



# The Arc Journal

## Tanzania Forest Conservation Group

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# BIODIVERSITY

To mark the end of 2010, the Year of Biodiversity, this edition of the Arc Journal highlights the extraordinary biodiversity of the Eastern Arc Mountains and Coastal Forests of Tanzania and focuses attention on some hidden threats.

## Inside

- Find out about the latest bird, primate, amphibian and reptile discoveries in the Eastern Arc Mountains.
- Are invasive alien species threatening our forests?
- Uzungwa Scarp: a call for action.
- Medicinal forest plants: a lifeline for millions of people.

Photo by Andrew Perkin

## 2010. Year of Biodiversity. What does it mean?

Neil D. Burgess

**2010 has been proclaimed by the United Nations as the 'International Year of Biodiversity'. But why has this particular year been chosen and what is its significance globally and to Tanzania?**

In this article we outline some of the history and reasons for choosing 2010 for this honor.

The reason for 2010 being chosen as the year of biodiversity goes back to 2002. In that year world leaders committed, through the Convention on Biological Diversity, to achieve a "significant reduction in the rate of biodiversity loss by 2010". This "2010 target" has been incorporated into the

United Nations Millennium Development Goals in recognition of the impact of biodiversity loss on human well-being. Today, 191 countries around the world have become members of the biodiversity convention and are working to achieve its goals. These countries met during October 2010 in Nagoya, Japan at the 10<sup>th</sup> combined international meeting. Here, the world's nations, observed by many NGOs and others, reviewed whether they had collectively achieved the overall target to reduce biodiversity loss, or the many sub-targets relating to the protection of the world's forests, woodlands, deserts, islands and other habitats.

### Has the 2010 biodiversity target been met?

Answering this question requires considerable amounts of data, collected from all over the world. Many agencies, including UN bodies and government departments, have been working hard over the past years to gather this data to show progress towards achieving the 2010 biodiversity target. Earlier this year a group of scientists, representing many different organizations, presented a comprehensive assessment of progress towards achieving the 2010 target.

These authors used data from 31 separate sources to report the trends in the *status* of species and habitats, the *pressures* (threats) impacting species and habitats, and the *responses* by people, governments and other organizations to protect species and habitats. Most data on the *state* of biodiversity (e.g. species population trends, extinction risk, habitat extent) showed declines since 2010. In addition, there was no significant reduction in the rate of decline in biodiversity state over time. As such it was concluded that the overall 2010 biodiversity target had not been achieved.

In comparison, data on *pressures* on biodiversity (including resource consumption, invasive alien species, nitrogen pollution, overexploitation, and climate change impacts) showed increases. More encouragingly, the rate of *responses* to this biodiversity crisis, for example the extent of protected areas and sustainable forest management, have all increased. Despite this effort, the rate of biodiversity loss does not appear to be slowing, presumably mainly because the rise in the pressures on biodiversity outweighs the impact of the response.

### Focus on protected area coverage

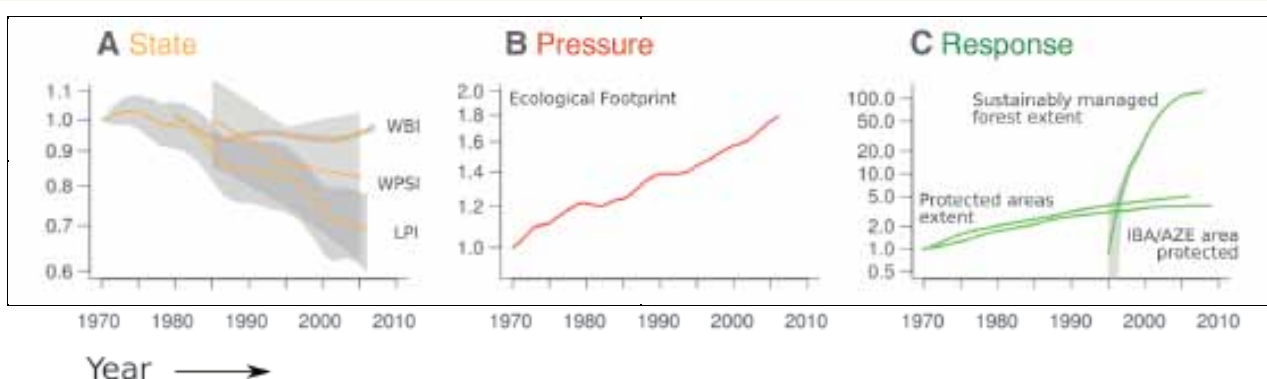
Protected Areas have been one of the cornerstones of global conservation efforts over the past century, with almost all nations on earth recognising their value and designating areas of land for the dedicated protection of habitats and species. Both the Convention on Biological Diversity (CBD) and the Millennium Development Goals (MDGs) have established terrestrial and marine targets for protected area coverage, to be achieved by 2010 and 2012 respectively. These targets call for “at least 10 per cent of each of the world’s ecological regions [to be] effectively conserved”.

Globally the world has, by 2010, conserved over 12% of the land surface, but still under 0.5% of the marine areas. This achievement is not in every ecological region, but in more than 50% of ecological regions around the world the protected area target has been achieved. This is a very positive achievement for governments.

In Tanzania the achievement is even more impressive, with close to 40% of the land within protected areas or reserves of one type or another (including community level protection). Over 10% of the shelf sea area is also within a network of Marine Reserves and Marine Parks. Even though these are impressive figures, key conservation areas continue to be gazetted in Tanzania, and the area under community based natural resources management is being expanded with the establishment of new Village Land Forest Reserves and Wildlife Management Areas.

### Focus on protected area effectiveness

The Convention on Biological Diversity, and the countries who are a part of it, have also agreed to



**Figure 1. Trends in the global status of species (WBI=World Bird Index, WPSI=Waterbird Population Status Index, LPI=Living Planet Index), pressure on species and habitats as measured by the ecological footprint index, and responses to conserve species and habitats as measured by the extent of protected areas, the area of Important Bird Area/Alliance for Zero Extinction sites and sustainably managed forests that are conserved. Derived from paper by Stuart Butchart and others in Science, July 2010**

improve management of protected areas. This was in recognition of the fact that many protected areas existed globally, but that large numbers of these were not well managed. The target set by the Convention on Biological Diversity was that 30% of the reserves in each country should have been assessed in terms of their management effectiveness by 2010.

A global analysis of more than 8,000 of the world's 130,000 protected areas has shown that although the effectiveness of management is improving, many areas of the world do not yet have effectively managed protected areas. And that this is largely correlated with the wealth of the country. This analysis also shows that the target to assess 30% of all protected areas for their effectiveness has not been achieved.

In Tanzania progress towards improving the effectiveness of protected areas is continually being made. Management plans are prepared for National Parks, game Reserves and also now for the expanding network of Nature Reserves. Assessments of the effectiveness of Forest Reserves have been made across more than 150 sites in the Eastern Arc and coastal forests, and in a number of the National Parks.

### **Focus on forests**

In response to the rapidly progressing forest loss and in view of the high biological value of this habitat, the CBD has set the target that "at least 10% of each of the world's forest types" should be effectively conserved. In 2008, the 10% protection target for the world's forest types was reconfirmed by the 9th Conference of the Parties to the CBD.

Globally around 7.7% of the world's forest was protected by 2005, and it has certainly increased since then. But it is not known if the world has reached its 10% protection target. And, as with the general 10% target to conserve ecological regions within protected areas, some of the world's forest types are better protected than others.

In Tanzania, the remaining areas of tropical rainforest in the lowlands and on mountains are mainly found within protected areas of one type or another. Some of these reserves are not well managed, and there is loss of forest cover and condition. In addition large areas of miombo woodland and Acacia woodland habitats are protected in reserves – perhaps as much as 50% of what remains.

### **Conclusion**

2010 is a watershed year for the conservation of biodiversity. It is clear that despite major efforts

by governments and others to achieve the targets set out in the Convention on Biological Diversity programmes of work on protected areas, forests, and others, biodiversity continues to decline globally. And the rate of that decline has not been slowed over the past 10 years. This recognition fed into the CBD meeting in Nagoya in Japan (18-29<sup>th</sup> October). The following targets were agreed in the Strategic Plan arising from the meeting (as reported in <http://www.iisd.ca/biodiv/cop10/>).

### **Headline targets from Nagoya**

The following targets have a 2015 deadline:

- the anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning;
- the Nagoya Protocol on Access to genetic resources and the fair and equitable sharing of benefits arising from their utilisation is in force and operational, consistent with national legislation; and
- each party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated National Biodiversity Strategy and Action Plan.

The following headline targets have a 2020 deadline:

- people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably;
- biodiversity values have been integrated into national and local development and poverty reduction strategies and into national accounting, as appropriate, and reporting systems;
- incentives, including subsidies, harmful to biodiversity are eliminated, in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, in harmony with the Convention and other relevant international obligations;
- governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits;
- the rate of loss of all natural habitats, including forests, is at least halved and, where feasible, brought close to zero and degradation and fragmentation is significantly reduced;

- all fish and aquatic plants are managed and harvested sustainably, legally and applying ecosystem-based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits;
- areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity;
- pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity;
- invasive alien species (IAS) and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment;
- at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected Protected Area systems and other effective area based conservation measures, and integrated into the wider landscape and seascapes;
- the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained;
- the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity;
- ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable;
- ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15% of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification;
- Traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels;
- knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied; and
- the mobilization of financial resources for effectively implementing the Strategic Plan 2011-2020 from all sources, in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from current levels. This target will be subject to changes contingent on resource need assessments to be developed and reported by parties.

These targets challenge national governments to deliver tangible improvements over the next decade. Tanzania has its part to play in delivering against a number of these targets, and will need to review how it plans to do this. Donor partners and NGOs will need to assist in the achievement of the targets and there will be an important task to measure progress and achievement over time, to facilitate reporting back to the Convention at the various Conferences of the Parties that will occur in the coming years.



