

Lakeside

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The Quarterly Newsletter of the
Lake Tanganyika Biodiversity Project
UNDP/GEF/RAF/92/G32



Table of Contents -

Foreword	2
LTBP Visits Lake Malawi Wrap-Up Conference <i>by Gaspard Ntakimazi & Muderhwa Nshombo</i>	3
Pollution in the Tanzanian Waters of Lake Tanganyika <i>by Francis M. M. Chale</i>	4
BIOSS Training in Taxonomy <i>by Alexis Bashonga</i>	5
BIOSS Team Surveys Mahale Mountains National Park <i>by Bakari Mnaya</i>	6
LTBP's MTE & TPR: Summary of Main Conclusions & Recommendations	8
LTBP's MTE & TPR: Project Co-ordinator's Comments <i>by Andy Menz</i>	9
LTBP's MTE & TPR: UNOPS' Response <i>by Margaret Chi</i>	9
Space - The Final Frontier: The Role of GIS in LTBP <i>by Alan Mills</i>	10
World Environment Day in Burundi <i>by Cécile Gakima</i>	12
LTBP News	13
Calendar of Progress & Upcoming Events	14

'Pollution Control & Other Measures to Protect Biodiversity in Lake Tanganyika'
'Lutte contre la pollution et autres mesures pour
protéger la biodiversité du lac Tanganyika'

UNDP/GEF/RAF/92/G32

Foreword

Throughout the last months we have been busy analysing the report of the mid-term evaluation (MTE) of LTBP. The report was carefully considered at all levels of the project, namely: the technical special studies, the national working groups, the LTBP management consortium, the Steering Committee and finally, the donors and executing agency. Representatives from all these groups met in Nairobi from 25-27 May 1999 for a Tripartite Review to discuss their findings. These discussions are summarised in this issue of *Lakeside*, in reports from the Project Co-ordinator and UNOPS, together with a summary of the principle recommendations from the MTE report that were accepted by the meeting.

Other articles in this issue deal with regional project activities, including: a report from the LTBP delegation sent to Malawi to attend the wrap-up conference of the Lake Malawi/Niassa Biodiversity Project; the pollution special study activities in Kigoma Bay; biodiversity special study activities carried out by a regional team, including an intensive taxonomic training course and a survey of Mahale Mountains National Park in Tanzania; news about the GIS which will be installed in the region in November, and finally, an account of Burundi's efforts to commemorate World Environment Day.

Finally, please do not hesitate to forward articles for the next edition of *Lakeside* to the Project Co-ordination Unit. We look forward to receiving your input!



-Andy Menz
Project Co-ordinator

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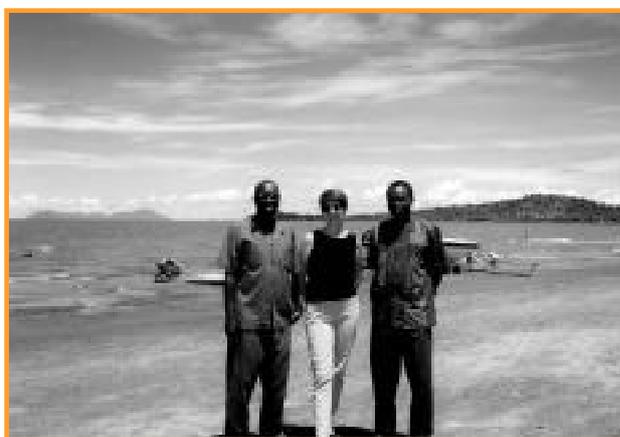
LTBP Visits Lake Malawi for Wrap-Up Conference

by Gaspard Ntakimazi and Muderhwa Nshombo

A delegation from the Lake Tanganyika Biodiversity Project (LTBP) participated in a conference from 4-5 March 1999 organised by its sister project on Lake Malawi/Nyassa. The delegation, led by Dr A. Menz, LTBP Co-ordinator, also included Dr K. West, LTBP Scientific Liaison Officer; Dr F. Chale, PSS Co-ordinator for Tanzania; Dr M. Nshombo, BIOSS Co-ordinator for DR Congo; Dr G. Ntakimazi, BIOSS Co-ordinator for Burundi; and Mr L. Mwape, PSS Co-ordinator for Zambia.

Called Nyassa in Tanzania and Niasa in Mozambique, Lake Malawi has its largest area in the country which bears its name. Formed under similar conditions as Lake Tanganyika, i.e., as a part of the East African Rift, Lake Malawi is also a centre of interest for both the riparian populations and the international scientific community because of the extraordinary diversity of its fauna.

The SADC/GEF Project for Conservation of Biodiversity in Lake Malawi started in 1995 and ended in July 1999. Before winding up, the Project Management organised an international conference on the present state of knowledge about the lake. This was an opportunity to publicise project results and outputs and include a larger group in the deliberations over future projects for Lake Malawi.



Drs. Gaspard Ntakimazi, Kelly West, and Muderhwa Nshombo at Senga Bay, Malawi

After the opening ceremony chaired by the Malawian Minister for Forests and Fisheries, the Project Co-ordinator, Mr Tony Ribbink, presented an overview of Lake Malawi and the main research activities carried out so far within the project.

Using varied means such as sampling surveys on the lake for different studies, aerial observations, and remote sensing, the project completed a tremendous amount of research, and presented unique results in the fields of fish taxonomy and systematics, ecology of coastal and benthic fishes, and limnology and lake water quality. Activities were also undertaken in the fields of 'training and awareness' and environmental education

within the riparian communities to promote conservation of the biological riches of the lake, in order to fight poverty and promote tourism.

