

## **Biodiversity and Conservation of the Eastern Arc Mountains of Tanzania and Kenya**

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# **BIODIVERSITY AND CONSERVATION OF THE EASTERN ARC MOUNTAINS OF TANZANIA AND KENYA**

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Morogoro, Tanzania

1st-5th December 1997

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& E. Vanden Berghe

**Production editor:** L.A. Depew

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## **DEDICATION**

This conference volume is dedicated to the memories of Karanja Murira (1947–1998) and Christine Mrema (born Mmari) (1959–1997).

Karanja Murira was the Director General of TAFORI and chairman of the Eastern Arc Mountains Conference Planning Committee. His contribution to the realisation of the conference, and thus to these proceedings was immense. May he rest in peace.

Christine Mrema died in a motor accident while conducting field survey work for one of the papers presented in this volume. We hope that the final product serves as an acknowledgement of her achievements. May she also rest in peace.

## LIST OF DELEGATES

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## ACKNOWLEDGEMENTS

The Eastern Arc Conference was held in Morogoro, Tanzania, between 1 and 5 December 1997. It was attended by over 200 delegates from a wide variety of countries, representing biologists, resource managers and social scientists with an interest in the biodiversity and conservation of the mountain forests and associated human communities of the Eastern Arc Mountains of Kenya and Tanzania. The gathering was a great success with papers presented by experts from all over the globe to the assembled delegates. In addition 53 posters were exhibited and discussions held on a number of relevant subjects in six working groups.

Funding for the conference was provided by a variety of donors. Especially thanked in this regard are FINNIDA, DANIDA-ENRECA, the RSPB, Belgian Aid and NORAD. Collectively these organisations funded the main expenses of the conference and paid for the participation of a number of delegates. Considerable time and energy was committed before and during the conference by members of the Tanzania Forestry Research Institute (TAFORI), members of the FORST (Finnish Support for Forestry Research in Tanzania) Project, staff of the Danish Centre for Tropical Biodiversity (CTB) and the Zoological Museum in Copenhagen, and representatives of the National Environment Management Council, University of Dar es Salaam, Sokoine University of Agriculture, Tanzania Forest Department, the National Herbarium in Arusha, and the GEF programme in eastern and Southern Africa.

A Planning Committee held several meetings prior to the conference to oversee the development of the programme and planning of the main aims of the conference. A wide variety of Tanzanian Institutions was represented on this committee, and its members were K.K. Murira (Chairman), M. Nummelin, G.C. Kajembe, J. Salehe, L. Nshubemuki, U. Eerola, J.S. Mgoo, T.H. Msangi, A.W. Chihongo, M.L. Mhando, J. Saramaki, N.D. Burgess, W.A. Rodgers, K.M. Howell, P. Phillipson. A further Task Force, mainly of staff members of TAFORI, attended to the practical details of the conference organisation and its implementation. This group consisted of K.K. Murira, M. Nummelin, T.H. Msangi, L. Nshubemuki, M.L. Mhondo, A.W. Chihongo and N.D. Burgess.

Their efforts led to the good organisation of the conference and in particular the presence of the Vice President of Tanzania (Dr Omar Ali Juma), the Honourable Minister for Natural Resources (Mrs Zakia Meghji), and the Director of Forestry and Beekeeping (Professor S. Iddi).

An editorial committee made comments on the papers, and this edited volume. This committee consisted of the editors of this volume and Peter Phillipson, Lars Dinesen, Tom Romdall and especially Louis A. Hansen who read the entire proceedings twice and found many errors.

The guest editors, Tanzania Forest Research Institute (TAFORI) and the Journal of East African Natural History wishes to warmly thank the donors who made the production and printing of this issue possible. These are the FORST project (funded by FINNIDA) at TAFORI in Morogoro, the East Usambara Catchment Forestry Project (funded by FINNIDA) based in Tanga, and the Danish Centre for Tropical Biodiversity (based in Denmark) which allowed N. Burgess to spend much time on the editorial work.

## LIST OF POSTERS AND PAPERS PRESENTED AT THE CONFERENCE, BUT NOT WRITTEN UP FOR INCLUSION IN THE PROCEEDINGS

### Key-note presentations:

- Norden, L.G. Land use (changes) and effects on the water resource.
- Thomsen, J.B., N. Myers & R. Mittermeier. An overview of the biodiversity importance of the Eastern Arc Mountains in the global context.

### Posters:

#### *Biological posters:*

- Alstrup, V. The lichens of the Eastern Arc.
- De Meyer, M., M. Clifton & L. Lens. Entomological research in the Taita Hills I: Diversity and biogeography of butterflies.
- De Meyer, M., L. Lens & D. Gitau. Entomological research in the Taita Hills II: Syrphidae (Diptera) diversity in the forest fragments, a preliminary survey.
- Fridmodt-Møller, C. Distribution of African *Impatiens* and *Begonia*: Endemism and diversity patterns using WorldMap.
- Heinonen, J. & I. Zilihona. Looking for cheap, quick and comprehensive method to investigate the insect community.
- Honess, P.E. Galago diversity and distribution in the Eastern Arc Mountains, Tanzania.
- Jøker, D. The Udzungwa Scarp Forest Reserve.
- Klemens, M.W. The male nuptial characteristics of *Arthroliptides martiensseni* Nieden an endemic torrent frog from Tanzania's Eastern Arc Mountains.
- Klemens, M.W., A.M. Nikundiwe & L.S. Ford. Amphibian and reptile biodiversity of the Udzungwa Mountains National Park: Some preliminary findings.
- Lens, L. & M. De Meyer. The Taita Hills Project, a study on biodiversity and habitat fragmentation.
- Lyaruu, H.V.M. & L.B. Mwasumbi. The future of the Eastern Arc Mountains in Tanzania: a review on fragmentation and tropical forestry.
- Madoffe, S.S. The diversity of timber living beetles and their pest status in Kimboza Forest Reserve, Tanzania.
- Moshi, G. The influence of disturbance on status and regeneration rate of a selected forest in the Udzungwa Mountains.
- Mremi, J.D. The relationship between tree species abundance, slope and soil properties in the Udzungwa Scarp Forest in the Udzungwa Mountains.
- Msanga, H.P. & L. Uronu. Seed handling of some fruit-bearing trees in the Eastern Arc Mountains.
- Msuha, M. Important bird areas in the Eastern Arc Mountains.
- Mtika, J. NTSP activities in establishment of seed sources in the Eastern Arc Mountains.
- Mutangah, J.G. & W.M. Musila. Species endemism in Taita Hills: Diversity and distribution of rare and endemic species.
- Ogue, N. & R.O. Oketch. Small mammals research in the Taita Hills.
- Ruffo, C.K. NTSP seed sources in the Eastern Arc Mountains and economic importance of the seeds.