*Photo by Andrew Perkin*

# News of the Arc

Perseverance has paid off as we see 2010 heralding success in three longstanding processes. The GEF Coastal Forest project entered its inception phase after an application process that started in 1995; Derema Forest Reserve was finally gazetted after a process that began in 1976; and the Tanzania Forest Service was launched after at least six years of trying.



*The Rondo Plateau in Lindi Region is one of the priority areas for the GEF Coastal Forest Project.  
Photo by Andrew Perkin*

## GEF/ UNDP Coastal Forest projects gets started...after 15 years of trying!

In January 2010, the GEF financed project 'Extending the Coastal Forest Protected Area Subsystem in Tanzania' entered its inception phase. This is a four year project involving an investment of US\$ 3.5 million from GEF. The concept for this project was first proposed in 1995. However due to a combination of factors, including changing procedures and criteria within GEF, the proposal was not finally approved until last year. The project's objective is that 'the spatial coverage and management effectiveness of the Coastal Forest protected area sub-system is expanded and strengthened.'

The Project Objective will be achieved through three Project Outcomes:

**Outcome 1.** Strengthened enabling environment is functioning for conservation of Coastal Forests in mainland Tanzania, leading to increased funding, staffing and oversight.

**Outcome 2.** The Protected Area System for Zanzibar is strengthened in terms of both representativeness, connectivity, financing and managerial capacity.

**Outcome 3.** Effective Protected Area Management Systems in place at four project priority landscapes, with co-management between central, local and village government partners, leading to improved conservation of biodiversity values.

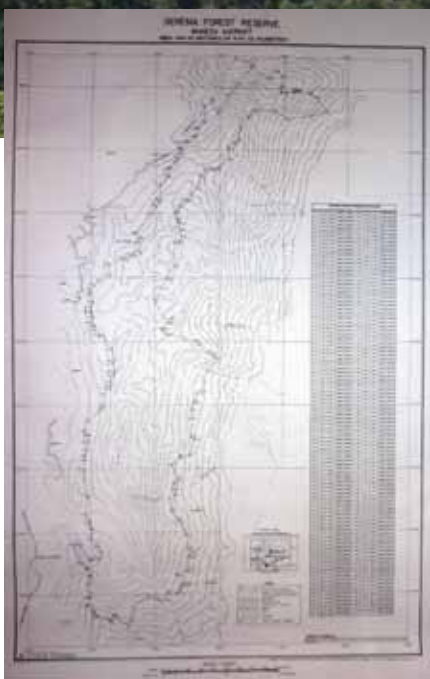
The project is being implemented through the Forestry and Beekeeping Division and the Department of Commercial Crops, Fruits and Forests, Zanzibar – with technical support from WWF. The focal areas for the project are Lindi, Kilwa, Rufiji and Zanzibar.

## Derema Forest Reserve – gazetted after 34 years

Derema forest in the East Usambara Mountains has for many years posed a conservation challenge in the Eastern Arc Mountains. The Derema Forest Reserve was first proposed in 1976. The forest is a critical forest corridor between Amani Nature Reserve and the more northerly of the East Usambara mountains. But a process to declare the area a Forest Reserve had foundered for many years. The gazettelement process was taken up as a part of the UNDP GEF / Forestry and Beekeeping Division project 'Conservation and Management



*View of the southern tip of the Derema Corridor. Photo by Nike Doggart*



*Map 1: JB Map of the Derema Forest Reserve.*

of the Eastern Arc Mountains Forests' and the Critical Ecosystem Partnership Fund 'Eastern and Coastal Forests Hotspot' investment in 2004, and work continued until these projects closed in June 2010. During the gazettelement process, more than one thousand villagers from 5 villages were compensated for giving up their farming land in the forest area, which

was primarily cardamom underplanting of the trees. The cost of the gazettelement process and compensation payments between 2004 and 2010 has been in excess of \$4 million, and many thousands of hours of input from Tanzanian government officers and their NGO and donor partners. However, after all this effort, the 968 ha Derema Forest Reserve was gazetted on the 9<sup>th</sup> July 2010 in Issue No.28 of the Government Gazette of Tanzania as Government Note (GN 255) of 2010. Now begins the hard work of safeguarding local peoples livelihoods around Derema, and putting in place sound management of the reserve within the context of the surrounding reserve network.

### **Tanzania Forest Service Launched**

The Tanzania Forest Service has been formed out of

the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism. It has taken over some of the roles and functions of FBD and is responsible for the management of national forest reserves (natural and plantations), bee reserves and forest and bee resources on general lands. FBD will remain with responsibility for the development of the forest policy, laws and regulations and overseeing their implementation in the sector. TFS's vision is to be 'A centre of excellence in the conservation and sustainable supply of quality forest and bee products and services in Tanzania'. Amongst its targets for the period 2010 – 2013 is the target of reducing illegal activities in forest areas by 80 %.

### **New NGO REDD piloting projects get underway**

Since the last edition of the Arc Journal two new REDD projects have been launched in the Coastal Forests. In Zanzibar, CARE-Tanzania in partnership with the Department of Commercial Crops, Fruits and Forests is implementing a project that aims to promote a pro-poor and gender equitable approach to community forest management including piloting of carbon financing for REDD. The project will benefit at least 29 communities and will improve management of 25,000 ha of forest. In Kilwa, the Mpingo Conservation and Development Initiative aims to integrate new carbon financing flows from REDD with participatory forest management and forest certification. The project will benefit at least 12 villages with approximately 50,000 ha of forest. Both projects are financed by the Norwegian Ministry of Foreign Affairs as part of their investment in REDD readiness in Tanzania.

# TFCG News

**TFCG is working with 130 villages around 150,000 ha of Eastern Arc and Coastal Forest in 14 Districts. Some recent highlights of our work are described below.**

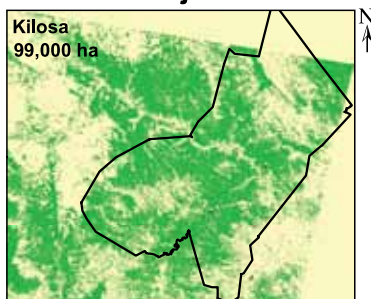
## **REDD project launched in 29 villages in Lindi and Kilosa**

In partnership with MJUMITA, TFCG is implementing the project 'Making REDD work for communities and forest conservation in Tanzania'. The project aims to demonstrate a pro-poor approach to REDD and involves the establishment of a community-led carbon enterprise. The project is being implemented in two sites involving 29 villages. Based on an initial analysis of the land cover for both sites, the project will be working with 64,000 ha of coastal forest, woodland and miombo in Lindi within a total project area of 120,000 ha; and 65,000 ha of submontane forest, woodland and miombo in Kilosa within a total landscape of 99,000 ha. Both sites lie within biodiversity hotspots.

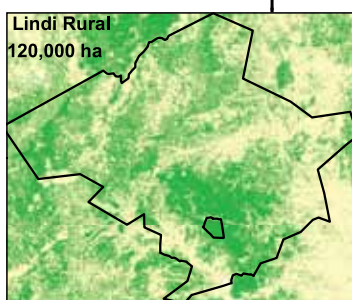


*Nuru Nguya, TFCG Community Development Officer, during the launching of the REDD project in Ruhoma Village, Lindi. Photo by Raymond Nlelwa.*

### **REDD Project Areas**



So far the project has carried out intensive stakeholder consultation and awareness raising including meetings in all 127 sub-villages and 29 villages. Each village has selected their Village Natural Resources Committee and the process of establishing village forest reserves and developing village land use plans is underway in 12 villages. The project has also conducted a detailed feasibility assessment to compare the direct and opportunity costs of REDD with the potential revenues that the communities could generate. The project also includes an advocacy component and a focus on monitoring, learning and communication.



*Map 1: Map of the project areas for the TFCG and MJUMITA REDD project*

Our experiences so far have highlighted the importance of secure land tenure for communities and secure rights to carbon revenues. In particular it is critical that Village Land is properly recognised as it covers 70 % of the country (the rest being either Reserved Land (28%) or General Land (2%)). It is also clear that for REDD to work effectively, communities need to be able to access directly the revenues attributable to reduced deforestation on their land. Finally, it is important that Tanzania adopt clear safeguards with regard to the impact of REDD on biodiversity and communities.

### **REDD training materials for communities and District staff**

TFCG have produced and field-tested training manuals on REDD and Participatory Forest Management for communities and District Officials. The manuals were produced with technical input from the Regional Community Forestry Training Centre, based in Bangkok and will be available from January 2011.



TFCG Executive Director, Charles Meshack (second from the left) makes a presentation on REDD Readiness in Tanzania during the UNFCCC meeting in Cancun in December 2010.

**TFCG attends the CBD-COP 10 meeting in Nagoya, Japan**

On 25<sup>th</sup> October 2010, Charles Leonard, TFCG Rubeho Project Manager, presented some experiences from Tanzania to a packed side event at the Convention on Biological Diversity (CBD) – 10th Conference of the Parties held in Nagoya, Japan. The event, which was entitled ‘The Role of the Critical Ecosystem Partnership Fund (CEPF)’, aimed at demonstrating how civil society partnerships have helped to achieve progress towards the CBD 2010 Targets. The event kicked off with the launch of the special study on the CEPF’s contributions to the CBD 2010 target and sub-targets, followed by a panel discussion by donor, governmental and nongovernmental partners about their CEPF experiences, results and lessons learned. The panel discussion included speakers from non-governmental organization which received grants from CEPF including Tanzania, Nepal, Brazil and Philippines. CEPF invested US\$ 7 million dollars in civil society projects in the Eastern Arc Mountains and Coastal Forests between 2004 and 2009.