The scientific presentations that followed were grouped into five themes:

Systematics and Taxonomy of Fishes (8 presentations).

It was revealed that about 300 species of fish have been identified and studied to date, but that an enormous amount of work remains, as the lake is expected to host about 600 species.

Ecology of Coastal and Benthic Fishes (4 presentations). Current knowledge, again, covers only a limited area of the lake and only the most common species in the captures. Much work remains to be done.

Education and Implication of Riparian Communities (4 presentations)

Limnology and Water Quality (11 presentations).

Researchers from the Canadian Centre for Inland Waters conducted many of the studies in this theme. One result of particular interest was the noted change in the composition of algal communities toward a less desirable species indicative of a reduction in water quality.

Geography and GIS Applications (6 presentations).

This theme received most of its contributions from researchers belonging to the Centre for Earth Observation Science of Canada.

After the scientific presentations, the delegation from Lake Tanganyika was able to visit the project laboratories, library, and fish collections. The Biodiversity Conservation Project for Lake Malawi has different objectives than those of our Lake Tanganyika Project. While LTBP essentially aims at establishing a regional programme for long term management of the lake by formulating a legal framework and a Strategic Action Programme (SAP) to conserve and maintain biodiversity in the lake, the Lake Malawi Project has consisted mainly of carrying out scientific research for a better knowledge of its resources.

Whereas LTBP contracts national institutions to execute work programs, the majority of work in the Malawi project was conducted by teams of expatriate researchers with African counterparts. The African counterparts were receiving on-the-job training and in many cases conducting research for graduate degrees.

In discussions on the objectives for a second phase of the Lake Malawi Project, it was noted that, similar to LTBP, they will move more towards targeting local stakeholders in the management and conservation of the lake's resources.

Dr. Gaspard Ntakimazi is a professor of biology at the University of Burundi. Dr. Muderhwa Nshombo is Directeur Général of the Centre de Recherche en Hydrobiologie at Uvira. They are the National Co-ordinators for the Biodiversity Special Study in Burundi and Congo, respectively.

Pollution in the Tanzanian Waters of Lake Tanganyika

by Francis M. M. Chale

Pollution can be defined as the anthropogenically accelerated inputs of plant nutrients, organic components of sewage, heavy metals, pesticides, and compounds likely to stem from oil exploitation and shipping. The LTBP Pollution special study sets out to identify the sources, trends, and impacts of such inputs.

Owing to its large size and volume, one might not expect Lake Tanganyika's water quality to be affected by human activities. However, the increasing pace of agricultural activities in the lake catchment, the tendency to cultivate on steep slopes bordering the lakeshore and the inflowing rivers, and the use of fertilisers and pesticides, all contribute to the deterioration of the lake's water quality. Shipping and industrial activities in the catchment also represent potential sources of pollution to the lake.

Pollution studies in Tanzania have centered on Kigoma Bay. The bay is shallow and on its eastern side are located ship docks, oil storage facilities and an oil jetty. The TANESCO power plant is situated on the south-western side of the bay. These industries and others have been shown to be having a significant effect on the water quality of Kigoma Bay.

Agro-chemicals : The amount of the agro-chemicals used in the lake's catchment on the Tanzania side is little. Rukwa Region, for example, used an average of 4963 tonnes of fertilisers annually between the 1991/92 and 1996/97 growing seasons, 5.40 tonnes of pesticides and herbicides, and about 3160 litres of chemicals, per year. Most of the chemicals (between 43% in 1991/92 and 92% in 1996/97 growing seasons) were used in Mpanda District which is not a part of the lake's catchment. Kigoma Region uses far less agro-chemicals than Rukwa Region. It can therefore be safe to say that there is hardly any pollution in the lake coming from agricultural run-off.



Stanislaus Muhoza working with pollution samples at the Kigoma Station, Tanzania

Shipping and Harbour oil spills : Kigoma town is at the terminus of the Central rail line. It handles goods for Burundi and the eastern part of the Democratic Republic of Congo. Mixed dry cargo and oil products pass through the harbour. Between 1992 and 1997 there were an average of 345 ships and 556 wooden boat rotations, respectively, per year. The amount of oil products exported through the harbour averaged 18,520 cubic metres

annually between 1995 and 1997. Studies on bottom-dwelling organisms in the dock area showed the presence of oil in the sediments and, probably as a direct result of this, the absence of live macro-invertebrates, such as snails, which are very sensitive to oil pollution.

Power generation : For a long time, it has been observed that waste oil from the Tanzania Electricity Supply Company (TANESCO) has been flowing into the lake. It is not uncommon for a substantial oil slick to be seen covering extensive areas including the town's water intake. In several areas, there are permanent pools of oil on the shore.

Human settlements : Kigoma town has a population of about ninety thousand people. These people depend on the lake as a source of domestic water, fishing and bathing. Also, for many people, Kigoma bay is used as a recipient of their domestic wastes including sewage. The current levels of plant nutrients (nitrogen and phosphorus) in the bay is higher compared to the open waters. For example, nitrogen and phosphorus levels in the bay average 54 $\mu\text{g/l}$ and 16 $\mu\text{g/l}$, respectively. In the open waters



Dr. Francis Chale preparing water samples for analysis at the Kigoma Station, Tanzania

the levels for the two nutrients average 47 $\mu\text{g/l}$ and 7.1 $\mu\text{g/l}$, respectively. Similarly, plant biomass in the bay is higher (2.20 $\mu\text{g/l}$ chlorophyll *a*) compared to the open water (1.59 $\mu\text{g/l}$ chlorophyll *a*). In the bay, the water is green, leading to a low water transparency (average 4.54 m), while the open waters are much more transparent (average 11.14 m).