- 
- Schulman, L. & L. Junikka. A field guide to East Usambara trees.

*Social and management posters:*

- Gachanja, M. Integration of local institutions in management and conservation of forests: The case of Taita Hills forests.
- Kijazi, A.S., I.Y. Msovella, G. Anymike & F. Sabuni. Hima Programme, Hima, Tanzania.
- Kilahama, F.B., S.G. Johansson, M. Wambura & M. Kijazi. Conservation and the rural communities.
- Mkandi, S.H. & R.K. Kachroo. The hydrology of the Eastern Arc Mountains.
- Msangi, T.H., L. Norden, L.M. Mhando, C.K. Mabula, M.E. Shoo & C.F. Shangali. Reconnaissance survey of three hydrological monitoring areas in Chome Catchment Forest Reserve, South Pare Mountains.
- Msuya, T.S. & S.S. Madoffe. The effect of *Catha edulis* leaf harvesting: case of West Usambara Mountains, Tanzania
- Nandrie, J.S. Soil erosion control and agroforestry project.
- Sawe, C.T. & E.N. Nashanda. Amani nature Forest Reserve planning.
- Stephenson, P.J., P. Sumbi & E. Chengullah. Community conservation around Udzungwa Mountains National Park: TANAPA and WWF partnership.
- Tanzania Forest Conservation Group. Tanzania Forest Conservation Group.

## WORKING GROUP REPORTS

Within the conference time was devoted to allowing people to work in groups within defined discussion areas. The groups were as follows:

1. Status of remaining forest resource
2. Current Eastern Arc Forest Management structures
3. Non-timber forest products
4. Timber products
5. Forestry and Hydrology research
6. Biological research
7. Socio-economic issues and priorities for research

Reports are presented here from all these groups, with each following a similar format, and being of a similar length. In some cases this has meant considerable editing of the originally submitted text. The editors of this volume take full responsibility for any discrepancies that this approach may have caused in relation to what was originally intended to be conveyed.

### GROUP 1: STATUS OF REMAINING FOREST RESOURCES

This group aimed to further refine the available data on forest cover in the Eastern Arc Mountains. The group had access to relevant copies of the 1996 land cover vegetation maps (1:250,000 scale) produced by the Institute for Resource Assessment (IRA) at the University of Dar es Salaam for the Tanzanian Government (Ministry of Natural Resources and Tourism, 1996). These maps are based on satellite imagery from 1994-1995. A number of other satellite images (Landsat), and older 1:50,000 scale maps were also available, along with detailed maps of the forest cover in some mountains (*e.g.* in the East Usambaras). Use was also made of the many people present at the conference who had a detailed personal knowledge of the different mountain blocks, through either working there within the Kenyan or Tanzanian Government Forestry Division, or having conducted research there. The latter people came from many countries around the world.

#### Results

The group found that the classification of forest habitat on 1996 Land Use maps produced for the Tanzanian Government is insufficient for ecological and biological purposes. There is only one category of natural forest habitat, which includes coastal and riverine as well as montane forests. The classification is also flawed by some misinterpretations; some areas classified as forest (especially south and east of the Kibasira Swamps) are, according to on-the-ground knowledge, miombo woodland, bamboo-covered areas and even degraded bushland. Such problems are probably due to a lack of sufficient ground-truthing. Problems were also noted with the misalignment of protected area boundaries (national parks and forest reserves) with regard to other mapped features (for example some forest areas fell outside the reserve boundaries, when on-the-ground knowledge indicated that this was not so).

The group used its time to make adjustments to the Land Cover maps, using the different sources of information outlined above. A start on this process had partly been done in Copenhagen before the conference, so that the group could concentrate during the workshop on verification and compilation of further information from forests not known to Danish

research teams. Among the blocks, only East Usambara (EU) has been comprehensively classified and mapped both in 1988 and in 1993, so that there are complete land use maps (1:50,000, 1:25,000; 1:10,000) with a sub-classification of the forests (see references in Johansson *et al.*, this volume)

The group mapped the following finer subdivisions of forest habitat:

1. Montane, submontane and lowland/foothill forests (but only considering the lowland forests which can be associated with Eastern Arc fault blocks and disregarding the coastal forest formation),
2. Areas with an intact canopy, and of degraded or severely degraded forests (based on satellite imagery and personal knowledge),
3. Areas of montane cloudforest (as spongy, epiphyte-rich canopies are usually identifiable by a very saturated colour on satellite images),
4. Drier forest types, including semi-evergreen forests with *Euphorbia* trees etc.

Using the landcover map and the statistics for Forest Reserves in various reports, the group compiled a matrix (forest by forest) of total area, percentage of good and degraded forest habitat in montane, submontane and foothill zone, the biodiversity values and the management status (gazettement, managing authority, specific problems and in some cases a statement about urgency of corrective measures).

Based on this matrix and later adjustments, the total forest area is estimated to be 5,011 km<sup>2</sup>. However, this includes some large lowland areas where evergreen forest grades into miombo woodland or the two habitats form a mosaic, making any estimate of the evergreen forest habitat rather subjective. This estimate is fairly close to the 5,327 km<sup>2</sup> presented in Newmark (this volume), who included somewhat larger areas in Mahenge and along the Kilombero Valley in the forest habitat category. Our estimated area of montane forest of high quality was at least 1,560 km<sup>2</sup> and possibly as much as 1,900 km<sup>2</sup>.