Charles Leonard (second from left), in Nagoya for the 10<sup>th</sup> Conference of the Parties to the Convention on Biological Diversity.



Veronica Ngingo, Secretary of the Mbuga Village Natural Resources Committee participating in tree planting activities. Photo by Charles Leonard.

**TFCG support two new village forest reserves in the Rubeho Mountains**

Mafwomero Forest in the Rubeho Mountains is home to two strictly endemic species, the Rubeho partridge and the frog *Arthroleptis nikeae*. This area has some of the largest areas of unreserved Eastern Arc forest including the Ipondelo and Ilole forests. With support from Deloitte LLP TFCG have supported two communities to establish village forest reserves covering a total of 1048 ha and have assisted three communities to develop their village land use plans. The project has also supported 30 community groups to establish tree nurseries containing approximately 250,000 seedlings.

**Bringing water to the guardians of the water sources**

Whilst many people in Tanzania rely on water flowing from the Eastern Arc Mountains, many of the communities living in the Eastern Arc still do





*TFCG staff with Concern Staff. From right to left Mr. Mushi District Water Engineer Lushoto, Mr. Lugazo Project Officer TFCG, Mr. Tupa DWE Korogwe, Concern Water Engineer, Mr. Sambali Concern Researcher, Mr. Mkungu Environment Officer, Wycliffe Massolwa TFCG*

not have access to safe and reliable drinking water. With support from Gorta, TFCG has been working with 21 villages in two sub-catchments in the West Usambaras. The purpose of the project is to enhance the benefits to rural communities from ecosystem services and to reduce poverty. The project is focusing particularly on improving water supplies, agriculture and forest management.

This year the project has carried out awareness raising activities on forest conservation, conservation agriculture and integrated water resources management with over 9000 women and men. Project and District staff visited the Concern water project in Ngara to learn more about water user associations. They are now providing training and technical support to the 21 West Usambara communities to establish water user groups and water user associations. The project has also been supporting farmers from the 21 villages to adopt conservation agriculture practices including minimum till, permanent cover crops and crop rotation. Earlier this year, TFCG supported two villages to establish village forest reserves covering 1300 ha. These have been approved by Korogwe District Council.

TFCG's West Usambara project supported by Gorta was awarded the 2010 President's Prize for the best tree planting and water source protection project in the country.

### **Getting environmental education into schools**

Building the capacity and interest of the younger generation is critical if our efforts to conserve the Eastern Arc Mountains and Coastal forests are to be sustainable. One way that we have been trying to get children interested is by supporting better environmental education in schools. In 2009 TFCG developed an environmental education manual for primary schools including a series of lesson plans and information resources. Over the last year, TFCG has been training teachers to bring environmental education into the classroom. So far, 75 teachers, school inspectors and ward education officers have been trained and manuals have been distributed to more than 100 schools.

### **Community rights to Ngumburuni Forest finally recognised**

Following a longstanding dispute over the ownership of Ngumburuni Forest in Rufiji District, it was finally acknowledged that 10,501 ha of the forest belongs to the seven communities that surround the forest. In May 2010, meetings were held between the District and each of the seven villages to agree on a way forward. With support from Songas, TFCG has been assisting Muyuyu Village, the owner of the largest of the village forests in Ngumburuni, to establish community based forest management. Also with support from Songas, TFCG have been supporting six villages to develop village land use plans; establish village forest reserves; and adopt improved agricultural techniques. So far management plans and by-laws have been approved at the village level for eight village forest reserves covering 7000 ha of woodland, coastal forest and thicket.



*Illegal logging and timber harvesting continue to be a serious problem in Rufiji District. Photo by Simon Moshia.*



*This new species of chameleon, Kinyongia sp. is from the Udzungwa Mountains. Photo by Michele Menegon*

# A decade of discovery: 70 new Eastern Arc amphibian and reptile species

Michele Menegon, Natural History Museum of Trento

**On my work table at the Natural History Museum of Trento, there are dozens of jars filled with specimens of organisms that originated millions of years ago but have never been described by scientists. It is a great privilege to be a part of this amazing modern story of discovery...**

Since 1997 our group has conducted extensive field research on amphibians and reptiles in the Eastern Arc Mountains. Through a number of programs our group has tried to better evaluate the area's amphibian and reptile species diversity, particularly in the poorly known areas of the Eastern Arc Mountains. These projects have made significant progress in addressing sampling inequalities in order to improve our estimates of species diversity across the whole region.

Many of the data collected in the last ten years, are being analyzed by our group using traditional morphological and molecular systematic methods. We have identified a number of evolutionary significant units, revealing approximately 300 new distribution records and approximately 70 undescribed endemic amphibian and reptile species. **These discoveries double the number of amphibian species known to be endemic**

**to the Eastern Arc Mountains.** These results put into question current species estimates for the Eastern Arc Mountains and point to a need for a re-evaluation of biodiversity estimates in this area.

In summary, current species estimates in the Eastern Arc Mountains undervalue diversity and overestimate species' distributions. Modelling spatial diversity patterns for conservation planning with such data will produce inaccurate results.

One example of this is the South Nguru Mountains. Before 2003, the herpetofauna of this mountain block was almost completely undocumented. Surveys carried out between 2003 and 2010 have discovered an additional 16 species of which all are strictly endemic to the South Ngurus and highlights the critical importance of these forests.

Species described so far by our group (many others are in press or preparation):

*Rhampholeon moyeri*  
*Tetradactylus udzungwensis*  
*Urocotyledon rasmusseni*  
*Kinyongia magomberae*  
*Nectophrynoides poyntoni*  
*Nectophrynoides pseudotornieri*  
*Nectophrynoides laevis*  
*Nectophrynoides frontierei*  
*Nectophrynoides vestergaardi*  
*Nectophrynoides paulae*  
*Nectophrynoides laticeps*  
*Probreviceps duristrostris*  
*Callulina hanseni*  
*Callulina kanga*  
*Callulina shengena*  
*Callulina laphami*  
*Callulina stanleyi*  
*Arthroleptis nguruensis*

Sitting on my table, waiting to be named, there are at least five toads in the genus *Nectophrynoides* from

the Udzungwa, Nguru, Nguu, Mahenge and Uluguru Mountains; there is a gecko from Mahenge; there are several tree frogs in the genera *Afrivalus* and *Leptopelis* from across the Eastern Arc Mountains; several forest snakes in the genera *Dipsadoboa* and *Crotaphopeltis*; and a few chameleons including another species from the Udzungwa Mountains.

These new discoveries, combined with other published and unpublished information, reveal that Tanzania has the highest diversity of amphibians and the highest number of endemic amphibian species and genera in the whole of Africa. This is also true for chameleons and forest vipers in the genus *Atheris*. Tanzania should be aware of this great richness that is the result of a long and complex evolutionary history.

A decade ago the Eastern Arc Mountains were recognised as being a biodiversity hotspot. The discoveries described in this article demonstrate that their uniqueness has been underestimated. The evolutionary history of the Eastern Arc Mountains has resulted in levels of endemism and diversity that are



*Callulina hanseni* from the Nguru Mountains. Five of the recently described species are from the genus, *Callulina*, also known as warty frogs. Photo by Michele Menegon

exceptional on our planet. The unique biodiversity of the Eastern Arc Mountains will be recognised even further, when the new species and data that fill the notebooks and collections of the scientists that have worked in the Eastern Arc Mountains are published. In describing so many new species, the last decade has been an incredible opportunity to contribute to our knowledge of the diversity of this unique area. By bringing to the surface what the forest has been hiding for a very long time, our knowledge of the amphibian and reptile communities of the Eastern Arc Mountain blocks is very different to what it was a few years ago. Recently I have started to investigate the reptile and amphibian fauna of the Southern Highlands of Tanzania. Preliminary results show that this journey of discovery is not yet over!

The results achieved so far were possible thanks to the invaluable contribution of Simon Loader as well as Kim Howell, John Poynton, Krystal Tolley, Sylvain Ursenbacher, Jean Mariaux, Giovanna Lipparini and Family, Charles Msuya, Wilkirk Ngalason, Charles Leonard, Zobebe Fund for Research, Giancarlo Fracasso and Ivan Farronato, Colleagues of the Museo Tridentino di Scienze Naturali, friends and colleagues of the TFCG and the University of Dar es Salaam, that have shared discussions, projects and time in the forest.



*Lygosoma sp.* This newly discovered species of writhing skink is from the Udzungwa Mountains. Photo by Michele Menegon



*Hoplophryne* sp. This three fingered frog is from the Nguu Mountains. Photo by Michele Menegon



This newly described species of warty frog, *Callulina shengena* is from the South Pare. Photo by Michele Menegon

A photograph of a mountain galago (Galagoides orinus) perched on a tree branch. The animal is small, with a brownish-grey body and a lighter-colored face. It has large, prominent ears and is looking towards the right. The background is a blurred forest scene with green leaves and brown branches.

# Galagos galore: ranking Tanzania as # 1 for galago diversity!

Andrew Perkin

A mountain galago *Galagoides orinus*, endemic to the Eastern Arc mountains of Tanzania and Kenya. Significantly not all the Eastern Arc mountains contain this species and the existing populations show significant population differences in terms of their vocalizations. Photo by M. Menegon.

**Tanzania has more species of galago than any other country in the world and recent research hints that more species await discovery.**

Tanzania has the highest rate of galago endemism and diversity in the world. This article introduces Tanzania's galagos and explores some of the reasons for this exceptional diversity.

Galagos or bushbabies as they are sometimes called, are nocturnal primates found in sub-Saharan Africa. Tanzanian galagos come from three of the five known galago genera: the greater galagos *Otolemur* (600 - 2000g), the lesser galagos *Galago* (190 - 350g), and the dwarf galagos *Galagoides* (50 - 190g). Like many primates, most galago species live in forests with just a few living in more open woodlands.

