



NATURE EAST AFRICA

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'welcome'

to the new look *EANHS Bulletin*, the magazine for nature lovers everywhere.

In this issue is a variety of natural history features, which take you on a deep sea tubeworm adventure, and have you bubbling out with artesian wetlands in Bogoria; you will take flight with pollinating bees under the hot sun of Tsavo, and cool-off with a Hedgehog, under the canopy of trees in the Usambara Mountains, Tanzania. All this and more right here in *Nature East Africa*.

The amazing effect of rain on Catfish, is the subject of the Question and Answer 'Your mail' section. You are welcome to send in your observations, whether from home or from safari, and although we cannot publish them all, we will attempt to get some answers.

We also welcome contributions on nature and conservation and community involvement in these areas. Let me explain that these can be full length, or just a paragraph - mainly, we would like to hear from you, even if only to tell us what you think of our new style!

We will try to sustain this style with advertising, so if you are in a position to help or know where we can look, please drop us a line at office@naturekenya.org

Enjoy!

Catherine Ngarachu
Editor



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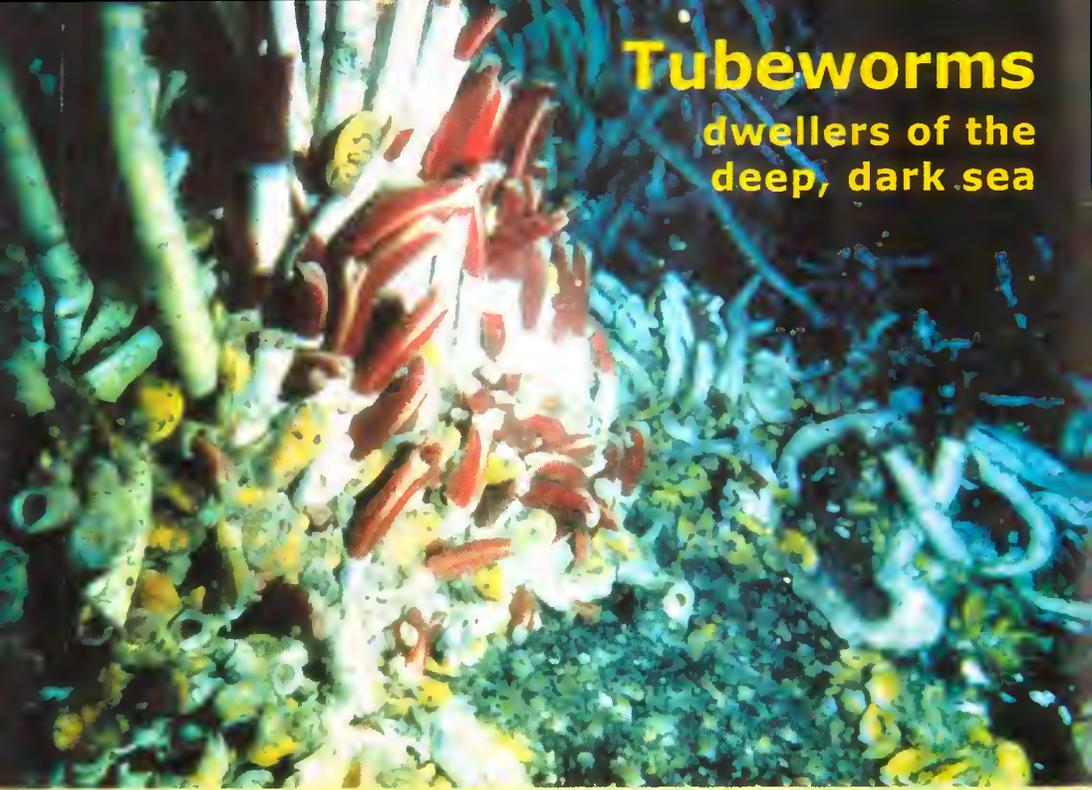
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Cover photo of *Lobelia aberdarica* credit Dino Martins

Tubeworms

dwellers of the
deep, dark sea



Tubeworms *Riftia pachyptila*, mussels and other sea life cluster near a hydrothermal vent on the floor of the Pacific Ocean. Image courtesy of J. Frederick Grossle, director, Institute of Marine and Coastal Sciences, Rutgers University, USA. This photo is from an article, 'Life After Death in the Deep Sea,' co-authored by Richard A. Lutz, in *American Scientist* magazine. Lutz is director of the Center for Deep Sea Ecology and Biotechnology at Rutgers Institute of Marine and Coastal Sciences.

The article describes how on an expedition in 1991 to hydrothermal vents more than 2,550 metres below the surface off the coast of Mexico, scientists found themselves in the middle of a volcanic eruption.

A blanket of fresh lava killed the sea life the researchers hoped to study. In a series of return trips over a nine-year period, the researchers found fresh geological formations, and an explosion of biological life, including new life forms ranging from microscopic crustaceans to two new species of octopus.

The creatures living around thermal vents function without light and near vent water that would seem too hot and toxic to support life, reports Lutz. Some of the strongest are two kinds of vent worms: the tubeworm (*Riftia pachyptila*), which can grow to 2 metres tall, yet has no eyes, mouth, stomach or gut; and the hairy, 25-cm Pompeii worm (*Alvinella pompejana*), which lives in the hottest environment of any animal on Earth.

Life All Around Us

a series about the Invertebrates, the Earth's most biodiverse creatures

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Deep sea tubeworms live in the dark depths of the oceans, more than 2,000 metres below the surface, where no sunlight reaches. They are part of a web of life, parallel to our own, that is not based on sun energy or plants making food. They live in dense colonies around life-giving hydrothermal vents and cold seeps on the ocean floor.

Deep sea tubeworms were discovered about 25 years ago, when scientific submarines reached mid-ocean ridges 2,000 to 3,000 metres below the ocean surface. The ridges are formed by volcanic activity, pushing up molten rocks from deep inside the Earth. In some places, sea water seeps through cracks and fissures down to the molten rocks. The water is heated beyond boiling and gushes out into the sea through cracks called hydrothermal vents. The intensely hot water carries dissolved minerals and gases from the volcanic rocks. Some of the dissolved minerals are deposited around the vents, forming enormous 'chimneys' - 'black smokers' or 'white smokers' depending on the colour of the dissolved minerals.

Tubeworms, molluscs, crustaceans, fish and microscopic bacteria live in profusion around the vents.

Deep sea tubeworms make tubes in which they live. The tubeworms are about two metres long, and several centimetres thick. Their bright red gills emerge from the white tubes. The gills are able to collect two kinds of chemicals that would normally counteract each other. These are oxygen from sea water and hydrogen sulphide from the hydrothermal vents. They also collect carbon dioxide.

Deep sea tubeworms are filled with bacteria. These special bacteria are chemosynthetic: They are able to use the energy in hydrogen sulphide molecules to make organic matter. (Just as photosynthetic plants use the sun's energy to make organic matter.) The tubeworms provide the bacteria with a safe place to live, and collect hydrogen sulphide and other chemicals on their specialised gills. The bacteria make organic matter - that is, food - for the tubeworms.

Deep sea tubeworms also live at cold seeps on the ocean floor. In certain areas of the sea floor there are rocks rich in hydrocarbons. There, chemicals such as methane and hydrogen sulphide seep out from the rocks into the sea. Chemosynthetic bacteria also live here, fixing methane or hydrogen sulphide to make organic matter. Tubeworms, molluscs, crustaceans and other living things live on the bacteria that live in this "alternate world" of high pressure, no light, and water laden with substances that we would consider toxic.

Deep sea tubeworms belong to the Invertebrate group **Vestimentifera**. Other worms that live at these great depths include the Sipuncula or Trumpet Worms; Echiura or Spoon Worms; Nemertea or Ribbon Worms; and Polychaetes or Bristleworms. These groups also have species that live where we can see them, on the shore between the tides.

Trumpet Worms (Sipunculo) live in the sea, from the water's edge to the dark "abyssal" depths. Most are about 5 to 10 centimetres long, and like a sausage in shape. They have a fairly thick body or "trunk" and a thinner front end that can be rolled out and rolled back in. Trumpet worms usually burrow in sand, mud, coral rubble or empty shells, or among seagrass or seaweed. They feed mainly on dead organic matter.

Several kinds of trumpet worms live at the coast, according to "A Guide to the Seashores of Eastern Africa". The worm **Mwata**, *Sipunculus indicus*, is pinkish-white in colour, about one cm in width and up to 50 cm in length. It burrows in coarse sand near the low tide line. Fishermen catch mwoto for food, or as bait for fish.

Spoon Worms (Echiura) burrow in sand, mud or rubble, from the shore to 10,000 metres below the surface. Most spoon worms have a short thick body, a few centimetres long, and a long proboscis which can be stretched out or shortened. A groove or "gutter" runs down the length of the proboscis. The proboscis produces mucus that collects bits of dead organic matter.

The worm looks a bit like a thick-handled spoon. Spoon worms on the Kenyan coast live mainly in the burrows of other sea animals, including trumpet worms such as mwoto.

Ribbon Worms (Nemertea) are usually long and thin. Their narrow bodies can contract and stretch - and some ribbon worms stretch to several metres long. Most ribbon worms live in the ocean depths; others live along the shore, on the ocean surface, in fresh water, even on land. Ribbon worms usually hunt and eat smaller invertebrate animals. They capture prey with their proboscis, a long tube that can be pushed out or pulled in.

Several kinds of ribbon worms live in coral rubble, sand or mud at the coast. Some are strikingly patterned, with a bold dark stripe running the length of their body. These beautiful worms often hunt at night or at high tide, and so are rarely seen.

Polychaetes or Bristleworms will be taken up in the next installment, the Annelids.

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Previous article in this series:

Corals and Jellyfish: Builders and Stingers, *EANHS Bulletin* vol. 30 no. 1
Flatworms, simple animals that wriggle inside us, *EANHS Bulletin* vol. 30 no.2
Nematodes: in soil, in sea, in plants and in you, *EANHS Bulletin* vol. 31 no.1 & 2

YOUR MAIL

Q. What was happening to the Catfish?

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On 15 January 2002 we departed for Amboseli National Park and it soon became apparent that large amounts of rain had fallen over this area. The 'road' from Namanga into the Park was washed away in many places, leaving many tour vehicles and trucks stranded. The normally dry lakebed was completely covered in water.