#### Forest areas per highland (plus area of closed montane forest in parentheses)

Mufindi Scarp and similar secondary forests to Ulangambi	119 km <sup>2</sup>
Udzungwa Scarp Forest Reserve	230 km <sup>2</sup> (100)
Kisinga-Rugaro Forest	176 km <sup>2</sup> (ca 50)
West Kilombero F.R., incl. Ndundulu	550 km <sup>2</sup> (180)
Eastern Udzungwa N.P.	179 km <sup>2</sup> (131)
Image (Selebu Mountains)	106 km <sup>2</sup> (?)
Lowland/foothill forest around Kilombero/Kibasira	ca 800 km <sup>2</sup> (0)
Mahenge highland (evergreen forest)	40 km <sup>2</sup> (5)
Uluguru Mountains	248 km <sup>2</sup> (180)
Adjacent lowland/foothill forests	240 km <sup>2</sup> (0)
Uvidunda, Rubeho and Usagara Mountains	400 km <sup>2</sup> (ca 50)
Ukaguru Mountains	182 km <sup>2</sup> (100)
Nguru and Nguu Mountains	600 km <sup>2</sup> (> 130)
West Usambara Mountains	328 km <sup>2</sup> (240)
East Usambara Mountains	413 km <sup>2</sup> (235)
South Pare Mountains	333 km <sup>2</sup> (120)
North Pare Mountains (excl. dry forest)	151 km <sup>2</sup> (25)
Taita Hills	6 km <sup>2</sup> (4)

Particularly important areas from a water catchment point of view are Mount Shengena, Mazumbai-Vugiri Forest, Mafi Hill, Mount Nilo, Amani, Nguru Mountains and Kilindi, Mamiwa Mountains in Ukagurus, the eastern ridge of Ukwiva forest in the Rubehos, Uluguru Mountains, and Mamiwa Mountains, Mwanihana, West Kilombero and Udzungwa Scarp forests in the Udzungwa Mountains.

In addition to these areas of evergreen forest, the Eastern Arc Mountains have large tracts of woodland, some of them severely degraded by fire but others of good quality, and considerable areas of dry forest, especially in outlying mountains to the north and in the Great Ruaha Valley.

## **GROUP 2: CURRENT EASTERN ARC FOREST MANAGEMENT STRUCTURES**

This group was asked to look at the management structures that have a responsibility for the management of the Eastern Arc Mountains forests, and to assess their weaknesses. In recognition of the fact that projects with funding from outside Tanzania are a major contributor to forest conservation in these mountains, the group was also asked to assess the current projects operating in the mountains and to come up with some ideas on what makes a project likely to succeed and what makes it likely to fail.

The issues surrounding the management of forest reserves in Tanzania have been very fully discussed in Rodgers (1993), although since then there has been a new Forest Policy (1998). This allows for the first time much more involvement of the local communities in the management of Tanzania's forests, and also much more ability to make private companies responsible for the management of forest resources. The process of implementing this policy has just begun and many years are needed to make it fully operational in and around all the Forest Reserves in Tanzania, including those of the Eastern Arc.

### **Management problems**

One of the main management problems in the Eastern Arc is that there is currently no coherent strategy for the conservation and wise use of these areas. Within this main problem there are a number of issues that contribute to the problem. For example, there is a complex and uncoordinated administration and institutional framework for forest management in Tanzania. Three parallel administrative structures control forest resources from central, regional and local governments. Forest Reserves are found at all levels in this structure, but the lines of management control are not the same and ultimate responsibility rests with different Ministries. There has also traditionally been a general lack of ability or will to involve all stakeholders (especially local people), and probable lack of stakeholder priority and interest in biodiversity conservation. Further problems are that there are conflicts of interests over land and forest use in these mountains, there is a general lack of capacity and resources within government and community institutions, and there are problems with poor governance and lack of equity at many levels within society (including corruption).

There are a number of other problems that affect the management of the Eastern Arc forests. The first is the relationship between poverty and population increase—where the poorest communities typically have the highest population growth rates. In Tanzania and Kenya there are regular concerns over funding provided by the central government and by aid donors—without money management cannot be carried out. Until recently the forest policy mechanisms of Tanzania did not allow forest-adjacent communities to use the forests at all. Their actions within the forest were illegal (although frequent), and hence they had no

incentive to support the conservation of the forests—if they were cleared then it would actually be beneficial to their interests. The overall decline in the funding and capacity of the Forestry Departments of Kenya and Tanzania has also meant that the boundaries of the reserves are sometimes indistinct. This is a further management problem as a lack of boundaries means that it is difficult for anyone to know if they are able to farm or collect fire wood from an area. Also, such a situation can be used to the advantage of corrupt officials (who can log areas and then say that they thought they were outside the reserve), or local people (who can farm areas and say that they did not know they were inside the reserve). Maintenance of the reserve border is perhaps the most important management activity of all.

Successful implementation of forest management approaches in these mountains would also allow countries to meet their obligations towards the global convention for biological diversity (Biodiversity Convention). Improved management could also assist national economies (see Iddi, this volume). However, there is still much to learn in order to make forest management systems work in practice, and there is much experience to gather from other projects experience (especially East & West Usambaras, Pare Mountains and Udzungwas in Tanzania), and from the local people living around the forests themselves.

### **Which approaches failed or succeeded?**

Simplistically viewed the top-down approach of project interventions in the Eastern Arc have failed (*e.g.* East Usambara Catchment Forest Project Phase I, SECAP (West Usambaras) phases I–III). One problem was an over-strong focus on the reserved areas at the expense of simultaneously working with the communities. Probably a stronger intervention at the local level would have been more effective. However, the system of forest reserves in Tanzania is a strongly top-down system and the fact that most forest is now found within these reserves also indicates that the policy has considerable value, but that it needs to be modified to assist its survival as times change and populations grow.