Twelve species of galago occur in Tanzania. Four of these species are only found in Tanzania: *Galagoides zanzibaricus*, *G. orinus*, *G. sp. nov. 3 Ukinga*, and *G. rondoensis*. Of the remaining eight species, two are found in Tanzania plus one other country (*Otolemur garnettii* and *G. cocos*) and six are found in Tanzania plus two or more other countries (*Otolemur*

*crassicaudatus*, *Galago senegalensis*, *G. moholi*, *Galagoides granti*, *G. thomasi* and *G. demidoff*).

In Tanzania, the Eastern Arc Mountain and Coastal forests have the most species. Fewer species are found in the habitats of central and western Tanzania. Several populations of *Galagoides orinus* in the Eastern Arc Mountains appear to be sufficiently distinct to be considered separate species (Table 1.). It is likely that these populations and others will be described as new species in the future.

Galagos are nocturnal, small (50-2000 g) and arboreal. This presents challenges when studying them in the wild. Fortunately galagos are vocal primates. This means that researchers can use a galago's call to find and identify it. Each species may have a repertoire of more than 20 different call types. These calls signify different things. There are alarm calls in response to predators or other threats; contact calls to help individuals keep in touch with each other; and advertising calls that are thought to help individuals vocally 'mark' their territories. These advertising calls are unique to each species and are a useful characteristic for identifying animals in the field.

Table. 1 The galago species of Tanzania. Dwarf galagos make up the majority of Tanzanian species. Most are considered as ‘Least Concern’ in terms of their conservation status. This is partly due to galagos naturally high population densities in the equatorial regions.

Species	Common name		IUCN	Habitat
GREATER GALAGOS <i>OTOLEMUR</i>				
<i>Otolemur garnettii</i>	Small-eared greater galago	NE	LR/lc	Forest
<i>Otolemur crassicaudatus</i>	Large-eared greater galago	W	LR/lc	Woodland
LESSER GALAGOS <i>GALAGO</i>				
<i>Galago senegalensis</i>	Senegal galago	W	LR/lc	Woodland
<i>Galago moholi</i>	Southern lesser galago	W	LR/lc	Woodland
DWARF GALAGOS <i>GALAGOIDES</i>				
<i>Galagoides cocos</i>	Kenya coast galago	NE	LR/lc	Forest
<i>Galagoides zanzibaricus</i>	Zanzibar galago	E	LR/lc	Forest
<i>Galagoides granti</i>	Grant's galago	NE	LR/lc	Forest/woodland
<i>Galagoides thomasi</i>	Thomas's galago	W	LR/lc	Forest
<i>Galagoides demidoff</i>	Demidoff's galago	W	LR/lc	Forest
<i>Galagoides orinus</i>	Mountain galago	E	NT	Forest
<i>Galagoides rondoensis</i>	Rondo galago	E	CR	Forest
<i>Galagoides sp. nov.</i> Ukinga	Ukinga galago	E	?	Forest

E = Endemic (only found in Tanzania) NE = Near Endemic (Tanzania + 1 other country) W = Widespread (Tanzania + 2 or more other countries)

Most research on galagos in Tanzania has focused on the basic questions of what species are present and where they are found. This has been done by recording the advertising calls of galagos in different parts of the country and comparing these with a reference collection of calls. This is backed up by visual records, photographs and examining animals close up after they have been trapped. In this way it has been possible to map the distribution of the various species and to begin to identify populations with distinctive calls. Only two (*Otolemur garnettii* and *Galagoides cocos*) of the twelve galago species occurring in Tanzania have been studied in detail over the long term with the aid of radio collars and these studies took place in Kenya.

The distribution and diversity of galagos in Tanzania's forests reflects the complex geological, climatic, vegetation and evolutionary history of these areas. On an evolutionary timescale, forests have expanded and contracted periodically in Tanzania. This has resulted in periods of isolation and periods of connection between galago populations. In addition, at any one point in time, there are many different types of forest in Tanzania depending on influences such as rainfall, altitude and geology. For example, coastal forests have very different

vegetation and climatic conditions to forests in the Eastern Arc Mountains. The different species appear to have taken different evolutionary paths following isolation from other galago species; and in response to different environments.

However there are some unusual patterns and anomalies in the distribution of galago species in Tanzania today. The most galago species that occur in a single forest in Tanzania is two (with a few exceptions where three species are found). This figure is much lower than in Congolese forests where up to four galago species plus the potto and the angwantibo or golden potto (from the related loris family) may be found in a single forest. Thus Tanzania's galago diversity in any one forest is low when compared to Congolese forests. Some Tanzanian forests appear to have only one species of galago (e.g Mt. Kilimajaro, Meru and Hanang). The forests of Mahale and Gombe National Parks famous for their chimpanzees do not appear to have any forest galago species (although one unidentified dwarf galago has been seen on the edge of Mahale NP). The reason for this pattern is not well understood but is likely to be influenced by a combination of climatic history, the age of the forest and its historical connectivity with other galago

populations. The other reason is that many areas have not been properly surveyed.

More recently, as deforestation and forest fragmentation take their toll on Tanzania's forests, we have lost some galago populations whilst others have been reduced to a few individuals. The loss of Kazimzumbwi forest, for example, represents the loss of a significant forest for the Critically Endangered Rondo galago.

Tanzania possesses the most diverse community of galagos in the world, particularly dwarf galagos. As more species are described the importance of Tanzania for primate conservation will only grow.

What next? There are many questions that require further research. If we are to fully understand the complex story of galago diversity and evolution further field surveys, ecological, behavioural and genetic studies are required.



Photo by J. Karlsson.

*A Rondo galago Galagoides rondoensis, from a recently discovered population in Ruawa FR near Lindi, SE Tanzania. This is endemic to Tanzania and is the most rare galago in the world. It is considered Critically Endangered ([www.iucnredlist.org](http://www.iucnredlist.org)); is on the Top 25 Most Endangered Primates list (<http://www.primates-sg.org/PDF/Primates.in.Peril.2008-2010.pdf>) and is a focal species of the EDGE programme's top 100 mammals ([www.edgeofexistence.org](http://www.edgeofexistence.org)), a list of mammals considered evolutionarily distinct and globally endangered (EDGE).*



# Uzungwa Scarp: an urgent call to protect one of Tanzania's most important forests and prevent irreversible species loss

*Hunting for bushmeat in Uzungwa Scarp has significantly reduced monkey populations.*



**A report coming out in January 2011 will highlight the dramatic degradation recorded in Uzungwa Scarp Forest Reserve by various researchers working in the area since 2004, with an urgent call to the Tanzanian Government and supporting agencies to take prompt action. Here, key findings and recommendations are presented.**

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The outstanding importance of the Udzungwa Mountains for biodiversity conservation and provision of ecosystem services to the country is well recognized, however this is not adequately reflected in the protection efforts allocated to the area. While the Udzungwa Mountains National Park protects a significant portion of the range (about one fifth) and the Kilombero Nature Reserve was gazetted in 2007 to grant full protection to an even larger portion to the south, there is a major forest further south, Uzungwa Scarp, that has been totally neglected.

Yet, several studies indicate that Uzungwa Scarp Forest Reserve (USFR) may be the single most important forest block in the whole Eastern Arc. Covering an area of 200 km<sup>2</sup> with continuous vegetation cover 300-2000 m a.s.l., USFR uniqueness is paralleled only by the northeastern Mwanihana forest, within the Udzungwa Mountains

National Park. The recent analysis conducted for the candidature of selected Eastern Arc forests to the UNESCO's World Heritage Site indicated that USFR has the highest number (37) of threatened vertebrates in the Eastern Arc, according to the 2009 IUCN Red List. The number of Eastern Arc endemic vertebrates is the second highest (31) of any Eastern Arc forest. However, there is long-standing evidence of illegal activities and degradation threatening this forest.

At the first Udzungwa stakeholders' workshop held in Morogoro in 2004, within the framework of CEPF's (Critical Ecosystem Partnership Fund) investments in East Africa (see Arc Journal 20), USFR was identified as a priority site for conservation action in the region. Follow-up work conducted in 2006 confirmed the forest's poor conservation status and urgent need for greater protection. Moreover, the "Mngeta corridor" was identified as the only remaining chance to ensure connectivity between USFR and the northern network of protected areas (comprising Kilombero Nature Reserve, Udzungwa Mountains National Park and Nyanganje Forest Reserve;). Despite the urgent need for action, USFR was not included in the newly formed Kilombero Nature Reserve. In the absence of effective management, forest degradation and hunting for bushmeat has continued, and the situation has become so critical that if action is not taken as a matter of urgency,

Tanzania will lose one of its unique natural treasures. The report 'Uzungwa Scarp Forest Reserve in crisis' has been compiled to highlight the significant losses in biodiversity documented in USFR over the last few years, with evidence of a rapid increase in destruction, particularly over the last 2-3 years. If currently observed trends continue, local species extinctions are likely, especially for the endemic and flagship monkey, the Udzungwa red colobus, as well as the localized Angolan colobus and other forest mammals such as the duikers. The purpose of the report is to provide evidence of imminent population extinctions, drawn from three intensive studies, so that focused and effective actions to ensure protection of this forest can be carried out.

The three studies that form the basis for the upcoming report are:

- i) Primate and antelope monitoring conducted since 2004 to the present day (F. Rovero unpubl. data, Udzungwa Ecological Monitoring Centre 2009);
- ii) Studies of bushmeat hunting and duiker densities in the USFR and other Udzungwa forests 2001-2009 (M.R. Nielsen unpubl. data);
- iii) Comparative surveys of large mammal densities and levels of disturbance in USFR (2008) and other Udzungwa forests (2007-2009) (T. Jones, PhD thesis in prep.)

Biodiversity research was focused on medium to large mammals (especially primates and ungulates) as they are excellent indicators of forest ecosystem integrity and include species targeted by hunting.

