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**EXTRACTIVE FOREST RESOURCES OF THE TANA RIVER  
NATIONAL PRIMATE RESERVE, KENYA**

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EXTRACTIVE FOREST RESOURCES OF THE TANA RIVER NATIONAL PRIMATE  
RESERVE, KENYA. *Economic Botany* 47(2):171-183. 1993. Plant uses by the Pokomo and their  
influence on riverine forest structure and composition are examined in the Tana River National  
Primate Reserve, Kenya. Of a total 98 plant species identified with one or more uses, 15 are used as  
food, 34 for construction material, 43 for technology, 23 for remedy, 2 for commerce, and 20 for other  
uses. The mean basal area of cut wood is 3.21 m<sup>2</sup> / ha-, mostly from palms (1.96 m<sup>2</sup>/ha) and  
understory trees (1.20 m<sup>2</sup>/ha). Measured impacts on forest structure include the loss of large trees for  
canoes or beehives, lowered palm heights, and tree coppicing. Accessibility explains much of the  
spatial pattern of use. Extraction activities do not reduce forest area, and causal effects on  
productivity are complicated by the heterogeneous environment and past disturbances. In view of  
regional pressures on forests and cultural traditions, limited resource extraction offers incentives for  
local stewardship of a unique ecosystem.

**Key Words:** conservation; East Africa; plant uses; riverine forest; tropical ecology.

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The protection of forests in tropical regions is complicated by the dependency of local people on land and forest resources (Dasmann 1976; Olindo 1989). However, their knowledge of traditional plant uses and resource management practices contributes significantly toward assessing the economic value of indigenous biotic resources and establishing effective strategies for conservation (Balick and Mendelsohn 1992; Denslow and Padoch 1988; Pearl 1989; Posey 1983; Prance 1989). A policy, such as that promoted by the Man and the Biosphere Program, that integrates preservation (as core areas), with restoration, resource conservation, and local stewardship (as buffer areas) provides a framework for management at the landscape level (Lusigi 1981; MAB 1987). In order to complement human needs and the preservation/conservation of tropical forests, however, regional data are needed on indigenous plant resources and human influences on the ecology of forests.

During 1987-1988, the flora and ecology of riverine forests in the Tana River National Primate Reserve (TRNPR), Kenya were studied to acquire both qualitative and quantitative data on local human activities (Medley 1990). Human influences on forests in this region are twofold.

Firstly, demands for "land resources" have a direct effect on the areal extent of forest vegetation through: a) the burning of plains vegetation to enhance grassland production; b) forest clearing for agriculture; and c) cultivation of young flood-plain sites suitable for pioneer forest establishment. These activities, if allowed to escalate, are incompatible with resource conservation. Secondly, demands for "forest resources" have a more subtle and less understood influence on the structure and composition of forests. This second demand was investigated by compiling a check-list of known extractive plant resources, and quantifying levels and spatial patterns of use in the riverine forest patches. A study of forest extraction is therefore used to further address the issue of compatibility between human activities and resource conservation in the TRNPR.

## THE STUDY AREA

The Tana River originates in the humid high-lands near Mt. Kenya and the Aberdare mountain range and flows through arid-semiarid flood-plain to the delta at Garsen (Fig. 1). At Hola, approximately 40 km upstream from the TRNPR, annual minimum and maximum temperatures average 21.4°C and 33°C, respectively (Muchena 1987). Mean annual rainfall is low, 470 mm, falling principally during the short (October-December) and long rainy seasons (March- May) (Muchena 1987). The life zone is thorn woodland (*sensu* Holdridge 1967). Evergreen-semievergreen forest vegetation is confined to a narrow corridor along the floodplain of the lower river basin. The lateral extent of forest is determined sharply by the decline in water-table depth with distance from the river, while the longitudinal extent corresponds with floodplain development by alluvial erosion and deposition (Hughes 1988).

