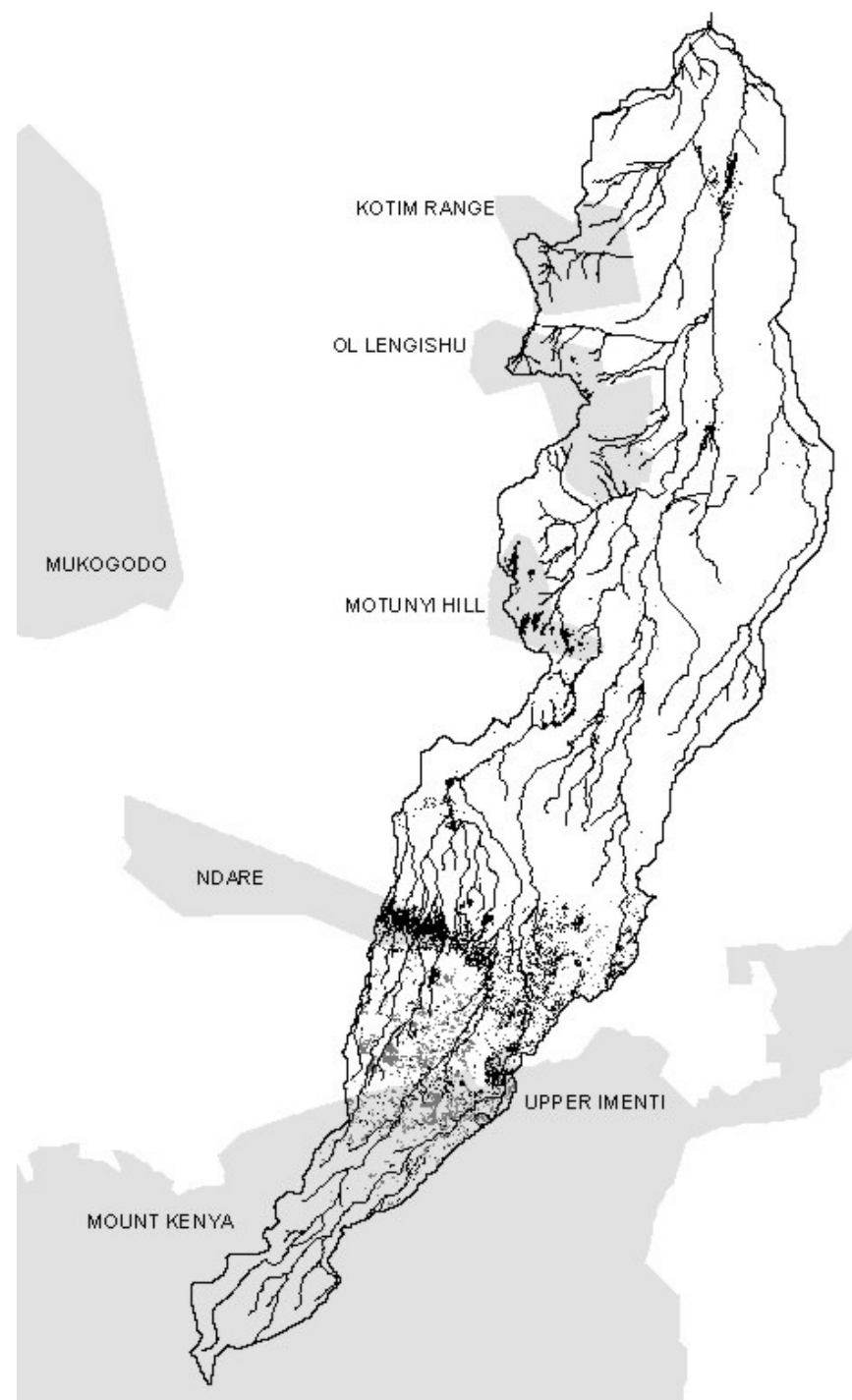
Land Cover in 1995

Grassland	20 % = 154 km ²
Woody grassland	52 % = 400.4 km ²
Forest	06 % = 46.2 km ²
Cropland	22 % = 169.4 km ²

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations	
Isiolo	Central	Central	Bulla Pesa Kampi Odha	
		Isiolo East	Kiwanjani Wabera	
		Isiolo West	Burat Isiolo West	
		Ngare Mara	Ngare Mara	
		Kiamiogo	Kiamiogo	
Meru Central	Abothuguchi West	Kibirichia	Kimbo	
		Ntugi	Mboroga	
		Ntumburi	Kamarete Thiira	
		Kiirua	Kithima Nkando	
	Buuri	Kisima	Ntirimiti	
		Rwarera	Kirwiro Mugae	
		Timau	Kisima	Buuri Mutonyi
	Mt Kenya Forest National Park	Mt Kenya Forest	Mt Kenya Forest	Mt Kenya Forest
		National Park	National Park	National Park
	Meru North	Akithi	Akithi	Thinyaine
		Tigania North	Buuri	Nturingwi
		Tigania West	Mituntu	Mumui