The most critical results are the following:

- Systematic monitoring of diurnal primates (the monkeys) from 2004 until the present

day shows **a significant decline in relative abundance of all diurnal monkey species**, with evidence of collapsing populations especially of colobus monkeys. Black and white colobus (*mbega mweusi*) were not observed in 2009 and the endemic Udzungwa red colobus (*mbega mwekundu*) have decreased rapidly.



Snared red duiker in USFR

- **Declining populations of duikers and other medium-sized forest mammals are confirmed from all three studies.** Comparative data with other forests in the Udzungwa Mountains show that USFR has a very low abundance of both primates and duikers, including the Endangered Abbott's duiker. Use of snares is currently targeting smaller species because most of the larger ungulates and bushpig have already been hunted out. Without effective intervention, we can expect these species to follow the elephant, buffalo and leopard into extirpation from Uzungwa Scarp.

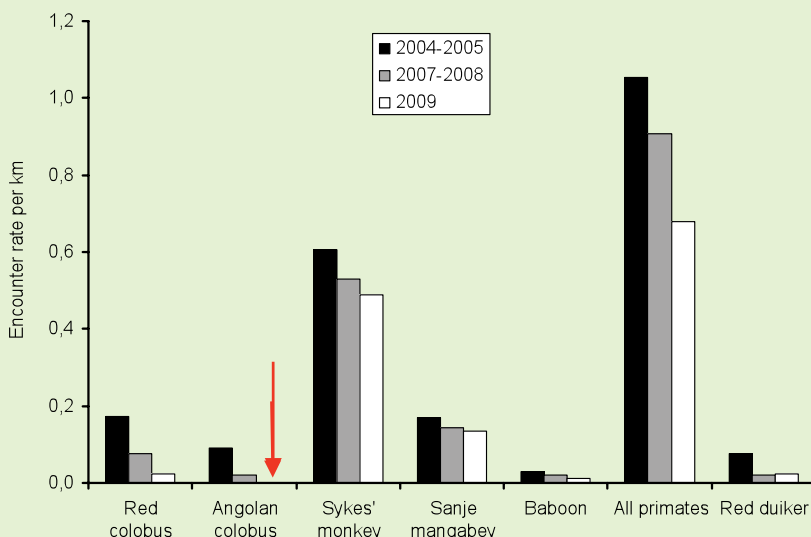


Figure 1. Relative abundances of populations monitored in USFR from 2004 till 2009. The greatest declines are seen in the Udzungwa red colobus, the Angolan colobus (that may be locally extinct, see red arrow pointing at the "0" recorded in 2009) and the red duiker, a commonly hunted forest antelope.

- Systematic data collected along the same transects used for wildlife census also indicate clear **increases in the incidence of logging, pole cutting, snaring, and other forms of disturbance.**
- Preliminary results from a detailed assessment of hunting practices suggest that **hunting is the greatest threat to biodiversity in the forest.** The study found that until about the mid 1990's hunting was intense and conducted for commercial purposes, while it subsequently shifted to hunting for local markets and household consumption. Although this change may have reduced the impact on wildlife, about 35% of households sampled currently consider subsistence hunting an important part of their livelihoods and an additional 15% rely on bushmeat as a gap-filler and security net.
- The same study found that bushmeat hunting occurs in the Kilombero valley including in the lowland villages adjacent to USFR. Transport of this bushmeat through USFR to the villages on the plateau and beyond is undertaken. Forest species rarely appeared in these informal markets. This however does not imply that forest species are not hunted, as smaller species are often consumed directly in hunters' households rather than sold.
- Provide training and support to adjacent communities to participate in the management and monitoring of the reserve, together with environmental education and awareness raising;
- Dialogue between the Forestry and Beekeeping Division and JKT (Jeshi la Kujenga Taifa) in order to raise awareness on the importance of the portion of the forest which is managed by JKT, and to seek greater cooperation on forest management;
- Take prompt steps to upgrade the legal status to Nature Reserve.

#### Medium to long-term recommendations:

- Support livelihood alternatives to bushmeat in the communities around the reserve;
- Support tree planting amongst communities adjacent to the reserves;
- Protect the Mngeta corridor through expanding the Kilombero Nature Reserve to include this critical connectivity area and support community based forest management of adjacent areas;
- Provide environmental education and awareness raising to adjacent communities;
- Continue to monitor the status of the biodiversity and the threats to the USFR, including through the participation of adjacent communities.

With the support of TFCG, a draft of the report was presented to senior staff of the Forestry and Beekeeping Division (FBD) of the Ministry of Natural Resources and Tourism on July 27, 2010. The positive and encouraging comments which arose from this meeting have been incorporated in the report.

## **RECOMMENDATIONS**

In order to reverse the trends reported, it is recommended that increased protection of this Forest Reserve be implemented as a matter of urgency by the Tanzanian Government. In this regard, it is encouraging that FBD is currently "taking efforts to ensure sustainable forest management of the area including i) to upgrade Uzungwa Scarp Forest Reserve into a Nature Reserve and ii) to reserve the Mngeta Corridor"

#### Short-term recommendations:

- A swift increase in law enforcement measures, including a greater budget allocation for forest patrols, as the most urgent priority is to stop hunting;

Given that biodiversity loss is a global and pressing concern, we urge international donors to support this process, and to make a long-term commitment to supporting effective management of the forest under its improved status. Also desirable, as FBD intends to achieve, is the protection of the already identified and well-researched "Mngeta corridor", the only existing but rapidly vanishing area providing ecological connectivity between USFR and the Kilombero Nature Reserve. Finally, the stricter regulations that will be associated with increased protection will require investments into adjacent communities' livelihood alternatives to bushmeat hunting, timber tree cutting and extraction of other non-timber forest products. The report highlights that recent development projects such as distribution and loans for purchase of domestic animals, training on domestic animal rearing, woodlot establishment and environmental education are perceived to have decreased hunting effort. Finally, increased institutional collaboration between FBD, Tanzania National Parks, Wildlife Division and JKT will be critical to tackle the bushmeat trade and illegal logging.



# Still more species to discover in the Eastern Arc and Coastal Forests

*Jon Fjeldså and Neil Burgess, University of Copenhagen, Denmark  
Jakob Kiure, Ornithologist, Tanzania*

**One of the aspects of the year of Biodiversity is the focus on declines and extinctions of species. Although these depressing statistics are important to highlight the scale of the biodiversity crisis, they do not provide inspiration and hope. In this article we change the focus and look a little into knowledge of the biodiversity of Eastern Arc and Coastal Forests, focusing on new species that have been found in recent years as a result of intensive exploration. This message of hope is provided to show just how amazing these forests are, and how they do need our continued attention.**

## *The situation in 2004*

A data compilation made for the Arc Journal in 2005, prepared for the Forestry and Beekeeping Divisions 'Conservation and Management of the Eastern Arc Mountains Forests' UNDP GEF project in 2004, reviewed the known diversity of the Eastern Arc forests at that time. In terms of overall biodiversity, this compilation showed that 97 species of vertebrate animal were endemic to the Eastern Arc Mountains, split as follows: 10 mammals, 20 bird, 29 reptile and 38 amphibian species. Seventy two of these species were threatened with extinction according to the IUCN red list, mainly due to the small and fragmented nature of the habitat and the ongoing slow decline of forest extent.

In 2004 three mountain blocks were of the highest importance for rare and endemic species : Uluguru, East Usambara and Udzungwa. The Nguru and Rubeho blocks were close behind in the priority ranking. Together, these five blocks were regarded as the most important for conservation attention, although it was also known that every part of the Eastern Arc has high value in global terms, and the lack of study in some areas meant that the rankings would be subject to change.

## *Work to fill survey gaps*

From 2004-2008 around \$1 million was provided by the Critical Ecosystem Partnership fund for biological surveys in the poorly known North Pare,

Nguu, Nguru, Rubeho, Mahenge and Ukaguru blocks. In addition to this Danish funding was used to complete additional bird focused surveys in South Pare, Usambara, Losongonoi, Nguu, Nguru, Kiboriani and Udzungwa, as well as some sites along the Tanganyika-Rukwa-Malawi Rifts. The aim of all this work was to complete survey gaps, study unknown forest patches, and collect blood samples from birds to look at their DNA, to study variation between and within species across the various mountain blocks.

*What has this new work discovered?*

In terms of mammals and birds, in particular, one might think that after 100 years of study by people from all over the world, the number of species in the Eastern Arc would be well known, and there would be nothing left to discover. After all, mammals move and leave signs of their presence, and birds fly and are often colourful and make a noise. However, recent and ongoing work shows that the world does not yet know all the species found in these mountains, and that there may still be more surprises in store for biologists.

To illustrate our incomplete understanding, we provide some examples of new and undescribed species that have been found in the Eastern Arc in the past 5 years. In terms of mammals, a new species (and genus) of large monkey – *Rungwecebus kipunji* - was described in 2005 from the Udzungwa Mountains within the Eastern Arc, and the Southern Highlands further south. In addition, a new species of shrew (*Congosorex phillipsorum*) was described during 2005 from the same Udzungwa mountain forest; and the new ‘grey-faced Sengi’ (*Rhynchocyon udzungwensis*) - found in the same forest area in the mountains of the Udzungwa - was described shortly afterwards.

Work at the Zoological Museum in Denmark, in collaboration with the University of Dar es Salaam and private ornithologist in Tanzania, and a South African DNA scientist based in the USA, has also shown that there are actually many more species of birds in these forests than we know already. First of all, it appears that many of the well-known “species” are genetically very complex, suggesting that isolated populations should be regarded as separate species, rather than as subspecies of the same more widespread species. Many of these new species are “cryptic”, in the sense that the stable environmental conditions have resulted in species that, in spite of strong genetic divergence, are very similar by external appearance. However, there are also some distinctive, colourful and spectacular new species.

We provide examples of some newly described bird species, which are illustrated by paintings by Jon Fjeldså.