TRNPR was established in 1976 to preserve the best remaining riverine forest and the primary populations of the endangered Tana River red colobus (*Colobus badius rufomitratu*s) and crested mangabey (*Cercocebus galeritu*s *galeritu*s) (Marsh 1976). The riverine forest mosaic has served as an isolated refuge for plant and animal species adapted to a moist climatic regime. Local disturbances by river meanders, flooding, and human activity have created a patchy distribution of forest vegetation and a mosaic of community types (Fig. 2; Medley 1992). The TRNPR is one of the smallest reserves in East Africa (171 km<sup>2</sup>-), and the forest area is much smaller (9.5 km<sup>2</sup> in some 26 patches).

Pastoral and agricultural people use the floodplain resources for their subsistence (Kaplan 1983). The Arma and Somali-Wardei are pastoral ethnic groups that reside on the plains above the floodplain and use the river only during the dry seasons. The Pokomo are an ethnic group that practices floodplain agriculture, and are thereby restricted to low-lying depositional riverbanks and oxbows. When the TRNPR was first established, approximately 550 Pokomo in 88 families maintained plots in the reserve (Marsh 1976), and their population growth has been about 1% per annum between 1975-1991 (Seal et al. 1991). Settlements include: agricultural plots (home outside of the reserve), rural settlements (home at the site of cultivation), and the village of Baomo and surrounding agricultural lands. Human land use accounts for approximately 155 ha and is distributed in seven locations along the river (Fig. 2). This study focused on the forest products that are extracted by Pokomo living in and adjacent to the TRNPR. They are the local ethnic group that resides near the forests and is most dependent on its resources.

## DATA AND METHODS

Vernacular names and uses for plant resources were compiled from local Pokomo informants, and from information obtained in earlier studies (Geider 1985; Homewood 1976; Marsh 1976). In some instances the names differed between the Ndera (southern) and Gwano (northern) locations of the Pokomo in the TRNPR vicinity. Uses for plant species were also identified in ecological and/or ethnobotanical studies conducted in Kenya (Geider 1985; Gichathi 1987; Johns and Kokwaro 1991; Kuchar 1981; Morgan 1981), Somalia (Maunder 1988), and Africa (Abbiw 1990; Booth and Wickens 1988; Cunningham and Wehmeyer 1988; Williams 1949). These references identified uses not yet realized by the local Pokomo population or compiled from the local informants. Voucher specimens were collected and placed in the East African Herbarium (EA), with duplicates, as available, distributed to herbaria at Michigan State University (MSC), Royal Botanic Gardens, Kew (K), and the Missouri Botanical Garden (MO). Use categories follow Prance et al. (1988) and include: food, construction material, technology, remedy, commerce, and other (e.g., firewood, ritual, scents). For some heavily-used timber species, specific gravities ( $sg = \frac{\text{wet weight}}{\text{volume}(1 + \text{moisture})}$ ) were determined from extracted cores. Specific gravity is an index of wood density or strength, with most commercial trees ranging between 0.29, a soft conifer, and 0.76, a temperate hardwood (Brown, Panshin, and Forsaith 1952).

Vegetation data were collected on the woody flora using point-centered quarter sampling for canopy trees (> 20 cm dbh), 112 m<sup>2</sup> plots for subcanopy trees and lianas (10-20 cm dbh) and palms (> 1 m ht), and 24 m<sup>2</sup> plots for saplings and lianas < 10 cm dbh, > 1 m ht (Grieg-Smith 1983). Sampling points (n = 363) were located systematically in 12 forest areas (Fig. 2), and the plots were randomly oriented from each point. Basal areas (m<sup>2</sup>/ha) of uncut and cut stems, number of individuals, number of basal stems at < 50 cm ht, and plant heights were determined at each point. As measures of impact on understory trees (> 1 m ht and < 10 cm dbh), a coppicing ratio was calculated by dividing the number of basal stems by the number of individuals and a cutting ratio was calculated by dividing the basal area of wood cut by the total basal area (cf. Reid, Marroquin, and Beyer-Münzel 1990). The sampling procedure quantifies relative impacts on trees, palms, and lianas, which are major structural components of the riverine forest. A geographic information system (GIS) was used to show spatial patterns of use (i.e., m<sup>2</sup>/ha cut) in the studied forest areas by extrapolating from the sampling points (ESRI 1987).