Loss of forest between 1995 and 2002

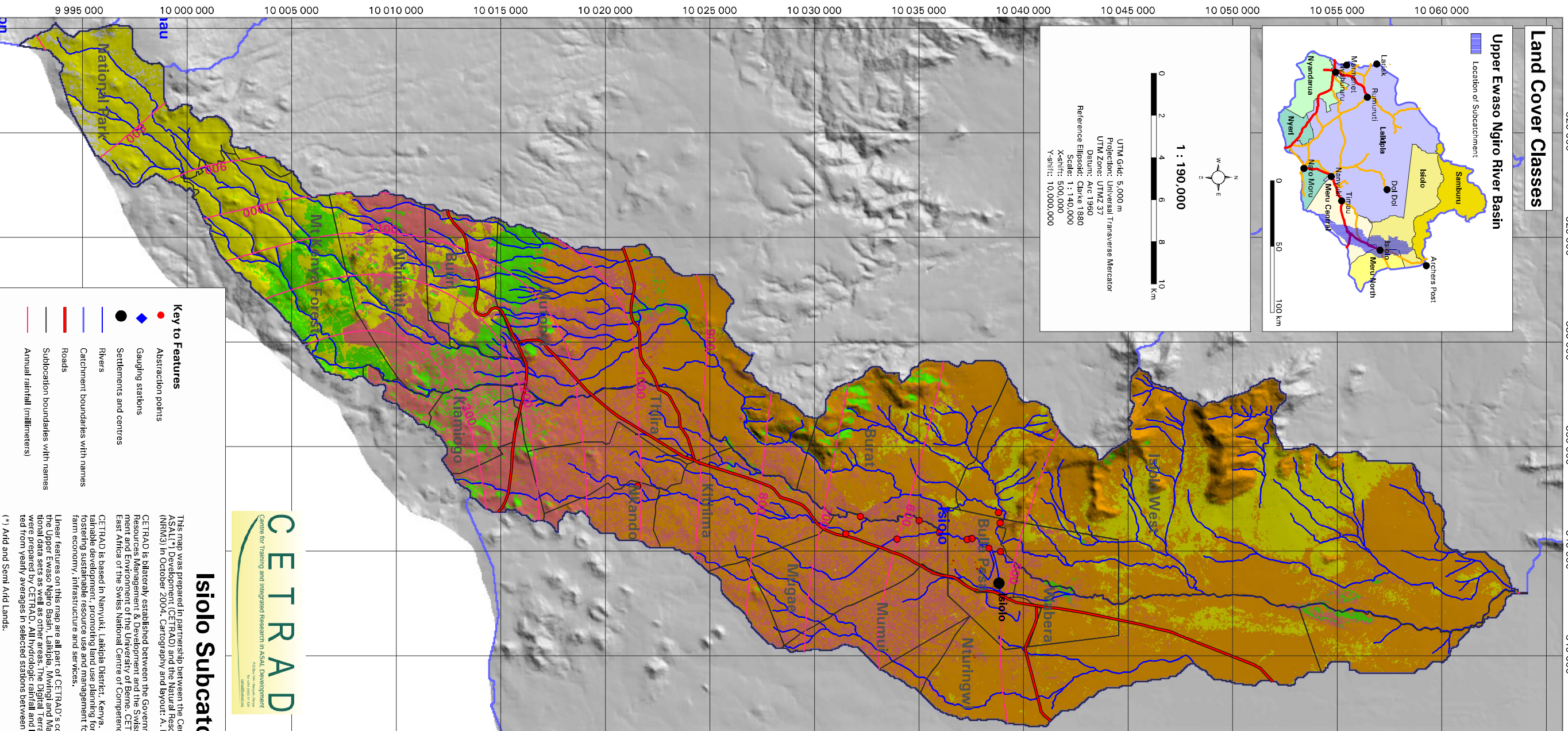
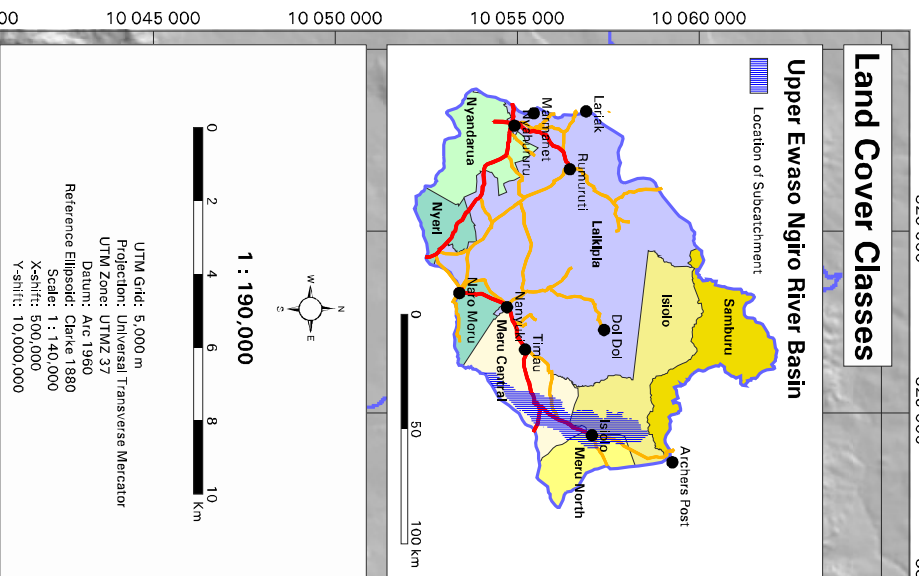