It should also be noted also that a focus on the communities is not a guarantee of success. For example, an IUCN project ran for almost 10 years in Amani, East Usambaras, with a distinct focus on forest conservation and local community development. However, five years since the project stopped, evidence of its existence has faded away and there are no longer any signs of the intervention. The project operated using the principles of an Integrated Conservation and Development (ICD) project, which has been strongly advocated as the best avenue for conservation. Here the issue of sustainability stands out. The project developed its own structures and organisation and everything was paid through external support, at a rate that was much higher than the local norms. Once the funds were stopped, there was no longer any structure or organisation to sustain the work. There are a fair number of reports that, at the end of the lifetime of the project, tried to put it back on course. These could be useful reading for those who plan conservation interventions in the Eastern Arc.

Finding examples of successes that have been sustained over long timer periods is much more difficult, and only promising signs can be seen in some projects. However, even in these projects there is a strong reliance on external funds and the issue of sustainability is also highly relevant. Indeed, this problem could be applied to most forest conservation actions throughout Africa.

### **Possible reasons for failure**

Projects that use a top-down approach, *i.e.* a lack of involvement of the communities, have been shown to fail in most cases. Although this seems to be a general truth, the precise mechanisms are often different. Some of the reasons seem to be:

- Inadequate conservation awareness among some stakeholders,
- Inadequate baseline information/data,
- Inflexibility of policies,
- A lack of transparency in the project set up,
- A lack of sustainability, especially in terms of who will carry the work on when the project stops,
- The development of structures of management which are wholly within the project, and not linked to bodies which are likely to persist in an area in the longer term,
- Inappropriate, badly designed or implemented interventions.

### **What are the possible reasons for success?**

The possible reasons for success are more difficult to determine, especially as project interventions have not lasted for many years, and the whole philosophy of project intervention has been developing rapidly over the past 10 years. The things that can be said to work, might only be true while the funding is being provided. It is much more difficult to be sure about what will still work, say 10 years after a project has ceased to operate. This is the real test of success and there are almost no examples of it globally, and none from the Eastern Arc at the present time. The Catchment Forestry system under the Tanzanian Government Forest and Beekeeping Division is probably the most successful programme as the Forest Reserves generally exist after years of little funding, supported here and there by various donors. However, in modern Tanzania the pressure on Catchment Forestry has been to loose staff and reduce budgets. The management role of these authorities has also changed, with the emphasis being now on the involvement of the people and in genuine participation in the management of the forests. Hence, the lessons from projects trying to involve local communities becomes of even higher importance, as this has to happen and it has to be made to work if the forest resources are to survive, even within forest reserves.

Within the project culture the following are believed to assist the project success and the long-term sustainability of the results:

- Conducive project environment: staff motivation, incentives, training,
- Availability of inputs on time,
- Empowerment of stakeholders in the project cycle,
- Effective project management systems,
- A carefully constructed mission for the project intervention,
- The establishment of income-generating activities,
- Government/Political Commitment built into the projects in terms of resources,
- Community-based projects/initiatives,
- Use of locally available resources,
- Some project activities should be on a self-help basis,
- Capacity building to local partners,
- Establish sustainability indicators during the planning stage of all projects.

Different strategies are valid depending on *e.g.* different land tenure situations (*e.g.* forest reserves, nature reserves, national parks, local authority forest reserves, public land forests etc.).

Another major issue relating to the above is the role and capability of institutions; *e.g.* the Forest and Beekeeping Division has the mandate for the management of most of the valuable Eastern Arc forests because they are in forest reserves. Other institutional issues are the

incentives the institution and organisation provide for rewarding good work and ‘punishing’ bad work. And probably the most important issue is the financing. What means are there to secure financing (at least a minimal core funding) for conservation in the EA for those institutions with the major responsibilities? This is a highly critical question.

### **Overall management vision for the Eastern Arc**

This group also discussed an overall vision for the Eastern Arc, and the following was proposed: “The forest cover, biodiversity and catchment values of the Eastern Arc Mountains are maintained, together with a productive agricultural system which sustains human well being”.

One comment on the vision, but especially the strategies for its implementation is the following. The Eastern Arc is special and has global significance because of (1) the diversity of flora and fauna but especially (2) because of the high number of endemic species. We also know that most of this value is associated with or dependent on (primary) forests, and to a large degree to the sub-montane forests. Hence the aim, if we wish to preserve and protect those globally important biodiversity values, is to protect and focus on near-natural state forests. A considerable proportion of the forests of the Eastern Arc is found within forest reserves and hence is already awarded a level of legal protection. Much of these reserves are ‘catchment reserves’ and thus are primarily for water catchment, and not for timber production. However, the vision gives us clear guidance on where to focus efforts.

*Our long-term vision for the Eastern Arc would include:*

- (a) The maintenance of biodiversity values through:
  - No further loss and degradation of natural forest cover,
  - No loss of species or specialised habitats such as wetlands, montane grasslands, or elfin forest areas,
  - Rehabilitation of degraded lands.
- (b) Improved land management which:
  - Maintains soil fertility,
  - Maintains water flow and quality,
  - Allows productive and sustainable agriculture with an emphasis on increased tree cover.
- (c) An institutional framework which has:
  - Adequate stakeholder involvement,
  - An emphasis on increased local community participation.

### **List of projects working in the Eastern Arc Mountains**

Integrated Forest Conservation and Management—Taita, Box 20110, Nairobi or Box 1043 Wundanyi, Taita, Kenya.

Tanzania Forest Action Plan (TFAP) - North Pare, P.O. Box 195, Mwanga, Kilimanjaro - Tanzania.

Soil Erosion Control and Agroforestry Project (GTZ - SECAP), P.O. Box 72, Lushoto, Tanzania.

National Resources Management and Buffer Zone Development Programme, Box 85, Lushoto, Tanzania.

Tanzania Forest Conservation Group, Box 23410, DSM - Tanzania.