On a drive the next day, we immediately noticed a number of Fish Eagles eating large Catfish. Driving over the causeway, which links the Ol Tukai area with the airstrip, we were astonished to see numerous Catfish, probably numbering in the hundreds,



all splashing in the shallow waters. Luckily, some were very close to the causeway so we were able to observe them very easily.

We have been speculating that with large amounts of fresh water flowing in from the various swamps perhaps the Catfish were spawning, but what we witnessed close up could only be described as warfare! The Catfish were literally attacking each other and taking large bites out of each other. Most of the injured fish seem to have been bitten on their backs and nowhere else, although we could not be certain of this.

a . Reply and comments

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The catfish species Dave & Val Richards observed in Amboseli N.P. is called *Clarias gariepinus*, the most common and widespread African catfish, commonly named 'mudfish' or sometimes 'sharptooth catfish'.

What they observed was definitely part of the spawning behaviour of this species. According to Bruton (1979) the spawning behaviour of *C. gariepinus* can be divided into six phases: premigratory aggregation, migration, postmigratory aggregation, prenuptial aggression, courtship and mating. The latter four phases take place close inshore of the water bodies where they live.

According to the Richards' information I think that this is a good description of *Clarias*' prenuptial aggression' prior to spawning. Indeed it has been reported (Bruton, 1979) that those catfish perform several intraspecific aggressive actions after aggregating, but before commencing courtship. Initially, aggressive actions consist of low intensity ritualized displays, but as group activity increases, aggression takes the form of high intensity displays which sometimes leads to body contact and fighting. In all cases observed by Bruton, the aggressive

actions were performed rapidly and graded almost imperceptibly into one another.

Catfish participating in prenuptial aggression could not be sexed, but the indications were that the aggressive displays were performed exclusively by males. At least five types of low intensity displays are identified while high intensity displays involved direct 'mock' attacks on other catfish, and in contrast to low intensity displays, body contact is common. The mouth and pectoral spines are used and slight injuries may be inflicted if the encounter continues for more than a few seconds. The barbells are extended forwards and the fins are erected by an aggressor, whereas an escaping submissive fish trails the barbells under the head and lowers all fins. Six types of high intensity displays were observed, including butting, nipping, mouth fighting, biting, spine tear and chasing. During combat, catfish occasionally leap out of the water, or engaged in frenzied circular swimming and rolling over one another at the water surface.

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Vegetation on Artesian Blister Wetlands around Lake Bogoria

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Geologic surveys in the Lake Bogoria area in 2001-2 have revealed some unique wetland habitats. These wetlands are found on faulted volcanic bedrock forming mounds of about 15 m wide and to 1 m high. They have water discharging under a hydraulic head, which is capped by a dense fibrous root mat that covers a mound of clayey peat, that are springy and wobbly when walked on. These mounds are typically encircled by wet meadows comprising predominantly of sedges and grasses, and have a central water blister with a volume of <1 m³. Water sampled from up to 80 cm below the blister mound is cool, fresh, dysaerobic and with a near neutral pH (Ashley et al., 2002).

Zonation on the blister wetlands

The vegetation on the blister mounds can be divided into three types, with water depth appearing to be the main factor determining the kind of vegetation on the wetlands. The vegetation gradient observed from Zone A with standing water, Zone B with perennially wet soil and Zone C on the edge of the wet flush is similar to observations at the nearby Lobo Swamp at similar wetness (Muasya et al., in preparation).

In Zone A, the vegetation capping the mounds is up to 25 cm tall and grows in standing water of 10 cm depth. Zone A is dominated by the mat-forming sedge *Pycnus mundtii* Nees, but at times with scattered sedge *Cyperus laevigatus* L. and the grass *Leersia hexandra* Sw. Zone B is on the flush area with water of 5cm depth and comprising a dense vegetation band with graminoids to 30 cm tall. Species found in Zone B include sedges *Cyperus laevigatus*, *Fimbristylis camplanata* (Retz.) Link, grasses *Leersia hexandra*, *Panicum repentellum* Napper and *Paspalidium geminatum* (Forrsk.) Stapf. Zone C is the wettish base of the mounds, with no standing water and dominated by grasses growing under 25 cm height, including *Sporobolus spicatus* (Vahl) Kunth and/or *Cynadon dactylan* (L.) Pers.).

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The Role of Bees in Pollinator Diversity

An Example from Tsavo

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Arid bush and scrub dominated by *Commiphora* and *Acacia* species forms a major portion of the vegetation through the lower altitudes of Kenya. The tangle of tortured branches, leafless for most of the year, is the typical backdrop associated with the arid parts of the country. At first appearances this habitat appears to be lifeless and monotonous but, a closer look reveals the very opposite is true. The *Acacia-Commiphora* scrub varies greatly in appearance, as does the plant composition from place to place. The key factors influencing the distribution and density of various plant species in this habitat are primarily rainfall and to a lesser degree, the activities of large herbivorous mammals, especially elephants. As with all habitats anthropogenic factors are also coming into play as the demand for charcoal, bush-meat and medicinal plants grows with an expanding human population.

Rainfall is the most crucial factor affecting Tsavo's vegetation. Slight changes in the amount of annual precipitation and the amount of moisture lost through evaporation govern the local distribution of plant species. An example of micro-climatic impact on vegetation from the Tsavo area is the distribution of Baobab trees. These gigantic trees are

common around Voi; however, just a few dozen miles further south they are almost completely absent. It is just that much drier, therefore limiting the survival of Baobabs. It is not just the lack of rainfall, but the high evaporation rate that makes the difference.

VEGETATION AND FLORAL RESOURCES IN ARID LANDSCAPES

Wild bee diversity and other insect species diversity in the Tsavo area is phenomenal. Wild bees are distinct species of insects; they are not honeybees. Wild bees seem to like it hot and dry and these are two conditions that Tsavo meets!

On a single *Acacia senegal* tree in flower in March, over thirty different insect species, and up to fifty different species, of wild bees could be observed foraging simultaneously. Acacias in flower literally buzz with activity, and this humming around Acacias is as characteristic a sound of the bush as the gentle, endless cooing of laughing doves.

The importance of understanding the arid bush and scrub becomes apparent when we realise that about two-thirds of Kenya receives rainfall of less than 500 mm annually, in addition to having a dry period of six months or longer. The woody trees species and the perennial grasses that survive these conditions are highly adapted to cope with drought.

This is accomplished through a wide range of structures as well as physiological mechanisms. Most of the woody plants, including *Commiphora* and *Acacia* species, remain leafless for most of the year. This simply means that moisture is not lost through evapo-transpiration by leaves. Being leafless does not necessarily mean that a plant is dormant. *Commiphoras* have a layer of green cells beneath their semi-translucent bark that allows them to continue the process of photosynthesis even while leafless. Other plant species are succulent, or store quantities of water in underground tubers, stems and bulbs. Most prominent and relevant as floral resources are various species of *Aloe* and *Euphorbia*.

The *Acacia-Commiphora* complex also contains species of the family *Capparidaceae*, such as *Boscia*, *Cadaba* and *Maerua*. These plants generally have flowers with many stamens and dense pollen and therefore form an important resource for bees. Members of the *Tiliaceae* such as *Grewia* also typify the understory of the bush. There are many species of annual and perennial grasses. Herbaceous plants are the other major floral group. These are generally in flower for brief periods during the rains. Here various species of *Cycnium*, *Chlorophytum*, *Ipomoea*, *Commelina*, *Indigofera*, *Pavonia*, *Pedalodiscus*, *Ocimum*, *Thunbergia*, and *Vernonia* can be included.

Each typical sunny day in Tsavo, the green plants convert about one percent of this solar energy into primary productivity using the process of photosynthesis. Some of the molecules they synthesize for their own cellular functions. Amongst these functions are the production and

development of reproductive gametes (including pollen) and reproductive structures (flowers, ovaries). Different species of plants 'invest' varied amounts of time and energy in floral production. Flowering, or rather the reproductive process itself, forms a major part of the plant's annual energy output. Measured in terms of using the net primary productivity, this aspect of ecology becomes crucial in terms of the amount of energy invested by the plant for floral development and reproductive success.

Floral production by plants can be placed in the context of a food chain and energy pyramid. Bees and other insects visiting flowers, access focused energy in the pollen and/or nectar available. Bees (and other pollinators) are therefore the primary consumers of floral products. Different plants provide varied amounts of floral resources. This depends on their own particular physiology, degree of specialist or generalist adaptations as far as pollination is concerned and the local environmental conditions at the time of flowering. None of these factors are mutually exclusive. In fact, they all work in concert to determine the success of a flowering season in terms of numbers of viable flowers produced by an individual plant.

From an initial analysis of wild insect visitors to flowering plants in the *Acacia-Commiphora* scrub of Tsavo, it is evident that wild bee species form the bulk of floral visitors. On all the plants listed here, wild bee species constitute between 83% to 39% of total floral visitors.

Since most bee species rely on flowers as their exclusive source of food (pollen and nectar) this translates into repeated and regular visits to flowers. In addition, the hairs that most wild bee have on their bodies provide large surface area and adhesive structure for the transport of pollen.

Several areas remain to be investigated including the pollination success rates of wild bee floral visits in comparison to those by other insects.

Kenya's drylands have an abundance of wild bee species. Bees seem to like it hot and dry, and these are two criteria that our drylands can meet!

