# Biodiversity Status and Trends Report for the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania Region, 2012

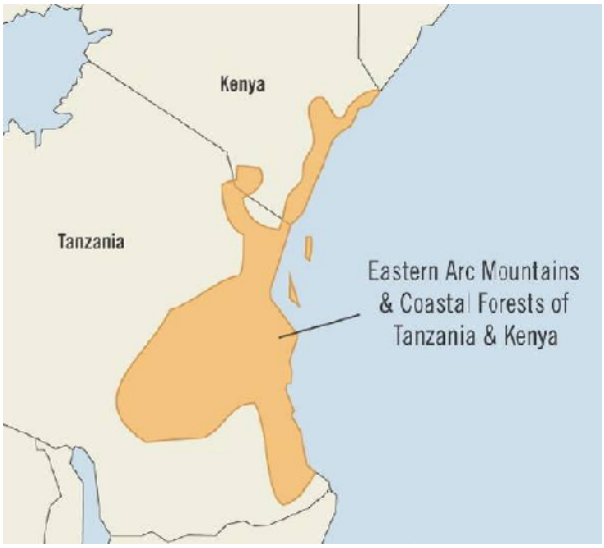


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**Table of Contents**

List of Acronyms ..... 3

Executive Summary ..... 5

1.0 Introduction and Background ..... 9

2.0 Approach and Methodology ..... 10

3.0 Results ..... 11

3.1 Status and trends ..... 11

3.1.1 Forest Quality and Health ..... 11

3.1.2 Area of different types of forest and degree of fragmentation ..... 13

3.1.3 Presence of endemic and globally threatened species, Changes in species IUCN Red List category and new species descriptions ..... 15

3.1.4 Percentage of area within protected areas ..... 20

3.1.5 Carbon storage ..... 20

3.2 Pressure ..... 22

3.2.1 Change in extraction intensity of Key species ..... 22

3.2.2 Changes in human population density in wards, divisions in the EACF ..... 24

3.2.3 Presence and coverage of invasive species ..... 24

3.3 Response Indicators ..... 27

3.3.1 Changes in forest management effectiveness ..... 27

3.3.2 Actions and research targeting biodiversity ..... 30

3.3.3 Policy Development (include site, species and focused issues) ..... 30

3.3.4 Number of sites from which benefits accrue to local communities ..... 31

4.0 Conclusions and Recommendations ..... 35

References ..... 36

ANNEX 1: List of a collapsed set of monitoring indicators and tools for aggregating information at the regional level as agreed by stakeholders in the EACF ..... 41

# List of Acronyms

| | |
|---|---|
| WMA | Wildlife Management Areas |
| JFM | Joint Forest Management |
| FBD | Forestry and Beekeeping Division |
| PFM | Participatory Forest Management |
| CPA) | Charcoal Production Association |
| SSG | Site Support Groups |
| CFA | Coastal Forests Associations |
| EACF | Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania |
| REDD+ | Reducing Emissions from Deforestation and Degradation plus carbon enhancement |
| GEF/UNDP | Global Environmental Facility/ United Nations Development Program |
| EAM | Eastern Arc Mountains |
| WWF | World Wildlife Fund |
| NEMA | National Environmental Management Authority |
| CEPF | Critical Ecosystems Partnership Fund |
| TANAPA | Tanzania National Parks |
| TFCG | Tanzania Forest Conservation Group |
| TFS | Tanzania Forest Service |
| PA | Protected Area |
| METT | Management Effectiveness Tracking Tools |
| VCUs | Voluntary Carbon Units |
| VCS | Voluntary Carbon Standard |
| NMK | National Museums of Kenya |
| DCCFF | Department of Commercial Crops, Fruits and Forestry |

| | |
|---|---|
| EARPO | East Africa Regional Project Office |
| KFS | Kenya Forest Service |
| KWS | Kenya Wildlife Service |
| FSC | Forest Stewardship Council |
| CARE | Cooperative for Assistance and Relief Everywhere |
| HIMA | Hifadhi ya Misitu ya Asili |
| CDTF/CEF | Community Development Trust Fund /Community Environment Facility |

## Executive Summary

1. This report assesses the status and trends of biodiversity in the Eastern Arc Mountains and coastal forests of Kenya and Tanzania (EACF) up to mid 2012. It is a follow up of a similar one done in 2008 and therefore status is assessed against the 19 biodiversity monitoring indicators agreed upon by stakeholders. This process is particularly important for Key Biodiversity Areas (KBAs) which are planning to build strong cases for REDD+ projects.

2. Indicators are grouped in such a way that they assess STATE (changes in forest quality, health, presence and abundance of threatened species, livelihood benefits and carbon storage), PRESSURE (change in extraction intensity human population, presence and extent of invasive species and fire frequency) and RESPONSE (changes in forest management effectiveness, actions and research targeting key species and investment in the region of the biodiversity in the EACF). The findings of the 2008 review formed the baseline for the current assessment of status and trends.

3. **Forest quality and health**: General evidence has started to emerge supporting the effectiveness of Participatory Forest Management (PFM) approach. At several coastal forest sites in both Kenya and Tanzania, evidence has been published showing that forest quality indicators such as canopy density, number of tree stems, percentage of herb cover and number of cut stems are better at PFM areas. Further evidence from the New Dabaga Ulongambi Forest Reserve on impacts of biodiversity showed increase in populations of hunted mammal species in PFM areas. PFM in its various forms is identified as a useful approach for establishing REDD+ projects.

4. **Area of different types of forest and degree of fragmentation:** Deforestation of Tanzanian coastal forests was estimated at 139.17 $Km^2$ over a 7 year period between 2000 and 2007 but only reported in 2012, with high deforestation rates at Pwani and Mtwara areas. It estimated that 66% of forest was lost around Shimoni in coastal Kenya between 1990 and 2011. There were no corresponding data on deforestation rates for the Eastern Arc Mountains (EAM) and for most of the other Kenyan coastal forests. An updated forest cover change map for the EACF is expected to be produced in 2013 with support from the CEPF. However indications are that large tracts of forest, both coastal and EAM, continued to be lost through charcoal extraction and conversion to agriculture e.g. pineapple farming in Dakatcha Woodlands Kenya.

5. **Changes in species IUCN Category and new species descriptions:** Between 2008 and 2012 there was a total of 26 species that had their IUCN Red list Status changed. Of these 17 species were up-listed to higher threat status and 6 were down-listed. Discovery of new species has continued in the Eastern Arc Mountains in Tanzania especially among amphibians and reptiles. About 300 new distribution records and approximately 70 undescribed endemic species for these taxa were reported for the

Tanzanian EAM. One amphibian species *Nectophrynoides asperginis* from the region may have gone extinct. There were no new species discovered in the coastal forests but a probable new species of Sengi (elephant-shrew) of the genus *Rhynchocyon* was discovered in Boni and Dodori forests but is awaiting confirmation through DNA analysis. There were new range extensions for the critically endangered Aders' duiker *Cephalophus adersi.*

6. **Percentage area within protected areas:** The 968 ha Derema Forest Reserve was gazetted in Tanzania's East Usamabara mountains while over 120,000 ha of village forest reserves were established in Tanzania EAM and coastal forests. However in some coastal forests there is confusion on status and who is tasked to manage them.

7. **Carbon storage**: The amounts of carbon stored in the EACF are only partly known and need to be assessed especially for purposes of establishing REDD+ projects. In Kenya assessments have only been done for Arabuko-Sokoke where the forest supported between 2.8-3.0 Tg C estimated using satellite imagery land cover data and ground-truthing collected between 1992 and 2004. Tanzania currently has sufficient data to calculate carbon loss approximately from deforestation for a limited number of forest types. An estimated loss of c. 34 million t of carbon (or c 1.7 million t per annum) has occurred over the last 20 years of deforestation with some 347 t ha -1 of carbon having been lost in East Arc mountain forests and mosaics of East African Coastal forests.

8. **Change in extraction intensity of key species:** Increase in illegal hunting for subsistence was recorded in each year since 2009 in Kenyan coastal forests and is blamed for the disappearance of some mammal species in some sites e.g. Daktacha woodlands. Bans on commercial timber extraction appear to be ineffective.

9. **Invasive species**: Invasive alien species are a more serious problem in the EACF than had previously been realized. In Kenya *Prosopsis juliflora* has heavily invaded the Tana River Delta while in Tanzania 20 invasive plant species were recorded in the Eastern Arc Mountains with *Maesopsis eminii*, *Rubus sp.* and *Cedrela odorata* being considered as the most serious.

10. **Changes in forest management effectiveness:** There were declines in management effectiveness scores at four Kenyan coastal forest sites while two sites improved and two remained the same. Taita Hills assessed in 2012 had a score of 62.61 the highest in Kenya. In Tanzania assessment of 18 EAM sites showed that 36% were ineffective, 29% had an effectiveness scores over 50%, and 9% had top effectiveness scores (90-100%). Chronic underfunding for conservation was identified as one of the drawbacks for effective management in the EAM, as reflected in the corollary observation that the best funded sites have the highest METT scores.

11. **Actions and research targeting key species:** A four year project aimed at strengthening the enabling environment for a functioning conservation of coastal forests by increased funding, staffing and oversight was launched in Tanzania in 2010. In Kenya several research projects targeting key species have been ongoing. These include monitoring and support of nature-based enterprises in Dakatcha woodlands, species specific projects include the monitoring of Clarke's Weaver and Sokoke Scops-Owl in Arabuko and Dakatcha with the aim of tracking changes in their populations and identifying and conserving their breeding habitats. The previously unknown breeding sites for the Clarke's Weaver have now recently been located in Dakatcha Woodlands and Arabuko-Sokoke Forest, thanks to funding was raised in 2011.

12. **Policy development including site, species and focused issues:** In 2010 the Tanzania Forest Service (TFS) was formed out of the Forestry and Beekeeping division of the Ministry of Natural Resources and Tourism. During the same period a conservation strategy for the Eastern Arc Mountain Forests was developed and a tourism act and tourism policy enacted for Tanzania. In Kenya a management plan was developed by the Kenya forest Service for Marenji forest. During the same period the Kenya Constitution 2010 and the Land Policy 2009 came into operation and this appears to have empowered local communities to take charge of land use decisions and has contributed to communities being able to oppose the proposed biofuel projects in Tana River Delta and Dakatcha Woodland. In Kenya, Forest (charcoal) rules 2009 were gazzetted. The rules provided for all commercial producers to organize themselves and form Charcoal Producers Associations (CPAs). The rules also stipulated the roles of the CPAs which include self regulation and ensuring members implement reforestation and conservation plans.