From the above, it can be concluded that for the Tanzanian coastline, agriculture currently poses little threat to Lake Tanganyika. The only place which can be considered to be polluted is Kigoma Bay, which is heavily impacted by oil, oil by-products and domestic wastewater. The use of untreated water from the bay may thus be considered a health hazard.

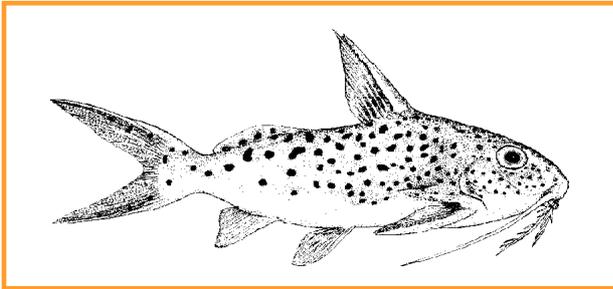
Dr. Francis Chale is the LTBP Pollution Special Studies Co-ordinator for Tanzania.

BIOSS' Training in Taxonomy

by Alexis Bashonga

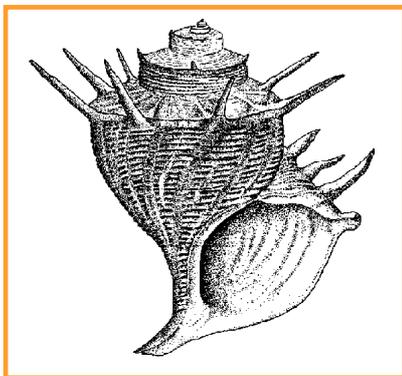
The Biodiversity Special Study (BIOSS) teams from the four Tanganyika riparian countries participated in a regional training course in fish and mollusc taxonomy organised by the Lake Tanganyika Biodiversity Project in Kigoma, Tanzania from 10-18 March 1999.

The taxonomic training course directly followed a SCUBA dive training course in which eight new divers, two each from Burundi, DR Congo, Tanzania, and Zambia, joined the BIOSS team to reinforce its existing capacity. All BIOSS team members then participated in the taxonomic training course designed to improve their skills in identifying fishes and molluscs. The course was co-ordinated by Richard Paley, the BIOSS facilitator, and taught by Drs. Gaspard Ntakimazi, Muderhwa Nshombo, and Kelly West.

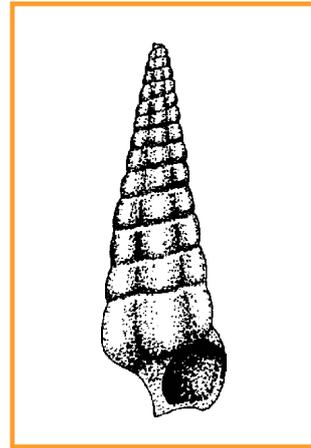


Synodontis multipunctatus, a parasitic mouthbrooding catfish (after Coulter, 1991)

The course began with a general introduction to Lake Tanganyika's history, geography, biotopes, and fauna. Students were then introduced first to the overall taxonomy of Tanganyika's fishes and then to each family, genus, and species of fish in the lake. Lectures emphasised the diagnostic features, habitat, and distribution of each species. Slide shows and books on aquarium fish were used as teaching aides in lecture. In addition to physical descriptions, students used diagnostic keys and specialist literature to identify fish. Fishes were gill-netted or purchased at the market for students to practise their identification skills in laboratory sessions. However, as a dead fish in one's hand may look very different than a live fish in the lake, students also refined their identification skills by snorkelling and diving.



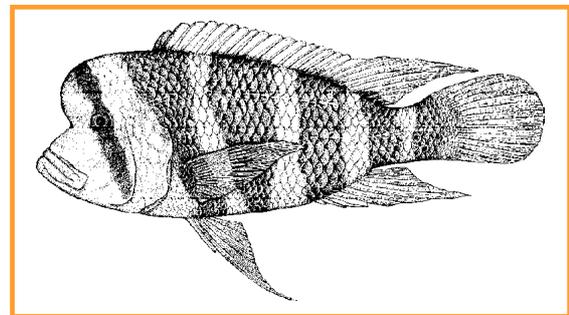
Tiphobia horei, one of Lake Tanganyika's most ornate snail shells.



Anceya giraudi, one of Tanganyika's many snail species that resembles marine species.

Students also became familiar with Lake Tanganyika's bivalve and gastropod molluscs, their taxonomy, diagnostic features, habitat, and distribution through lecture and laboratory sessions.

Generally speaking, Lake Tanganyika consists of a mosaic of biotopes containing at least 294 fish species, including 111 non-cichlid species distributed among 45 genera and 18 families and 183 cichlid species distributed among 56 genera in the single family Cichlidae. The lake also hosts 86 species of molluscs, including 15 bivalve species distributed among 10 genera and 5 families and 71 gastropod species representing 8 families and 32 genera. Like Tanganyika's fishes, much of the mollusc diversity is concentrated in a single family, Thiaridae, which includes 20 genera and 50 species of gastropods, most of which are found only in Lake Tanganyika.



Cyphotilapia frontosa, a highly sought after aquarium cichlid (after Coulter, 1991).

BIOSS team members practised and reinforced their taxonomic expertise immediately following the training course with an aquatic survey of Mahale Mountains National Park, along the southern Tanzanian coast (see page 6).

Alexis Bashonga is a researcher at the Centre de Recherche en Hydrobiologie - Uvira and a member of D. R. Congo's BIOSS team.