A list of fifty common trees and other plants that were visited by a wide range of wild bees and other insects

Herbaceous Plants and Succulents

- ◆ *Aloe desertii*
- ◆ *Aloe dawei*
- ◆ *Aloe klasenii*
- ◆ *Aloe parvidensis*
- ◆ *Aloe hybrid sp. (parvidensis x secundiflora)*
- ◆ *Barleria spp.*
- ◆ *Chlorophytum sp.*
- ◆ *Commelina spp.*
- ◆ *Cyphostemma sp.*
- ◆ *Euphorbia spp.*
- ◆ *Heliotropium steudneri*
- ◆ *Ipomoea obscura*
- ◆ *Kalanchoe sp.*
- ◆ *Microcoelia sp.*
- ◆ *Ocimum fischeri*
- ◆ *Pavonia gallaensis*
- ◆ *Pedalodiscus macrocarpus*
- ◆ *Scadoxus multiflorus*
- ◆ *Solanum incanum*
- ◆ *Talinum portulacifolium*
- ◆ *Thunbergia alata*
- ◆ *Vernania spp.*

Trees/Shrubs

- ◆ *Acacia senegal*
- ◆ *Acacia nilotica*
- ◆ *Acacia tortilis*
- ◆ *Acacia mellifera*
- ◆ *Acacia bussei*
- ◆ *Acacia zanzibarica*
- ◆ *Acacia brevispica*
- ◆ *Adenium obesum*
- ◆ *Boswellia neglecta*
- ◆ *Cassia abbreviata*
- ◆ *Cassia sp.*
- ◆ *Combretum aculeatum*
- ◆ *Combretum hereroense*
- ◆ *Commiphora africana*
- ◆ *Commiphora baluensis*
- ◆ *Commiphora celeastris*
- ◆ *Commiphora edulis*
- ◆ *Delonix elata*
- ◆ *Dichrostachys cinerea*
- ◆ *Lawsonia inermis*
- ◆ *Melia volkensii*
- ◆ *Opuntia vulgaris*
- ◆ *Platycelyphium voense*
- ◆ *Senna singueana*
- ◆ *Sterculia africana*
- ◆ *Tecoma stans*
- ◆ *Terminalia brownii*



Chairman's Report

92nd Annual General Meeting, May 2002,
of the East Africa Natural History Society

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It is usually easiest to begin at the beginning. Let me remind you therefore why your Society actually exists.

The **aim** of the EANHS is to promote the study of natural history, and conservation of the natural environment, in eastern Africa.

The EANHS works regionally, for example through its scientific publications and through two national components: Nature Kenya and Nature Uganda. I will focus on the activities of Nature Kenya.

In pursuing the Society's aims within Kenya, Nature Kenya strives to:

- build a strong constituency for conservation across the country
- enhance knowledge of Kenya's biodiversity
- advocate policies favourable to biodiversity conservation
- promote conservation of key species, sites, and habitats
- encourage community participation in conservation through promotion of sustainable benefits

Over the past year we have made substantial progress on all fronts. As always, a great deal of work has been done by particular committees and projects.

I will focus on the efforts of the Society's staff and Executive Committee.

NATURE KENYA GROWTH

This is my eleventh AGM report as Chairman, and almost certainly my last. Given how much more there is to report on now than in 1991, this is something of a relief! In its membership, activities, budget and effectiveness the Society really has grown dramatically. We have over 1300 members now, compared to 600 in 1991. A decade ago we had one-half of a staff member; now 20 are on the payroll. Our turnover in 1991 was 150,000 KSh, compared to 7.6 million KSh last year. In 1991 we were regarded as a rather dusty and sleepy, if definitely well intentioned, bunch of birders and botanists. This perception hasn't entirely disappeared, which is perhaps not a bad thing, but we are now being invited on to Government committees, sought out for our point of view, and leading the region in developing innovative approaches to conservation, priority-setting and biological monitoring.

MEMBERSHIP has never been higher - up to 1325 - but is still well below the targets that we had set ourselves. Considerable thinking has gone into a membership development plan.

Awareness

The Society's monthly events and outings are an important part of its public programmes. It was particularly good to see outings focusing on **plants, insects and bats**, as well as birds. The biggest single bird event was **World Birdwatch 2001**, where a record number of observers recorded 729 confirmed species across the country. **Fundamentals of Ornithology**, the certificate course for bird guides and birders, was successfully run once again in collaboration with the National Museums of Kenya.

Media attention to Nature Kenya's work is improving steadily. There has been good coverage of a number of our concerns and projects in the press and on radio and television too. There is still scope for much better media linkages, and a press morning held last August, and focusing on World Birdwatch, was a step in the right direction.

As seems to be the case almost every year, our publications achieved mixed success. There was good progress on the scientific front, with Volume 88 of the *Journal of East African Natural History* appearing and Volume 89 going to press. After a lengthy break, *Scopus* also showed renewed signs of life with the appearance of Volumes 21 and 22. The popular publications, apart from the ever-reliable monthly newsletter, were less vigorous. There was no issue of *Kenya Birds* published in 2001, and only

one of the *EANHS Bulletin*. Volume 31 of the *Bulletin* is being distributed at this AGM, and the next *Kenya Birds* is expected to go to press shortly, but their longer-term future is under review. On the brighter side, the capacity for desk-top publishing in the office has significantly improved over the past year, so that staff can now help to handle some of the production work and reduce at least one of the present publication bottlenecks.

Nature Kenya believes that building **environmental awareness** among young people is particularly important. Several Site Support Groups already work closely with schools around particular Important Bird Areas. Through our links with the Royal Society for the Protection of Birds, there is now an exciting possibility to expand this input dramatically.

Information

Our strategic plan states that 'In order to target its advocacy and conservation efforts effectively, Nature Kenya must set clear and defensible priorities. These need to be backed up with comprehensive and accessible information about status and threats.'

Identifying priorities and monitoring status operates at three inter-linked levels: species, sites and landscapes.

Nature Kenya is not primarily a research organisation, but we have many members who can, and do, contribute valuable data. To collate and analyse these data, and to carry out targeted research in priority areas, we link up with others - notably the National Museums of Kenya. With funds from the RSPB, we currently provide support to NMK's Ornithology Department in particular, including the stipends for two **IBA Research Fellows** whose primary responsibility is co-ordinating a monitoring scheme.

Last year the focus continued to be mainly on birds, though there are still plans to follow up recommendations from the workshop '**Broadening the taxonomic scope of priority-setting**' held in May 2001. Ornithology Department surveys covered several little-known IBAs or potential IBAs, including Mwea National Reserve, Dakatcha Woodlands, Mau Narok-Molo Grasslands, Tana River Primate NR, Amboseli NP (re-assessing bird communities after three decades of vegetation change) and Loima Forest.

Exciting discoveries included a huge Barn Swallow roost in Mwea, a new population of Sokoke Scops Owl in Dakatcha, and good numbers of Sharpe's Longclaw in Mau Narok-Molo.

Monitoring continues to grow in importance, and is an area where Nature Kenya members can make a real contribution. For the last year we have been piloting a two-tier monitoring scheme for Important Bird Areas, with basic information collected on forms for all IBAs, and more intensive efforts at particular sites. IBA Site Support Groups are becoming increasingly involved with detailed monitoring, which is now underway at Kinangop Grasslands, Kereita (Kikuyu Escarpment Forest) and Arabuko-Sokoke Forest. The **annual waterbird counts**, which involve many members, monitor a set of key wetland IBAs. A significant boost to IBA monitoring is the award of a **Darwin Initiative grant** to the project 'Kenyan Important Biodiversity Areas: Improving monitoring, management and conservation action'.

Several long-term schemes continue to pull in data that add to our basic understanding of bird biology and distribution. These include the **nest record card scheme**, **National Birdmap**, and the **ringing scheme of eastern Africa**. Again, these all provide excellent opportunities for members to become involved and contribute genuinely valuable information.

Advocacy

We continue to make significant headway in advocacy. Nature Kenya's views are increasingly respected and sought-after, and we have established effective ways of making our voice heard.

The Important Bird Areas **National Liaison Committee**, which brings together more than 20 Government and non-Government organisations, continues to be an excellent forum for sharing conservation information and co-ordinating approaches. Another such mechanism, focusing more specifically on policy, is the recently created **Environmental Legislation and Policy Working Group - ELPWiG**. This consists of Society members with an interest in law and policy. ELPWiG recently won a competitive BirdLife grant to work on forest policy and the use, in environmental policy, of birds as indicators: these will be the initial themes on which the group focuses.

Nature Kenya continues active participation in the **Inter-ministerial Committee on the Environment**. Preparations for the **Convention on Biological Diversity's** 6th Conference of the Parties formed a particular pre-occupation in 2002: we were closely involved, alongside Government, in the preparatory consultation processes and as part of the delegation to COP 6 in April 2002.

On behalf of the **BirdLife African Partnership**, we were also able to intervene effectively in the final negotiations of the revamped **African Convention on Nature and Natural Resources**. This resulted in a number of important points, such as the explicit listing of threatened species, being acknowledged in the Convention and its appendices.

Closer to home, we remain actively engaged in the **Kenya Forest Working Group**, where we sit on the Management Committee. As we all know it has been a sad and difficult year for forest conservation. With its partners in KFWG, Nature Kenya did everything it could, publicly or behind the scenes, to achieve a more favourable outcome. We will continue to press home the simple truth that sustainable development fundamentally depends on environmental conservation, and specifically the safeguarding of our disastrously diminished forests.

Action

BirdLife's **African Species Action Plan** project, co-ordinated by Nature Uganda, continues to make good progress. The project will build national capacity for action planning and develop action plans for a selected set of threatened species that cross national boundaries.

The EU-funded **Arabuko-Sokoke Forest Management and Conservation Project** was completed early this year. Nature Kenya has had an increasing input to the project, and particularly to the Management Plan, which was its final output. Nature Kenya and the BirdLife International secretariat are in discussion with several organisations that may wish to fund parts of the plan's implementation.

Another chapter came to a happy close at Arabuko-Sokoke when, as planned, we formally handed over the **Kipepeo Project** to the National Museums of Kenya. What was once a gleam in an entomologist's eye is now a world recognised, prize-winning example of the sustainable use of biodiversity. It is also a viable enterprise, with an annual turnover of 7 million shillings, that is creating substantial profits for the local communities and for conservation. Outline action plans for other IBAs are also in development, focusing initially on activities for site support groups.