13. **Number of sites from which benefits accrue to local communities:** There were several pilot REDD+ projects initiated in Tanzania by TFCG, Mpingo conservation and development initiative, WWF and Care Zanzibar. One of the projects focussing on the Kilosa-Lindi rural districts hopes to achieve a 110,000 tonne reduction in carbon dioxide emissions from deforestation and degradation and to ensure the livelihoods of 20,000 poor people become beneficiaries from forest sustainable forest management and REDD financing. In Kenya there was no REDD project launched within the EACF area but the Kasigau Corridor REDD project that lies just outside the Taita Hills became the first ever REDD+ project to be issued Voluntary Carbon Units (VCUs) under the Voluntary Carbon Standard (VCS). There are also many alternative livelihood intiatives. These include: numerous bee keeping ventures (e.g. at Taita Hills, East Usambaras and Arabuko); medicinal and aromatherapeutic plants in Kwale District and the East Usambaras; ecotourism ventures at Kaya Kinondo on the Kenya coast; and butterfly farming at Arabuko-Sokoke, Taita Hills and Amani. A butterfly exhibit has been constructed by the National Museums of Kenya (NMK) at a key tourist site in Mombasa which will provide a local market for community bred butterflies and other products.

14. **Conclusion and recommendation:** Several knowledge gaps need to be addressed and include (i) More studies on carbon storage and estimates of emission offsets potential for various sites are urgently needed especially in Kenya, (ii) Studies focusing on assessing the extent and intensity of extraction activities e.g. charcoal in Dakatcha woodlands, and (iii) an updated forest cover change map as planned with support from the CEPF consolidation Grant.

# 1.0 Introduction and Background

The Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania (EACF) region is very important due to its biological richness. It is characterized by a high level of species endemism, a severe degree of threat and exceptional diversity of its plant and animal communities and was thus previously classified as a global biodiversity hotspot by itself, but now lies within two hotspots (Eastern Afromontane Hotspot and an expanded Coastal Forests of Eastern Africa Hotspot). In the beginning of the year 2004, the Critical Ecosystem Partnership Fund (CEPF) made a five-year investment of US$7 million allocated to 103 projects in this region. The investment focused on improving human wellbeing and scientific knowledge and reducing the extinction risk for 333 globally threatened species through improved protection for the sites where these species are found. Beyond this investment as well as when it was on, other biodiversity research and conservation work continues in the region due to the interest it attracts; however efforts to put together and avail the information for wider use by conservation workers, governments and other stakeholders are still needed.

This report is as a result of an initiative (funded by a CEPF Consolidation Grant) that is collating data from researchers and from the field against some standard agreed biodiversity monitoring indicators that are used to assess State, Pressure (threats) and Response (actions) for biodiversity in the EACF.

This report which is a follow-up of a similar one done in 2008 by Ndang'ang'a *et al.* (2008) addresses the following:

1. Review of existing reports, publications, online journals and databases against a set of agreed biodiversity indicators ***(Annex 1)*** and extraction (into a database) past and recent data (up to mid 2012) for use in preparing a biodiversity status and trends report. Special emphasis is placed in collating data sufficient to build strong cases for the following indicators at Key Biodiversity Areas (KBAs) in the EACF where REDD+ projects are in place or planned.
   Status and changes in:
   (a) Occurrence, distribution and abundance of threatened species,
   (b) Forest quality and health,
   (c) Forest cover,
   (d) Carbon storage,
   (e) Socio-economic co-benefits
2. Filling in of major information gaps in data for the highlighted indicators in 1 (a) to (e) above.

3. Feed all collated data into an existing database.

## 2.0 Approach and Methodology

Prior to the preparation of the 2008 status and trends report for the EACF a stakeholder workshop was held in Dar es salaam in 2005 where the stakeholders reached consensus in the region and agreed on the following:

i. To institute a collaborative and coordinated approach to biodiversity monitoring based on the pressure-state-response model. Towards the end the stakeholders agreed on a set of 19 indicators (**see** Ndang'ang'a *et al.* 2008 for details) for the model

ii. Draw a list of indicators for monitoring at species, sites, habitat/landscape level and develop appropriate monitoring tools/frameworks and

iii. Network among all stakeholders in data gathering, management, sharing and dissemination

BirdLife International then took the initiative to enhance the coordinated acquisition, storage, handling and sharing of biodiversity monitoring data across the EACF region. Towards this effort in this report the status of biodiversity in the EACF up to 2012 is assessed against the 19 indicators but collapsed since some are overlapping. This review uses the 2008 report as the baseline and therefore assesses trends of each of the biodiversity indicators (wherever information exists) building on what was reported in the 2008 status and trends report.

# 3.0 Results

## 3.1 Status and trends

### *3.1.1 Forest Quality and Health*

Since the 2008 status and trends report a comparative study by Matiku *et al.* (2011) between PFM areas and non PFM areas at Arabuko-Sokoke Forest showed significantly higher measures of forest quality in PFM areas than in non PFM areas. Generally they found that canopy density, number of tree stems of various DBH and the percentage of herb cover were significantly higher in PFM areas while measures of forest disturbance (number of cut stems) were higher in non PFM areas. However impacts of PFM on avifauna diversity were not apparent probably because in non PFM zones human disturbance has not reached critical ecological thresholds to affect bird species diversity (Matiku *et al.* 2011). PFM programmes which involve local communities provide valuable opportunities for REDD initiatives.

In Tanzania two forms of PFM are practiced- Joint Forest Management (JFM) and Community Based Forest Management. By 2011 there were over 200,000 ha of coastal forest under JFM and over 250,000 ha under community based forest management. General evidence showed that forest reserves under joint forest management were in better condition than reserves with no community involvement. In a properly controlled study spanning 7 years from 2001 to 2008 and using bush meat hunting as an indicator of conservation outcome revealed a considerable though skewed conservation improvement in PFM areas (Nielsen and Treue 2011). In the study, populations of Blue and Harveys duikers increased significantly while a population of the IUCN Red listed Abbott's Duiker established itself in a PFM zone (Nielsen and Treue 2011). In the study PFM was also credited with a 79% reduction in the number of active hunters in the PFM zone.

The threat to forest quality within the coastal forests may come from other unexpected outcomes e.g. the well intended electric fence that now surrounds the entire Arabuko-Sokoke forest. In 2003 the forest was fenced off as a solution to the perennial Human-Wildlife conflict specifically crop raiding by elephants. The fence cut through a hitherto homogeneous and continuous mixed lowland forest habitat on the eastern part of the forest. The fence hived of *ca* 1% of the 400 $km^2$ total area of the forest but the area is still legally forest land. Njoroge *et al.* (2011) and Banks *et al.* (2010) used this opportunity to investigate ecological impacts of the electric fence on the biodiversity of the mixed forest type in Arabuko-Sokoke. Initial results show clear disturbance differences between the inside and outside of the fence in the mixed forest (Njoroge *et al.* 2011, Figure 2). On the inside of the fence, disturbance appears to be driven by elephant activities and illegal logging. Bird and plant species diversity were higher but not significantly on the outside of the fence (Njoroge e*t al* 2011). However according to the same study, highly valued timber species such as *Brachylaena hulliensis* had higher tree densities inside the fence. The same study found that the alien and aggressive Longhorn crazy

ant *Paratrechina longicornis* was overwhelmingly the most dominant species on both sides of the fence. Banks *et al.* (2010) concluded that elephant effects on litter and habitat disturbance may be rendering the habitat less suitable on the inside of the fence for the near threatened East Coast Akalat *Sheppardia gunningi* by contributing to reduced beetle abundance, the main prey item for the species. Longer-term and potentially unsustainable impacts of the fence on biodiversity are anticipated as a result of the complete confinement of the elephants within the forest.

Dakatcha woodlands suffered moderate deterioration due to increased uncontrolled charcoal production and pineapple plantations (Mwinami *et al.* 2012). This was initially under control in 2009 but because of the controversy over proposed plantation of *Jatropha curca* for biofuels in 2010, the pro-jatropha proponents caused difficulties with regard to forest management by established Site Support Groups (Mwinami *et al.* 2012). The success by NEMA to block the development of biofuel plantations in Dakatcha is yet to translate to an improvement in forest quality and health.

It is believed that coastal scrub forest if left alone could eventually recover to forest, as the most species-rich Coastal Forest in eastern Africa, e.g. the Rondo Forest in SE Tanzania has itself regenerated from severe disturbance over 100 years ago and rare birds have been observed in areas of plantation forest that were established even more recently (Clarke 2011).

Figure 1. Forest Destruction by elephants during the dry season in Arabuko-Sokoke forest (*photo by Winnie Musila*)

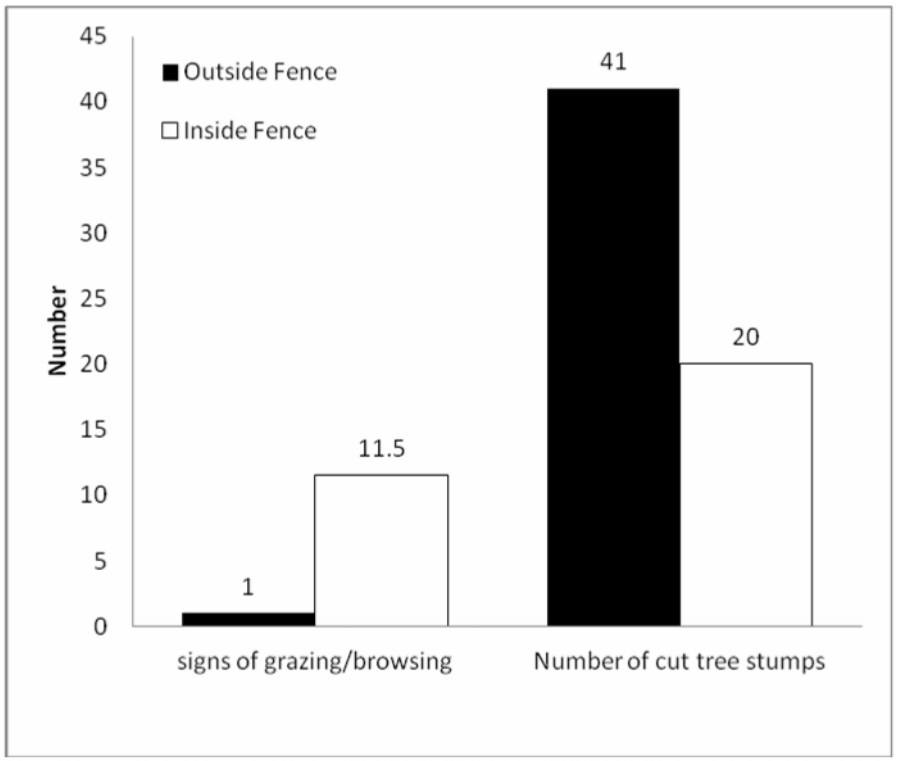


Figure 2. Frequency of disturbance activities at Arabuko-Sokoke forest mixed forest (Njoroge *et al.* 2011)

### *3.1.2 Area of different types of forest and degree of fragmentation*

An analysis of 7 year data by Griffin (2012) estimated a yearly deforestation rate of Tanzanian coastal forests at 139.17 $Km^2$ per year with high deforestation rates at Pwani (43.80 $Km^2$/yr and Mtwara (43.54 $Km^2$/yr) areas. Other areas assessed by the study were Dar es Salaam (1.53 $Km^2$/yr), Lindi (29.81 $Km^2$/yr), Morogoro (1.32 $Km^2$/yr) and Tanga (19.17 $Km^2$/yr). The FBD found that between 2000 and 2007/8 there was a significant decrease in woodland deforestation compared to the 1990-2000 period, with 2.8% and 13% of cover lost respectively (Burgess *et al.*, 2010; FBD 2010). In Unguja, Masingini Forest Reserve which serves as the main catchment forest for Stone Town, but is also important for wildlife and supports a population of the endangered Zanzibar Red Colobus, is now completely isolated (Siex 2011) from all other wildlife habitat on Unguja and needs special conservation efforts to ensure its survival and that of the wildlife that it supports.