The black areas in the figure above (29.1 km²) show the areas of Isiolo catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (14.1 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 15 km² (average annual forest loss = 2.1 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2018.**

The light grey area represents various protected forest areas (see labels) as defined in the Kifcon database; the continuous thin lines show the rivers within the catchment.

Forest classification for the year 1995 carried out by NRM3 (P. Niederer)
 Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
 Both classifications on the basis of Landsat ETM satellite images.

Name	Isiolo River Water User Association
Contact	Mr. Mbae, Chairman, Maili Saba (Isiolo)
In existence since	2003
Registered as	Association
Trigger of formation	Claims and counter-claims between upstream and downstream users. Recurrent conflicts during dry spell. Too much pressure on local water office. Current water act stipulates that each river should have a WUA.
Objectives	Initially: Catchment conservation, tree planting along the river, economic use of water and solving of water related conflicts. New: Reduce grazing along river banks, prevent tree cutting along river.
Availability of sanctioning system	Yes: Committee is called and asked to deliberate and to recommend action to be taken.
Role of horticulture farms	None
Sources of conflicts	Shortages during dry season. Lack of water. Bad water quality. High competition for water. Depletion of riverine forest. Wanton destruction of catchment area. Upstream water pollution.
Problems forwarded to the WUA	Inadequate water. Water rationing, blocking of river. Water pollution through car wash.
Unexpressed conflicts	Selective piped water supply in the different water projects, where only officials are benefiting. This is a potentially explosive issue.
Availability of conflict guidelines	Yes, drafted by all officials and committee members. Consensus achieved through visiting of the 5 zones by the officials after drafting the guidelines, reading them, making alterations.
Concrete way of solving conflicts	Committee members and officials meet and deliberate on the course of action to take (e.g. water storage facilities, rationing, sharing, adjusting hours for abstraction, etc.). Cases beyond their jurisdiction are forwarded to the relevant authorities. Awareness campaigns are bearing fruits, as conflicts are going down.
Cases of conflicts dealt with	3 cases, all of them pending. Were brought to them by members as complains. They have not been addressed and concern wasteful water use (2 cases); cutting of indigenous trees; selective water supply. There are logistic problems to bring the officials and the committee together to decide on action. As the job is voluntary, people lack incentive to fully participate. There is also internal wrangling between members who are antagonistic.
Other activities the WUA is engaging in	Education, awareness creation. Building water storage facilities. Helping in planning water projects. Untapped potentials include: provision of piped water to all users, introduction of levy, education on proper water use (e.g. making field visits to other successful projects), doing own plumbing and reticulation.
Achievements	Raised level of awareness, established indigenous tree nurseries, built livestock watering points, planted trees around water springs
Hindrances	Lack of funds
Advices to others	Plant trees along the rivers and in catchment area. First instil awareness among the community to pave the way for smooth running. WUA should not be managed in an amateurish way; there is need for professional management.



- #### Key to Features
- Abstraction points
 - ◆ Gauging stations
 - Settlements and centres
 - Rivers
 - Catchment boundaries with names
 - Roads
 - Sublocation boundaries with names
 - Annual rainfall (millimetres)