Nature Kenya's conservation action continues to be focused on **Important Bird Areas**, in particular the most severely threatened sites in the

'Critical' class. Our approach is to build capacity in local conservation groups (site support groups, or *SSGs*) to carry out conservation projects of their own. These projects focus on achieving conservation through building sustainable livelihoods. With support from the regional GEF/UNDP office, I think we are making tremendous progress, and building up a really exciting model for community-based conservation that really works.

Site Support Groups are well established now at Arabuko-Sokoke, Kakamega, Kikuyu Escarpment Forest, Kinangop, Kisumu and Naivasha, and upcoming at several other IBAs. Site-based interns are helping to form or develop groups of seven sites, while gaining experience themselves of practical conservation. Several groups are now implementing substantial conservation projects. It was particularly pleasing when the Kijobe Environment Volunteers crowned a string of funding successes by winning the BP Conservation Programme follow-up award for the **Kikuyu Escarpment Outreach Project**. This generated substantial publicity abroad and in Kenya. The *Daily Nation* summed up Nature Kenya's approach in an editorial: *'The Kikuyu Escarpment Outreach Project proceeds quietly away from the glare of television cameras or multi-million shilling publicity campaigns... a home-grown project that plays the critical role of educating the community that their future well-being depends on survival of the forest.'*

Finances & Admin

We have developed and are implementing a business plan to guide our operations in 2002 and 2003. In 2001 we once again deliberately ran a deficit and drew down our reserves in order to implement our development strategy. In the current financial year we intend, though it will possibly be painful, to balance the budget. The year 2003 and beyond present serious challenges as one major prop of our conservation work, the regional GEF project, comes to an end.

For the last year, therefore, fundraising has been an even higher priority than usual. There have, as always, been successes and failures. Recent successes have included the Darwin Initiative IBA monitoring grant; a grant from the UNDP/COMPACT to develop an Eco-resource Centre for Mt Kenya; and more modest grants for policy work and for the Mau Narok-Molo Grasslands survey. Several other applications are in the pipeline, some having already taken considerable work, notably for GEF/UNDP (mid-sized grant), the European Union's Biodiversity Conservation Programme and Community Development Trust Fund, the UK Department for International Development, and USAID. In the short-term, continuing our activities at the present level depends on at least some of these being successful.

As the Society's activities expand and new challenges emerge, its structure continues to evolve. As well as some changes among the staff, there has been a redefinition of the roles of the Executive Committee (to concentrate on its primary function of governance), the **Management Sub-committee** and the **Forum of Committees and Projects**. We have been fortunate to be able to take advantage of a high-level BirdLife Partnership training programme, **Building on Experience**. This has assisted the efforts of all staff and Management Sub-committee members to improve the work planning and budgeting process. Though the systems will no doubt need more fine-tuning, I believe our administrative mechanisms are now fundamentally sound and that we now have the capacity to handle even larger and more demanding projects than at present.

At some stage in the next few years, our current office space will become part of the new National Museum galleries. This is part of a general **restructuring of the Nairobi Museum** and should result in a much-improved layout. For us, of course, the move will be a substantial disruption. We are starting to plan for it now, both for the short-term relocation and for our long-term future on the Museums' site where, it is strongly felt, the EANHS office should remain. No doubt you will hear more about this at future AGMs.

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Corrigendum

In the article on poisonous aloes, in the last issue of the *EANHS Bulletin* (vol. 31, no. 1 & 2, pp. 8-9), "g-coniceine" should have appeared as "γ-coniceine".

Biodiversity, Birds & People

Key Lessons from the Important Bird Areas Project

'African NGO-Government Partnerships for Sustainable Biodiversity Action'

A five year project to build capacity for the conservation of Important Bird Areas in 10 African countries

Looking back at six years of struggle and successes

The past six years have seen momentous changes in the East Africa Natural History Society, BirdLife International, and action to conserve Important Bird Areas critical sites for biodiversity conservation. Important Bird Areas provide habitat for endangered or threatened species; support large numbers of breeding, migrating or wintering birds; or provide habitat for species, which occupy specific biomes or that have limited ranges.

The following series of articles examines different aspects of the struggle and its successes. An outline of the IBA programme in Kenya was published in *Kenya Birds* volume 9. You can buy *Kenya Birds*, the *Important Bird Areas in Kenya* book and other IBA publications at the Nature Kenya office.

**Paul Matiku &
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'The programme is bound to make significant impact in the conservation of biological diversity in Kenya. Its approach of working with local communities and at the same time striving to inform and influence national decision making will have long-term impacts on conservation in Kenya' *Quote from a Government official*

- Funded by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP)
- Implemented by the African Partnership of BirdLife International
- Project countries are Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Sierra Leone, South Africa, Tanzania, Tunisia and Uganda

KEY LESSONS LEARNED FROM THE IBA PROGRAMME

- Birds are an excellent initial focus for developing local interest in conservation
- The participation of communities near target sites is essential in biodiversity conservation
- Groups and communities need to 'own' their activities
- A small amount of pump priming funding can achieve significant conservation outputs by helping to raise additional resources
- Institutional co-ordination and community mobilization for biodiversity conservation are both possible, but they represent a challenge and there is much still to be learned
- Challenges exist at different entry levels to local communities, hence the need to monitor group dynamics, particularly during their developmental stages
- Work planning needs to be flexible enough to accommodate unforeseen events and outputs
- It is essential to involve local communities in any monitoring scheme so as to make it cost-effective and sustainable
- It takes time before local communities are completely on board a conservation project, and planning for such a project should take this into account; the resources required also tend to be more than originally estimated
- There is great interest among local communities in environmental

conservation. With encouragement, support and some input of resources, local groups can potentially make a real difference for biodiversity conservation. However, the local community's needs must be addressed – conservation cannot be tackled in the abstract

- Local communities may not see the immediate benefits of conserving biodiversity unless there are economic incentives for them
- Conservation projects can open a window of opportunity for starting income generating activities
- A monitoring scheme provides group members with an opportunity to learn about their surroundings through the information collected
- Creative and innovative ways of spreading conservation education and awareness, such as the use of games and sports, puppetry, plays and drama, etc., are powerful tools
- Involving the government and local political structures in conservation is important
- Capacity building such as management training is essential in strengthening community groups
- Pervasive poverty and high illiteracy levels within rural yet bio-diverse areas is a major drawback to conservation initiatives
- Unique species such as threatened birds act as good flagships for conservation; the importance of certain species, however, may lead to a misconception that such species can be a direct source of income

The Last Forest

Arabuko-Sokoke Forest: Unique, incomparable, home to six globally threatened birds and site of an innovative, participatory management system

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Arabuko-Sokoke Forest is the last large remnant of the East African coastal forest ecosystem, which once extended from Somalia to Mozambique. This forest is ranked second in importance in mainland Africa for threatened bird species. It shelters a breathtaking array of rare and endangered species: the unusual golden-rumped elephant shrew, often glimpsed scurrying in the leaf litter; six different kinds of globally threatened birds; and a number of plants, frogs and insects, some found nowhere else on Earth. Surrounded by communities of subsistence farmers and tourist developments, the whole forest is highly threatened.

Three distinct forests make up the forest reserve. The nature trail near the visitor centre passes through thick mixed coastal forest growing on pale sandy soil - a tangle of low trees, shrubs and vines, rich in flowers and butterflies. A driving trail winds to the open *Brachystegia* woodland on plain white sand, where traveling parties of birds flutter among spreading trees. Further inland the land rises, the soil changes abruptly from white to red,

and the forest becomes low and close again: the *Cynometra* thicket. Seasonal pools appear with the rains, fill with frogs, birds, dragonflies and other life, and disappear again in dry years.

ARABUKO-SOKOKE FOREST MANAGEMENT AND CONSERVATION PROJECT (ASFMCP)

This groundbreaking project was coordinated by BirdLife International Secretariat in close collaboration with Nature Kenya and the Secretariat of the Memorandum of Understanding between the Forest Department (FD), Kenya Wildlife Service (KWS), and the National Museums of Kenya (NMK). It was financed by the European Union and overseen by a Project Manager (first Jahn Fanshawe, then Phillip Franks and finally Ian Gordon) and a Project Steering Committee that included Nature Kenya. Four Kenyan institutions implemented the project activities through the Arabuko-Sokoke Forest Management Team (ASFMT) composed of the Forest Department (FD), Kenya Wildlife Service (KWS), National Museums of Kenya (NMK) and Kenya Forest Research Institute (KEFRI). March 2002 marked the completion of the six-year project. Key results include:

PIONEERING INNOVATIVE MANAGEMENT SYSTEMS

Four collaborating institutional stakeholders (FD, KWS, NMK, KEFRI) within a single management team is regarded as a model for other forests in Kenya. The Arabuko-Sokoke Forest Management and Conservation Project Steering Committee, chaired by the Permanent Secretary in the Ministry of Environment, met annually to advise on progress, work plans and budgets. The project made important contributions towards forest management: rehabilitation of forest stations and outposts, maintenance of forest roads and firebreaks, support for routine forest patrolling, infrastructure for

communications and a survey of the forest boundaries. The promotion of community participation in forest management and the preparation of a long-term management plan for the forest laid a new and solid foundation for the future.

Arabuko-Sokoke Forest served as a pilot project for the concept of Participatory Forest Management. This may be defined as 'the involvement of communities living adjacent to forests, in partnership with other stakeholders, in forestry management activities, within a framework that also improves the community's livelihoods'. This concept is expected to be incorporated in the incoming forest policy and the next forest bill.