East Usambara Catchment Forest Project, Box 5869/1449, Tanga, Tanzania.

Establishment and support of Udzungwas National Park and Agroforestry Programme, WWF, Box 63117, DSM - Tanzania and TANAPA Mang’ula Tanzania.

SUA/SUSKEGEE - Udzungwas community forestry based conservation, Box (Dept. of Agric. SUA—Morogoro, Tanzania).  
 Hifadhi Mazingira Iringa (HIMA), Box 1187, Iringa, Tanzania.  
 Uluguru Mountain Agricultural Development Project (UMADEP), Box 3094, Morogoro - Tanzania.  
 National Tree Seed Programme (NTSP), Box 373, Morogoro.  
 Global Environmental Facility (GEF) new approaches to reduce the loss of biodiversity at cross border sites in East Africa - South Pare and Taita starting early 1998, Box 1041, Arusha.  
 Conservation of Forest Biodiversity Resources in the Eastern Arc Mountains (GEF)—planned project for Eastern Arc conservation (NEMC/FBD), focal areas planned for the East Usambaras and the Ulugurus.  
 Uluguru Mountains Biodiversity Conservation Project, WCST Morogoro Office, P.O. Box 312, Morogoro.  
 Morogoro Environment Conservation Action Group - MECA Group, Box 1686, Morogoro.

## REFERENCE

Rodgers, W.A. (1993). The conservation of the forest resources of eastern Africa: past influences, present practices and future needs. Pp 283–331 in Lovett, J.C. & S.K. Wasser (eds): *Biogeography and Ecology of the Rain Forests of Eastern Africa*. Cambridge University Press, Cambridge.

## GROUP 3: NON-TIMBER FOREST PRODUCTS IN THE EASTERN ARC MOUNTAINS

This group was asked to review the resource diversity (non-timber forest products) found in the Eastern Arc Mountains, and to identify the various stakeholders involved in their use. The group was also given the task to identify the current management approaches of non-forested slopes of the Eastern Arc Mountains, with emphasis on their successes or failures and possible reasons for both cases.

### Results

The group managed to identify the existing publications, useful plant species (medicinal, food plants, fibres, dyes, ornamentals) from the Arc Mountain Forests and the main groups of stakeholders as requested. Management initiatives in buffer areas to the Eastern Arc Mountain Forest Reserves were also identified and lessons derived from experience were noted for the use of natural resource managers. In the process about 21 publications on useful plant species of the Eastern Arc Mountains were identified and 37 different uses of various non-timber forest products found on 10 Arc Mountain blocks were recorded. However, data were not available at the time of the conference for the Nguru, Nguu, Ukaguru and Mahenge blocks.

Medicinal values of forest plants were given a special attention because traditional medicines are often cheaper and easier to access for the local people, than western medicine. An example was given of a 100 diseases and symptoms which were reported to be cured or treated in N.E. Tanzania (MSc thesis of Msangi from 1991). Medicinal plants were also considered a genetic resource, for example *Cinchona algeriana* or 'quinine' used in Amani for treating malaria. This medicinal tree is exotic but is of wide utilisation. There are also natural herbs used for cancer treatment in the Pares. In Tanga Region, N.E. Tanzania, there

is a Health Working Group composed of a local Non Governmental Organisations and traditional healers who work to treat AIDS-related diseases. Traditional herbalist's skills were also documented.

Generally, it was noted that non-timber forest products were under threat, due to conversion of forests and the disappearance of traditional knowledge and values. Some of the threatened species in the Eastern Arc Mountains were noted as *Osyris lanceolata* (sandalwood, which is a medicinal and cosmetic tree species, threatened by extraction in North and South Pare Mountains and the West Usambaras); *Saintpaulia* species (African violets) which are commercially collected in the Taitas; *Catha edulis*, a natural drug over-collected in E. and W. Usambara Mountains; 10 other plant species in the W. Usambaras threatened by exportation, five of which are being excessively harvested and exported to the United States of America. Mammals and birds from the Pares, Ulugurus, Udzungwas and W. Usambaras were also noted as facing high threats especially the duikers, hyraxes, and leopards. Major stakeholders were identified as adjacent communities and non-adjacent communities in the Eastern Arc Mountains, Government sectors and International communities.

A total of 22 organisations were identified who are carrying out joint forest management ventures in the Eastern Arc Mountain slopes buffering the gazetted areas. Management approaches were grouped as involvement (empowering) of local communities in the management of the biodiversity, provision of more benefits to adjacent communities, evaluation, awareness and sensitisation of local people on environmental conservation and transparency. The top-down approaches practised in the East Usambara Catchment Forest Project Phase I, SECAP Phases I-III were considered to have failed, but the North Pare TFAP-Community Improvement Project was identified as showing significant success. Other successful forest management ventures included the East Usambara Catchment Forest Project Phase II, The new SECAP approach and the Udzungwa Conservation Projects within the HIMA programme. Reasons for the successes were given as conducive project environment including staff motivation, incentives and training; timely availability of inputs; empowerment of stakeholders in the project cycle and finally effective project management.

Possible reasons for the failures were identified as lack of transparency and involvement of adjacent communities; inadequate conservation awareness among some stakeholders; inadequate baseline information and data as well as inflexibility of some of the policies. Gaps and opportunities were identified as inadequate data, especially on economic values, quantification of the effects of use of non-timber forest products on the forests, as well as collaboration between traditional healers and the Muhimbili Traditional Medicine Research Centre. Repatriation of knowledge back to Tanzania, including on Non-Timber Forest Product (NTFP) uses was considered important. Joint forest management ventures to assist the sustainability of the harvesting of NTFP products was also recommended.

#### GROUP 4: TIMBER PRODUCTS

The group aimed to assess the level of logging and how it is controlled. Two types of logging are being practised in the natural forests of the Eastern Arc, namely legal and illegal. The former being done in the East and West Usambaras, Nguu, Ulugurus and Mahenge escarpment. Whereas the later is common in the Pares, Usambaras, and Ukaguru Mountains and likely in the Nguru, Rubehos, Ulugurus, Udzungwas and Mahenge mountains.