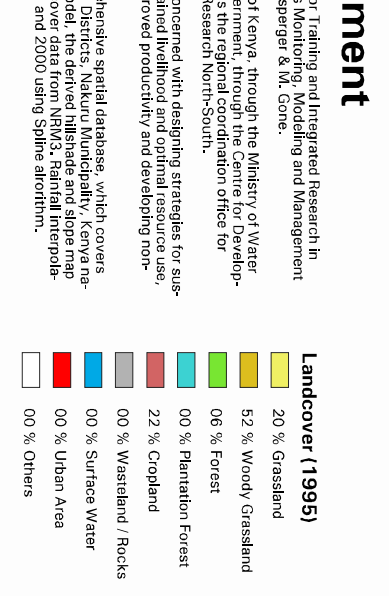
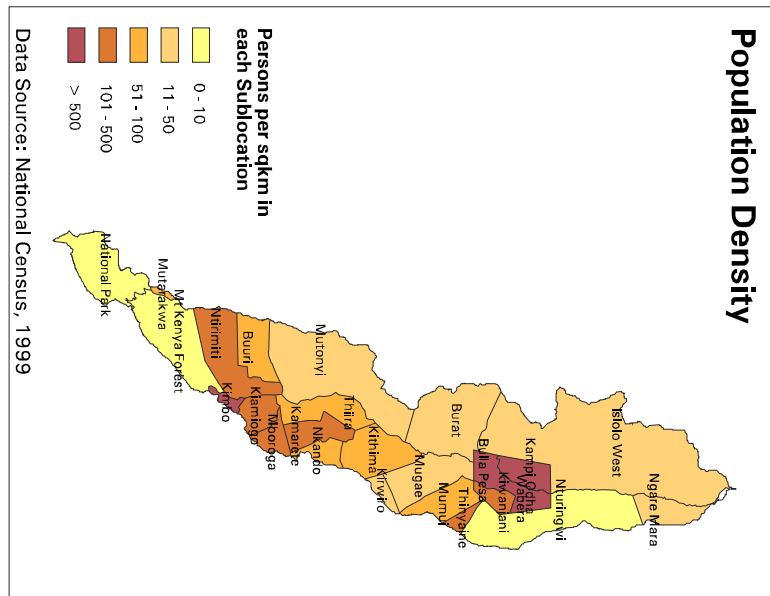
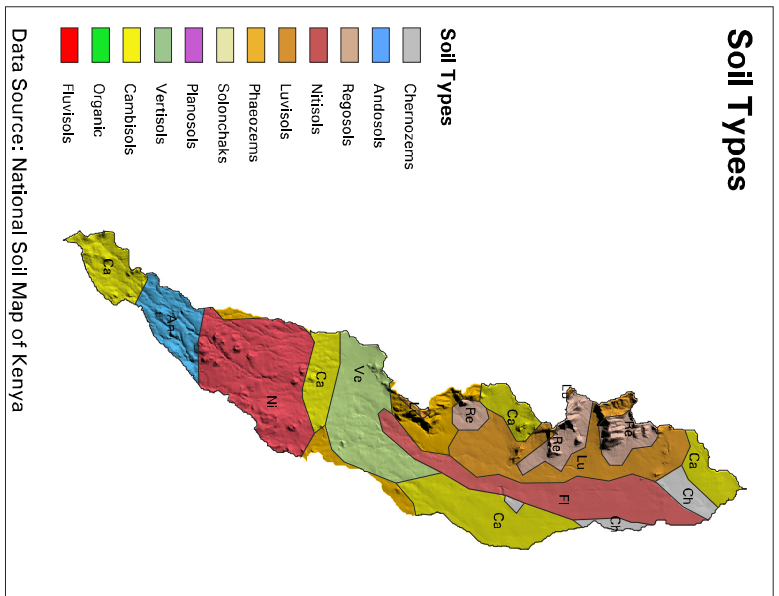
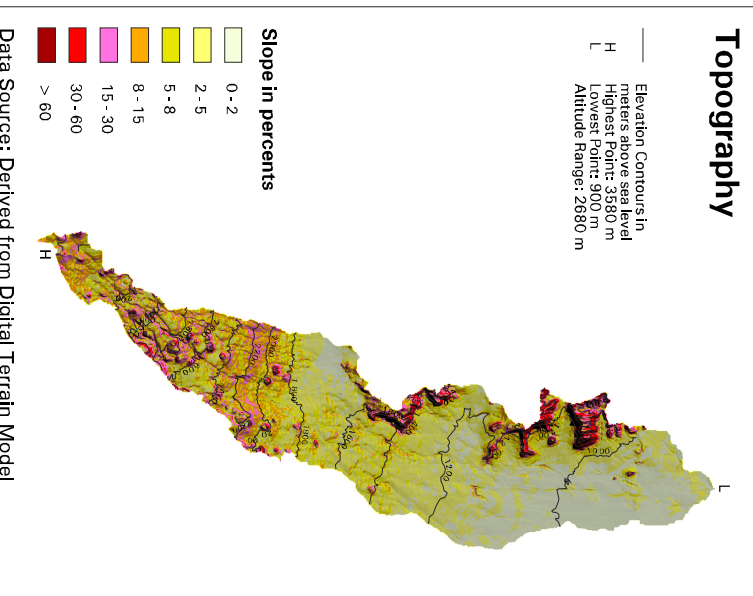
This map was prepared in partnership between the Centre for Training and Integrated Research in ASAL (CETRAD) and the Natural Resources Monitoring, Modelling and Management (NRMM3) in October 2004. Cartography and layout: A. Ertzenpenger & W. Gome.