TABLE 1. CHECKLIST OF POKOMO PLANT RESOURCES IN THE **TRNPR** FORESTS. THE LIST INCLUDES PLANT NAMES (BOLD TYPE) AND USE, RECORDED FOR THE POKOMO PEOPLE LIVING ADJACENT TO OR RESIDENT IN THE **TRNPR**. NOMENCLATURE FOLLOWS THE FLORA OF TROPICAL EAST AFRICA (TURRILL ET AL. 1952). ALL VOUCHER SPECIMENS ARE AT THE EAST AFRICAN HERBARIUM (EA); AUTHOR'S COLLECTION NUMBERS (KM-).

## Monocotyledoneae

### Arecaceae

*Borassus aethiopum* Mart./**Mtalpa**.

Food: fruit edible, stem sap used in preparing palm wine.

*Hyphaene compressa* H. Wendl./**Mkoma**.

Food: fruit edible; construction material: poles, roof thatching; technology: traps, beehives.

*Phoenix reclinata* Jacq. (KM 219)/**Mkindu**.

Food: fruit edible, stem sap used in preparing palm wine; construction material: poles; technology: twine, mats, baskets, brooms, traps; commerce: decorative mats (Mkeka), baskets; other: dolls (see Kinnaird 1992).

## Dicotyledoneae

### Alangiaceae

*Alangium salviifolium* (L.f.) Wangerin (KM 223)/ **Mununa**.

Construction material: poles, furniture.

### Anacardiaceae

*Lannea schweinfurthii* (Engl.) Engl. var. *stuhlmannii* (Engl.) Kokwaro (KM 224)/**Mhandarako**.

Other: often host beehives within its tree crown.

*Mangifera indica* L. (naturalized)/**Muembe**.

Food: fruit edible; construction material: canoes.

*Sorindeia madagascariensis* DC. (KM 217)/ **Mniembembe**.

Remedy: roots boiled for stomach.

### Annonaceae

*Monanthes trichocarpa* (Engl. & Diels) Verde. (KM 281 )/**Mndagoni**.

Remedy: leaves and roots boiled, burned.

*Uvaria scheffleri* Diels (KM 324)/**Mndagoni**.

Remedy: roots/leaves boiled, burned.

### Apocynaceae

*Carissa edulis* (Forssk.) Vahl (KM 259, KM 280)/ **Mlalanche**.

Remedy: branch & root tips, malaria.

*Hunteria zeylanica* Thw. var. *africana* (K. Schum.) Pichon (KM 231)/**Mchunguchungu**.

Technology: combs (**Shanua**).

*Rauvolfia mombasiana* Stapf (KM 225)/**Ufeke**.

Remedy: milky sap used in eyes.

*Saba comorensis* (Boj.) K. Schum. (KM 210)/ **Maungo**.  
Technology: rope; food: fruit is edible.

*Schizogygia coffaeoides* Baill. (KM 277)/ **Ufeke mfupi**.  
Other (ritual): symbolic, protection from evil.

*Strophanthus courmontii* Franch. (KM 312)/ **Fimbo**.  
Technology: walking sticks.

#### Asclepidaceae

*Parquetina nigrescens* (Afz.) Bullock (KM 306)/ **Mkungacheu**.  
Technology: twine used to tie winnowing baskets; very fibrous.

*Pergularia daemia* (Forssk.) Gniou. (KM 333)/ **Mumbwiga**.  
Technology: strings obtained from small stem sections.