BIOSS Team Surveys Mahale Mountains National Park

by *Bakari Mnaya*

The LTBP BIOS S teams from Burundi, D. R. Congo, Tanzania, and Zambia united together for a special underwater biodiversity survey at Mahale Mountains National Park from 23rd March to 07th April 1999. This Park was officially gazetted in 1980, and it is situated 120 km south of Kigoma, Tanzania. It lies on a peninsula that extends into the lake and covers an area of 1613 km². To the West, the Park extends its boundary into the Lake, protecting the adjacent 1.6 km wide strip of coastal waters of Lake Tanganyika. The terrain of the Park is mostly rugged and hilly, dominated by the Mahale Mountain chain running roughly north-west to south-east across the middle of the Park. Owing to its remote location, the park normally receives less than 300 tourists per year.

Vegetation of the Park

Mahale Mountains National Park is one of the few places in the Tanganyika basin where one can see original primary forest. About three quarters of the Park is covered by Miombo woodland, mainly the *Brachystegia*, *Isoberlinia* and *Julbernardia* species. The mountain range imposes its effects on the types of vegetation present and their distribution. Rainfall data indicate that the Western slopes of the mountain get more rain than elsewhere; Kanyana, in the West receives 1870 mm per year compared to Bilenge in the North which receives only 1400 mm of rainfall. This accounts for why the western vegetation is composed of lowland forest while that in the North is miombo woodland. Where the mountain chain converges with the lake, there is a broad blanket of lowland forest up to about 1300 m. Above 1800 m, there is a mixture of bamboo bushland and montane forest including trees such as *Podocarpus*, *Bersana*, *Macaranga* and *Croton megalocarpus* which live in similar forests on Kilimanjaro and Meru mountains, and Ngorongoro Conservation Area. Above 2300 m, the forest gives way to montane grassland.

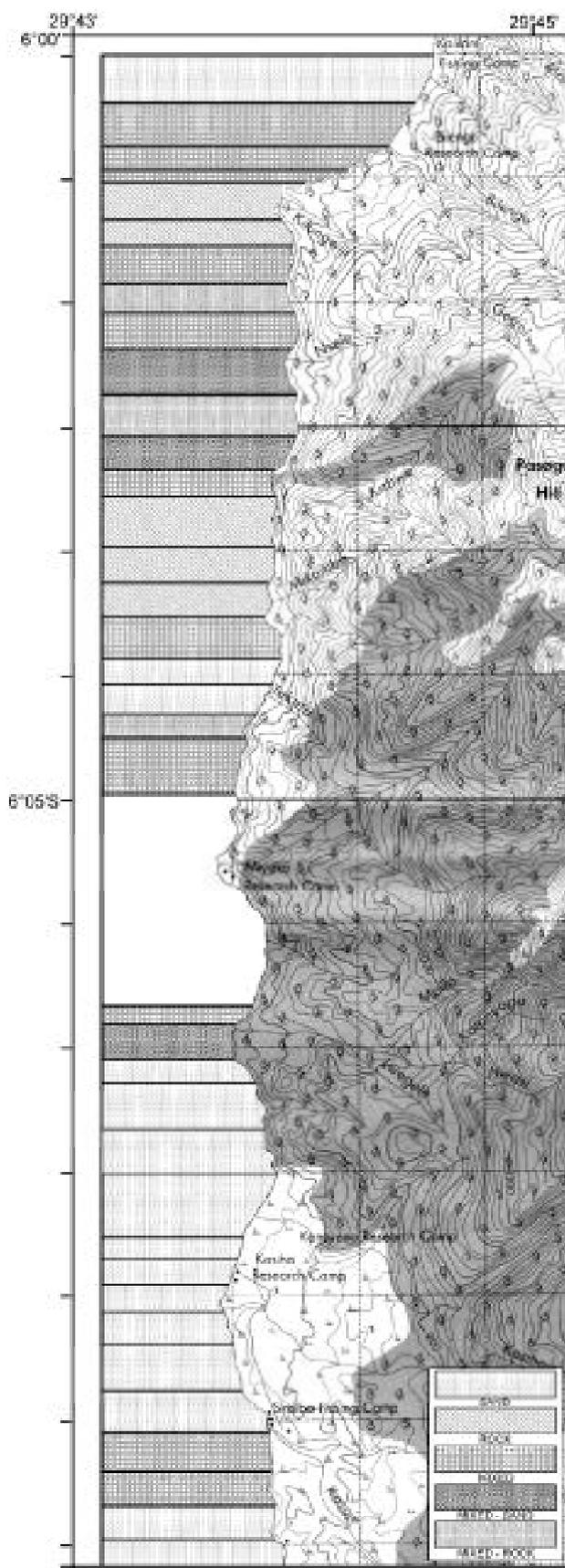
Mammals of the Park's Terrestrial Habitats

Due to its great size and variety of habitats, the park hosts many different mammal species. In the eastern woodlands of the Park, mammals like elephants, warthogs, giraffes, zebras, roan antelopes, and buffaloes can be found along with their predators including lions, spotted hyenas, and wild dogs. In the lowland forests, bushbucks and some mammals more typical of West Africa can be found (e.g. Brush-tailed Porcupine and Giant Forest Squirrel). Chimpanzees and other primates are also found in the Park.

The Bioss Survey At Mahale Mountains National Park

As a general rule of conservation biology, before setting your goals on conserving or managing any kind of natural resource, one should know in detail what the resource consists of in both biotic and abiotic forms. The LTBP aquatic survey of the Mahale Coastline will assist Tanzanian National Park Authorities (TANAPA) to understand and make informed decisions regarding conservation and management strategies for the aquatic sector of the park.