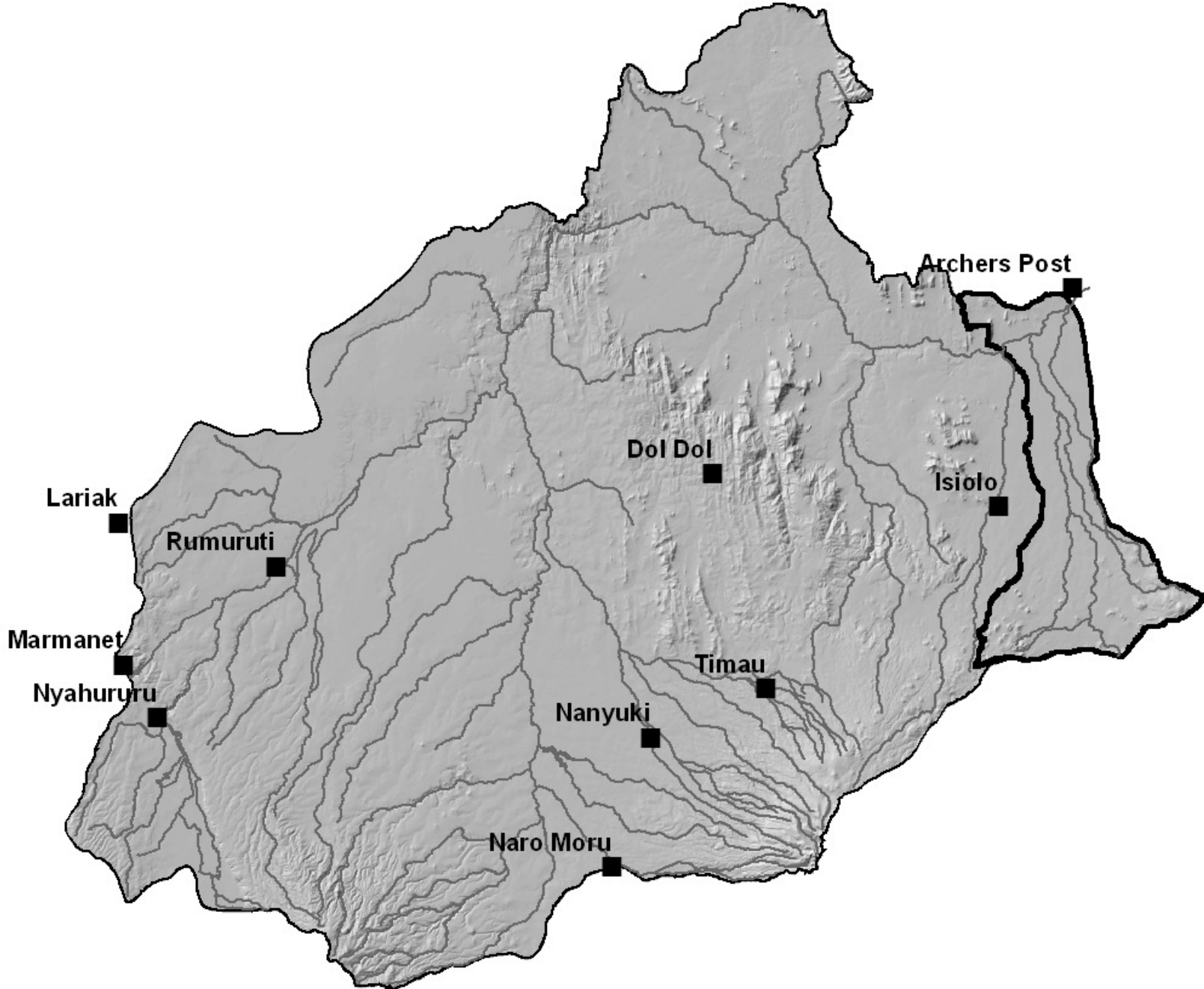
CETRAD is bilaterally established between the Government of Kenya, through the Ministry of Water Resources Management & Development and the Swiss Government, through the Centre for Development and Environment of the University of Berne. CETRAD is the regional coordination office for East Africa of the Swiss National Centre of Competence in Research North-South.

CETRAD is based in Narivuki, Laikipia District, Kenya. It is concerned with designing strategies for sustainable development, promoting land use planning for sustained livelihood and capital resource use, fostering sustainable resource use and management for improved productivity and developing non-farm economy, infrastructure and services.

Linear features on this map are all part of CETRAD's comprehensive spatial database, which covers the Upper Ewaso Ng'iro Basin, Laikipia, Murang'a and Makueni Districts, Nakuru Municipality, Kenya national data sets as well as other areas: The Digital Terrain Model, the derived hillshade and slope map were prepared by CETRAD. All hydrologic rainfall and land cover data from NIVS, Rainfall Interpolated from yearly averages in selected stations between 1991 and 2000 using Spline algorithm.