#### Bignoniaceae

*Kigelia africana* (Lam.) Benth. (KM 202, KM 243)/ **Mbwoka**.  
Food: fruits used in making an alcoholic beverage.

#### Boraginaceae

*Cordia fauknerae* Verde. (KM 272).  
Technology: seed aril used as a glue.

*Cordia goetzei* Guerke (KM 269)/ **Mdoko**.  
Construction material: poles; technology: seed aril used as a glue.

*Cordia sinensis* Lam. (KM 258)/ **Mhali**.  
Technology: aril used as a glue; other: firewood.

#### Caesalpiniaceae

*Azelia quanzensis* Welw. (KM 299)/ **Mgamba-kompfe**.  
Construction material: main structural pole, canoes; very hard wood.

*Caesalpinia volkensii* Harms (KM 338)/ **Msadeka**.  
Other: very hard, round seeds used in the game **Hesabu**.

*Cassia abbreviata* subsp. *beareana* (Holmes) Brennan (KM 305, KM 340)/ **Mbaraka mtoni**.  
Remedy: roots boiled for bilharzia; other: firewood.

*Cynometra lukei* Beentje (KM 222, KM 381, KM 409)/ **Mpakata**.  
Construction material: canoes, furniture.

*Oxystigma msoo* Harms (KM 326)/ **Mucho**.  
Construction material: canoes.

*Tamarindus indica* L. (KM 245)/ **Mkwayu**.  
Food: seed aril used as a flavoring (drinks, porridge).

### Capparidaceae

*Capparis tomentosa* Lam. (KM 251)/**Mbutula**.

Remedy: roots boiled to drink or use topically.

*Maerua subcordata* (Gilg) DeWolf (KM 362, KM 392)/**Mti wa maji**.

Other: swollen tuber used to settle sediment in water (a flocculant).

*Maytenus heterophylla* (Eckl. & Zeyh.) N. Robson  
(KM 240, KM 318, KM 322, KM 343)/**Mlalanche**.

Remedy.

*Salacia stuhlmanniana* Loes (KM 201 )/**Impo**.

Remedy: wood burned to repel mosquitos.

### Combretaceae

*Combretum butyrosom* (Bertol. f.) Tul. (KM 241, KM 254)/**Mkioa**.

Technology: rope, capable of pulling heavy objects (canoes).

*Combretum constrictum* (Kl.) Engl. (KM 276)/ **Mkioa**.

Food: fruit edible but will scratch the throat: technology: rope for heavy pulling.

*Combretum paniculatum* Vent. (KM 411)/**Muambo ngoma**.

Technology: dull recurved spines are used to attach animal skins to a hollowed log for a drum.

*Terminalia brevipes* Pampan. (KM 275. KM 302. KM 357)/**Mkokole**.

Construction material: poles.

*Terminalia sp.* (possibly *T. brevipes*. but large and without thorns) (KM 356)/**Mualango**.

Construction material: poles.

### Compositae

*Pluchea dioscoridis* De. (KM 405)/**Mnoynwe**.

Remedy: boil roots.

*Vernonia sp.* (KM 304)/**Lufacho**.

Remedy: used for the stomach.

### Convolvulaceae

*Hewittia sublobata* (L.f.) O. Kuntze (KM 286)/ **Muviazi**.

Food: tuber edible; other (ri tuai): fruit. symbolic against evil.

### Cucurbitaceae

*Coccinia grandis* (L.) Voight (KM 399)/**Mhombhombo**.

Food: fruit edible.

*Kedrostis foetidissima* (Jacq.) Cogn. (KM 328, KM 371)/**Kanuke**.

Remedy.

*Momordica trifoliolata* Hook. f. (KM 204)/**Muchuraga**.

Food: fruit edible.

#### Ebenaceae

*Diospyros ferrea* (Willd.) Bakh. (KM 378, KM 383)/**Mnwiza**.

Construction material: poles.