In Kenya, most of the studies since 2008 onwards do not estimate the amount of forest deforestation but indicate steady forest loss. A report by Wijtten *et al*. (2012) indicate that , forest cover surrounding Shimoni in south coast decreased by 66% between 1990 and 2011 with main threats being illegal charcoal burning, logging and encroaching agriculture. Mwinami *et al.* (2012) reported that despite ban on the issuance of charcoal transport permits by Kenya

Forest Service, intense logging for charcoal production has continued unabated at Dakatcha. There are however plans to institute and register Charcoal Producers Association (CPA) for the area. The role of CPA in collaboration with CFA and SSG will be to make sure there is no charcoal production in the areas designated for conservation and this will help in conservation of *Brachystegia* habitats. Though there are no estimates, large tracks of forest have also been lost in Dakatcha to pineapple farming (Figure 3).

Figure 3. Recently established pineapple farm in Dakatcha woodlands (picture by K. Katana)

In the last decade, Dakatcha, Tana Delta and Tana River forests have been centres of interest for agricultural investments from international investors. Bio-fuels have been aggressively promoted as viable alternatives to fossil fuels and therefore capable of combating climate change. Large tracts of land in Dakatcha were earlier marked for planting of *Jatropha curcas*- a biofuel crop- without proper cost-benefit analysis of the sustainability of the crop. This proposal was however rejected by NEMA, in part as a result of analyses by Nature Kenya and the RSPB. Commercial farming of the bio-fuel crop would have irreversibly impacted on the woodlands' biodiversity. Studies warn that *Jatropha curcas* is not commercially viable in Kenya, and there are calls for further tests to be carried out to back up its alleged high-energy production potential.

A recent study of area and species composition changes of six indigenous forest fragments in the Taita Hills using 1955 and 1995 aerial photography showed that a total of 260 ha (50%) of indigenous tropical cloud forest was lost to agriculture and bush-land between 1955 and 2004

(Pellikka *et al.* 2009). However large scale planting of exotic trees on barren land during the same period resulted in an unchanged forest area which in a way is deceptive because forest quality and species composition are compromised (Pellikka *et al.* 2009).

### *3.1.3 Presence of endemic and globally threatened species, Changes in species IUCN Red List category and new species descriptions*

The Kihansi spray toad *Nectophrynoides asperginis*, endemic to the Uzungwa Scarp Forest Reserve, is now probably extinct in the world (Seki *et al.* 2011). In the Zanzibar coral rag forests, Zanzibar Leopard (*Panthera pardus adersi*) is now presumed extinct (Siex 2011). However there have also been rediscoveries of species previously thought to be extinct-: *Erythrina schliebenii* Harms and *Karomia gigas* (Faden) Verdc., have been rediscovered in the little-known Namatimbili–Ngarama forest block located some 35 km inland of Kilwa in south-east Tanzania (Burgess 2012). *Nectophrynoides wendaye*, another hyperendemic, was recorded at a new site, 0.5 km from the original site in Uzungwa Scarp Forest Reserve (Seki *et al*. 2011) while the Critically Endangered Long-billed Tailorbird *Artisornis moreaui* was recorded at the Misalai village landscape (Leonard *et al.* 2010) thus extending the range for both species. A recent compilation of the past records of the African golden cat *Caracal aurata*, Africa's least known felid, suggest that this species' range extends to Arabuko-Sokoke Forest on the Kenya coast (Butynski *et al*., 2012). This is based on an observation made in 1993, but this needs confirmation.

Discovery of new species has continued in the East Arc Mountains in Tanzania especially among reptiles and amphibians. Recent analysis of reptile and amphibian data collected since 1997 from the Eastern Arc Mountains mostly by the Natural History Museum of Trento has doubled the number of these species known to be endemic to the mountains TFCG (2010). The yet to be completed analysis has identified a number of evolutionary significant units, with c 300 new distribution records and c 70 undecscribed endemics. These discoveries are said to double the number of amphibian species known to be endemic to the Eastern Arc Mountains (TFCG 2010). In the South Ngurus 16 herpetofauna species strictly endemic to the mountain block have been identified (see table 1.0).

**Table 1.0: List of New herpetofauna species described from South Nguru Mountains, Tanzania (Source: TFCG 2010)**

| | **Species name** |
|---|---|
| 1 | *Rhampholeon moyeri* |
| 2 | *Rhampholeon moyeri* |
| 3 | *Tetradactylus udzungwensis* |
| 4 | *Urocotyledon rasmusseni* |

| | |
|---|---|
| 5 | *Kinyongia magomberae* |
| 6 | *Nectophrynoides poyntoni* |
| 7 | *N. pseudotornieri* |
| 8 | *N. laevis* |
| 9 | *N. frontierei* |
| 10 | *N. vestergaardi* |
| 11 | *N.paulae* |
| 12 | *N. laticeps* |
| 13 | *Probreviceps durirostris* |
| 14 | *Callulina hanseni* |
| 15 | *C. kanga* |
| 16 | *C. shengena* |
| 17 | *C. laphami* |
| 18 | *C.stanleyi* |
| 19 | *Arthroleptis nguruensis.* |

Several new species were also yet to be named including five *Nectophrynoides* species from Udzungwa, Nguru, Nguu, Mahenge and Uluguru Mountains, one gecko species from Mahenge, several tree frogs in the genera *Afrixalus and Leptopelis,* several forest snakes in the genera *Dipsadoboa and Crotaphopeltis,* and several chameleons (TFCG 2010).

A possible new species of Sengi (elephant-shrew) was discovered in Boni and Dodori forests by Andanje *et al.* (2010). The new species of the genus *Rhynchocyon* is entirely different from R. *chrysopygus* whose distribution now seems confined only to the south of Tana River. The probable new species is awaiting DNA analysis and it comes soon after the description of a new sengi species *R. udzungwensis* from the Udzungwa Mountains (Rovero *et al.* 2008). A new population of the Critically Endangered Aders' duiker *Cephalophus adersi* was also discovered in the same area (Andanje *et al.* 2011) thus extending the range of the species formally thought to only occur in Zanzibar and Arabuko-Sokoke forest. Unpublished reports (Colin Jackson pers. comm.) indicate the species also occurs in Dakatcha woodlands north of Arabuko-Sokoke forest.

Between 2008 and 2012 there was a total of 26 species that had their IUCN Red List Status changed (Table 2) in the EACF. Of these 17 species were upgraded to higher threat status and 6 were downgraded. The Rombo Shrew *Crocidura tansaniana* previously listed as data deficient was reviewed to Least Concern on account of its wide distribution while the Geata Mouse Shrew *Myosorex geata* was upgraded to Critically Endangered status. *Procolobus rufomitratus* previously listed as critically threatened was downgraded to Least Concern status.

Other species suffered steady declines over the period, although their IUCN threat status did not change. Studies conducted by Borghesio *et al.* (2010) in 2009 and 2010 strongly suggest that a major population crash of the Critically Endangered Taita Apalis *Apalis fuscigularis* is underway. Compared with 2001, sighting rates in April-May 2009 had dropped by about 38%; repeated counts done in September-December 2009 and May-July 2010 showed even larger decreases, approaching 80%. This means that the global population of the species might now be only 60-130 individuals, almost all of which are located in a single forest, Ngangao, which is only about 120 ha. Elsewhere, monitoring data collected over a three year period from 2005 to 2008 in 67 permanent transects in Arabuko-Sokoke forest by Virani *et al.* (2010) showed a steady but not statistically significant decline in Sokoke Scops-Owl densities. This equated to 22.5% decline over a 16 year period going back to density estimates of 1993 (Munir 1995). However the study did show that densities were relatively higher and degree of human disturbance lower at Dida where a PFM project has been implemented. The discovery of the Dakatcha population, with densities higher than those of the Arabuko-Sokoke and Usambara populations (Njoroge *et al.* 2011), has boosted the species survival chances, but it is still predicted to suffer rapid declines and shift in distribution due to climate change in the near future (Monadjem *et al.* 2012). Research conducted in 2010 on phylogeography of the Angolan black and white colobus monkey, *Colobus angolensis palliatus*, in Kenya and Tanzania highlighted the evolutionary distinctiveness of Kenyan populations of the species relative to Tanzanian populations. With the Tanzanian population better protected than the Kenyan population. IUCN red-list status of palliates is now being reassessed and status change seems likely (Mcdonald and Hamilton 2010).

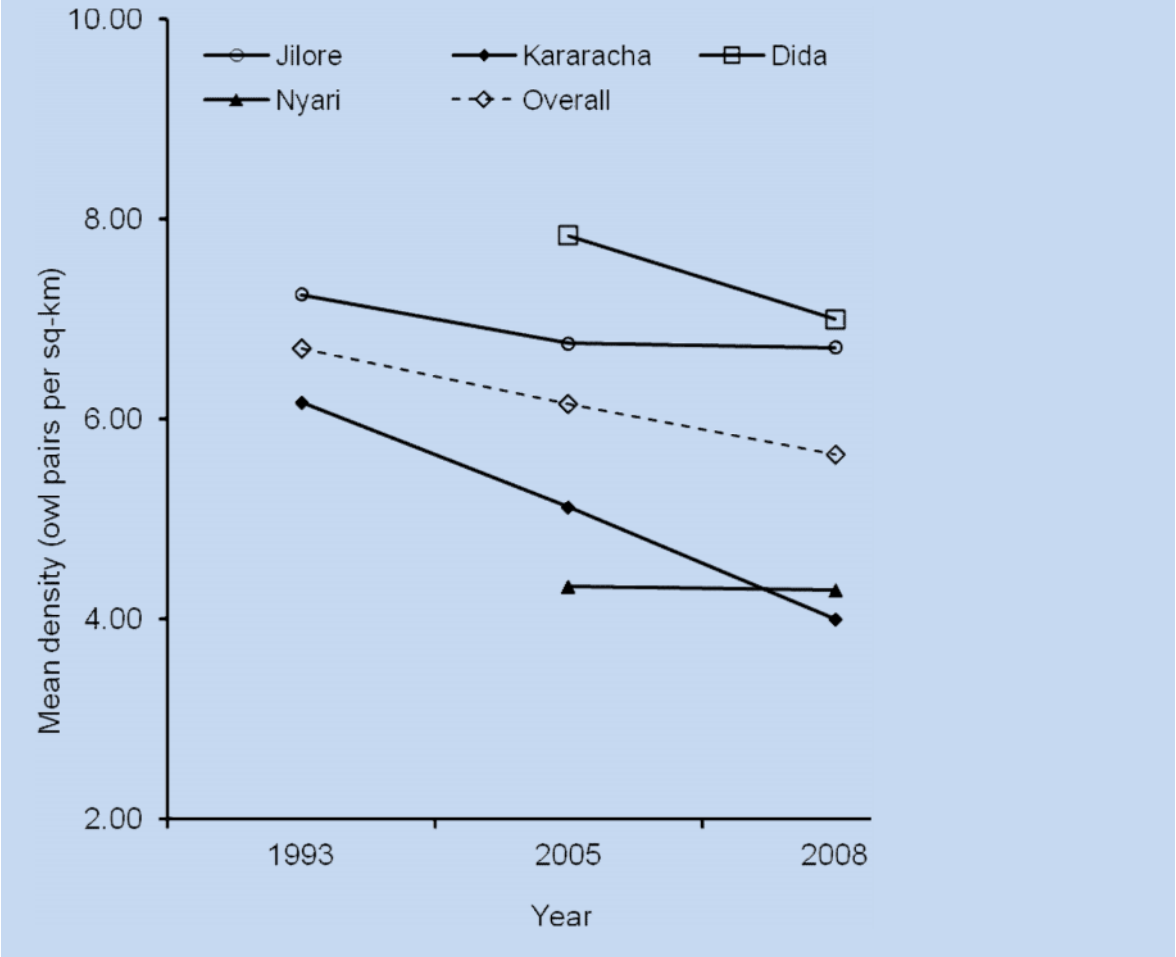


Figure 4: Population Trends of the Sokoke Scops-Owl at Arabuko-Sokoke forest between 1993 and 2005 (Virani *et al.* 2010)