(*) Acid and Semi Acid Lands.





Ewaso Ngiro Subcatchment

Fact Sheet

Status of data: June 2004

Topography (all topographic figures derived from Digital Terrain Model)

Area	940 km ²
Perimeter	217 km
Area to perimeter ratio	4.33
Highest point	2300 m
Lowest point	820 m
Average altitude	1214 m
Altitude range (highest point – lowest point)	1480 m

Meteorology (rainfall interpolated from data of selected stations over the period 1991 – 2000)

Annual rainfall quantity (volume)	data incomplete
Average annual rainfall in catchment area	data incomplete
Location with highest annual rainfall	data incomplete
Location with lowest annual rainfall	data incomplete

Hydrology (abstraction points and gauging stations from NRM database)

Approx. total length of main river	74 km
Total length of all rivers in catchment	660 km
Number of gauging stations	1
Number of recorded abstraction points	1
Water User Association	No

Socio – economy

Population	---
Urban centres	---

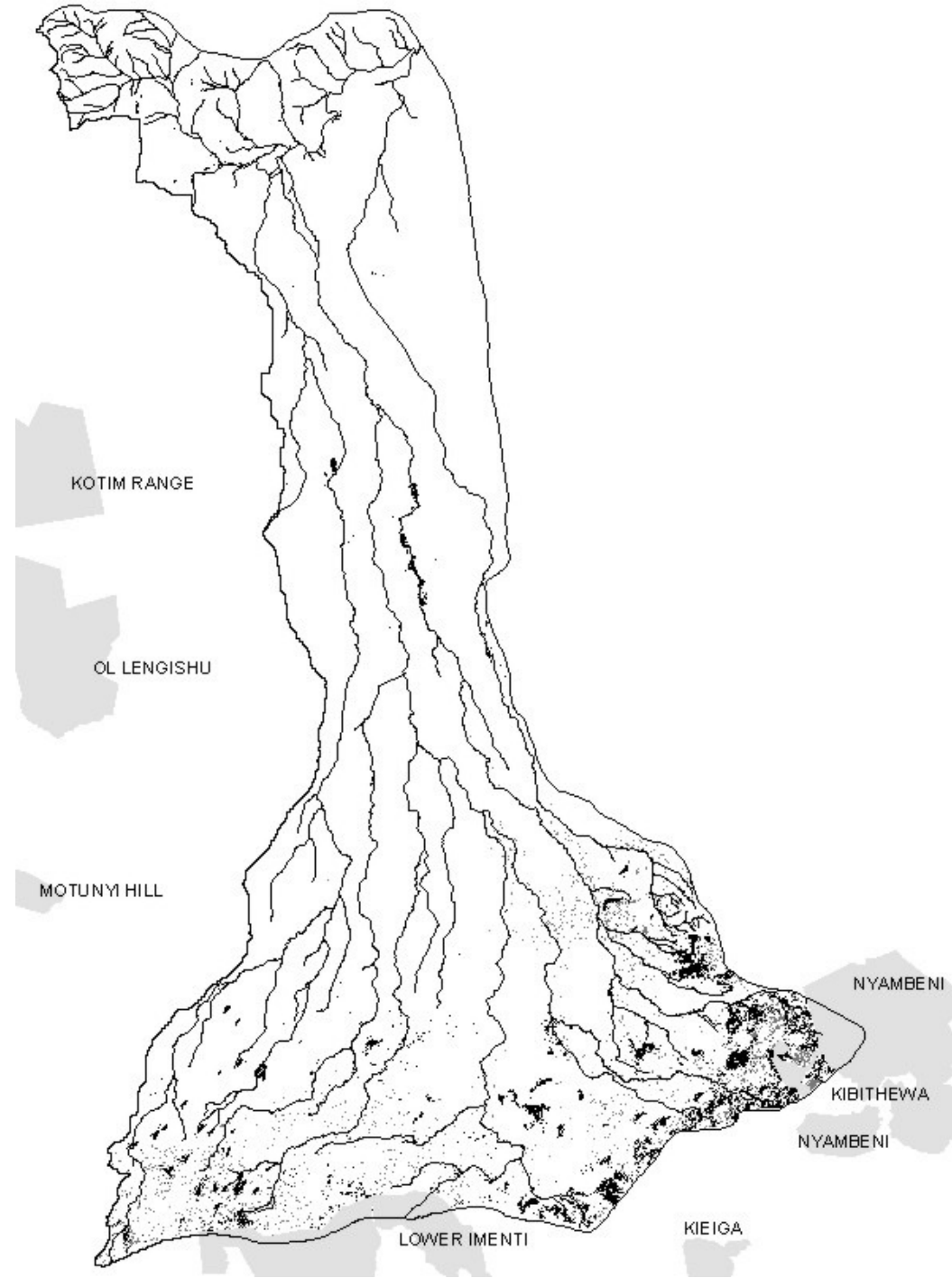
Land Cover in 1995

Grassland	05 % = 47 km ²
Woody grassland	58 % = 545.2 km ²
Forest	04 % = 37.6 km ²
Cropland	32 % = 300.8 km ²
Wasteland / Rocks	01 % = 9.4 km ²

Administration (Sublocations located partly or completely within the catchment and the higher administrative units they belong to).