Rubeho Partridge

*Rubeho Partridge.* In 1994 a team of Danish ornithologists surprised the world with their paper describing a new species of ground dwelling and largely flightless forest partridge from the Udzungwa Mountains (*Xenoperix udzungwensis*), that had affinities to species in Asia, but had no other African relatives. Work in the Rubeho mountains some years later discovered a similar partridge in the forests there. Subsequent work in the laboratory on the DNA of the two populations, on separate mountains, clearly showed that they are separate species and the new bird on the Rubeho mountains is named *Xenoperdix obscurata*.



Dark Batis

Short-tailed Batis.

*Forest Batis.* Originally the forest batis (a small flycatcher) in the Eastern Arc and Coastal forests was regarded as a single species across the whole area. However, detailed work in many forests, and analysis of the DNA of 83 individuals has shown that there are in fact two species of similar-looking birds, which are highly different according to their DNA. The batis from the Southern highlands and up to Ukaguru Mountains is now regarded as a different species, Dark Batis, from those of Nguru mountains

and localities further near the east coast, which are now referred to as Short-tailed Batis.



*Mrs. Moreau's warbler.* This brightly coloured bird is endemic to the Eastern Arc and was known from a few forest areas in the central part of the range. As with the batis described above, detailed field work and the study of DNA samples has determined that populations in the Rubeho-Ukaguru mountains and in the Uluguru mountains are genetically distinct. They are now recognized as separate species, with a new name, Rubeho Warbler, for the Rubeho-Ukaguru population.

Other examples of similar species splits are found in other groups of birds in the Eastern Arc. They are

also found in the adjacent lowland coastal forests.

*What else is still out there?*

All indications are that there are still plenty of species left to discover in the Eastern Arc Mountains. This includes new species of birds, as well as other more poorly known taxa such as amphibians and reptiles. In the birds, the Udzungwa Mountains are still the prime place for new bird species; for example there is a new-discovered sunbird about to be published. The recent work has shown that many species are 'hidden' within similar looking groups of birds, as different populations have very different DNA makeup, showing that they have been isolated and breeding separately for millions of years. In some cases, where such populations meet, it can be shown that they compete, and do not hybridize. This demonstrates that they, in spite of very similar plumages, are different species. This cryptic diversity is extremely high in a region like the Eastern Arc where stable ecological conditions have allowed populations to persist on separate mountains for millions of years.

Finally – it seems logical that if there are more species of bird than was previously known, then there are certainly going to be more species within other vertebrate groups – especially in similar-looking species that are found in many forests across the region, or which have a few widely separated locations where they live.

Table 1. Numbers of endemic and near-endemic vertebrates and trees in different Eastern Arc Mountain blocks (November 2005). In brackets, putative additional new endemic bird species based on on-going molecular studies; note that these figures are preliminary and are increasing year by year.

Mountain block	Approximate forest area remaining (hectares)	Single block endemic (one mountain only)	Eastern Arc endemics (one to 13 blocks)	Near endemic (also coastal forest, Southern Highlands, or Kilimanjaro area)	Number of Eastern Arc endemic trees
Taita (Kenya)	300	6	8 (1)	11 (1)	8
North Pare	2,500	0	5 (1)	12 (2)	0
South Pare	13,540	2	8 (2)	19 (2)	1
West Usambara	26,500	5	22 (6)	48 (3)	27
East Usambara	25,800	4 (1)	35 (6)	78 (5)	40
Nguu	24,900	0 (1)	9 (1)	27 (2)	6
Nguru	34,000	0	20 (3)	52 (4)	25
Uluguru	27,000	14	45 (2)	82 (4)	26
Ukaguru	17,400	1	10 (6)	27 (1)	4
Rubeho	47,400	2 (1)	12 (7)	35 (1)	0
Malundwe	450	0	0	2 (2)	4
Mahenge	1,940	0	2	11 (1)	5
Udzungwa	102,400	17	41 (6)	96 (1)	37



The pink and yellow flowers of *Lantana camara* beside the blue flowers of *Stachytarpheta jamaicensis*. Both invasive alien species. Photo by Nike Doggart

# Are invasive plant species a problem in the Eastern Arc Mountains?

Neil Burgess, Seif Madoffe, Geoge Kajembe, Rosie Trevelyan and Andrew Perkin

The term *invasive alien species* refers to a subset of species which are introduced or non-native to an area, but which are able to colonise their new habitat and can spread over large areas to the detriment of the native vegetation and associated fauna. Invasive alien species are introduced by people, either intentionally or accidentally and become a problem in their new location. Most introduced species do not cause significant ecological damage because they mainly live in places that are already heavily altered by human activity. However, some introduced species are able to directly establish themselves in natural habitats and outcompete the native species that live there. In these cases they can establish virtual monocultures over large areas and cause significant, sometimes devastating ecological damage – including causing species to go extinct.

Until recently, the issue of invasive alien species was not regarded as a significant conservation problem

in the Eastern Arc Mountains. It has been known for many years that the Amani Botanical Garden had introduced some plants that had become native in the East Usambara forests, and that the tree *Maesopsis eminii* had invaded disturbed forest areas. But elsewhere in the Eastern Arc the problem was not mentioned by ecologists or foresters and was broadly assumed not to exist. However, recent compilation work by the Tropical Biology Association with New Zealand's National Centre for Advanced Bio-Protection Technologies and Sokoine University of Agriculture, together with extensive field work in the East Usambaras in particular, has shown that invasive alien species are a more serious problem in the forests of the Eastern Arc than had previously been realised. It also seems that the problem is increasing in importance as a threat to forests and the species of plants and animals that live in these forests, including perhaps some of the endemic species for which the area is globally famous.

Table 1: Examples of species of invasive alien plant species found in the Eastern Arc Mountains, Tanzania.

Species	Native range	Where found in the Eastern Arc	Scale of the problem
<i>Acacia mearnsii</i>	Australia	South and North Pare	Minor problem.
<i>Arenga pinnata</i>	Asia	East Usambara	Serious problem. High seed production.
<i>Castilla elastica</i>	Neo-Tropics	East Usambara	Rapidly spreading into forest fragments, edges and disturbance gaps.
<i>Cedrela odorata/mexicana</i>	Central and South America	East Usambara, Uluguru (lowlands)	The problem is serious in forest gaps and disturbed areas.
<i>Clidemia hirta</i>	Pantropical invader from Neotropics	East Usambara	Spreading in forest interior.
<i>Cordia alliodora</i>	Neotropical pioneer	East Usambara	High seedling / sapling densities.
<i>Elaeis guineensis</i>	Afrotropical regions	East Usambara	Becoming dominant in teak planted areas of Longuza.
<i>Eucalyptus</i> sp.	Australia	S. and N. Pare & W. Usambara	Not a major problem, but covers some slopes after fire.
<i>Landolphia owariensis</i>	Congo and Central Africa	East Usambara	Blankets ground and smothers canopy.
<i>Lantana camara</i>	Tropical America, Tropical, and Southern Africa	Most mountain blocks	Colonizes open areas and forest edges. Increasing problem.
<i>Leucaena</i> sp.	Texas to Peru	W. Usambara	
<i>Maesopsis eminii</i>	West Tanzania and Central Africa	East Usambara, Ukaguru, Uluguru	Serious in East Usambara on previously logged forest. Not so bad elsewhere.
<i>Phyllostachys bambusoides</i>	Asian	East Usambara	Dense thickets spread into forest rapidly.
<i>Piper aduncum</i>	Neotropical	East Usambara	Found in forest edges. Grow near rivers.
<i>Psidium cattleianum</i>	South America	East Usambara	Shade tolerant. Vegetative growth.
<i>Pyrostegia venusta</i>	Tropical South America	East Usambara	Causes crown dieback of tree in the forest.
<i>Selaginela</i> sp.	Tropical and Warm temperate Europe	East Usambara	Hinder all regeneration and mainly smothers small trees and shrubs.
<i>Syzygium jambos</i>	South East Asia	East Usambara	Shade tolerant. Grow near rivers
<i>Tectona grandis</i>	Asia	Udzungwa	Not a serious problem.
<i>Rubus</i> sp.		Ukaguru, Uluguru, Udzungwa	Serious problem where established as growing into tangles and into forest canopy causing trees to fall over