**Table 2.0: List of species whose IUCN Red List status has changed between 2008 and 2012**

| | Globally Threatened Species | Common Name | Class | Family | Status 2008 | Status 2009 | status 2010 | status 2011 | status 2012 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | *Lanistes farleri* | | Gastropoda | Ampullaridae | EN | EN | VU | VU | VU |
| 2 | *Lanistes stuhlmanni* | | Gastropoda | Ampullaridae | EN | EN | NT | NT | NT |
| 3 | *Lettowianthus stellatus* | | Magnoliopsida | Annonaceae | VU | NT | NT | NT | NT |
| 4 | *Polyceratocarpus scheffleri* | | Magnoliopsida | Annonaceae | VU | EN | EN | EN | EN |
| 5 | *Toussaintia orientalis* | | Magnoliopsida | Annonaceae | VU | EN | EN | EN | EN |
| 6 | *Uvariodendron gorgonis* | | Magnoliopsida | Annonaceae | VU | EN | EN | EN | EN |
| 7 | *Uvariodendron oligocarpum* | | Magnoliopsida | Annonaceae | VU | EN | EN | EN | EN |
| 8 | *Uvariopsis bisexualis* | | Magnoliopsida | Annonaceae | VU | EN | EN | EN | EN |
| 9 | *Uvariodendron usambarense* | | Magnoliopsida | Annonaceae | VU | EN | EN | EN | EN |
| 10 | *Schefflera lukwangulensis* | | Magnoliopsida | Araliaceae | VU | EN | EN | EN | EN |
| 11 | *Nectophrynoides asperginis* | | Amphibia | Bufonidae | CR | EW | EW | EW | EW |
| 12 | *Procolobus gordonorum* | Udzungwa red colobus | Mammalia | Cercopithecidae | VU | EN | EN | EN | EN |
| 13 | *Procolobus rufomitratus* | Tana river red colobus | Mammalia | Cercopithecidae | CR | LC | LC | LC | LC |
| 14 | *Loxodonta africana* | African elephant | Mammalia | Elephantidae | NT | VU | VU | VU | VU |
| 15 | *Bersama rosea* | | Magnoliopsida | Melianthaceae | VU | LC | LC | LC | LC |
| 16 | *Hoplophryne rogersi* | | Amphibia | Microhylidae | VU | EN | EN | EN | EN |
| 17 | *Beamys hindei* | Lesser hamster-rat, Long-tailed pouched rat | Mammalia | Muridae | NT | LC | LC | LC | LC |
| 18 | *Dendrohyrax validus* | Eastern/Southern tree hyrax/dassie | Mammalia | Procaviidae | LC | EN | EN | EN | EN |
| 19 | *Canthium robynsianum* | | Magnoliopsida | Rubiaceae | EN | VU | VU | VU | VU |
| 20 | *Paraxerus vexillarius* | Svynnerton's bush squirrel | Mammalia | Sciuridae | VU | NT | NT | NT | NT |
| 21 | *Myosorex geata* | *Geata mouse shrew* | Mammalia | Soricidae | DD | EN | EN | EN | EN |
| 22 | *Crocidura monax* | Rombo shrew | Mammalia | Soricidae | DD | LC | LC | LC | LC |
| 23 | *Crocidura tansaniana* | Tanzanian shrew | Mammalia | Soricidae | VU | EN | EN | EN | EN |
| 24 | *Sylvisorex howelli* | Howell's shrew | Mammalia | Soricidae | VU | EN | EN | EN | EN |
| 25 | *Atilax paludinosus* | Marsh Mongoose | Mammalia | | EN | LC | LC | LC | LC |
| 26 | *Teinobasis alluaudi* | | Insecta | | EN | VU | VU | VU | VU |

### *3.1.4 Percentage of area within protected areas*

The percentage area within the protected area increased with the gazettement of the 968 ha Derema forest reserve in Tanzania's East Usambara Mountains on 9th July 2010 after 34 years of trying (TFCG 2010). The reserve was first proposed in 1976. It is a critical forest corridor connecting Amani Nature Reserve and the more northerly East Usambara mountains. The gazettement was a joint initiative between the Forestry and Bee keeping Division, and the UNDP GEF conservation and management project of the Eastern Arc Mountains in 2004. The gazettement led to the displacement of over one thousand villagers in 5 villages. Although CEPF was unable to support this resettlement owing to World Bank safeguards, it was able to assist with facilitating compensation payments. With the support of Deloitte LLP and TFCG two communities in Rubeho Mountains established village forest reserves covering a total of 1048 ha while within Kilwa region 12 village forest reserves were established during 2011 covering a total area of 90,900 ha (Kashaigili 2011). The new village forest reserves are Lupyagile, Liwiti, Mrambani, Likawage, Long'ou, Nambondo, Mtandi, Kiranjeranje, Milumba, Mbarawala, Likawage WMA, Nakiu WMA. More village forest reserves were established covering a total area of 30, 000 ha in the Lindi region of coastal Tanzania (Kashaigili 2011). These include Ruaha, REDD project, Njau, Nandambi, Nambidi, Namangale, Milolo-REDD, Mihima, Lwii, Ntene A, and Liganga.

### *3.1.5 Carbon storage*

The amounts of carbon stored in the various forest types in the EACF are partly known for only a few forests. There is an urgent need for these estimates because a country or project participating in the REDD+ mechanism is compensated based on positive changes to its forest carbon stocks. Overall the available estimates of the mean values of carbon per hectare are: Miombo woodlands of Tanzania 87 tons carbon per hectare; Eastern Arc Mountain forests- 306 tons carbon per hectare, and the East African coastal forests- 157 tons carbon per hectare. In a recent analysis Willcock *et al.* (2012) estimated that the EAM sub-montane forest contains the most aboveground live carbon per unit area (283 [252–329] Mg ha21), followed by montane forest (228 [190–286] Mg ha21), lowland forest (207 [195–220] Mg ha21), upper montane forest (202 [73–332] Mg ha21) and forest mosaic (187 [174–201] Mg ha21).

In Kenya assessments have only been done for Arabuko-Sokoke forest (Glenday 2008). The study found that the Arabuko-Sokoke forest supported between 2.8-3.0 Tg C carbon stocks. Carbon losses were calculated by quantifying disturbance from the basal areas of cut tree stumps per sample plot. The study indicated that Madunguni Forest, an adjoining forest patch, which had lost 86% of its forest cover, had also lost 76% of its terrestrial carbon stock.

According to Burgess *et al.* 2010, Tanzania currently only has sufficient data to calculate carbon loss approximately from deforestation for a limited number of forest types. An estimated loss of c. 34 million t of carbon (or c 1.7 million tons per annum) has occurred over the last 20 years

of deforestation (Burgess *et al.* 2010). Much of this loss is believed to come from woodlands and forests outside the network of government or co-managed reserve areas.. However Burgess *et al.* 2010, using data by FBD (2007) and Hall *et al.* 2009, have estimated that some 347 t ha -1 of carbon have been lost in Eastern Arc Mountain forests and mosaics of East African Coastal forests when carbon in pristine condition is compared with carbon in degraded forest up to 2000( See Table 2). Percentage estimates by Burgess (2012) of the total carbon emissions per annum from the coastal forest areas of Tanzania were 631,933 $tCO^2yr$-1, for the period 1990-2000 and had declined to 198,154 $tCO^2$ per annum by the period 2000-2007). There is an urgent need to assess whether this downward trend has continued to present day.

**Table 3.0 EACF Forest types in Tanzania with estimates of carbon (stem, branches and roots) in pristine and degraded forest and indicative loss through degradation (source: Burgess *et al.* 2010)**

| Forest Type | Historical area (ha) | Area in 1990 (ha) | Area in 2000 | % loss | Carbon in pristine forest t ha -1) | Carbon in degraded forest | Estimated loss |
|---|---|---|---|---|---|---|---|
| **Eastern Arc mountains** | 1,799,200 | 355,000 | 353,100 | 1 | 306 | 83 | 223 |
| **East African coastal forest mosaic** | 1,500,000 | 704,200 | 684,100 | 7 | 157 | 33 | 124 |
| **Mangrove forests** | No data | 109,500 | 108,100 | 2 | No estimates | No estimates | |

In the EAMs, the past 20 years of deforestation have resulted in the loss of c. 34 million t of carbon, c. 1.7 million t per annum (Burgess *et al.*, 2010). Much of this comes from the woodlands and forests outside the network of PAs (FBD, 2007; Hall *et al.*, 2009; Scharlemann *et al.*, 2010). Degradation is estimated to reduce carbon storage by 65 million tons from the network of 150 reserves within the EAMs of Tanzania (Burgess *et al.*, 2010).

## 3.2 Pressure

### *3.2.1 Change in extraction intensity of Key species*

WWF Eastern Africa Coastal Forest programme (WWF- EARPO, 2006) ranked the threat status of several extraction activities and top of their list was charcoal, unsustainable logging for timber and poles, overharvesting for wood carving and unsustainable hunting and mining. None of these extraction activities are well quantified in the region even though many studies acknowledge they are a major threat in the EACF. High intensity of charcoal extraction occurs in areas close to towns e.g. a total of 6777 bags are reportedly transported to Dar es Salaam daily (Malimbwi 2007). The catchment area for the sourcing of charcoal for Dar es salaam has expanded from 50 km radius in the 1970s, to 200 km in the 1990s (Ahrends *et al.* 2010) to over 1000km today (Burgess 2012). Unsustainable hunting for commercial and subsistence use has increased by 10% every year in Kenya's coastal forests between 2008 and 2010 (2008:52%; 2009: 62% and 2010 72%; Mwinami *et al.* 2011). This has contributed to the localized change of status of species like Golden-rumped Elephant Shrew (*Rhynchocyon chrysopygus),* and the critically endangered Ader's Duiker (*Cephalophus adersi*), e.g, within Dakatcha woodlands.