On arrival at Mahale, the Park Warden In-Charge, Mr. Mbaga, gave a welcome speech to the team members. The survey began

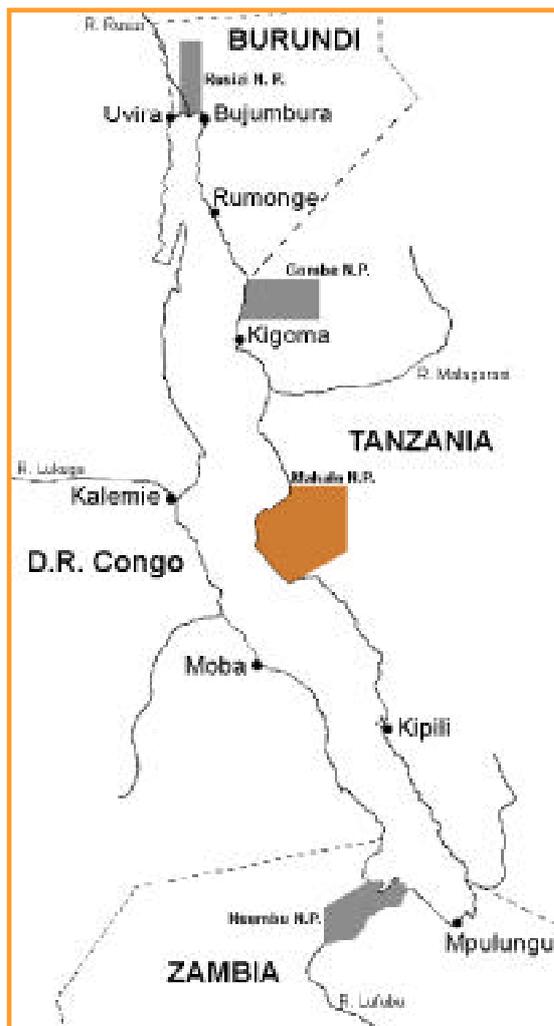


Distribution of habitats in the northern portion of Mahale N. P. determined from 'Manta board' surveys.

with team members doing manta surveys along the 60 kilometres of park coastline. This provided a description of the lake's substrate characteristics, e.g. inclination, percentage composition of sand, gravel, rocks, boulders and bed rock; coast line characteristics. Based on the distribution of habitats established through the manta survey, the team established which sites would be surveyed in detail. Though the initial plan was to survey 30 sites, due to weather, illnesses, and other complications, the team was only able to thoroughly survey 27 sites, which is 90%; and still a great success.

The surveys were divided into four components: habitat profile, mollusc census, and two different methods to census fishes.

The regional group divided into 3 different teams which each worked a different site each day. At each site, the first pair of divers conducted the habitat profile, descending to 25 m depth and recording the characteristics of the substratum (e.g., percentage of rocks and sand and their characteristics) and fauna at 10 m intervals along an 80 m transect. This was done using a marked reel which remained underwater throughout the other surveys.



Location of Mahale N. P. (orange) on Lake Tanganyika (modified from sketch by Coulter and Lowe-McConnell, November 1995).



Richard Paley (BIOSS Facilitator) and Reuben Shapola (Dept. of Fisheries, Mpulungu, Zambia) discuss survey preparations.

The second pair of divers conducted the mollusc survey, following the transect line set by the previous team. The divers worked at 25 m, 15 m, 5 m and snorkelled at 0-2 m. At each depth, divers tried to note all the gastropod and bivalve species present. Search times and techniques varied depending on the nature of the substrate. On rocky substrates, both divers searched on, under, in and among rocks for gastropods and bivalves. On mixed or sandy substrates, one diver used a sieve to collect micromolluscs from the sediment while the other followed a wider search pattern for larger molluscs. Representatives of each species were brought to the surface for definitive identifications.

Three different methods were used to survey fishes, the Stationery Visual Census (SVC), Rapid Visual Census (RVC) and Gill-netting. In the SVC, a pair of divers descended to 15 m and remained there for 15 minutes recording all the fish species they encountered. The divers then repeated the same technique at 10 m and 5 m depths. In the RVC, a pair of divers descended to 15 m depth and swam parallel to the shore for 15 minutes, recording each species of fish they encountered at 3 minute intervals (species were recorded only once). The technique was repeated at 10 m, 5 m and 0-2 m depths, the latter using snorkel technique. Finally, gill nets were set every day at the end of the diving activities and recollected the following morning. At this point, species were identified and the number of each species present was recorded. Gill-netting offered a glimpse of the nocturnal fish fauna, and was a great teaching tool for all who were not familiar with various species of fish.

The regional BIOSS teams are currently analysing the survey data and compiling a report of the Mahale Mountains National Park Survey. This report will be of great interest to TANAPA and other conservationists, for it will provide a baseline study of the Park's aquatic fauna and hence provide data for decision-makers on the proper ways of conservation and management.

The regional BIOSS teams would like to express their heartfelt and sincere gratitude to the Director General Mr. G. Bigurube and the Chief Ecologist Mr. E. Gereta, of TANAPA, for their permission to conduct this survey and also the Mahale Mountains National Park Management for all their efforts to provide a comfortable stay for all the team members.

Bakari Mnaya is Park Ecologist for Gombe Stream and Mahale Mountains National Parks and a member of the BIOSS team in Tanzania.