*Diospyros kabuyeana* F. White (KM 246, KM 274, KM 325)/**Muhino** (Swahili), **Mhero** (Pokomo).

Construction material: strong pole; other: firewood.

*Diospyros mespiliformis* A. DC. (KM 239)/**Mkuru**.

Construction material: canoes, furniture.

#### Erythroxylaceae

*Erythroxylum fischeri* Engl. (KM 252a, KM 298)/ **Mluhe** (Ndera location).

Construction material: poles; weak.

#### Euphorbiaceae

*Acalypha echinus* Pax & K. Holfm. (KM 249, KM 300, KM 308, KM 335)/**Mvundakiundu, Mgawabarisa**.

Remedy: leaves used as a poultice in circumcision.

*Antidesma venosum* Tul. (KM 252)/**Msasuzi**.

Technology: tool handles.

*Drypetes natalensis* (Harv.) Hutch. var. *leiogyna* Brenan (KM 237, KM 242)/**Munghadama**.

Construction material: poles used in old-style thatch homes.

*Flueggea virosa* (Willd.) Voigt subsp. *virosa* (KM 248, KM 297)/**Mkwamba**.

Technology: flexible branches used in fish traps.

*Phyllanthus sepialis* Muell. Arg. (KM 361)/ **Mkambachana**.

Technology: flexible branches used in fish traps.

*Spirostachys venenifera* (Pax) Pax (KM 234, KM 296)/**Mchalaka**.

Other: poison; milky sap is very toxic.

#### Flacourtiaceae

*Oncoba spinosa* Forssk. (KM 218)/**Mpuju**.

Construction material: poles; wood soft.

#### Guttiferae

*Garcinia livingstonei* T. Anders. (KM 200)/ **Mchachozi** (tree).

Construction material: canoes; other: used to rest beehives; **Mpekecho** (young sapling). Technology: decussate terminal stem used for stirring porridge.

#### Lamiaceae

*Ocimum suave* Willd. (KM 271, KM 407)/**Uvumbani**.

Food: flavoring in tea.

#### Loranthaceae

*Oncella ambigua* (Engl.) Van Tiegh. (KM 213)/ **Mudawa**.

Remedy: to reduce brain swelling in children.

*Tapinanthus zanzibarensis* (Engl.) Danser (KM 384)/**Munyuni**.

Remedy: for children, heat sticks and touch to skin.

#### Lythraceae

*Lawsonia inermis* L. (KM 221 )/**Muasimini** (near farms), Msurua (forest).

Other: fragrant flowers used as perfume.

#### Malvaceae

*Hibiscus micranthus* L. f. (KM 206, KM 279)/**Mvunjahukumu**.

Other (ritual): symbolic, for the prevention of punishment.

*Thespesia danis* Oliv. (KM 209)/**Muoro**.

Technology: pestle; very hard wood.

#### Menispermaceae

*Anisocycla blepharosepala* Diels subsp. *tanzaniensis* Vollesen (KM 413)/**Kivila kiangi**.

Technology: rope used to tie traps made from *Hyphaene compressa*.

*Cissampelos mucronata* A. Rich. (KM 372)/**Kivilabara**.

Technology: rope to tie *Hyphaene* traps (not preferred).

#### Mimosaceae

*Acacia robusta* Burch. subsp. *usambarensis* (Taub.) Brenan (KM 403, KM 410)/**Munga**.

Construction material: poles; wood decays quickly.

*Newtonia erlangeri* (Harrns) Brenan (KM 370, KM 388)/**Mkame**.

Technology: pestle; other: firewood; very hard wood.

#### Moraceae

*Ficus bussei* Mildbr. & Burret./**Mvuli** (Swahili), **Chemeri** (Pokomo).

Construction material: furniture; technology: mortar.

*Ficus sycomorus* L./**Mkuyu**.

Construction material: canoes; technology: beehives, drums.