In Tanzania, commercial timber extraction for export primarily to China was banned in the late 1980s. However illegal timber extraction by local people and by tea companies which use large amounts of firewood for drying tea has continued (Schaafsma 2012). Heavy logging for hard wood for export has occurred in the coastal forests of the Rufiji, Kilwa and Lindi Districts (WWF 2012). This threat is exacerbated by the expansion of settlements around coastal forests (Burgess *et al.* 2012). Figure 5.0 below shows an example from South Nguru forest in Tanzania, where all the village households rely on firewood collected from Forest Reserves.

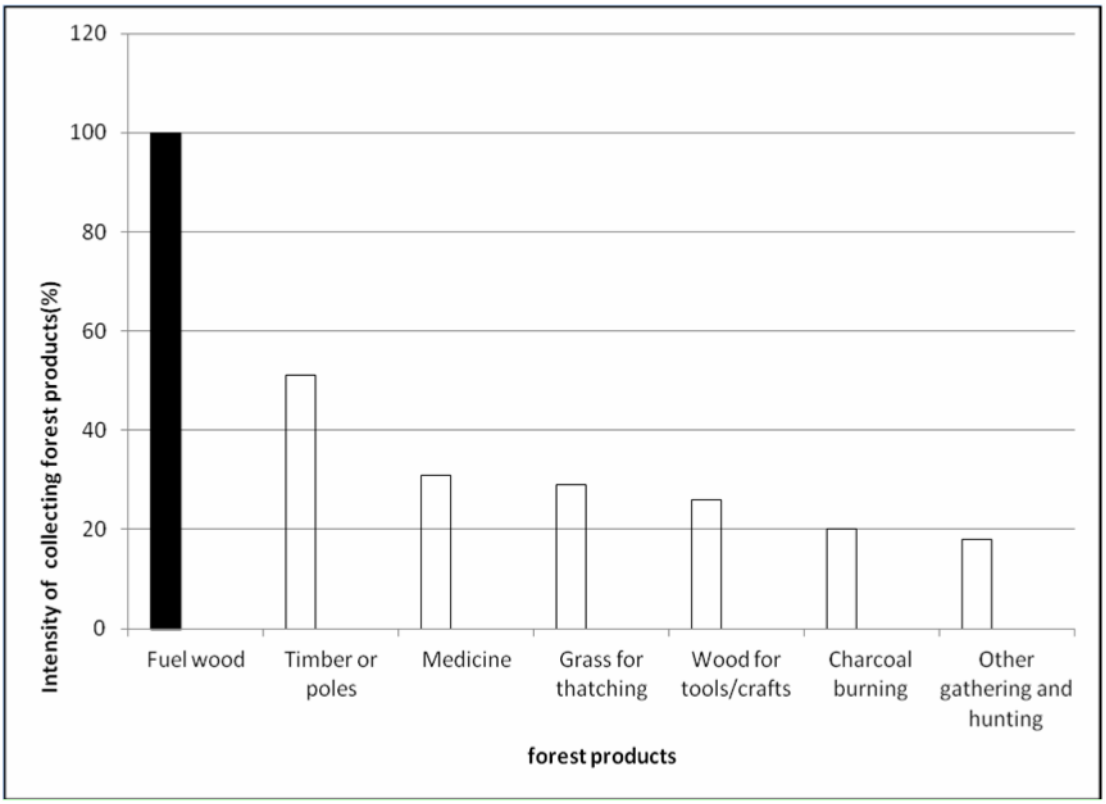


Figure 5. Intensity of firewood collection from South Nguru forest in Tanzania **(**Source: *http://www.tfcg.org/downloads/People-Forests-South-Nguru-Landscape-FINAL-en.pdf)*

Most of Kenya's coastal forests have experienced uncontrolled firewood collection with the threat being bad at 71% of coastal sites in 2008 (Adhola *et al..* 2008) and increasing to 72% by 2010 (Mwinami *et al..* 2010). In many coastal IBAs, such as Dakatcha Woodland, firewood is collected on a commercial basis (Ruuska 2012).

In the forest surrounding Shimoni in the south coast of Kenya, resource extraction was determined between 2008 and 2012 (Wijtten et al. 2012). Results showed timber and pole extraction increased and there was a strong increasing trend in the encounter rate of charcoal pits even though the number of shelters, houses or evidence of chainsaw use did not increase significantly.

Titanium has been discovered on Kenya's coast, from Kwale to Malindi District and underneath Arabuko-Sokoke Forest. The mining of titanium within forests is currently a major threat and there are larger reserves where Tiomin Resources Incorporation plans to strip mine starting with an area of 64 $km^2$ in Kwale District, which will be mined for at least 14 years. This will have impacts on Shimba Hills National Reserve, Arabuko-Sokoke, Dakatcha woodlands, Kaya Diani, Dzombo , Mrima hills and Kaya Kinondo forests.

### *3.2.2 Changes in human population density in wards, divisions in the EACF*

The human population in Malindi County has increased from c. 282,000 people in 1999 to c.378, 000 in 2010 (National Bureau of Statistics, 2010). In the past when human population was small and density of wild animals high across the woodlands, hunting supplied the community's protein demands within sustainable levels. This increase in human population now threatens the very existence of Dakatcha woodlands biodiversity and livelihoods for the local community. Forest antelopes have become increasingly rare in Dakatcha (Wildlife Direct, 2010) probably as a result of hunting pressure associated with population increase. Expansion of subsistence agriculture (mostly maize) has been responsible for the disappearance of most habitats of unprotected forest within Eastern Arc Mountain (Maeda *et al.* 2010). Agricultural expansion and intensification remain a key problem in the Tana River Delta, Tana River forests, Dakatcha woodlands, Mangea Hill and around Arabuko-Sokoke forest in Kenya and Ruvu South, Mang'alisa Forest Reserve in Rubeho Mountains, Kazimzumbi Forest Reserve, East Usambara, Pande Grassland Reserve & Rondo Forest Reserve, and Mlinga FRs, Pangani Falls, Tongwe Forest Reserve, Nyumburuni in Tanzania. All regions of Unguja and Pemba, and in particular the remaining patches of coral thicket forest, are severely threatened by a very high human population density (400 individuals/km$^2$), which is increasing at an estimated rate of five percent per year (three percent intrinsic and two percent immigration) (Siex 2011). Zanzibar is currently losing an estimated 1.2 percent of its forest each year (DCCFF 2008); shrinking forest patches and rapidly diminishing any potential to maintain and restore connectivity.

### *3.2.3 Presence and coverage of invasive species*

There are no studies that have assessed the extent of invasive species in Kenya's coastal forests, although there has been a dramatic spread of *Prosopsis juliflora*, especially in the Tana Delta region north of Malindi. The neem tree *Azadirachta indica* whose seeds spread prolifically has also become invasive in some parts of coastal Kenya and Tanzania, especially causing serious problems in Diani beach, Kenya.

It has been recently realized that invasive plant species are a major threat in the Eastern Arc forests of Tanzania. Burgess *et al.* (2010) identified over 20 vascular plant species (Table 4.0) present in the Eastern Arc Mountains which are invasive. *Maesopsis eminii*, *Rubus* sp. and *Cedrela odorata*/*mexicana* are considered to be the most serious invasive species in the EAM Tanzania. Indian House crows continue to be a persistent problem in the matrix surrounding coastal forests, particularly close to urban centers. Although they do not occur within the forests, their negative effects on other birds extend all the way along the coastal biodiversity hotspots.

**Table 4.0: Examples of invasive alien plant species found in the Eastern Arc Mountains Tanzania (Source: Burgess *et al.* 2010b in The Arc Journal 2010)**

| Species | Native Range | Where found in the Eastern Arc | Scale of problem |
|---|---|---|---|
| ***Acacia mearnsii*** | Australia | South and North Pare | Minor problem |
| ***Arenga pinnata*** | Asia | East Usambara | Serious problem. High seed production |
| ***Castilla elastica*** | Neo-tropics | East Usambara | Rapidly spreading into forest fragments, edges and disturbance gaps |
| ***Cedrela odorata/ Mexicana*** | Central and South America | East Usambara, Uluguru (lowlands) | The problem is serious in forest gaps and disturbed areas |
| ***Clidemia hirta*** | Pantropical invader from Neotropics | East Usambara | spreading in forest interior |
| ***Cordia alliodora*** | Neotropical pioneer | East Usambara | High seedling/sapling densities |
| ***Elaesis guineensis*** | Afrotropical regions | East Usambara | Becoming dominant in teak planted areas in Longuza |
| ***Eucalyptus sp.*** | Australia | S. and N.Pare & W.Usambara | Not a major problem, but covers some slopes after fire |
| ***Landolphia owariensis*** | Congo and Central Africa | East Usambara | Blankets ground and smothers canopy |
| ***Lantana camara*** | Tropical America, Tropical and Southern Africa | \|Most mountain block | Colonizes open areas and forest edges. Increasing problem |

| Species | Native Range | Where found in the Eastern Arc | Scale of problem |
|---|---|---|---|
| ***Leucaena sp.*** | Texas to Peru | W. Usambara | |
| ***Maesopsis eminii*** | West Tanzania and Central Africa | East Usambara, Ukaguru, Uluguru | Serious in East Usambara on previously logged forest. Not so bad elsewhere. |
| ***Phyllostachys bambusoides*** | Asian | East Usambara | Dense thickets spread into forest rapidly |
| ***Piper aduncum*** | Neotropical | East Usambara | Found in forest edges. Grow near rivers |
| ***Psidium cattleianum*** | South America | East Usambara | Shade tolerant. Vegetative growth |
| ***Pyrostegia venusta*** | Tropica South America | East Usambara | Causes crown dieback of tree in the forest |
| ***Selaginela sp.*** | Tropical and warm temperate Europe | East Usambara | Hinder all regeneration and mainly smothers small trees and shrubs |
| ***Syzygium jambos*** | South East Asia | East Usambara | Shade tolerant. Grow near rivers |
| ***Tectona grandis*** | Asia | Udzungwa | Not a serious problem |
| ***Rubus sp.*** | | Ukaguru, Uluguru, Udzungwa | Serious problem where established as growing into tangles and into forest canopy causing trees to fall over |

### 3.3 Response Indicators

#### *3.3.1 Changes in forest management effectiveness*

The World Bank/WWF management effectiveness tracking tool was used to capture data on the management effectiveness across > 100 forest sites in the Eastern Arc Mountain forests in Tanzania during 2005 (Madoffe *et al.* 2005b) and over 49 sites in Kenya in 2006 (Ngari 2007). In Kenya the activity was repeated for a further 11 Kayas in 2008. In the 2008 report (Ndang'ang'a *et al.* 2008) most forests in Tanzania had a score of 31 % to 45% management effectiveness, where private forests had better management effectiveness than government forest reserves and village forests, and the proposed forests were least effectively managed. In Kenya however state-owned forests had higher management effectiveness scores with Arabuko-Sokoke forest scoring the highest mark (68%).