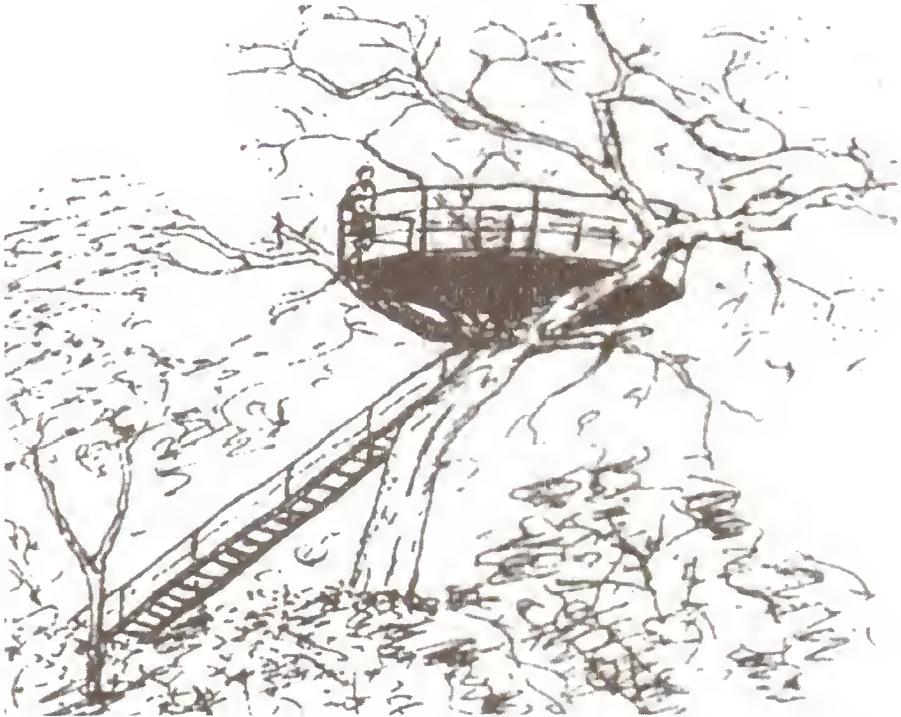


Illustration from Arabuko - Sokoke Forest, A Visitor's Guide by Tansy Bliss



IMPROVING THE BALANCE OF BENEFITS AND COSTS FOR FOREST ADJACENT COMMUNITIES

People living around the forest have used it from time immemorial: for wood, water, wild foods and medicines, and sometimes for ceremonial and religious purposes. As farms began to surround the forest, however, cutting it off from other natural habitats, communities felt the full brunt of human-wildlife conflict. Before the project began, the balance of forest-related benefits and costs for forest adjacent communities was decidedly negative. Wildlife crop raiding and deaths and injuries caused by forest animals had turned the people against the forest. The communities continued to benefit from 'free access' to forest resources, but a lot of it remained largely illegal and therefore seen as something they got in spite of the forest rather than because of it.

To tackle this problem, the project promoted income generating activities, agro-forestry, small scale water projects and problem animal control. Income generating activities (IGAs) focused on sustainable use of forest products, to provide conservation incentives by linking livelihoods with the continued existence

of the forest. Successful IGAs include butterfly farming (through the award-winning Kipepeo Project), beekeeping, ecotourism (in cooperation with the Arabuko-Sokoke Forest Guides Association), and tree nurseries.

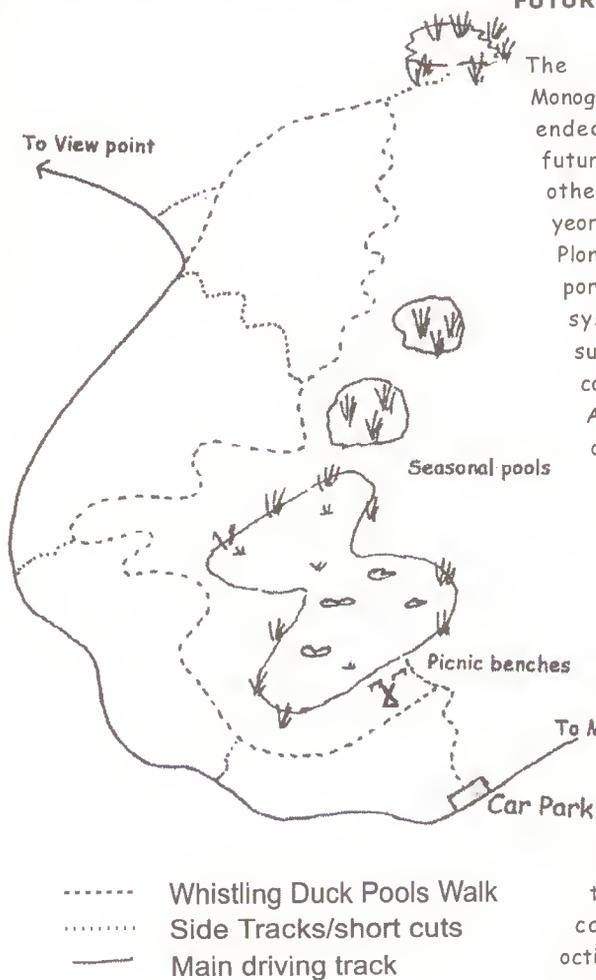
PROMOTING PUBLIC AWARENESS OF THE VALUE OF ARABUKO-SOKOKE FOREST

Despite its unparalleled importance for biodiversity conservation, Arabuko-Sokoke Forest can seem hot, humid and unremarkable to the casual visitor. To improve this perception, an attractive and informative visitor centre was established at Gede Forest Station. A network of signposted walking, running and driving trails were developed, along with a viewing platform, educational nature trails and camping sites. Maps and printed guides to the forest are available to visitors, and posters and brochures promote Arabuko-Sokoke Forest as a tourist destination (several of the publications are available at the Nature Kenya office). Visitors to the forest have increased steadily, from less than 1000 in 1997 to nearly 4500 in 2001. School-focused education and awareness reached 54 schools, and 36 of them formed environmental clubs for enthusiastic young people.

The Arabuko-Sokoke Forest Guides Association (ASFGA) was formed by local guides skilled in finding and identifying the characteristic birds, mammals and plants of the forest. A set fee is paid for a guided visit, providing income from ecotourism. The Guides Association is part of the network of Site Support Groups affiliated with Nature Kenya. The Forest

Whistling Duck Pools Walk

CHARTING A COURSE FOR THE FUTURE



The Arabuka-Sokoke Forest Management and Conservation Project ended by building bridges to the future. The Management Team and other stakeholders developed a 25 year Strategic Forest Management Plan. The plan was developed in a participatory way and based on a system of forest use zones: subsistence, non-extractive use, commercial use, and intervention. A copy of the Plan may be viewed at the Nature Kenya office or downloaded from the BirdLife website www.birdlife.net

Now the challenges outlined by the Strategic Plan need to be taken up. Two new initiatives are already ongoing. Under the European Community's Biodiversity Conservation Programme, a 14 million shilling grant is helping to finance the construction of a 20 kilometre elephant fence, and to fund expansion of the community income generating activities, especially bee keeping and eco-tourism. Nature Kenya is also employing an intern who is working closely with the KWS office of Gede, the Forest Guides Association and the German BirdLife partner (NABU) to promote eco-tourism in the forest. In the pipeline are other projects, focusing mainly on improving livelihoods of people living adjacent to the forest.

Illustrations from Arabuko - Sokoke Forest, A Visitor's Guide by Tansy Bliss

Adjacent Dwellers Association (FADA), was established to help coordinate all site-based local conservation and user groups, to support the survival of Arabuko-Sakoke Forest in perpetuity.

Icy peaks on the Equator

Mount Kenya Eco-Resource Centre a new asset for the mighty mountain

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Mount Kenya is a World Heritage Site, a Biosphere Reserve, a National Park and Forest Reserve, all affirming the biological and cultural importance of Africa's second highest mountain. From the forestland below, belts of vegetation ring the ancient volcano: highland forest, mountain bamboo, Hogenio-Hypericum woodland, Erica heathland, Afro-alpine moorland with tussock grasses and giant plants, and finally rock, snow and ice. Mount Kenya is a vital water catchment for Kenya's largest river and main source of hydro-power, the Tano. Today Kenya's highest peak is also an important site for recreation such as mountain hiking and climbing, bird watching and wildlife viewing.

The forest belt has been under severe stress over the past few years, with uncontrolled logging, encroachment by farmers, charcoal making, and clearing in order to grow bhong (morijuno). Even the high peaks are not spared degradation, with climbers leaving trails of rubbish behind.

THE ENVIRONMENTAL RESOURCE CENTRE

Nature Kenya has received funding from the UNDP/COMPACT Programme to start work on an Environmental Resource Centre to provide information and encourage appreciation of the local and global importance of the Mount Kenya ecosystem and its biodiversity. The centre will also assist the peri-forest community to benefit from the forest in a way that does not degrade the resource base, through selling artefacts and fresh horticultural produce and providing guiding services. The resource centre is planned to include a library, lecture room, internet and e-mail facility, cultural museum, herbarium and arboretum, canteen, compost and gift shop.

This project builds on and expands work initiated through the GEF/UNDP funded project 'African-NGO Government Partnerships for Sustainable Biodiversity Action', whose main aim has been to build institutional capacity at national and local level for the conservation of Important Bird Areas in ten countries across Africa, including Kenya. Only part of the cost of the Mount Kenya initiative has been received, and fund raising from potential donors is ongoing. Construction is about to start.

Local communities – part of the problem, or part of the solution?