SECOND PROJECT TRIPARTITE REVIEW MEETING Nairobi, Kenya, 25-27 May 1999

SUMMARY OF THE MAIN CONCLUSIONS AND RECOMMENDATIONS:

1. *For the remainder of the project, UNOPS should reinforce its role of technical control according to the decisions that would have been taken at the next Regional Steering Committee meeting; (point 4.7 para 118)*
2. *UNOPS should present a summary table at the next Steering Committee meeting, indicating the present situation as well as the expenses that have been undertaken but still not settled, among these the UNOPS costs; (point 4.7 para 123)*
3. *The project should identify which institutions are (or will be) mandated to fulfil each of the follow-up/evaluation functions that are planned for the future; (point 4.7 para 133)*
4. *The project should involve the nationals further in the definition of the work programmes; (point 4.7 para 134)*
5. *The project should make the best qualified national experts at the regional level, work in close relation with the recently recruited facilitators; (point 4.7 para 136)*
6. *The mission expenses (for expatriate or national experts) for project meetings should be limited to the minimum compatible with the achievement of expected outputs; (point 4.7 para 139)*
7. *Any charging of time to expatriate experts on the project budget should be limited to tasks carried out in the region, tolerating, however, (according to the agreement to be made between UNOPS and the NRI Consortium) the time spent on preparing and writing reports, if necessary; (point 4.7 para 141)*
8. *The project should complete the databases regrouping the existing data and install them in the appropriate institutions; (point 4.7 para 149a)*



Drs. Kelly West (Scientific Liaison Officer), Andy Menz (Project Co-ordinator), and Mr. Jean-Berchmans Manirakiza (Burundi National Co-ordinator and Chairman of the Meeting)

9. *The project should make a synthesis of all the pertinent scientific knowledge acquired until now, which is necessary for the definition of the special studies and for the elaboration of management tools for the Lake; (point 4.7 para 149b)*
10. *The project should treat, as a major problem, the question of verifying (or invalidating) the basic hypothesis concerning the environmental impacts that are threatening the Lake; (point 4.7 para 155)*
11. *Maximum effort should be exerted by the project in a timely implementation of all the special studies and the overall planning of activities shall assure that they can provide the necessary background for the Strategic Action Plan; (point 4.7 para 156)*
12. *The project should prepare a document (as a supplement to the present 'standing instructions' concerning the sampling and the laboratory work) on the overall technical approach and on the way the collected data may contribute to a better knowledge of the problems and to the development of the future management tools; (point 4.7 para 157)*
13. *The project should prepare and implement, before the end of the project, sustainable mechanisms/procedures for professional exchanges between the national experts in order to meet from now on the future needs for exchange of information, of experiences and of continuous harmonisation; (point 4.7 para 158)*
14. *The project should target the training towards the identified needs for the post-project phase; (point 4.7 para 216)*
15. *The project should target the equipment of the national structures towards the needs of the monitoring post-project as well as against the intercalibration and the exchange of data; (point 4.7 para 221)*

LTBP's MTE and TPR: Project Co-ordinator's Comments

by Andy Menz

After some delay owing to the difficulty of finding a time slot when all parties were available and the need to move the venue from Bujumbura to Nairobi related to the unstable security situation in eastern DR Congo, the Second Tripartite Review and the 4th meeting of the projects regional Steering Committee (SC) were held in Nairobi from 25-27 May 1999.

Present were representatives from the four countries, GEF, UNDP, UNOPS, the PCU and a number of resource persons from the NRI consortium. All representatives were present at both the TPR and SC meetings, the meetings being held consecutively. Although the meetings were undoubtedly very fruitful, it is unfortunate that once again the majority of countries were not represented at the Principal/Permanent Secretary level as called for by the agreed composition of the Steering Committee.

The meetings analysed the Mid-Term Evaluation report and discussed the future of the project in detail. All the key issues concerning project implementation were raised as the meeting assessed each of the MTE recommendations in turn. Of particular importance to delegates were matters related to national capacity building and participation in project planning. In addition, the crucial question of what happens beyond August 2000, the current end date of the project, was addressed. While it was made clear by UNOPS that some additional funds remain from the original total allocation and would be made available to the project to complete its work, this would not be sufficient to extend the current time frame of the project. UNOPS and NRI were asked to clarify the final amount of funds available and, taking account of the resolutions of the meeting, draw up a final workplan and budget to take the project to the end of its current phase. This workplan would also make provision for a strategy to secure funds for a second project to build on the current one. In this respect it was stressed by the representative from GEF that "process indicators" would be crucial to improving chances of obtaining funds from GEF for a second project. These are indicators that clearly demonstrate country commitment in terms of allocation of country resources albeit modest to the goal and purpose of the project. It was agreed that the revised budget and workplan would be presented and discussed at an extraordinary meeting of the Steering Committee, tentatively scheduled for November 1999.

The project is thus in its final year of implementation and notwithstanding setbacks, a sound and successful conclusion is well within our grasp. It is, however, entirely dependent on everyone working on the project, in whatever capacity, doing all they can to support and facilitate in whatever way possible the activities of the project during this crucial period.

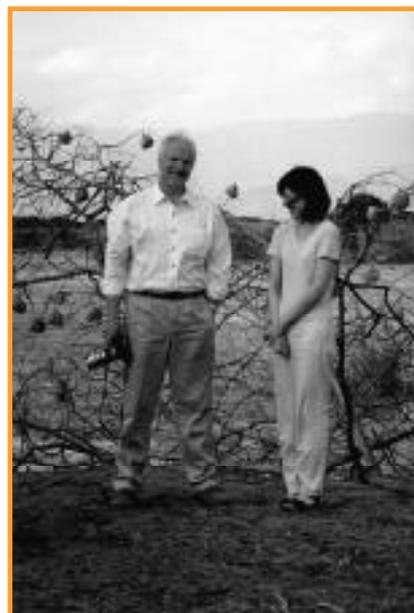
Andy Menz is the Project Co-ordinator for LTBP.