After the 2005 and 2006 METT surveys in Kenya, it appears that the only follow-up survey available since then was the 2008 survey for 11 coastal forests (mostly kayas) and Taita Hills during 2012 in Kenya. The results are shown in Figure 6.0 below. Out of the 11 coastal forests, six had an effectiveness score of over 50% while the rest scored less than 50% and Kambe Rocks scored the least with 29%. Taita hills had a score of 62.61 but were assessed in 2012. Four sites (Gede ruins, Kayas Kabe, Kauma, and Rabai) showed a decline in management effectiveness scores while two improved (Kaya Fungo and Kambe rocks) and two remained almost the same (Kayas Ribe and Jibana).

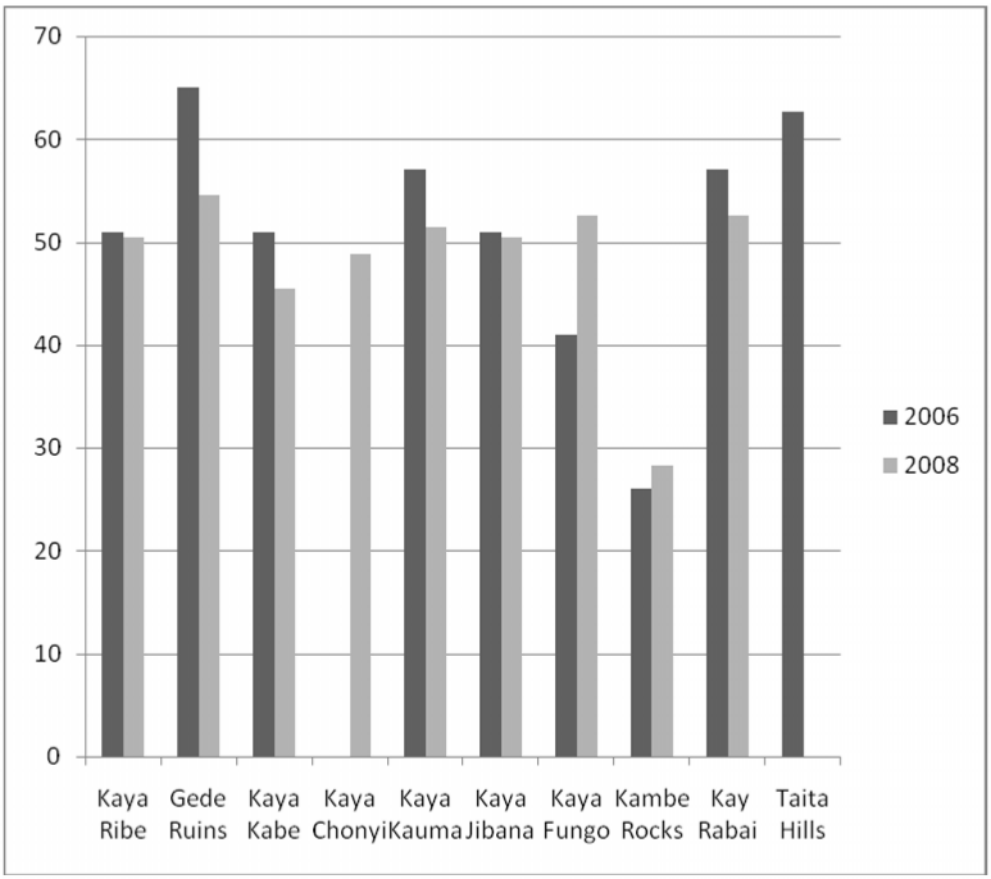


Figure 6.0 Overall effectiveness scores for 11 Kenyan coastal forests (2006 and 2008) and Taita Hills (2012). Source: Nature Kenya.

In Tanzania, the evaluation of management effectiveness was applied for 183 protected areas within the Eastern Arc Mountains (EAMs) for the first time in 2004 and only 18 a second time in 2009 (FBD, 2010b). The 18 evaluated in 2009 were Kiverenge, Mramba, Chambogo, Vumari, Mkusu, Mazumbai, Ambangulu, Bombo West, Nilo, Kilindi, Idewa, Ihang'ana, Mselezi, Nambinga, Ihanga, Ukwiva, and Kanga. Larossa (2011) analysed these METT assessments and found that of the 183 PAs for which effectiveness score were estimated, 36% were ineffective, 29% had an effectiveness scores over 50%, and 9% had top effectiveness scores i.e. 90-100% (Table 5.0). The five PAs which were most ineffective against deforestation were Handeni Hill FR, Talagwe FR, Zinge FR, Kisinga Rugaro FR, and Uponera FR.

**Table 5.0: Protected Areas with top effectiveness scores in the Eastern Arc Mountains of Tanzania (Larossa 2011)**

| Protected Area | Main Type of cover |
|---|---|

| | |
|---|---|
| **Irunda FR** | Forest |
| **Ngongwa-Busangi FR** | |
| **Kibao FR** | Forest |
| **Mninga FR** | Forest |
| **Gulosilo FR** | Forest |
| **Sao Hill FR** | Forest |
| **Kigogo FR** | Mixed forest and woodland |
| **Muhezangulu FR** | Mixed forest and woodland |

In a further analysis of METT for PAs across the coastal forests of Tanzania, Burgess *et al.* (2012) calculated METT mean scores (Table 6.0) and found that the best managed reserves are National Parks managed by TANAPA, and village land forest reserves managed at the village level while National and Local Authority Forest Reserves had weak management effectiveness. Forests with low scores also were heavily logged, encroached by farmland and largely cleared for charcoal.

**Table 6.0: METT mean scores of protected areas across coastal districts of Tanzania (Burgess *et al.* 2012)**

| District | METT mean Score |
|---|---|
| **Lindi** | 30.9 |
| **Rufiji** | 39.46 |
| **Kilwa** | 51.3 |
| **Zanzibar** | 51 |

In considering management effectiveness of forest PAs, it is important to keep in mind management costs of such PAs. Green *et al.* (2012) examined the management costs of the EAM and found that 55% actual spending on PA management was on recurrent expenditure (20% salaries and 35% operating costs), while capital expenditure accounted for only 21%. The management cost of the EAM is within the range of 1.6-62USD ha $^{-1}$ reported for PAs in areas of

high human density in developing countries (Balmford *et al.* 2003). Green *et al.* (2012) estimated that just 3% of Tanzania's military budget or 13%of the revenue generated from tourism could cover the management costs of conserving 17% of the EAM.

### *3.3.2 Actions and research targeting biodiversity*

GEF/UNDP coastal forest project for Tanzania was started in 2010 after a 15 years delay. The project "***Extending the coastal Forest Protected Area sub system in Tanzania***" aims to

i. Strengthen the enabling environment for a functioning conservation of coastal forests leading to increased funding, staffing and oversight. Chronic underfunding for conservation has been identified as one of the drawbacks for effective management e.g. Green *et al.* (2012).

ii. Strengthen the PA system for Zanzibar in terms of representativeness, connectivity andmanagerial capacity.

In Kenya several research projects targeting key species have been ongoing during the period 2008 to 2010. In Dakatcha woodlands Nature Kenya in collaboration with NMK, KFS (formerly FD) and *A Rocha Kenya* have since 2006 intensified work on the woodlands with funding from Critical Ecosystem Partnership Fund (CEPF) at the start. Two other projects were initiated in 2008. One funded by the Finnish government entitled, "Conservation for Sustainable Living: Investing in capacity building, nature-based enterprises and business support to conserve the Dakacha Woodland by and for local communities and the other supported by CDTF – CEF, "Enhancing Local Governance Capacities for Sustainable Biodiversity Action at Dakatcha Woodland in Malindi District. CDTF funded project ended in December 2010 while Finnish project is expected to end in 2012. These two projects have enhanced the capacity of the SSG through trainings on bird identification and biodiversity monitoring. Five SSG members are now key birders at Dakatcha woodland IBA. With funding from the Mohammed bin Zayed Species Conservation Fund, Nature Kenya has also implementing a project aimed at searching for the nest of the Clarke's Weaver with the aim to conserve the species breeding habitat. Surveys of the recently discovered Dakatcha population of Sokoke Scops-Owl have also been ongoing and initial analysis indicated that the woodlands may hold densities of the species higher than those of the Arabuko-Sokoke forest and Usambara populations.

### *3.3.3 Policy Development (include site, species and focused issues)*

In 2010 the Tanzania Forest Service (TFS) was formed out of the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism. TFS took over some functions of the FBD including management of national forest reserves, bee reserves and forest and bee resources on general lands. TFS targets to reduce illegal activities by 80% between 2010 and 2013. A

conservation strategy for the Eastern Arc Mountain forests was developed in 2008 in addition to the enactment of a tourism act and tourism policy in Tanzania during the same period.

During 2010, a management plan by the Kenya Forest Service was developed for Marenji forest at the coast (Mwinami *et al.* 2012) and this probably led to Marenji forest being one of 3 forests in Kenya to record moderate improvement (Mwinami *et al.* 2012). Nature Kenya and NEMA also successfully lobbied for the stopping of the proposed bio-energy projects at Dakatcha Woodlands and Tana Delta (Mwinami *et al.* 2012).

The Kenya Constitution 2010 and the Land Policy 2009 appears to have empowered local communities to take charge of land use decisions and contributed to communities being able to oppose the proposed biofuel projects in Tana River Delta and Dakatcha Woodland. The Tana River Delta was successfully proposed by KWS and listed as a wetland of international importance under the Ramsar convention. There have been deliberate efforts to implement and enforce the Forest policy and the Forest Act of 2005, and strengthening of community participation in decision-making and management of forests and forest resources as a result of which several Community Forest Associations have been formed and sensitized on the Forest Act 2005 and subsidiary legislation such as forest harvesting rules, Charcoal rules and guidelines on community participation in sustainable forest management. Following the guidelines of the forest policy management plans have been developed and launched for four coastal forest IBAs: Arabuko-Sokoke Forest, Dzombo Hill Forest, Shimba Hills and Taita Hills. There are also ongoing efforts on community mobilization by Nature Kenya to create Community Conserved Areas in unprotected areas such as Tana River Delta and Dakatcha Woodland.

### *3.3.4 Number of sites from which benefits accrue to local communities*

REDD is a new experience, both for Tanzania and Kenya as it is in other tropical forest countries. It is a concept that proposes to provide financial incentives to help developing countries voluntarily reduce national deforestation rates and associated carbon emissions below a baseline. The Bali declaration (COP 13, December 2007) encourages countries to undertake REDD pilot activities to gain experience and test different models. There are several REDD pilot projects in Tanzania (see table 7.0).