#### Papilionaceae

*Indigofera schimperi* Jaub. & Spach var. *schimperi* (KM 215)/**Mcharara**.

Technology: fine branches used in making brooms.

*Rhynchosia viscosa* (Roth.) DC var. *breviracemosa* (Hauman) Verde. (KM 285)/**Mchumbivi** (seeds). Food?

#### Rubiaceae

*Gardenia volkensii* K. Schum. (KM 355)/**Mpekecho bara**.

Technology: decussate terminal stern used for stirring.

*Ixora narcissodora* K. Schum. (KM 266, KM 321)/**Mwano**.

Technology: fine branches used to make arrows.

*Kraussia kirkii* (Hook.f.) Bullock (KM 401)/**Mukuwano**.

Technology: small branches used in fish traps.

*Lamprothamnas zanguebaricus* Hiern (KM 313)/ **Mchome**.

Construction material: poles.

*Pavetta sphaerobotrys* K. Schum. subsp. *tanaica* (Bremek.) Bridson (KM 208)/**Mluhe** (Gwano location).

Construction material: poles; not often straight.

*Polysphaeria multiflora* Hiem subsp. *multiflora* (KM 349)/**Mrora**.

Construction material: poles.

*Uncaria africana* G. Don. subsp. *africana* (KM 283, KM 404)/**Gora**.

Remedy: bark is used with saliva to stop bleeding.

#### Salicaceae

*Populus ilicifolia* (Engl.) Rouleau (KM 220)/**Mlalahe**.

Construction material: poles, canoes; soft wood.

#### Salvadoraceae

*Azima tetraacantha* Lam. (KM 301)/**Mughogho**.

Remedy.

*Dobera g/abra* (Forssk.) Poir (KM 386)/**Mkupha**.

Technology: pestles, mortars.

*Dobera lorantifolia* (Warb.) Harms (KM 387)/**Mkupha**.

Technology: pestles, mortars.

*Salvadora persica* L. var. *persica* (KM 394)/ **Mswaki**.

Remedy: small branches used for brushing teeth.

#### Sapindaceae

*Aporrhiza paniculata* Radlk. (KM 244, KM 262)/ **Mubo** (Ndera location).

Other: firewood.

*Blighia unijugata* Bak. f. (KM 243b, KM 339)/ **Mubonyeuni** (Ndera location) or **Mubo** (Gwano location).

Construction material: canoes.

*Chytranthus obliquinervis* Radlk. (KM 203)/ **Mkondokondo**.

Ritual: poor pole that is specifically avoided as bad luck.

*Haploeoecium inoploeum* Radlk. (KM 366)/ **Mhumbe meusi**.

Other: firewood; wood very dense.

*Lecaniodiscus fraxinifolius* Bak. subsp. *seassellatii* (Chiov.) Fries (KM 247, KM 31 O)/**Mhumbe meupe**.

Technology: tool handles; other: firewood.

*Paullinia pinnata* L. (KM 363)/**Mkawa**.

Technology: rope, especially used in binding traps.

#### Sapotaceae

*Mimusops obtusifolia* Lam. (KM 250)/**Mnguvwe**.

Construction material: canoe.

*Paehystela msolo* (Engl.) Engl. (KM 216)/Mchambia.

Construction material: canoes; technology: canoe paddles, spoons.

Simaroubaceae

*Harrisonia abyssinica* Oliv. (KM 214)/**Cheiwa**.

Remedy: roots are boiled and the solution is taken for the stomach.

Sterculiaceae

*Cola minor* Brenan (KM 291, KM 344)!**Mwana fankuku** (Ndera).

Other: firewood.

Thymeliaceae

*Synaptolepsis kirkii* Oliv. (KM 397).

Remedy: roots.

Tiliaceae

*Grewia stuhlmannii* K. Schum. (KM 257)/**Mkirinkonko**.

Technology: rope used to tie fishing traps

*Grewia trichocarpa* A. Rich. (KM 375, KM 391)/**Mkole**.