LTBP's MTE and TPR: UNOPS' Response

by Margaret Chi

UNOPS was pleased to note that at the TriPartite Review and Steering Committee Meeting, 25-28 May 1999 in Nairobi, all national teams were represented and that consensus was reached on several priority issues.

The mid-term evaluation, on the basis of which the TPR was conducted, offers an overall forward-looking approach in calling our attention to project elements that require accelerated efforts during the remaining project period, including increased national capacity building and participation, increased collaboration among the national teams, and the development of a Lake Tanganyika Convention including the definition of a Convention Secretariat. UNOPS (with and through NRI) will strive during the next 3-4 months to develop a workplan, which will focus on priority activities for the remaining project period as agreed upon during the TPR, incorporating as well, activities that will be necessary to ensure a smooth bridging between the current and a possible future project phase. It is expected that the project will need to be extended beyond 31 July 2000 to achieve the goals of this phase. The workplan will be presented and discussed at the extraordinary meeting of the SCM, to be held in Arusha, tentatively scheduled for November 1999.



Ingolf Scheutz-Mueller & Margaret Chi (UNOPS) at
Rusizi National Parc, Burundi

Following the TRP/SCM, Mr. Ingolf Schuetz-Mueller and Ms. Margaret Chi travelled to Burundi to meet with the Minister of the Environment, review the status of the project, and discuss the location of a possible future Lake Convention Secretariat. This meeting was followed by a visit to the Scientific Liaison Office of the Project and to the lakeshore, which has certainly deepened their appreciation of Lake Tanganyika.

*UNOPS is the Executing Agency for the Lake Tanganyika
Biodiversity Project.*

Space - The Final Frontier: The Role of GIS in LTBP

by Alan Mills

State agents say that the three most important things when buying a house are location, location and location. The same is true of the activities of the Lake Tanganyika Biodiversity Project (LTBP). They are all played out on the world's surface; pollution occurs in the same bays as the fish live and the fishermen work. These activities have both their own absolute location and relate spatially to all other phenomena. We can map all this information and work out these relationships, where there are conflicts and where there are not.

Traditionally, we used maps and charts to plan out or record these activities. These were useful, but rather static representations of the world's surface. Now we use Geographical Information Systems (GIS) to do this. They provide a much more dynamic environment in which data can be organised and spatial problems solved. They tend to be computerised systems consisting of facilities to enter map data (such as digitising), store and manipulate data, and present results in maps, charts or tables.

Data can come in many different forms. It can occur in vector or raster format (see box 'Understanding the Jargon') and all kinds of data can be mapped. These could be common features such as heights above sea level, roads and rivers, or specialist information like surveying data, satellite imagery and even statistics (e.g., district populations).

Many people have the wrong impression of what GIS is or can do. Some believe it is a "black box" that you can throw at a problem and solve all ills. Others believe it is just a computer-mapping package. These are rather simplistic views. GIS also allows you to interact with your data, pan around or zoom into different scales of data. Most importantly, GIS is a toolbox from

which you can select individual tools to answer specific questions, such as:

What is where? where you point at a place on a map and find its location, its soil resources, its population.

Where is what? This could be where you want to know all the locations of certain Cichlid fishes. These questions can be more sophisticated and, because GIS contains spatial data, can combine data from disparate sources. (i.e., where *Neolamprologus sexifaciatius* is located on boulders within 50 km of Uvira.)

What happens if..? This is where you might integrate data on slope, land cover and vegetation with rainfall to predict erosion rates, both totally across the catchment and between regions.

LTBP is capitalising on the utility of GIS to assist the project. NRI is assisting in this in several ways. First, we have developed a simple interface to allow people to view, interrogate and present all the data very easily. We call this 'TANGIS'.

GIS is a very powerful tool to answer spatial questions, but it does not work properly without accurate data. The projects' Special Studies are now generating large datasets (e.g. the Biodiversity Survey and Literature Databases, the Pollution monitoring data, the reports from Fishing Practices, the Sedimentation surveys in the lake and rivers). Our second role is to integrate these data with others; maps of administrative boundaries, roads, a digital elevation model, satellite data and socio-economic statistics.

We want people to be able to get access to this data easily, and we catalogue it all using a metadatabase. Metadata are data about data. The metadata we create includes geographical information (the dataset's location in space, its original scale), their attribute

Understanding the Jargon

GIS - Geographical Information Systems - Usually applied to the computer hardware or software, or the entire database system. Sometimes it means the processes used to model spatial data.

Vector - One way in which to store map data in a GIS - it involves identifying features in terms of points (e.g. survey sites or landings), lines (e.g. rivers or roads) or areas (e.g. Lakes or National Parks).

Raster - Another way to store map data in a GIS. It involves dividing up the earth into equal sized squares (called pixels) and assigning data to them. They are useful data layers for satellite information, digital elevation models or other environmental data where information is continuous. These can be useful for data such as soils where every piece of land can be classified.

Digital Elevation Models - these are pixel maps showing height information. They are more useful in a GIS than traditional contours because of the watershed and slope modelling you can do with them (see *Modelling with GIS*).

Pixel - a square in a raster grid that contains data (for example from a satellite image).

Query - Asking questions of the data.

Digitizing - Using an electronic drawing board to transfer vector data from a map to the computer. It is one of the most popular (but time consuming) ways of entering new data into GIS.

Projection - A way of representing the curved surface of the earth on a flat map or GIS screen. The project uses two; Plate Carre which references latitude and longitude as equal distances, and Universal Transverse Mercator, Zone 35, a metre-bases system that is the standard for many maps in the region.