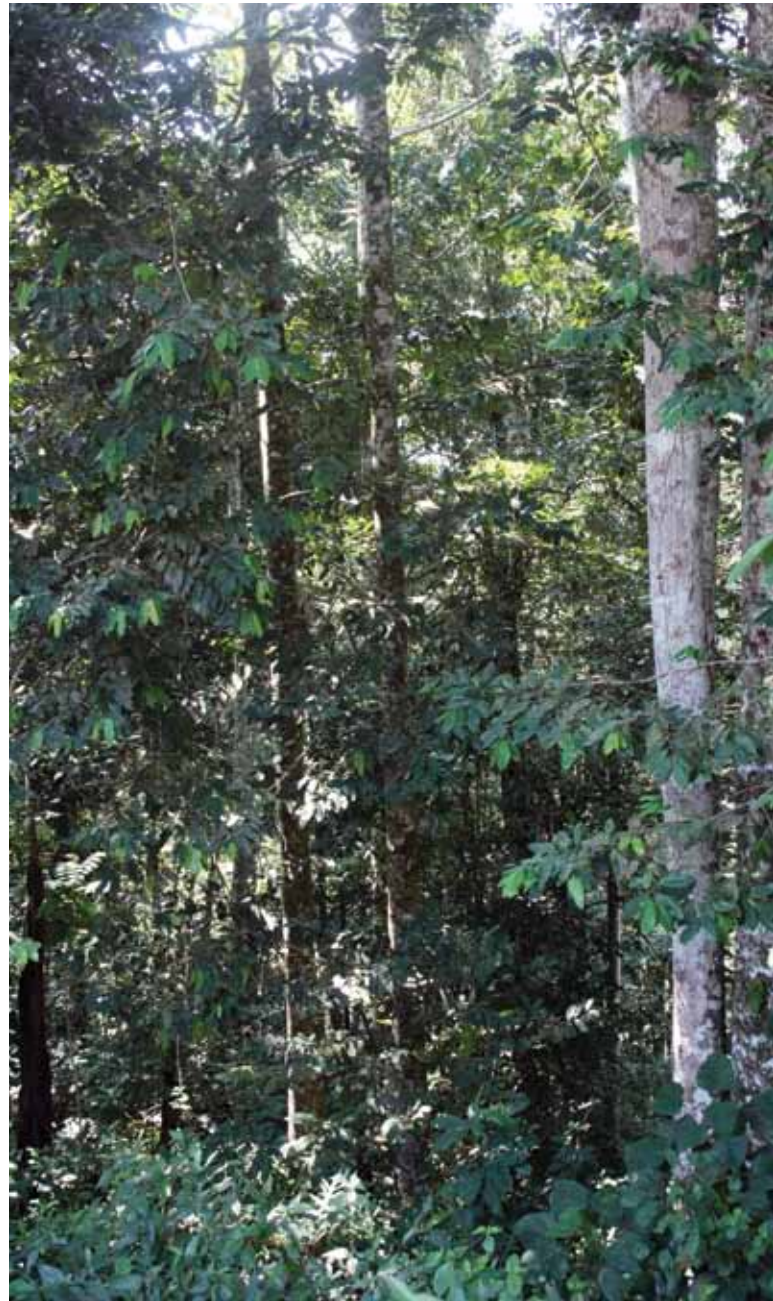
A compilation of available knowledge on common invasive alien species in the Eastern Arc Mountains (Table 1) has revealed over 20 of these vascular plant species that are present in the area. In most mountains there are only one or two invasive plant species but in the East Usambaras Wayne Dawson and colleagues found that there are 49 alien species of which 17 have become invasive. These are all found in the natural ecosystem of Amani Nature Reserve and in other adjacent natural forests and plantations. As such this is the most heavily impacted area of the Eastern Arc in terms of challenges posed by invasive species.

### Focus on some of the most serious invasive species

***Maesopsis eminii*.** This tree produces numerous edible fruits that are eaten by mammals and larger fruit eating birds such as hornbills and are distributed widely across the landscape. Seeds germinate easily and seedlings are rapidly growing light demanding plants that favour disturbed forest areas, especially after logging or tree falls. *Maesopsis* was planted in the East Usambaras in the 1960s and 1970s and after commercial logging of the East Usambara forests in the 1970s and 80s, invasion of this tree into the natural forest became a serious problem. The management response has been to keep the forest canopy intact, because seedlings of *Maesopsis* cannot then establish. Moreover, native species grow in the understory of *Maesopsis* as they are more shade tolerant. As the short lived *Maesopsis* dies, the native trees will replace them and the forest will return to a more natural state.

***Rubus* species.** The bramble species complex is widely distributed globally, but was not reported in the Eastern Arc until recently. Surveys of the Uluguru Mountains in 2004/05 showed that tangles of bramble had spread into considerable areas of the forest, and that bramble tangles growing into the canopy were even pulling trees over. Similar invasions are seen in parts of the Udzungwa Mountains. It is assumed these invasions are having a negative impact on biodiversity values, but this is not measured. *Rubus* species produce highly edible berries in large quantities and are easily spread by mammals and birds. So far no control has been attempted and is likely to be difficult.

***Cedrela odorata / mexicana*.** This fast growing tree is widely appreciated by local people as it has



*Maesopsis eminii* dominate parts of the forest in the Amani Nature Reserve. Photo by Nike Daggart

good timber and can reach saleable sizes in under 20 years. It prefers low to middle altitudes and wetter regions. Unfortunately it produces seeds which are easily dispersed and germinate in open and shady areas. In the *Cedrela* plantation of Kimboza in the lowland Uluguru many seedlings of this tree can be found, as they can in parts of the Amani Nature reserve. Members of the TBA project carried out the first experimntnal control of this species in Kimboza. Their preliminary findings suggest that chemical treatment is more effective than girdling: about 10% of chemically treated *Cedrela* trees died compared to only 1% of all girdled trees. Continued planting



*Cedrela* has been a popular species for tree planting programmes and even for forest boundary marking, however it can become invasive and spread into forest gaps and disturbed areas. Photo by Andrew Perkin



*Acacia mearnsii* in Pare. Photo by Neil Burgess.

of this tree for agroforestry and income generating purposes in the Eastern Arc Mountains carries a significant risk to any surrounding lowland or sub-montane forests.

### Management of invasive species

As a general principle the control and management of invasive plants in this region needs to be guided by experience from similar climatic regions in tropical Africa. Control methods are perhaps most highly developed in South Africa, and some of their experiences plus the experiences from the Tropical Biology Association Eastern Arc work are summarised below:

- Biological control (using another species to control the problem plant): This has shown success in controlling *Salvinia modesta* but has failed to combat *Lantana camara*.
- Mechanical removal or ring girdling of trees: In general this proved very labour intensive, expensive and is not effective for woody species that readily resprout or for herbaceous invasive species covering larger areas. It has been used successfully for certain species of trees and shrubs.
- Herbicides: This can be useful over large areas but only if the target species is not herbicide resistant, and only if there are no endemic or rare plants remaining. This can also be a useful method if herbicides are applied manually via stem injections for example so that only the target species are affected.

The above short summary shows that controlling the invasive alien plant species in the Eastern Arc is not likely to be easy, and the scale of the problem and potential ways to solve it requires further investigation. However, the Tanzanian Government, as a signatory of the Convention on Biological Diversity, has a commitment “to strictly control the introduction of non-indigenous species”. To try and address this emerging conservation issue, partnerships between the Government, NGOs, and research institutions are highly encouraged. And where necessary, action is needed on the ground before some of the invasive alien species gain too great a hold on these critical forest areas.

A group of children in Lushoto town are shown holding and displaying various medicinal plants. They are outdoors, with a backdrop of lush green hills and mountains under a cloudy sky. The children are dressed in colorful, traditional-style clothing. One child in the foreground is holding a large, leafy plant, while others around them hold smaller plants. The scene is vibrant and captures a moment of local knowledge sharing.

# Medicinal plant use in Lushoto: protecting wild plants to protect health

Samantha Ross

**One market day in Lushoto town 95 residents were asked, “If your child is sick, what is the first action you take?” Over 35%, mostly women and elders, said they would use medicinal plants, and a further 5% said they would first visit a doctor for diagnosis *then* use plants.**

These results illustrate the importance of medicinal plants for health. Worldwide it is estimated that 3.5 to 4 billion people rely on plants for medicine, and in Tanzania, 80% of people regularly utilise medicinal plants.

This article examines the use of wild medicinal plants in Lushoto District in the West Usambara Mountains where competing needs and a rising population challenge a fragile and complex environment for sustainable management of natural resources. The article explores how wild plants are utilised and identifies the most popular medicinal plant species providing insights into the value of the mountain ecology for the health of its residents.

## Health care options in Lushoto

For those who prefer modern medicine because it is ‘better’, ‘stronger’ or ‘faster acting’, modern health care provision in Lushoto district consists of two hospitals, four health centres and 48

dispensaries. Modern medicine is available from local dispensaries with costs ranging from 7,000/- to 13,000/- for malaria tablets, 1200/- per course of general antibiotics and 100/- for 10 Paracetamol and registration at the district hospital costs 500/- and a bed and food a further 1000/-. This does *not* include medication.

However these resources are over-stretched and under-resourced and struggle to cater for a population of almost half a million. This mountainous district scattered with isolated villages makes access to these facilities problematic with walks of several kilometres or drives of over 30 kilometres on pot-holed roads to reach care.

Thus, for those living in remote villages with financial constraints, medicinal plants and traditional healing practices are an essential health care choice. A healer or herbalist, present in every village, charges

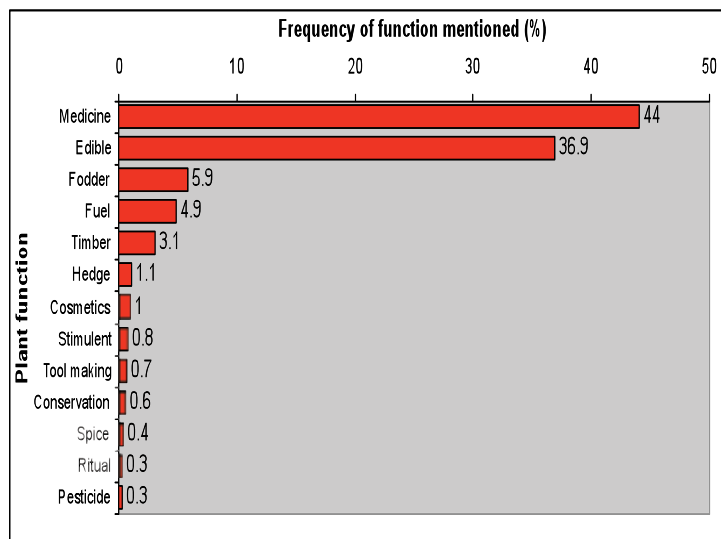
from 500/- to 1000/- for a healing session *and* plant based medication.

Alternatively, if you are knowledgeable on what to look for and where to locate it, plant based medication is free. Many Lushoto residents, especially the elderly and women, have a cursory knowledge in medicinal plant use and herbal cures for common ailments such as coughs or fevers are widely known, with even youngsters able to name, source and prepare plants for treatment. Medicinal plants are also thought to be more 'natural' with 'no side effects' or 'fear' of the unknown. The type or degree of illness also guides choice - a low fever may provoke plant use, while severe symptoms the hospital.