The group also considered the current forest management but this was hindered by the general lack of data on illegal logging with the exception of the Frontier-Tanzania (NGO)

surveys in the East Usambaras and confiscation records of forest officers. Logging is not permitted in Forest Reserves and by permit only in the public land. It was recommended that commercial logging should not be permitted due to lack of knowledge of forest dynamics and inability to control extraction of timber and timber products. It was emphasised that the key problem in forest management is how to measure sustainability of the Eastern Arc forests.

In order to control extraction volumes, there is need to: issue logging permits, carry out patrols, set up check points on roads; train forest officers at SUA in extension work; pay financial incentives to informers on illegal logging and to create woodlots and tree planting on farms that would reduce pressure on the natural forests of the Eastern Arc Mountains. Reasons stated for illegal logging include corruption, lack of equipment and resources to ensure effective patrolling; low number of staff, low salaries of staff; lack of co-operation between forest officers and villagers; lack of communication facilities and lack of education and information sharing among forest officers and forest managers.

Agents of illegal extraction were identified as: businessmen from urban areas, village governments, Forest officers working in the Eastern Arc mountains, army people, high forestry personnel, missionaries and free lance operators. In order to portray the actual situation there is a need to gather and provide hard data on the illegal extraction of timber.

The timber markets (legal) are found in urban centres such as Arusha, Dar es Salaam, Moshi, Morogoro, Zanzibar and Iringa. Here the building and furniture industries are quite large and hence there is a considerable demand for wood. Timber from the Eastern Arc Mountains also finds a ready market overseas in countries such as Italy, Germany, Japan and various Middle Eastern countries.

The group recommended measures to reduce illegal extraction. These are:

1. Increase the number of trained Forestry Division staff and provide them with adequate equipment.
2. Increase staff salaries so as to reduce corruption and in certain cases ensure tougher disciplinary actions on corrupt staff.
3. Carry out staff restructuring and create conditions for the better co-ordination of activities.
4. Train staff in Participatory Resource Appraisal, biodiversity conservation and community involvement in forest management.
5. Involve communities in the management of forests by educating and involving them, by establishing woodlots and buffer zone farm forestry, and by giving incentives to informers and through the creation of village Forest Reserves.
6. Maintain Forest Reserve boundaries.
7. Ban the transportation of forest products at night, nation wide from 6 p.m. to 6 am.
8. Sensitise transporting agencies on issues surrounding forest products.
9. Issue shorter duration logging permits.
10. Review royalties in light of the market values for products.
11. Prepare management plans for individual forest blocks.
12. Privatisise productive forest through the parastatals or other agencies.
13. Introduce alternatives to forest products on the open market.
14. Promote the use of sun-dried mud bricks instead of timber in rural house construction.
15. Increase and promote the use of fuel-efficient stoves.
16. Promote the use of treated timber in the construction industry with a view to reduce annual removals from the forest.

## **GROUP 5: FORESTRY AND HYDROLOGY RESEARCH**

The group considered issues and recommendations arising from the Tanzania Forestry Research Master Plan (1992) and the proceedings of the TAFORI workshops on setting forestry research needs and priorities (1996, 1997). Research areas considered were those with relevance to the management of the Eastern Arc forests and the conservation of biodiversity, and which could be undertaken with available resources.

The priority research areas were a) natural forest tree communities, b) natural regeneration processes in the natural forests, c) the growth and yields of the various timber species in the Eastern Arc forests, d) the influence of forests on the generation of water supplies and the volume of water flowing from the Eastern Arc forests, and e) the gathering of relevant management lessons. From this list the group defined areas specific to the Eastern Arc forests where research is most required. It also identified important organisations and institutions in Tanzania, which could collaborate with TAFORI in undertaking this research.

For each of the highest priority research areas identified, an outline of the required research was prepared. These outlines are presented below.

### **Inventory of plant communities in Eastern Arc Mountains**

Within this programme it is proposed that the plant communities (in general) and forest tree communities of the Eastern Arc Mountains need to be described. This aspect of the research was regarded as particularly important for TAFORI scientists. A second theme within this subject is that of biodiversity of the Eastern Arc forests, in particular the numbers of endemic plant species in different forests and the fragile or threatened areas which are a priority for conservation. It was also regarded as important within the context of the current situation in Tanzania that all available literature on forest research in Tanzania, in particular on the Eastern Arc forests, is available in Tanzania so that local researchers have a source within which to place the context of their own work.

The group considered that the primary responsibility for forest research in Tanzania should be with TAFORI. Collaboration with other researchers, particularly with botanists, forest ecologists, zoologists and geographers could be sought from UDSM, SUA, Traditional Medicine Research Institute, FBD and TANAPA.

### **Development of criteria to demarcate production and protection areas**

For proper management of the Eastern Arc forests it is necessary to have clear cut guidelines as to where, when and how various activities can be carried out. Areas for strict conservation and those where harvesting is allowed have to be earmarked. The type and intensity of harvesting must also be specified.

The primary responsibility for demarcation falls to the Forestry and Beekeeping Division (FBD) whereas the research responsibility falls on TAFORI.

### **Studies on abiotic and hydrological processes in Eastern Arc natural forests and specifically to study the contribution of cloud forests to overall hydrology**

Many of Tanzania's most important rivers and sources of water for urban populations have their headwaters in the Eastern Arc Mountains. Hydrological processes are complex and dependent on many interacting factors as well as the scale at which problems are assessed. In order to contribute to the management of the Eastern Arc catchment forests it is important to study hydrological processes and the role of cloud forests in the maintenance of important water flows from the mountains. Particular emphasis should be placed on the role of cloud

forests in maintaining dry season flows of water in the various important rivers.

Research findings in the field will enhance development of management plans for the department of water and TANESCO. Potential research partners in Tanzania are UDSM - IRA, Dept. of Geography and Dept. of Water Resources Engineering.