Districts	Divisions	Locations	Sublocations	
Isiolo	Central	Ngare Mara	Ngare Mara	
	Abothuguchi West	Ntugi	Mboroga	
Meru Central	Buuri	Kiirua	Kiirua	
			Kithima	
			Nkando	
		Ruiru	Kamutune	
			Mutuma	
			Ncoroiboro	
	Rwarera	Kathewene		
Kirwiro				
Mworoga				
	Imenti Forest	Imenti Forest	Imenti Forest	
Meru North	Akithi	Akithi	Athwana	
			Ncooro	
			Thinyaine	
	Igembe North	Nkinyanga	Laikumu Kumu	
			Liliaba	
	Tigania Central	Micii Mikuru	Micii Mikuru	
			Antuanduru	
	Tigania North	Buuri	Lailuba	Lailuba
				Lanjiru
				Maburwa
				Nturingwi
		Karama	Mbaranga	Mbaranga
				Urru
				Muthara
	Tigania West	Mitundu	Mitundu	Mumi
Thau				
Mitundu				
Kianjai		Miathene	Nairiri	
			Kianjai	
			Miathene	
Uringu	Nkomo	Kilenchune		
Samburu	Waso	Waso East	Archer's Post	

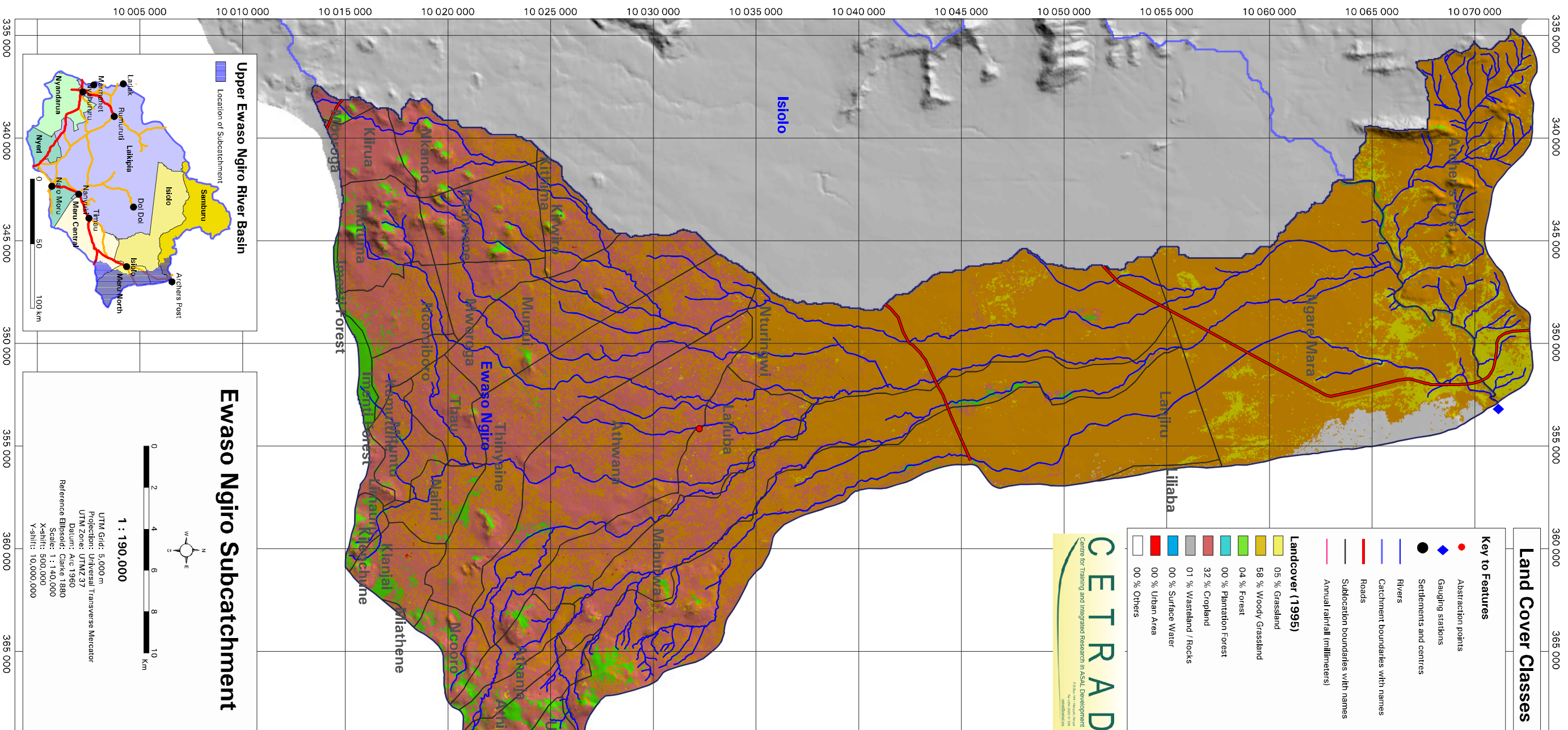
Loss of forest between 1995 and 2002



The black areas in the figure above (29.5 km²) show the areas of Ewaso Ngiro catchment, which were classified as forests (natural and plantation forest combined) in 1995 and not in 2002. The dark grey areas (12.3 km²) were classified