**The value of wild plant species in Lushoto District**

In order to assess if people perceived their local environment as holding any 'medicinal' value participants (n=107) were asked to freely recall ten wild<sup>1</sup> plant species they knew *and* the main function of that plant. By counting the number of times a wild plant was mentioned as having a particular function established a ranking of the chief uses of plants in the wild, as well as the level of knowledge people have surrounding wild plant practices.

Figure 1: The function of wild plants in daily life

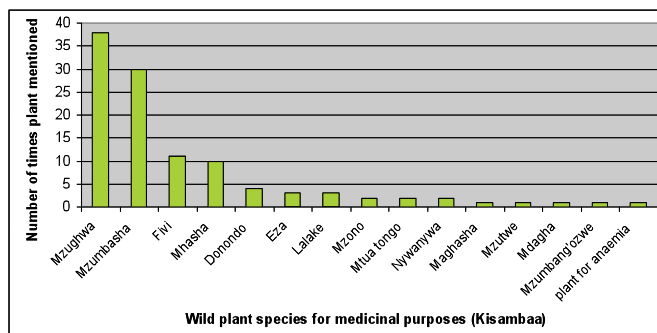


NB: Some participants listed more than 10 species and some fewer giving a total plant count of n=1184.

Figure 1 demonstrates that medicine is the primary reason for wild plant use, closely followed by food but far above fodder, fuel or timber despite these having more tangible economic benefit. This reveals the significance of wild plants for medicinal use in daily life.

Another line of questioning asked participants (n=107) which wild plants they protected or had transplanted to their land specifically for medicinal purposes. A total of 15 different species were identified with a variety of medicinal uses as illustrated in Figure 2 and Table 1.

Fig 2: Wild plant species used for medicinal purposes



Bark damage to the Mkulo (Camphor) tree possibly during medicinal plant collection, 2007. Photo by Samantha Ross.

1 The term 'wild plant' distinguishes between wild and domesticated species and does not refer to areas where plants are sourced. A plant transplanted from the 'wild' for domestic purposes is still considered wild for this study.

Table 1: Medicinal plant species with common use

Kisambaa name	Botanical Name	Family	Illness
Donondo	<i>Vernonia subligera</i> O. Hoffm.	Asteraceae	Stomach problems, chest pains, cough
Eza	<i>Crassocephalum bojeri</i>	Asteraceae	Stomach problems
Fivi	<i>Artemisia afra</i>	Asteraceae	Malaria
Lalake	<i>Tetradenia riparia</i> (Hochst.)	Lamiaceae	Pneumonia, sprains
Maaghasha	<i>Psidia Arabica</i> (?)	?	Fever
Mdagha	<i>Clutia abyssinica</i> Jaub & Spach.	Euphorbiaceae	Fatigue, chest problems
Mhasha	<i>Vernonia</i> sp.	Asteraceae	Malaria (mix)
Mtua tongo	<i>Phyllanthus</i> sp.	Euphorbiaceae	Babies worms
Mzono	<i>Ricinus communis</i> L.	Euphorbiaceae	Stomach problems
Mzughwa	<i>Plectranthus barbatus</i> Andrews	Lamiaceae	Malaria (mix), fever, headaches, babies worms
Mzumbang'ozwe	<i>Helichrysum schimperi</i> (Schultz. Bip.)	Asteraceae	Cough
Mzumbasha	<i>Ocimum suave</i> Willd.	Lamiaceae	Cough, malaria (mix), fever, stomach problems
Mzutwe	<i>Dodonea angustifolia</i>	Sapindaceae	Dental problems
Nywanywa	<i>Rumex usambarensis</i> (Engl.) Damm.	Polygonaceae	Malaria, stops bleeding
?	?	?	Anaemia

NB: Plant identification was verified at TAFORI. The name for the anaemia plant could not be remembered by the elderly participant.

When the participants were divided into urban (Lushoto town with easy access to medicinal facilities) and rural (Goka, an isolated village two and a half hours away from Lushoto town by bus with one small dispensary and a rudimentary clinic five kilometres away) it was evident that Goka residents cultivate a greater number of medicinal plants, in actual number and species variety (13 compared to 9 in Lushoto). This can be explained by having a further distance to travel for alternative health provision, the financial implications of modern health care, or alternatively a greater knowledge of and access to appropriate wild plants.

**Threats to wild medicinal plant use**

In an area with already one of the highest population densities in Tanzania at 121 people per km<sup>2</sup> and a rising population, human pressure on this fragile mountainous environment is threatening the West Usambara’s unique plant diversity. As land is cleared for agriculture and trees felled for timber and charcoal the degradation of the environment is apparent,

resulting in a decrease in overall plant abundance. It is argued that if people knew the value of what they were destroying, this decline would stop. Elders complain,

“Our fathers knew a lot about the environment. They had no education but they could conserve the environment by preserving various plants which they used as medicine for malaria. But the youth of today don’t understand, even if they are educated.”

“My children want the hospital because they don’t know the power of plant medicine or which plants to use.”

And a healer reiterated “People cut down trees and plants because they don’t know the value”. Herbalists now travel further to find medicinal plants, one complaining he had to walk a further two hours to harvest.



Short term perceptions of plenty combined with illusions that the resource is inexhaustible can set in motion the eventual over harvest of a wild population previously abundant. There is a risk that the growing global herbal market threatens plant biodiversity due to over-exploitation as botanists at the University of Dar es Salaam and local NGOs report visits from buyers seeking help to locate and identify plants for these rapidly expanding markets.

*Fivi* (*Artemisia afra*), is one local example of a medicinal species under threat. *Fivi* has been scientifically proven to be an effective component of the artemisinin-based combination anti-malarial. A reliable supply could be instrumental in preventing thousands of African deaths. In Lushoto, *Fivi* is being collected on a commercial-scale for sale to markets in Arusha and Dar es Salaam. There are no protection regulations and it is locally understood that *Fivi* is disappearing. Other locally threatened species include *Mzughwa* and *Mzumbasha* both also used to treat malaria. Unsustainable harvesting techniques an increasing incidence of malaria and low levels of domestication are responsible for these declines.

***Protecting the health of the people by saving wild medicinal plants***

The findings demonstrate that wild plants are an integral part of health care in Lushoto, replacing or complementing modern medicinal choices. In the interests of protecting a nation's health, Tanzania's wild medicinal plants should be tested for efficacy, and appropriate policies put in place to protect threatened species, regulate use and promote sustainable harvesting. Documenting *all* traditional indigenous knowledge, including medicinal plant knowledge, and inserting it into mainstream education would protect the knowledge and ensure inter-generational transfer. Domestication would enhance livelihood options, income generation and economic development for the local populace whilst preventing the irrevocable loss of species. Conservation of these plants and their habitats is vital for the health of the environment *and* the health of the nation.

A traditional healer in Goka village, 2007.  
Photo by Samantha Ross.

# Obituary

## Corodius Thomas Sawe

Founder of Tanzania's Nature Reserves

21<sup>st</sup> September 1959 – 20<sup>th</sup> December 2009

Corodius Thomas Sawe played a pivotal role in the establishment of Tanzania's Nature Reserves. Through his determination, vision and single-mindedness Sawe, as he was known to his colleagues, successfully managed to increase the number of Nature Reserves from zero to four with another four in the pipeline at the time of his death. These reserves represent the foundation for conserving the biodiversity of the Eastern Arc Mountains. As such many consider him to have been one Tanzania's most important conservationists.

Sawe grew up in Machame Division, Kilimanjaro Region. He studied at the Forestry Training Institute at Olmtonyi before pursuing a Bachelors and then a Masters degree at Sokoine University of Agriculture. Sawe spent his entire professional life working for the Forestry and Beekeeping Division. He began his career in the Silviculture and Management Department and then moved to the Planning and Implementation of Logging section of the Northern Zone Forest Management Office. At the age of 30, he was transferred to the Tanga Regional Catchment Forest Office where the focus of his work switched from logging to the conservation of the unique forests of the East Usambara Mountains. Between 1999 and 2008 he served as Conservator of Amani Nature Reserve. The management approach piloted in Amani Nature Reserve under his leadership convinced the Forestry and Beekeeping Division to establish more nature reserves including Nilo, Kilombero and Uluguru. Sawe was appointed as coordinator of all of the Nature Reserves and determinedly initiated the establishment of four more nature reserves namely Chome, Magamba, Mkingu and Uzungwa Scarp. Undoubtedly the establishment of these reserves owes much to Sawe's dedication. Sawe also worked tirelessly to develop Tanzania's application to UNESCO to recognise the Eastern Arc Mountains as a World Heritage Site, a process that is still ongoing.

Sawe was an inspiration to his colleagues and was considered a vital member of the think tank within the Ministry of Natural Resources and Tourism. He died while serving as the Country Coordinator of the Conservation and Management of the Eastern Arc Mountain Forests Project as well as a Component Leader for declaring the Eastern Arc Mountains as a World Heritage Site.

His wife Mama Jane Uiso and five children survive him.

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**About the Tanzania Forest Conservation Group**

The Arc Journal is published by the Tanzania Forest Conservation Group (TFCG). Established in 1985, TFCG is a Tanzanian non-governmental organisation promoting the conservation of Tanzania's high biodiversity forests.

**TFCG's Vision**

We envisage a world in which Tanzanians and the rest of humanity are enjoying the diverse benefits from well conserved, high biodiversity forests.

**TFCG's Mission**

The mission of TFCG is to conserve and restore the biodiversity of globally important forests in Tanzania for the benefit of the present and future generations. We will achieve this through capacity building, advocacy, research, community development and protected area management in ways that are sustainable and foster participation, cooperation and partnership.

TFCG supports field based projects promoting participatory forest management, environmental education, community development, advocacy and research in the Eastern Arc Mountains and Coastal Forests. TFCG works with 130 villages in 14 Districts.

To find out more about TFCG please visit our website [www.tfcg.org](http://www.tfcg.org).

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