A case of KENVO, a Community Based Organisation
Kikuyu Escarpment Forest – part of the Southern Aberdares

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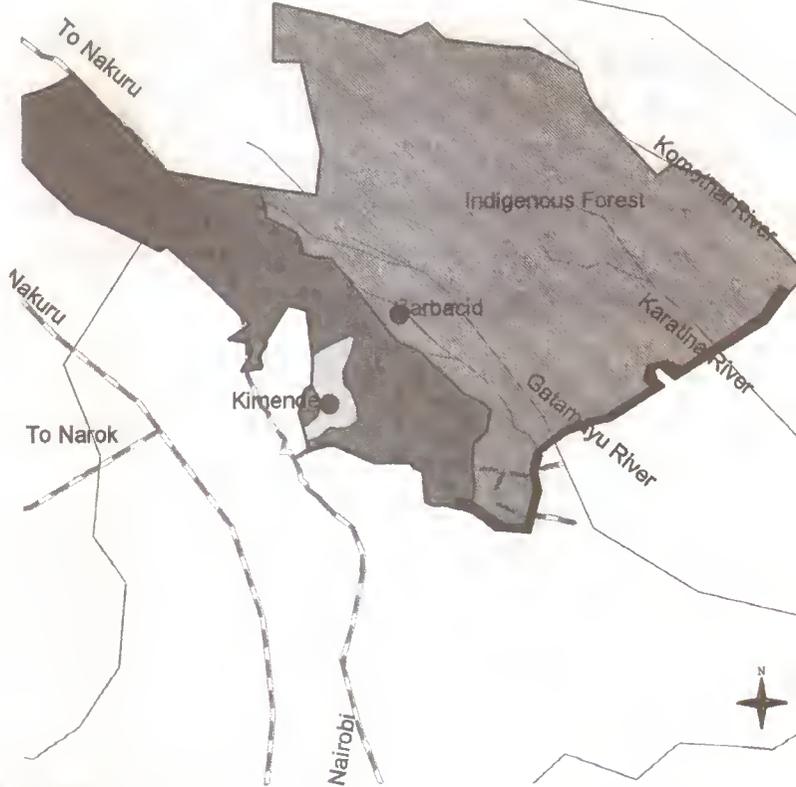
Local communities in Africa and elsewhere have long co-existed harmoniously with wildlife, a function of the intrinsic value they attached to their environment. This was usually not recognised by conservationists in the last century, who wanted to 'set aside' protected areas, and often regarded adjacent communities as a problem. The 'protectors' did not understand that local communities often have a sophisticated indigenous knowledge of the local resources and how to manage them sustainably. Happily, BirdLife's Important Bird Area programme recognises that communities living in or near sites of global biological diversity importance have a crucial role to play in their conservation.

KIJABE ENVIRONMENT VOLUNTEERS (KENVO)

KENVO began in 1994 as a group of mainly young people, many of whom were just leaving college. With no immediate government job prospects, they wished to do something on a voluntary basis about the forest degradation they observed. A simple research project showed that the

two main causes of degradation were poverty and lack of environmental awareness. The group felt that they could not do much about poverty, but that they could have a significant effect in terms of raising peoples' awareness. KENVO began to take part in community barazas (meetings) organised by the Forest Department and to organise other simple educational events, consultations and workshops.

KENVO had become less active by 1998, but the advent of the Important Bird Areas programme and support by Nature Kenya gave the group a new focus and vision. The group found that a focus on birds was very useful in engaging interest and support and began to organise weekly bird walks, mainly for young people. The links with Nature Kenya and the IBA programme also resulted in training opportunities for KENVO volunteers (for example in writing funding proposals) and a series of successful applications for funding, each of which has allowed the group to strengthen and widen its educational and research activities.



KIKUYU ESCARPMENT FOREST – PART OF THE SOUTHERN ABERDARES

Kereita Forest

Map from the Kenya Forest Working Group

The Kikuyu Escarpment forests include Gotamaiyu, Ragia, Kieni, Kamoe, Kinale, Kereita and Uplands forests and form the southern end of the forests covering the Aberdore or Nyondoruwa range of mountains. They are situated close to Nairobi on the eastern wall of the Great Rift Valley, and are part of the catchment for Sosumua dam, a major source of water

for the copitol city. The forests ore home to a globally threatened forest storling, Abbott’s Starling, several regionolly threotened species, and o rich variety of highlond forest birds.

‘The (Important Bird Areas) programme has contributed significantly towards empowerment of local communities to conserve the environment and to engage in sustainable-development programmes’
Quote from a Site Support Group

Using Kereita farest os o model oreo of operation and study, KENVO has learned that neighbouring communities have troditionolly relied upon the forest to supplement their livelihaads, and have values for over forty species of birds. Volues ronge fram maral, decarotive, pest cantral, telling time, enviranmental indicators ond traditianol beliefs. Findings by KENVO also revealed that the forest is heavily degraded by

unsustainable human activities such as charcoal burning, illegal commercial timber harvesting and poorly managed shifting cultivation systems.

KENVO'S ROLE IN THE CONSERVATION OF THE KIKUYU ESCARPMENT FORESTS

As a demonstration of the possibility of balancing biodiversity conservation and community survival, KENVO has initiated some community-based interventions such as bee-keeping for honey production, tree nurseries, forest rehabilitation and ecotourism. These efforts have been supported by UNEP (the United Nations Environment Programme, based in Nairobi), the Wildlife Conservation Society of USA and the BP Conservation Programme of the BP oil and energy company in U.K.

UNEP is supporting an initiative to rehabilitate an area of forest. UNEP departments provide funds in relation to their use of paper, e.g., use of 2,000 reams of paper results in money for growing 2,000 seedlings. The programme is expanding and involves all key stakeholders (the community, farmers and KENVO; the Forest Department and UNEP).

In 2000 KENVO were the winners of a BP Conservation Award for their project to investigate causes of forest degradation and track community resource use, perceptions and attitudes towards Kereita Forest. It was particularly exciting that in 2002 KENVO won the prestigious fallow-up award for their "Kikuyu Escarpment Outreach Project". By combining money-making activities and

awareness raising, KENVO are helping to convince their community that conserving the forest is in their own best interest.

KEYS TO SUCCESS

KENVO was a 'home-grown' group, formed out of a genuine concern, with its own motivation and a will to achieve conservation benefits for the local area. The group was not formed because of donor funding; instead, it achieved considerable impact on its own and without funding, initially, and was then able to build on this experience and motivation provided by Nature Kenya and other partners.

Secondly, KENVO found the Important Bird Areas concept very useful. Initially, there was some misunderstanding, with people thinking KENVO's interest was related to one species of bird, but efforts to explain wider, holistic concepts of forest ecosystems have led to much better understanding, particularly among young people.

Crucially, the fact that the IBA concept was introduced through local people and structures has helped its favourable reception and adaptation: it is not viewed as a western-driven concept. KENVO has used the IBA concept successfully to link conservation with people's livelihoods. The message is not 'watch birds and receive money', but (for example): 'plant trees and see the benefits this brings you'.

David Kuria recently spent several months at the BirdLife International office in Cambridge, U.K., working with the Important Bird Areas project.

The Only Rainforest

Kakamega Forest

Easternmost Outpost of the Congo Basin Tropical Rainforest

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WORKING WITH LOCAL COMMUNITY GROUPS

An isolated remnant of the vast rainforest to the west, Kakamega Forest covers some 10,000 hectares, part Forest Reserve and part KWS National Reserve, in Western Province at the same altitude as Nairobi. It is an important catchment for Isiukhu and Yala rivers, and home to 20% of Kenya's plants and 40% of its butterflies. To the bird watcher, it is like stepping into another world - many of the birds are found nowhere else in Kenya. Two of the bird species are globally threatened, 15 are regionally threatened, and 194 depend on closed canopy forest to survive.

This remarkable forest is under heavy pressure. Part of it has been excised and cleared. The many people who live nearby collect firewood, timber and medicinal plants, graze their cattle and hunt forest wildlife. These uses are no longer sustainable. Protection of the forest alone, however, will not solve the problems of forest loss and degradation. Alternative sources must be found or created to supply the rural communities' needs and replace the proportion of household income that is derived from the unsustainable use of the forest.

Since 1998, Nature Kenya has been working with and strengthening community based organisations as Site Support Groups (SSGs). These include the Kakamega Environmental Education Programme (KEEP), an environmental education arm of the Kakamega Biodiversity Conservation and Tour Operators Association (KABICOTOA). Members of KEEP and KABICOTOA work together to implement 'Conservation of Kakamega Forest: Investing in community development and capacity building'. Their activities include environmental education programmes for the local community, and guided tours in the forest for domestic and international tourists. KEEP, with the assistance of Pittsburgh Zoo of the United States, built an environmental education centre at Isecheno Forest Station in the southern part of the forest.

To promote the value of the forest, and to alleviate rural poverty through forest-based income generating activities, KEEP, with funding from the GEF/UNDP Small Grants Programme and other donors, is now undertaking the following initiatives:

ENVIRONMENTAL EDUCATION: The main targets are primary and secondary schools close to the forest, women groups, churches and local administrators. Awareness programmes in schools include development of conservation clubs, excursions to the forest and other sites, talks and video shows, helping clubs to set up tree nurseries and bird study tables, and organizing environmental art and music competitions. Barazas, seminars, workshops, and guided tours advocate the conservation of Kakamega Forest to the wider community.

BUTTERFLY EXHIBIT: A walk-in butterfly display enclosure and a small butterfly breeding room were built to entertain and educate the public and raise money.

SOLAR ENERGY: Solar panels are used to provide electricity for the environmental education centre, the butterfly enclosure, the Forester's offices and a few staff houses.

CANOPY VIEWING TOWERS: There are plans to build viewing towers at Buyangu and Isecheno to enable visitors to get 'a bird's eye view' of life in the treetops.

RE-AFFORESTATION: To improve tree cover and reduce dependency on the forest for fuel wood and timber, KEEP and KABICOTOA acquired a plot from the Forest Department to establish a tree nursery. Seedlings raised in the nursery are used for replanting degraded parts of the forest and some are given to visiting children to plant at home.

Jameson's Wattle eye, illustration by Peter Gaede



Marula

An under-utilised resource
for the drylands of Kenya

**Grace Ngugi & Geoffrey
Mwachala**

E.A. Herbarium

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In rural areas of Africa, many people are dependent on local plant life for their basic subsistence and prosperity. The marula tree *Sclerocarya birrea* is of high value and can be used for food, medicine, fadder, carvings and shade. In many parts of Africa, the marula tree forms an integral part of the household economy and it is not uncommon to find individual trees protected in farms and near homesteads and generally conserved this way.

Classification and Distribution

Marula is a member of the Anacardiaceae family, which includes cashewnut and mango. It grows throughout the sub-humid and semi-arid areas of tropical Africa.