Construction material: poles: technology: fibers stripped and used as a twine in baskets.

Violaceae

*Rinorea elliptica* (Oliv.) O. Kuntze (KM 207)/**Mwanafankuku** (Gwano), **Mrhigati** (Ndera).

Other: firewood.

Vitaceae

*Ampelocissus africana* (Lour.) Merr. (KM 255, KM 287)/**Mchikichi**.

Remedy: tuberous root boiled for swollen legs or stomach.

*Cissus rotundifolia* (Forssk.) Vahl (KM 211)/**Murhrabahaba**.

Remedy: boiled leaves used as a poultice.

*Cyphostemma* sp. (KM 396)/**Mwengale**.

Remedy: used as a tooth medicine, but not to be swallowed because it contains silicate or oxalate crystals.

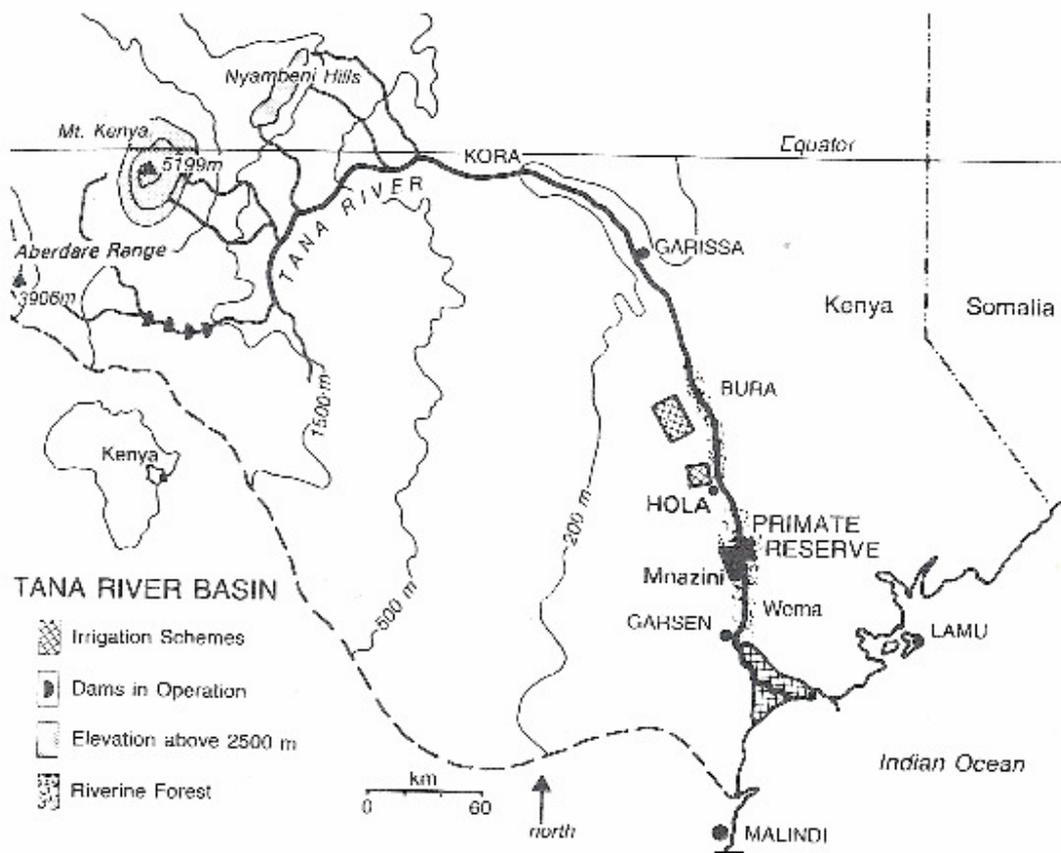


Fig 1. The Tana River basin in Eastern Kenya (reprinted from Medley 1992)