Tanzania was one of the initial countries under the UN REDD programme in which pilot projects are designed to be part of a learning process, and to build capacity and prepare for a more comprehensive REDD system in the medium term (3-5 years). Pilot REDD projects were launched in Tanzania in 2009. One of the pilot projects launched focussed on an area covering 50,000 ha of montane and lowland coastal/miombo forest in the Eastern Arc and coastal Forest biodiversity hotspots within the Kilosa-Lindi rural districts (TFCG 2009). The project scheduled to run until 2014 will introduce participatory monitoring of forest status, establish baselines of deforestation rates, market carbon credits, test benefit sharing mechanisms and help address the drivers of forest loss and degradation. The project hopes to achieve 110,000 tonne reduction in carbon

dioxide emissions from deforestation and degradation and to ensure the livelihoods of 20,000 poor people become beneficiaries from forest sustainable forest management and REDD financing (TCFG 2009).

Other recent pilot projects include:

i. Zanzibar where CARE-Tanzania in partnership with the department of commercial crops, fruits and forests is implementing a project that aims to promote pro-poor and gender equitable approach to community forest management including piloting of carbon financing for REDD. The project aims to benefit 29 communities and improve management of 25,000 ha of forest (TFCG 2010)

ii. Mpingo Conservation and Development Initiative aims to integrate new carbon financing flows from REDD with PFM and forest certification to benefit at least 12 villages and 50,000 ha of forest in Kilwa (TFCG 2010)

iii. In lindi and Kilosa a project that will benefit 29 villages and covering 2100,000 ha (90,000 ha in Kilosa and 120000 ha in Lindi rural) of submontane forest and miombo woodland in biodiversity hot spots. The pro-poor project titled " Making REDD work for communities and forest conservation in Tanzania" aims to establish community led carbon enterprise

In Kenya the Kasigau Corridor REDD project became the first ever to be issued Voluntary Carbon Units (VCUs) for REDD under the Voluntary Carbon Standard (VCS), the most widely used carbon accounting standard among projects issuing credits in the voluntary market. The project protects 500,000 acres of forest and brings the benefits of direct carbon financing to Kenyan communities while also securing the entire wildlife migration corridor between Tsavo East and Tsavo West National Parks (Wildlife Works, 2011). The project is however just outside the EACF but a lot could be learned from its establishment and development.

**Table 7.0 List of Carbon REDD project in the EACF**

| | Project name | Lead organization | Project area-in EACF | KBAs in EACF under REDD project | Activities |
|---|---|---|---|---|---|
| **1** | Making REDD Work for Communities and Forest Conservation in Eastern Arc Mountains and Coastal Forests of Tanzania. | Tanzania Forest Conservation Group (TFCG)-since 2009 | Kilosa and Lindi rural Districts in Tanzania. | Lindi | To reduce greenhouse gas emissions from deforestation and forest degradation in Tanzania in ways that provide direct and equitable incentives to communities to conserve and manage forests sustainably. |
| **2** | Combining REDD, PFM and FSC Certification in South-Eastern Tanzania | Mpingo Conservation and Development Initiative | Kilwa and Lindi District coastal forests | Kilwa District Coastal Forests | Pilot the integration of new financial flows from carbon offsetting activities under REDD with PFM and forest certification, leveraging these revenues as a catalyst to further expand sustainable forest management and use in South Eastern Tanzania. |

| | | | | | |
|---|---|---|---|---|---|
| **3** | Enhancing Tanzanian Capacity to Deliver Short and Long Term Data on Forest Carbon Stocks across the Country | WWF | The project is national in scale. It seeks to establish a network of carbon monitoring plots across all major forest types. | Coastal Forests (Coast regions); Grasslands (Kilombero); Mangroves (Kilwa); Forests (Eastern Arc Mountains). | Contribute core data to the Tanzanian national monitoring, reporting and verifying (MRV) system that forms a part of the comprehensive forest carbon monitoring system for the country, and build capacity for sustainability in the future. |
| **4** | Piloting REDD in Zanzibar through community forest management | CARE Zanzibar | Ungula and Pemba Islands, Zanzibar | Ungula and Pemba Islands | HIMA project is specifically aiming at promoting a pro-poor gender-equitable approach to community forest management in Zanzibar, including piloting of carbon financing for Reduced Emissions from Deforestation and Degradation (REDD), which provides forest-dependent communities with secure property rights, equitable rewards for providing ecosystem services and other livelihood benefits, and which informs the priorities of Zanzibar in national REDD strategy. |
| **5** | The Kasigau Corridor REDD project-the community ranches | Wildlife Works | Kasigau Corridor-nearTaita Hills | Adjacent to the Taita Hills | Prevent deforestation caused by slash and burn and subsistence farming activities by empowering the local communities with employment opportunities and key infrastructure |

# 4.0 Conclusions and Recommendations

The importance of the EACF as a foremost biodiversity hotspot has continued to be enhanced by the continued discovery of new species but so have the threats continued to increase. However evidence of the effectiveness of some conservation initiatives has started to emerge e.g. the PFM success reported in Tanzania and Arabuko-Sokoke Forest in Kenya. Though there is increased knowledge about the state of biodiversity in the EACF, there clearly are several knowledge gaps that could be addressed:

i. More studies on carbon storage and estimates of emission offsets potential for various sites are urgently needed especially in Kenya.
ii. Studies focusing on assessing the extent and intensity of extraction activities e.g. charcoal in Dakatcha woodlands.
iii. Updating of the Forest Cover Change maps
iv. Validating unconfirmed reports of Globally Threatened Species such as the Golden Cat in Arabuko and continuing with efforts to track their population numbers, particularly in relation to the impacts of conservation interventions and the METT assessments.

Though we recognize REDD as a concept that proposes to provide financial incentives to help developing countries voluntarily reduce national deforestation rates, little has been done especially in Kenya to pilot and establish pilot projects. Unprotected sites such as Dakatcha woodlands could benefit immensely from the financial incentives provided by REDD projects.

Biodiversity in the Eastern Arc Mountains and Coastal forests of Kenya and Tanzania has continued to face increased pressure and unfortunately this is happening against the pressing issues facing conservation managers, communities and policy makers. It is however important that despite the critical issues, appropriate interventions be sustained to safeguard the forest habitats. More time and effort is required in directly responding to the specific threats –that if addressed would add value to the sites. Vigilance against new and emerging threats is required and collaborative approaches at all levels are highly recommended. There is need for increased knowledge, dialogue and data sharing at national level as well as linkages between national, regional and international processes so that appropriate interventions can be made.

There are also concerns emerging from the adoption of a new constitution in Kenya. This devolves powers from the Central Government to some 47 counties throughout the country. While Parks and Wildlife still fall under the jurisdiction of KWS, Forest Reserves will be subject to county level administration, and forests on Trust Land will be especially vulnerable. The late 90s history of local District Council support for degazettement efforts at Arabuko, and of the destruction of Madunguni Forest at the hands of the Malindi Municipal Council, suggests that forest status on the Kenyan coast will need to be closely monitored and rapid responses may be required.

# References

**Adhola, T., Ng'weno, F., Matiku, P., Mulwa, R., Ngari, A., Barasa, F., Madindou, I., Wanyiri, M., Mwango'mbe, J., Musyoki, C., Ndonye, P., Ogoma, M., Machekele, J. and Musila, S**. (2009). *Kenya's Important Bird Areas: Status and Trends 2008*. Nature Kenya, Nairobi.

**Ahrends, A.Burgess, N.D., Milledge, S.A.H., Bulling, M. T., Fisher, B., Smart, J.C.R., Clarke, G.P., Mhoro, B.E. and Lewis, S.L.** (2010). Predictable waves of sequential forest degradation and biodiversity loss spreading from an African city. *Proceedings of the National Academy of Sciences*. Available at: http://www.pnas.org/content/early/2010/07/28/0914471107

**Andanje, S., Agwanda, B. , Ngaruiya, G., Amin, R. and Rathbun, G**. (2010). *Sengi (Elephant-Shrew) Observations from Northern Coastal Kenya.* Journal of East African Natural History 99(1):1-8. 2010 doi: http://dx.doi.org/10.2982/028.099.0101

**Andanje, S.A., Bowkett,A. E,; Agwanda, B. R., Ngaruiya, G.W., Plowman, A. B., Wacher, T. and Amin, R**. (2011). *A new population of the Critically Endangered Aders' duiker Cephalophus adersi confirmed from northern coastal Kenya*. Oryx, 45, pp 444-447 doi:10.1017/S003060531000181X

**Balmford, A., Gaston, K.J., Simon, B., James, A., Kapos, V**. (2003). *Global variation in terrestrial conservation costs, conservation benefits and unmet conservation needs*. Proc. Natl. Acad. Sci. USA 100:1046-1050.

**Banks, J.E.; Jackson, C.; Hannon, L.M.; Thomas, C.M.; Baya, A.** and **Njoroge, L**. (2010). *The cascading effects of elephant presence/absence on arthropods and an Afrotropical thrush in Arabuko-Sokoke Forest,* Kenya.

**Blomley, T., Pfliegner, K, Isango, J., Zahabu, E., Ahrends, A.** and **N.D. Burgess** (2008). *Seeing The Wood For The Trees: Towards An Objective Assessment Of The Impact Of Participatory Forest Management On Forest Condition In Tanzania*. *Oryx* **42:** 380-392.

**Burgess, N. D**. (2010). 2010. *Year of Biodiversity. What does it mean?* Tanzania Forest Conservation Group. The Arc Journal. Issue 25.

**Burgess, N.D., Harrison, P.J., Laizer, J.L., Shemdoe, R.S., Kashaigili, J.J., Howell, K., Msuya, C., Miligo, C., Werema, C., Kihaule, P., Honorati, M.K., Suleiman, H., Clarke, P.G., Siex, K., Davenport, T., Grubb, C., Kijazi, A., Sumbi, P., Salehe, J., Malugu, I., Komba, R., Kinyau, N., DCCFF** (2008) *Zanzibar National Forest Resources Management Plan (2008-2020)* DCCFF.Zanzibar.

**Burgess, N.D., Madoffe, S., Kajembe, G., Trevelyan,R.** and **Perkin, A.** (2010b). *Are invasive plant species a problem in the Eastern Arc Mountains*? The Arc Journal 25:23-26.

**Burgess, Neil D., Bahane, B., Clairs, T., Danielsen, F., Dalsgaard, S., Funder, M., Hagelberg, N., et al.** (2010a). *Getting ready for REDD+ in Tanzania: a case study of progress and challenges.* Oryx, 44(03), 339-351.

**Butynski, T.M., Douglas-Dufresne, H. and de Jong, Y.A.** (2012). *Identification, distribution and conservation status of the African golden cat Caracal aurata in Kenya*. Journal of East Africa Natural History Society 101(1): 3–16.

**Clarke, G.P. (2011)**. Observations on the Vegetation and Ecology of Palma and Nangade Districts, Cabo Delgado Province, Mozambique. 130pp. *Downloaded from http://coastalforests.org/*

**CSERGE Working Paper 2012-05.** Centre for Social and Economic Research on the Global Environment. 19pp
*Deficient Areas of the World.* PLoS ONE 7(9): e44795. doi:10.1371/journal.pone.0044795.