There are three subspecies of *Sclerocarya birrea*: subsp. *birrea*, subsp. *multifoliolata* and subsp. *caffra*. These subspecies of *Sclerocarya birrea* have distributional ranges that are clearly associated with the different physiographic divisions of Africa. From Senegal to Sudan, only *birrea* occurs. In southern Africa, Angola to Mozambique, only *caffra* occurs.



Sclerocarya birrea, branch with leaves

from Gilbert, M.G (1989)

Botanical name: *Sclerocarya birrea* (A. Rich.) Hochst.

Synonyms: *Sclerocarya caffra* Sond., *Poupartia caffra* (Sand.) H. Perrier, *Poupartia birrea* (A. Rich.) Aubrév.

Common names: **English:** marula, marula plum, cider tree, elephant tree; **Swahili:** mng'ongo, mng'ong'o, mungango; **Borana:** didisa; **Chonyi:** fula (fruit), mfula; **Digo:** mng'ongo; **Giriyama:** mfula, tulafula (fruit); **Ilchamus:** imang'wai, imang'wa; **Kamba:** muu'wa, mau'wa (fruits); **Luo:** ong'ong'o, mang'u; **Maasai:** almang'uai, ilmang'uai (plural); **Marakwet:** arol, oroluo (singular); **Mbeere:** mukomothi; **Pokot:** araluo, oroluwo; **Sabaot:** kotelalam; **Teso:** ekajikai; **Tugen:** tololokwo

East Africa is the centre of diversity of the genus *Sclerocarya*, and material can be easily accessed in this region to create a wide genetic base. *Birrea* occurs in Ethiopia and Uganda; while in Kenya and especially Tanzania, all subspecies exist.

The southernmost extension of *birrea* is to about Iringa, Tanzania. The northernmost extension of *caffra* is the equator. The third subspecies, *multifoliolata*, occurs in northern central Tanzania.

A closely related species *Sclerocarya gilletii*, is endemic to eastern Kenya.

In Kenya marula occurs in the Coast, Eastern, Rift Valley and Nyanza provinces, usually on sandy loam soil and rocky hillsides. Fruiting takes place from April to August, depending on the region.

Description

Marula can grow up to 18 m tall. It is usually single stemmed with a dense, spreading crown and deciduous foliage; the bark is grey and usually peels off in flat, round disks, exposing the underlying light yellow inner bark. The leaves are compound pinnate, crowded at tips of branches.

The flowers range in colour from pale green to dark red with cream margins. The fruit is an egg-shaped or plum-like fleshy drupe 3 to 5 cm in diameter, with a yellow juicy pulp and a relatively tough bitter-tasting skin. The seed kernels (embryos) are encased in hard, light brown, smooth oval-shaped stones, each containing 2 to 3 embryos 1 to 1.5 cm in length.

Marula grows quickly and may attain a height of 3.5 m in 8 years. Both male and female trees are required for fruit production because the species is dioecious. Marula is dispersed by animals who eat fruit, but only a few disperse viable seed.

Uses

The marula tree provides an abundant supply of benefits to people, livestock and wildlife with virtually every part of the tree being potentially useful.

FOOD VALUE

In most parts of Africa, *Sclerocarya* fruit is used as a food. The fruit pulp has a sweet pleasantly acidic taste and is widely used as a raw material for preparation of alcoholic beverages, as well as juices, jams and jellies.

The flesh of the fruit has a high moisture content and high vitamin C. This makes them an important nutritional component of the local diet. Citric acid is the most abundant of the organic acids. The nut has high oil content with very good dietetic ratio of saturated to unsaturated fatty acids, a low moisture content and high fat, protein and mineral contents.

MEDICINE USE

Marula is used as a medicinal plant throughout its distribution range. Almost all parts of the plant are exploited for medicinal uses. Some of the reported uses are outlined below.

Bark

Traditionally, the bark provides the most commonly reported medicine for treating malaria, venereal diseases, diabetes, dysentery and diarrhoea. It is also used to treat haemorrhoids, snakebite, liver diseases, inflammations of the spleen, stomach ulcers and pain, gangrenous rectitis, blepharitis, skin inflammation and eruptions, leprosy, and to ease labour pains, haemorrhagic menstruation, headache, fevers, sore throat/mouth and toothache.

In addition, it is used to treat neuralgia, rheumatism, gout and gastrointestinal disorders.

Details on how the bark is used have not been systematically studied nor reported, and are mostly apocryphal.

It has been reported that the Hausa from West Africa use a cold infusion of the bark, with natron (hydrated sodium salts, used in ancient times in embalming, ceramic pastes and cleansing agents), for dysentery. In South Africa, a brandy tincture of the bark is drunk as a prophylactic for malaria while a teaspoonful of dried powder is taken as a cure. In Madagascar oral use of the bark is usually as a tisane, a tea that is made from the leaves and bark, and is commonly used as a sedative and antiseptic. It can also be used as a purgative and the Maasai and Pokot add a decoction of the bark or root to milk to make a health drink for children.

A decoction of the bark is used by many communities to bathe skin eruptions. A paste of the bark, either separate or mixed with other plants, is diluted and drunk to treat syphilis, gonorrhoea and leprosy. For external use, as a paste, powder or ointment, it is used as an astringent, antibiotic, antiseptic, and emollient.

For snakebite, the bark is pounded to a paste, rubbed on the bite until skin surface swells, then a bark decoction is drunk and applied as a dressing to the wound.

It is traditionally assumed that the mature bark is most potent. It is therefore the most commonly harvested part. In Kenya, it is not uncommon to find partially or completely debarked trees, especially near homesteads. Marula is intolerant of ring barking, with completely ring-barked trees dying within two seasons.

The bark of marula is also reported to be used in traditional veterinary medicine, to increase the appetite of stock and to treat intestinal problems of horses.

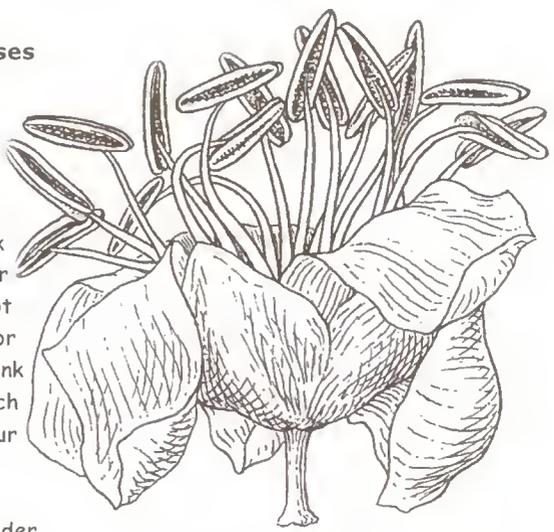
Leaves The leaves are rich in flavonosides and when mixed with the bark, have a wide application in traditional health care. Alone, they are used to treat fever, diarrhoea (boiled water extract recommended for children) and to make a tea for treating weak veins or capillaries. It is reported that in Madagascar, they are macerated with or without the bark, and used to treat skin irritations and insect bites; as pain suppressants and to make a tea for treating venereal diseases.

Roots The roots are not widely used, however, in Tanzania, they are pounded with water and drunk for schistosomiasis and for washing scabies.

Other Fermented fruit is highly intoxicating, but is also antiascorbic and a natural antimicrobial agent that prevents food poisoning. The oil from the nuts is also used in medicine, as an insecticide and as a skin moisturiser. It is especially valued by the cosmetic industry due to its slow oxidising properties.

Traditional Beliefs and Ritual Uses

The Housa people of Niger believe that bark powder added to baths will protect against snakebite. Hunters, to protect against the spirits of their prey, also use bark powder, by mixing with other ingredients. Powdered bark of the root is used to get rid of curses or for catching sorcerers. It is taken in a drink or added to oblations, either of which must be done three times for men, four times for women.



Sclerocarya birrea subsp. *caffra*, male flower
(enlarged) from *Flora of East Africa*

Marula is a beautiful shade tree, under which homestead craftsmen and labourers gather and work and is often the spiritual centre for ritual activity in homesteads and villages.

There is an annual morula festival in Swaziland, celebrated at the royal residence of the king between February and March, during which each household presents the king and queen mother with marula beer, but first they drink it themselves. The Tonga people of Swaziland pour offerings of fresh beer over the tombs of their dead chiefs.

Other Local Uses

The flowers are a source of nectar for honeybees and may therefore be useful in apiculture. The leaves are a food source for edible caterpillars such as the 'mopane worm', a nutritious and important dietary resource traditionally exploited in southern Africa, and 'ombembo' (Luo), eaten in parts of western Kenya. Buffalo grass, *Panicum maximum*, one of the most valuable fodder grasses, grows well under the marula tree.

The bark has a strong fibre that is plaited into rope and woven into mats. It is also used to prepare a 'khaki' coloured dye. The wood is coarse-grained, soft and grey, but taints reddish on exposure. The utility value of the wood in South Africa (larger sizes, easily worked, red colour) made it much sought after and was so over-exploited that it was made illegal to harvest it. This may in part account for it not being a commercial timber today. When planed it exhibits good surface that takes varnish well. It is suited for making packing crates and can be used in joinery. Its preservation requires care as it is not resistant to insect attack. It does not burn well, but is traditionally used for firewood and charcoal. It is also used in construction of homesteads, making of beehives, carving utensils, mortars and drums.

The leaves and leafy stems and branches make good animal forage, but is never a major source of browse except in times of general feed shortage as it is said to be slightly poisonous.

When the bark is damaged, marula exudes a clear light-brown coloured gum that contains very little tannin and is transparent, but not sticky on drying; these and other properties make it suitable for industrial applications. It is traditionally used to make ink by mixing with soot and water.

Commercial Importance

Marula yields products of actual or potential commercial value. Products are developed largely from the fruit, from which a juice can be extracted to make a refreshing drink or to make wine. The fruit pulp is used to make jam. The kernel is rich in oil, which is used in making butter, as a preservative or as an ingredient in skin cosmetics. In Madagascar, the nuts are boiled until an oily residue, rich in protein and iodine, forms at the surface. This oil is used as a moisturiser and marketed commercially as 'Sokoa Oil'.