A related research area is to study the effects of farming riverine forest strips in the Eastern Arc Mountains. Such practices have a potentially serious effect on forest hydrology and ecology, but this is not well known.

### **Sustainable management and utilisation of natural forests**

In order to conserve the Eastern Arc forests, we must consider who are the users, what products and values they get from the forests and match them with the natural regeneration potential of the species used. At the moment research on natural regeneration of the most commercially used timber species is being undertaken by TAFORI. The species involved are *Ocotea usambarensis*, *Cephalosphaera usambarensis*, *Milicia excelsa*, *Khaya anthotheca*, *Podocarpus* spp and *Juniperus procera*. In addition to knowing the regeneration rates and rates of productivity of the various timber species in the Eastern Arc, further research also needs to be undertaken on the most suitable timber harvesting methods for the Eastern Arc forests.

Further important research elements are the determination of the role of natural fires, animals and grazing on the ecology of the forests.

Another important aspect of this research is to find out more about the artificial propagation of Eastern Arc forest tree species. It is particularly important for the threatened endemic species as this knowledge could provide a safeguard to their continued existence.

A further related and important forestry research area is to find out as much as possible about community and farm forestry as the deforestation rate undergoing in the country indicates that this is a very high priority area for detailed research.

For all these research areas, collaboration should be sought with other forest researchers, in particular at the Sokoine University of Agriculture, and for seed propagation at the National Tree Seed Project in Morogoro.

## **GROUP 6: BIOLOGICAL RESEARCH**

The biological research group agreed that there are needs for both pure and applied research in these mountains. The concept of the 'Eastern Arc' arose from pure research, but applied research is needed to formulate appropriate management actions.

### **Research on human impacts in the Eastern Arc**

Detailed data are not available on the ecological effects of alteration and/or removal of forest resources in the Arc. Furthermore, although there have been many suggestions as to possible sustained use of natural resources in these mountains, little if any basic biological data exist to suggest what levels of use might be possible without reducing biodiversity values at the species, population and ecosystem levels.

The following needs were identified:

- Research that addresses possible sustainable levels of utilisation of specific resources and species, including the development of alternatives to current uses of natural resources such as afforestation, income generation through ecotourism, sale of edible plants, butterfly farming, and others.
- Investigations should also be made into the possibilities of mitigating the loss or

reduction of biodiversity through developing suitable techniques for restoration ecology in the Eastern Arc.

### Process studies in ecology

The need for studies in key areas of ecology was noted, *e.g.* autoecology (reproductive biology, environmental requirements of species, and species-species relationships); population biology (gene flow and dispersal, fragmentation and dispersal, demographic features and evolutionary processes) and community ecology (community responses to environmental changes).

Specific suggestions put forward as to how research should be carried out included:

- There is a need for co-ordination between and within studies on different taxonomic groups.
- When feasible, studies on different groups should be conducted at the same place and time; there is a need to choose representative sites on which to concentrate studies of different processes; to study functionally different taxa (*e.g.* vagile vs non-vagile); and to consider studying not only rare and endemic taxa, but also more common species.
- It was also noted that in addition to field and observational approaches, there was a need for experimental studies designed to test hypotheses.

### Taxonomic, species-oriented research

An Eastern Arc research co-ordinating body or steering committee for taxonomic research needs was suggested. This would not create more bureaucracy, but would work within existing institutional frameworks and structures to encourage and facilitate research. Such a group could also develop mechanisms for the development and maintenance of an electronic database with a web page on the Eastern Arc Mountains.

The East Usambara Catchment Forestry Project has addressed issues such as the compilation of digital species and bibliographic databases of existing information, including topographic, aerial photography and remote sensing landscape data (forest reserve sizes, boundaries, vegetation, land use etc.). However, compilations of such data are either lacking (Pares, Ngurus, Ukagurus, Rubehos, Mahenge), or only partially completed (Ulugurus and Udzungwas) elsewhere in the Eastern Arc.

The need was also expressed for a compilation of existing information on past as well as present studies (published and unpublished) in the Eastern Arc Mountains. This database would serve to identify gaps in knowledge and allow the planning of more effective future research. The production of an Eastern Arc Mountains database of taxonomic research and issues was also suggested as something that could be completed within a couple of years.

Attempts to prioritise various areas of the Eastern Arc proved difficult. However, it was recognised that the northern Nguru, Ukaguru, Mahenge and Rubeho were among the least known biologically and were in great need of survey and baseline studies. However, in the Eastern Arc 'well known' is very relative, and new species of vertebrates are still being discovered in the East Usambaras as well as the Udzungwas. Furthermore, recent finds in the Taita Hills have indicated the presence of taxa formerly thought endemic to the Tanzanian portion of the Arc. The absence of taxonomic keys for many groups, and field guides and distribution maps for almost all, were cited as factors seriously limiting knowledge on biodiversity. The general lack of curatorial ability at the institutional level at Museums and Universities in eastern Africa was cited as another seriously limiting factor to locally based research. Related to this was the scarcity of taxonomic specialists at all levels, from parataxonomists to those with more formal academic training. Taxonomy as a subject is often not taught, or taught with very few of the necessary resources. There is a general dearth of career opportunities for the few existing taxonomists within museums, government

departments and biological surveys. These factors all reduce the attractiveness of taxonomy as a career choice for younger biologists.

### **Bureaucratic issues relating to research in the Eastern Arc Mountains**

In Tanzania, all members of the group felt that there was a need to rationalise and streamline the fee structure related to research conducted in Tanzania.

In the past, a single research clearance fee paid to the Tanzania Commission for Science and Technology (COSTECH) was sufficient for workers from outside Tanzania. Currently however, a fee per person per night is being charged by the Forest Division for any researcher spending the night in a forest reserve. More recently, some researchers have also been required to pay fees to the Serengeti Wildlife Research Institute (SWRI). It is recommended that these fees be rationalised and their purposes clearly explained; a mechanism permitting a single payment to COSTECH would greatly simplify matters and prevent loss of time and money for all concerned.