as forests in 2002 but not in 1995. According to these two classifications, the net forest loss for the period 1995 – 2002 is 17.2 km² (average annual forest loss = 2.5 km²). **Should this deforestation rate remain constant, the catchment will be without forest cover around the year 2009.**

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Forest classification for the year 2002 carried out by CETRAD (S. Mumuli)
Both classifications on the basis of Landsat ETM satellite images.



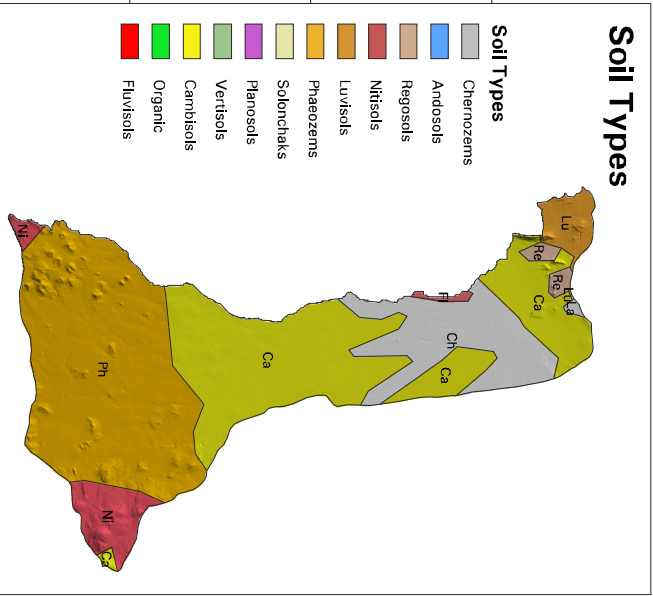
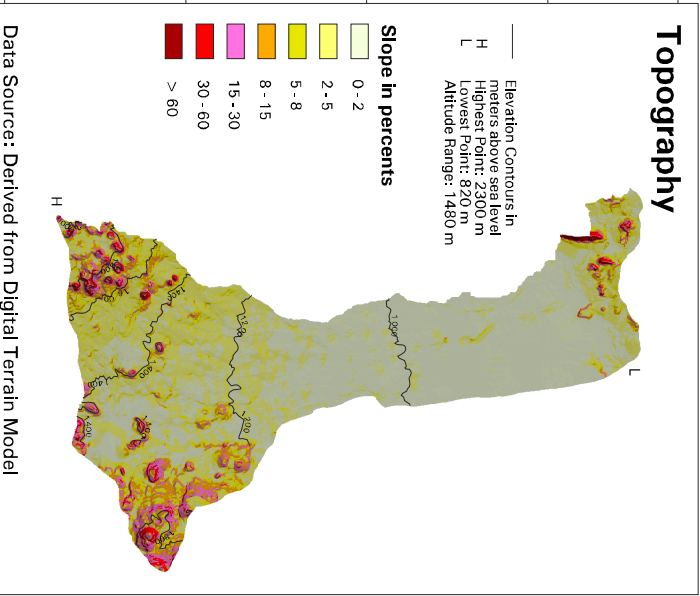
Land Cover Classes

Key to Features

- Abstraction points
- Gauging stations
- Settlements and centres
- Rivers
- Catchment boundaries with names
- Roads
- Subcatchment boundaries with names
- Annual rainfall (millimeters)

Landcover (1995)

- 05 % Grassland
- 58 % Woody Grassland
- 04 % Forest
- 00 % Plantation Forest
- 32 % Cropland
- 01 % Wasteland / Rocks
- 00 % Surface Water
- 00 % Urban Area
- 00 % Others



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(*) Arid and Semi Arid Lands.