Propagation and Management

To successfully propagate marula seed, proper storage and pre-treatment procedures need to be observed. Prolonged seed storage (one or more years) is a possible way of increasing germination success. Seed dormancy can be broken by removing the skin and pulp, sun drying the stones for seven days then storing the dry stones in a dry, well

aerated dark place in cold temperatures (less than 10 degrees celsius). The operculum should be removed, using a knife or a small chisel, before sowing the seed. It is recommended that the seeds be sown at the onset of the rainy season, October or March, using a mixture of earth, coarse sand and manure and well-drained sandy loam, as the substrate. This should be kept moist but not waterlogged. The seeds can be sown in plastic bags or pots, or seedlings can be grown in deep (>50 cm) seedbeds for germination and later transplanted. Germination takes two to four weeks, and 100% germination can be achieved within four weeks of sowing. Seedlings take 3-6 months to reach knee height, depending on the climate, the substrate, and the watering regime, at which height they should be transplanted to the field. The long taproot of marula seedlings, a sign of excellent adaptation to dry areas, makes nursery production of seedlings in small pots inadvisable, as it often leads to poor tree development in the field due to root curling and damage.

Vegetative propagation of *S. birrea* is a good alternative for two reasons. Firstly, since the plant is dioecious, it may be desirable to have more female fruit bearing trees than male pollinators. Secondly, the fruit quality of trees varies greatly and using vegetative propagation methods it is possible to capture some of the existing genetic diversity.

Marula trees are planted during the rainy season. Mature trees generally reach about 12 m in height with a 5 m crown. Ungrafted trees should be planted 10 meters apart and grafted trees 6 m apart.



Sclerocarya birrea, Botswana (Roland Kindt)

Management Morulo grows best in hot areas where the air is dry. Young plants can be damaged by frost, but are drought tolerant. Seedlings need to be protected from strong winds and staked for support.

Like mongos, *S. birrea* can grow in most soil types, but does not flourish in poorly drained soils. Compost or manure should be used during the first year after planting, applying 5 kg in October and March.

Young *S. birrea* trees need water for growth and 10 litres or one bucket of water should be applied every two weeks during the first two years after planting. After two years, the maturing trees will need less water and can survive in areas with little rainfall.

Seed extraction from Sclerocarya birrea, Namibia
(James Were)



Fruiting Fruit production is very high, even in years of drought. Fruiting occurs in cycles with boost years followed by scarce fruit set.

Pruning After planting, the trees need to be pruned regularly to ensure optimum benefits. Pruning promotes the growth of new branches and keeps the tree healthy. During pruning, the tree should be shaped so that the fruit gets the most sun, but the centre of the tree is still shaded and so does not burn. Shoots can be targeted for pruning according to their type.

Fruiting shoots grow much more slowly, and are of two kinds: lateral shoots that are long with buds all along their length and spurs that are short with buds at the tip. Fruiting shoots produce many more flower buds and potentially more fruit. Pruning of some fruiting shoots will promote the production of fewer but larger, better quality fruit.

Prospects for Marula in Kenya

Kenya has appropriate climatic areas where marula occurs naturally. As mentioned above, marula may be propagated naturally or artificially at minimal costs and the seedlings require very little input in management after planting. Existence of skilled manpower for identification, propagation and commercialisation add to the potential that the country has in developing marula to a crop. This, compounded with existence of affluent urban markets for commercial products as well as availability of extension services through research institutions, place the country at an advantage for marula crop development.



Samples of Marula products (Emma Youde)

For identification and further information on the marula tree and its usage, contact EA Herbarium, National Museums of Kenya. Detailed information on propagation and management is available at Kenya Forestry Research Institute (KEFRI), while information on domestication is available at Regional Land Management Unit (RELMA) and The World Agroforestry Centre (ICRAF).

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Marula fruit (Emma Youde)



Bird specimen collection

Is it still necessary in Kenya?

Above George Amutete of National Museums of Kenya marvels at the extinct species preserved at the Smithsonian Museum. The very presence of such a specimen in a country of origin is an inspiration to conservation of what is remaining.

George Amutete

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The purpose of a bird collection as held by museums is to preserve the avian record, providing a source of material for both present and future research. Each bird specimen is unique and cannot be replaced with any other.

Our knowledge of bird diversity relies immensely on collection-based research, and new bird species (ranging in hundreds) have been discovered, around the world,

in the past decade, mostly through the examination of museum specimens. Accurate and current taxonomical knowledge that inevitably draws from bird specimen collection is necessary for effective conservation. Thus with changes in climate, habitat and bird populations regular sampling is crucial.

There are four types of variations that are documented principally through preserved specimens: individual, geographic, short term (within-year or lifespan) and long term (decades) temporal variation. Each form of variation represents an important aspect of biodiversity and needs to be given special and specific attention.

Biochemical methods have evolved and have proved to be very efficient in separating species and helping to establish comprehensive taxonomical units, useful in conservation. However, few museums have sufficient tissue collection to satisfy this need.

To satisfy statistical analyses, samples from any given locality often have to be at least ten individuals, preferably of each sex and age class, for example ten adult females, ten immature males, etc. This is a challenge that is yet to be met by African museum collections. This often limits knowledge for practical conservation value.

Furthermore, there are species that need taxonomical revalidation because of the contrasting opinions held by taxonomists. Unfortunately worldwide holdings of both skeleton and fluid specimens inventoried, have been found to be far short of current and future research needs (Jenkinson and Wood 1985).

Collection of individual birds that have been carefully studied in life is often still necessary to learn the age or sex of birds showing certain behaviours. For instance, a collection of chickadees revealed that both sexes sing. Another collection of Wood Thrushes *Hylocichla mustelina* by Winker et al. (1990) showed that both sexes defend individual winter territories, an important aspect of non-breeding population dynamics.

It should be recognised that the conservation of some species has been hampered by lack of sufficient data (Bennun and Njoroge 1999). Accurate taxonomical knowledge is necessary and enhances more focused conservation efforts. With current rates of habitat alteration, species may be lost or displaced from an area where formerly common, and new specimen material may be impossible to obtain. Specimen collection is a practice that should go

hand in hand with a campaign for conservation, and be seen as a precautionary act lest everything be lost without trace.

The impact in collecting an individual bird, in a given habitat, is not significant and only temporary. If anything, it is typical that after one season, the territory previously occupied by a breeding individual, will be found filled by another individual.

Research has revealed that the greatest threat to birds is habitat loss coupled with fragmentation and isolation. The most common root causes are agricultural expansion, extraction of natural resources and infrastructure development. Other threats to bird life are hunting, trade and invasive species with climate change being an emergent looming problem.

With already 30,000 bird specimens from the East African region, it would be easy to boost Kenya's bird collection to be representative of the region. High bird diversity and endemism, further supports the urgency and importance of continued, but focused bird collection in Kenya.

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The White-bellied African Hedgehog

A new record from the Usambara Mountains

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The White-bellied African Hedgehog (*Atelerix albiventris*) is recorded in Tanzania as 'probably present but rare' ranging intermittently throughout the savannah and semi-arid zones of the north of Africa from Senegal to Somalia and Tanzania (Kingdon, 1997). This makes the finding of this hedgehog in a forested area in the East Usambara Mountains very exciting.

There seems to be no name for hedgehog in the local language, Kisambaa, which confirms their scarcity in this area.

The hedgehog was recorded from a patch of riverine lowland forest, bordering open grassy woodland, in Bombo East II Forest Reserve in the East Usambaras.

HEDGEHOG DETAILS

Name: Also known as 'Four-toed Hedgehog'

Location: Bombo East II Forest Reserve, East Usambara Mountains (S 04 48' 43.3" E 038 40' 26.0')

Altitude: 640 m

Habitat: Riverine Lowland forest

Micro-habitat: Leaf litter

Water association: 5 m from dry gully

Age: Juvenile

Sex: Male

Head-Body: 137 mm

Tail: 12.5 mm

Ear: 24 mm

Hind foot: 22 mm

Weight: 180 g

Hedgehog in the Nairobi Arboretum



The record was made during a biodiversity survey, carried out in March 2002, by the East Usambara Biodiversity Surveys (EUBS).

The habitat in which the hedgehog was found is unusual as Kingdon (1997) describes the hedgehog as requiring a dry shelter and not being found in damp environments such as forest. *Atelerix albiventris* has been recorded in the coastal forests of southern Kenya (Corbet & Hill, 1991), but there is no record of this species in the Coastal and Eastern Arc forests of Tanzania (Kingdon & Howell, 1993; Rodgers & Homewood, 1982), although it is thought to exist.

But, hedgehogs are known to be very tolerant of a range of latitudes, altitudes, climates and ecological zones (Kingdon, 1974) and it is therefore not so surprising that this species was found in a forest. Hedgehogs are primarily insectivores; they are known to eat small mammals, nestling birds, frogs and reptiles, as well as vegetative matter such as fruit, fungi, roots and groundnuts (Kingdon, 1974), all of which are plentiful in a forested environment. As pointed out by Kingdon (1974), hedgehogs have restricted home ranges so the habitat in which they live must supply a substantial amount of food availability. A forested environment therefore provides ideal ecological conditions for a hedgehog.

It is possible that this hedgehog had temporarily, or perhaps permanently, left its normal dry open woodland habitat for the forest. It may have been in search of a more reliable food source and perhaps also to avoid predation by Verreaux's Eagle-Owl (*Bubo lacteus*), which is known

to the Usambaras (Pohjonen, 2001) and favours the hedgehog as its prey (Brown 1968).

There has been little research carried out on the ecology of hedgehogs in East Africa and undoubtedly further study would shed some light on the natural history of these elusive spiny creatures.

The Frontier-Tanzania Forest Research Programme (a collaboration between the University of Dar es Salaam and the UK based Society for Environmental Exploration) and the East Usambara Catchment Area Management Programme (EUCAMP) have been working together under the title of the East Usambara Biodiversity Surveys (EUBS) since 1995. EUBS has been funded through EUCAMP, with financial support from Metsähallitus, Finnish Government and the European Union.

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