**Doggart, N. TFCG, Watkin, J. & CEPF**. (2009). *Assessing CEPF's legacy in the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania*. Tanzania Forest Conservation Group. The Arc Journal. Issue 23.

**FBD (Forestry and Beekeeping Division)** (2010*). Assessment of forest area changes (2000-2007/2008) for the Eastern Arc Mountains.* Training. Dar es Salaam.

**Glenday J** (2008) *Carbon storage and emissions offset potential in an African dry forest, the Arabuko-Sokoke Forest, Kenya*. Environmental Monitoring and Assessment 142: 85-95

**Green, J., Burgess, N.D., Green, R.E., Madoffe, S., Munishi, P. Nashanda, E., Turner, K. and Balmford, A.** (2012). *Estimating management costs of protected areas: A novel approach from the Eastern Arc Mountains, Tanzania*. Biological conservation 150:5-14.

**Griffin, O.** (2012). *Modelling the severity of deforestation in coastal Tanzania and a comparison of data sources*. Unpubl. Msc Thesis. Imperial College, London.

**Hall, J., Burgess, N.D., Lovett, J., Mbilinyi, B., Gereau, RE**., (2009). *Conservation implications of deforestation across an elevational gradient in the Eastern Arc Mountains, Tanzania.* Biol.Conserv. 142, 2510-2521.

**Howell, K.M., Msuya, C.A., Mligo, C., Werema, C., Kihaule, P.,. Honorati, M.K and. Suleiman, H.O.** (2012). Biodiversity Surveys of Poorly Known Coastal Forests of Southeastern Tanzania and Zanzibar. Unpublished report. WWF.

**Kashaigili, J., Nzunda, E.F. , Mwamakimbullah, R., Sirima, A. Shirima, D. & Mkumbo, P.** (2011).*Consultancy Report For Spatial Planning Baseline Focusing On The Coastal Forest Of Tanzania For The Coastal Forest Project.* WWF Tanzania

**Larrosa, C.,** 2011. *The effectiveness of a range of protected area governance and management regimes in reducing deforestation: the Eastern Arc Mountains of Tanzania*. Msc Thesis, Imperial college London

**Leonard, C., M. Mwangoka, V. Mkongewa, N. Doggart, and H. Vihemäki** (2010) Assessment of
**Madoffe, S., Munishi, P.** and **Burgess, N.** (2005a). *How disturbed by human activities are the Eastern Arc Mountain forests?* Arc Journal 19: 13-15.

**Madoffe, S., Munishi, P.** and **Burgess, N**. (2005b). *How well managed are the Eastern Arc Mountain Forests?* The Arc journal 19: 22-23

**Madoffe, S.S. and Munishi, P**. (2005). *Forest condition assessment in the Eastern Arc Mountain forests of Tanzania*. Unpublished report. Ministry of Natural Resources and Tourism, Forestry and Bee keeping Division.

**Maeda, E.E.., Pellikka, P.K.E., Siljander, M., Clark, B.J.F.,** (2010). *Potential impacts of agricultural expansion and climate change on soil erosion in the Eastern Arc Mountains of Kenya*. Geomorphology 123: 279-289.

**Malimbwi, R.E, Zahabu, E And Mchome, B**. (2007). *Situation Analysis For Dar Es Salaam Charcoal Sector: Charcoal Supply and Consumption.* Sokoine University Of Agriculture And WWF Tanzania Programme Office, Dar Es Salaam, Tanzania.

**Matiku, P. Ogol, C.** and **Mireri, C**. (2011). *The impact of participatory forest management (PFM) on forest integrity and biodiversity in Arabuko-Sokoke forest, Kenya*. Afr. J Ecology. 50:184-192.

**Matiku, P. Ogol, C.** and **Mireri**, C. (2012). *Does participatory forest management change household attitudes towards forest conservation and management?* African Journal of Environmental Science and Technology. Vol. 6(5): 237-246.

**Matiku, P., Ng'weno, F**. (2012). *Kenya's Important Bird Areas: Status and Trends 2010.* Nature Kenya, Nairobi.

**Mcdonald, M. M. and Hamilton, H.** (2010). *Phylogeography of the Angolan black and white colobus monkey, Colobus angolensis palliatus, in Kenya and Tanzania.* American journal of primatology 72:715-724.

**Monadjem, A. Virani, M.Z., Jackson, C.** and **Reside, A**. (2012). *Rapid decline and shift in the future distribution predicted for the endangered Sokoke Scops-Owl Otus Ireneae due to climate change*. Bird Conservation International. Doi:10.1017/s0959270912000330.

**Mwinami, T., Barasa, F.,Ngari, A., Matiku, P., Ng'weno, F., Musina, J., Mwang'ombe , J., Kanga, E**. (2010). *Kenya's Important Bird Areas: Status and Trends 2009*. Nature Kenya, Nairobi.

**Ndang'ang'a, P.K.; Eshiamwata, G.; Ngari, A.; Pius, E.; John,J.; Arinaitwe, J.** and **Mbwana, S.** (2008). *Status report of the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania. Unpubl ished report .* BirdLife International.

**Ngari, A**. (2007). *Biodiversity Status and Trends Report for the Eastern Arc Mountains and Coastal Forests of Kenya.* Unpublished Report. Nature Kenya.

**Nielsen,M.R.** and **Treue**, (2011). *Hunting for the benefits of Joint Forest Management in the Eastern Afromontane Biodiversity Hotspot: Effects on bushmeat hunters and wildlife in the Udzungwa Mountains*. World Development 40(6).

**Njoroge, P. Musila, W. and Warui, C. W.** (2011). *The Ecological impacts of an electric fence at Arabuko-Sokoke forest, a biodiversity Hotspot*. *Unpublished report*. National Museums of Kenya.

**Pellikka, P.K.E., Lo¨tjo¨nen, M., Siljander, M.** and **Lens, L**. (2009). *Airborne remote sensing of spatiotemporal change (1955–2004) in indigenous and exotic forest cover in the Taita Hills, Kenya.* International Journal of Applied Earth Observation and Geoinformation 11 (2009) 221–232

**Platts P.J., Ahrends A., Gereau R.E., McClean C., Lovett J.C., Marshall A., Pellikka P., Mulligan M., Fanning E. & Marchant R**. (2010). *Can distribution models help refine inventory-based estimates of conservation priority? A case study in the Eastern Arc forests of Tanzania and Kenya.* Diversity & Distributions **16** (4): 628-642. DOI: 10.1111/j.1472-4642.2010.00668.x

**Rovero, F.; Rathbun, G.; Perkin, A.; Jones, T.;. Ribble, D. O.; Leonard, C.; Mwakisoma, R. R.; Doggart' N**. (2008). *A new species of giant sengi or elephant-shrew (genus Rhynchocyon) highlights the exceptional biodiversity of the Udzungwa Mountains of Tanzania*. *Journal of Zoology* 274:126-133.

**Ruuska, E.M.** (2012). *The Significance and Sustainability of Charcoal Production in the Changing Landscape of Dakatcha Woodland, SE Kenya.* Msc thesis. University of Helsinki, Faculty of Science, Department of Geosciences and Geography.

**Schaafsma, M.** (2012*). Mapping ntfp collection in Tanzania: A comparison of surveys.*

**Scharlemann,J.P.W.,Kapos,V.,Campbell,A.,Lysenko,I.,Burgess,N.D.,Hansen,M.C.,Gibbs,H.K.,Dickson,B. and Miles,L**.(2010). *Securing tropical forest carbon: the contribution of protected areas to REDD*. Oryx; 44, 352-357.

**Siex, K.** (2011). *Protected area spatial planning for Unguja and Pemba Islands, Zanzibar. A Consultancy to the UNDP-GEF - Extending the Coastal Forest Area Protected Area Subsystem in Tanzania. World Wide Fund for Nature (wwf).*
TFCG Technical Paper No. 23. DSM, Tz. 1 – 91 pp.

**Virani MZ**. (1995). *Ecology of the endangered Sokoke Scops-Owl Otus ireneae.* MSc. Thesis, University of Leicester, UK.

**Virani, M.; Njoroge, P.** and **Gordon, I.** (2010). *Disconcerting trends in populations of the endangered Sokoke Scops-Owl Otus ireneae in the Arabuko-Sokoke Forest, Kenya*. Ostrich 81(2):155-158.

**Wijtten, Z., Grehan, L., Talianko, L. and others (2012)** *Terrestrial Programme Report GVI Kenya***.** Unpublished report by GVI Kenya Wildlife Marine Mammal Studies and Community Development, Shimoni.

**Willcock S, Phillips OL, Platts PJ, Balmford A, Burgess ND, et al**. (2012) *Towards Regional, Error-Bounded Landscape Carbon Storage Estimates for Data.*

**WWF-EARPO** (2006). *Coastal Forests of Eastern Africa: Conservation Strategy And Action Plan*. WWF East Africa Regional Project Office, Nairobi.

http://www.birdlife.org/community/2010/09/major-population-crash-of-critically-endangered-taita-apalis

http://www.knbs.or.ke/surveys.php

http://wildlifedirect.org/bloglist/?searchblogsregion=1

http://www.wildlifeworks.com/redd/resources.php

http://www.theeastafrican.co.ke/news/-/2558/817862/-/view/printVersion/-/xdfnjr/-/index.html

**ANNEX 1: List of a collapsed set of monitoring indicators and tools for aggregating information at the regional level as agreed by stakeholders in the EACF**

| | Indicator | Level | Tool/ method |
|---|---|---|---|
| STATE INDICATORS | Change in status of threatened species | Species | Assessment of the relative rate at which the number of species in each IUCN Red List category changes (Red List Index) |
| | Change in habitat extent in Key Biodiversity Areas (KBAs) | Landscape | Analyzing satellite data to track habitat change in KBAs over years |
| | Change in fragmentation in biodiversity conservation corridors | Landscape | Analyzing satellite data to track changes in the proportion of habitat far (> 1km) from non-habitat edge, and the proportion of habitat not in small (<100 $km^2$) isolated patches |
| PRESSURE INDICATORS | Change in extraction intensity of globally threatened species for commercial use | Species | Data derived from TRAFFIC database and Disturbance transects |
| | Change in human population density in administrative districts contained in the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania | Landscape | Review of National Bureau of Statistics Reports in Kenya and Tanzania |
| RESPONSE INDICATORS | Change in protection status of Key Biodiversity Areas (KBAs) | Site/ Landscape | Tracking the change in percentage of KBAs with official protection status using e.g. the World Database on Protected Areas (WDPA) database and requesting for information elsewhere |

| | Indicator | Level | Tool/ method |
|---|---|---|---|
| | Change in Management Effectiveness of Protected Areas/ KBAs | Site/ Landscape | The World Bank/ WWF Management Effectiveness Tracking Tool (METT). METT will be used to assess the % of sites being managed effectively and the mean % change in scores across sites between assessments. |
| | Change in number of threatened species with research and monitoring in place | Species | Assessment of species-related data collected using a species data request form |
| | Change in number and percentage of globally threatened species that have national protection status | Species | Review of relevant acts, policies, legal notices in Kenya and Tanzania |