### **Monitoring**

Monitoring allows the detection of changes over space and time, and provides opportunities for warning of changes in species and ecosystems. It further allows an objective evaluation of the effects of utilisation as well as management and conservation activities.

Monitoring is required at population, community and landscape levels, and needs to be done in all habitats in the Eastern Arc Mountains, not just forests. Long term processes and land use also need populations need to be monitored. It should be possible to standardise techniques in the Arc for monitoring of relative abundance, growth rates, and changes in species composition.

It was noted by the group that monitoring is taking place in the East Usambaras at the community, population and landscape levels and experiences there should prove useful in the establishment of monitoring programmes elsewhere in the Eastern Arc.

Priority for monitoring should be given to the Udzungwas because of the relatively large area of forest and the fact that some relatively pristine habitats are still found there.

Monitoring needs to be an integral part of management, and must involve not only biological, but also, social and economic aspects. However, it was also noted that monitoring requires long-term commitment in terms of person power and funds, and that these may not be easily forthcoming at the present time.

### **Recommendations**

One of the focal points of research in the Eastern Arc Mountains should be that of human impacts and possible sustained use of natural resources.

Research in key areas of ecology is needed and should also include experimental studies and modelling.

A suitable group is needed to compile existing information on the Eastern Arc Mountains, and to maintain this in an electronic form suitable for fast access.

While areas such as the northern Nguru, Ukaguru, Mahenge and Rubeho are among the least known and therefore in need of survey, considerable further research is needed in all of the Eastern Arc Mountains before we can be sure that we know what is actually there.

Strengthening the institutional ability of countries within the Eastern Arc Mountains to collect, maintain, and identify and analyse the results of biodiversity surveys is an urgent need.

The lack of taxonomic training at all levels needs to be rectified by the development of training courses and continued support to existing university training programmes.

Financial support is needed for the production of field guides, which are lacking for almost all animal and plant groups.

Provisions for long-term monitoring need to be put in place in both disturbed and undisturbed areas of the Eastern Arc.

The bureaucracy related to obtaining appropriate research permits needs to be streamlined, as does the fee payment.

## **GROUP 7: SOCIO-ECONOMIC ISSUES AND PRIORITIES FOR RESEARCH**

The work of this group was focused on the identification of key issues needing to be addressed, with some details of what needs to be done to solve them.

### **Key issue one**

Local socio-economic studies should be placed in wider historical and political contexts, and be based on a good knowledge of existing work.

#### *Rationale*

Participatory appraisal (PA), household socio-economic surveys and resource-use studies are often carried out for conservation and development purposes. The usefulness of these is limited without a proper understanding of local social institutions and political structures, and how these have arisen.

#### *Research priorities*

- a) Studies of local social institutions and political structures should be carried out when conservation and development activities are undertaken at Eastern Arc sites, in particular to make PA, household and resource-use studies of more use.
- b) An annotated bibliography of existing socio-economic, political and historical information should be prepared for the Eastern Arc Mountains.

### **Key issue two**

Systems of resource ownership, tenure and decision-making, and their possibilities for evolution should be determined at national and site levels.

#### *Rationale*

Ownership, tenure and decision-making structures at all social levels (national, regional, village, household) are vital elements in how natural resources are managed.

#### *Research priorities*

- a) National level. The implications of national policies relating to land-use and resource-use on the Eastern Arc Mountains should be studied and modifications recommended where considered desirable.
- b) Site level. Local ownership, tenure regimes and decision-making processes should be investigated when conservation and development initiatives are undertaken.
- c) Site level. There must be genuine involvement of local communities in decisions about environmental management, especially forest users. This should be the case whether management is in the hands of communities alone or under joint management involving forest users and agencies (parks, forestry).

**Key issue three**

There should be a focus on key links between social and natural systems at site level.

*Rationale*

This is vital if development activities are to have much influence on forest conservation.

*Research priorities (site level)*

- a) Focus research on those social groups within the community who actually use forest resources (for own use or trade). All their values of forest resources must be considered.
- b) Market chains for forest products (including economic values at different stages) should be studied.
- c) Studies should be undertaken of the sustainability of use of different forest resources and recommendations made for changes in management, if necessary.
- d) Research should be undertaken relating to the evolution of management agreements between communities and agencies.
- e) Within the context of sustainable sourcing, new products and value-added processes should be promoted at community level, aimed in particular at benefiting established forest users.

**Key issue four**

Ways should be sought of engaging educational and religious institutions in conservation.

*Rationale*

The effectiveness of management systems depends partly on values and knowledge gained in educational and religious fora.

*Research priorities (site level)*

- a) The effectiveness of existing environmental awareness and educational programmes should be studied and recommendations made for improvements where necessary (e.g. inclusion of local knowledge about the environment in school curricula). (b) Non-material values of forests should be analysed and followed up with collaborative work with members of both local and universal religious institutions present within communities.

**Relevant publications**

People and Plants Working Papers (available from Division of Ecological Sciences, UNESCO, 7 Place de Fontenoy, 75352 Paris, Cedex 07 SP, France).

Cunningham, A.B. (1993). *African medicinal plants: setting priorities at the interface between conservation primary health care*. People and Plants Working Paper No. 1. UNESCO, Paris.

Cunningham, A.B. (1993). *Sustainability of harvesting Prunus africana bark in Cameroon: a medicinal plant in international trade*. People and Plants Working Paper No. 2. UNESCO, Paris.

Cunningham, A.B. (1996). *People, park and plant use: recommendations for multiple-use zones and development alternatives around Bwindi Impenetrable National Park, Uganda*. People and Plants Working Paper No. 4. UNESCO, Paris.

Wild, R.G. & Mutebi, J. (1996). *Conservation through community use of plant resources*. People and Plants Working Paper No. 5. UNESCO, Paris.

Martin, G.J. (1995). *Ethnobotany*. Chapman and Hall, London.

People and Plants Handbook issues (available from UNESCO, address as above).