Scale - The relative ratio between the earth's surface and its representation on a map or in a GIS. A scale of 1:50 000 means that one cm on a map equals 50 000 or 0.5 km on the ground. Data from the project are represented at different scales. Some such as rivers cover the whole region (1:1Million or above), some survey data are best represented at a local scale (1:25 000).

Attributes - These are the associated data for each feature in your dataset. For example if a point represents a landing site, the associated attributes might be its daily catch, number of boats, number of fish species, the name of the site.

details, copyright restrictions and size. We publish catalogues of metadata on the LTBP website & CD-ROM, which is updated every 3 months.

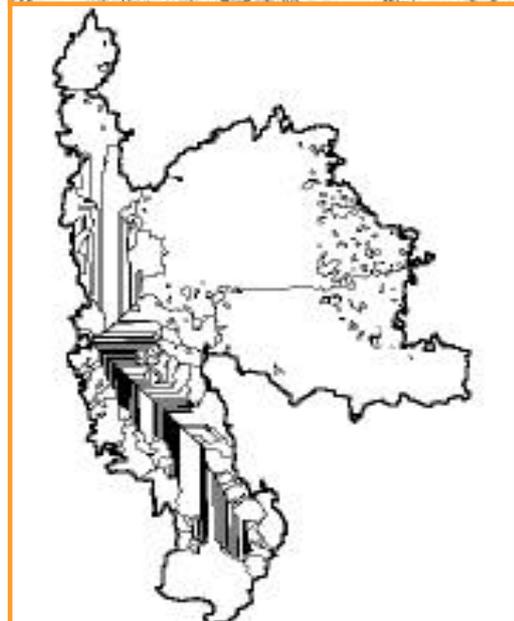
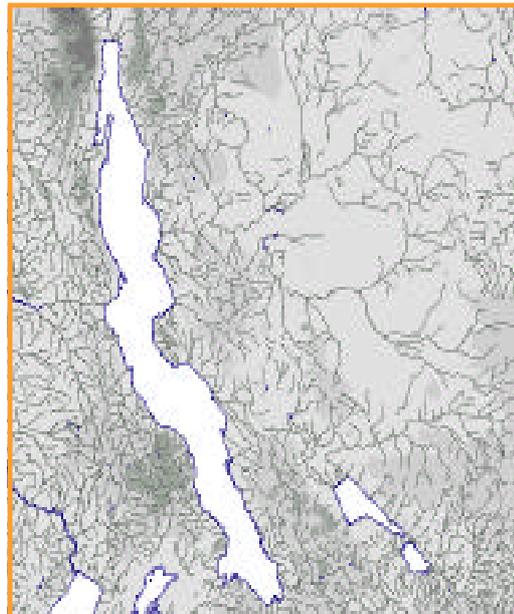
As well as the 300 digital datasets stored in TANGIS, we have also catalogued 100 non-digital datasets, such as paper maps held by the project and some references to other sources.

The GIS should not only be seen as a tool to solve spatial problems. Up-to-date data are necessary to support the Strategic Action Plan, and the current GIS framework will make it easy to allow future updates. The datasets and interface will be distributed to key sites in the following months.

How can you help us?

If you know of good sources of data or if you require data, contact Anne Jackson (ja06@greenwich.ac.uk).

Alan Mills is a Geographer in the GIS & Remote Sensing Department at the Natural Resources Institute, UK.



Modelling with GIS

GIS is not just about maps. The three maps above demonstrate how GIS can be used to make new information. The first shows the digital elevation model with heights above sea level (dark = high). The second map shows how GIS has been used to calculate direction of flow from one pixel to another. White areas are where water flows south and grey areas where water flows north. The third map is derived from these two layers. It has automatically defined the lake's sub-catchments, including the straight areas where the water from the rivers "extends" into the lake. The GIS has assisted in defining the lake's true catchment.

World Environmental Day in Burundi

by *Cécile Gakima*

In Burundi, celebration of World Environmental Day has become a habit. This year, many activities were organised under the theme suggested by the United Nations Environmental Programme (UNEP): “The Earth is our future : save it !”

Many activities were organised for the event, including:

A cultural evening organised in Gitega by local Environment Clubs; the aim of this event was to raise awareness among schoolchildren, teachers and civil servants in Gitega

A clean-up campaign organised by a women’s association from the Kinama zone of Bujumbura called “Women and Environment”

A symposium on the Environment to popularise the National Strategy for Burundi. All officials of the Ministry for Land Planning and Environment as well as other partners took part in the symposium

A day for raising awareness among the local population and administration.

In this issue, I will discuss the latter activity which was organised by the Lake Tanganyika Biodiversity Project, under the patronage of the Minister for Land Planning and Environment.



A dance troop from the Muhuta Commune, Burundi, performs for the World Environment Day celebrations.

The aim of the day was to raise awareness among decision makers, local administrators and the population on threats facing biodiversity in Lake Tanganyika. This was also the occasion to officially launch environmental education activities that will be carried out, in collaboration with partners, along the lakeshore within the Lake Tanganyika Biodiversity Project.

Ceremonies begun with a tour of Lake Tanganyika aboard the *R/V Tanganyika Explorer*. From this vantage point, participants observed for themselves the state of deforestation in the catchment. This tour also demonstrated to the local population that Lake Tanganyika can be used for tourism purposes.



Local Gitaza fisherman (left) receive awards for winning the boat race from members of the Ministry of Land Planning and Environment, including M. Gabriel Hakizimana (PSS Co-ordinator for Burundi), His Excellency the Minister, and Jean-Berchmans Manirakiza (National Co-ordinator for Burundi).

Upon their arrival, guests were welcomed by a large crowd and many cultural groups (farmers, schoolchildren, secondary school students, etc.). The cultural groups were supervised by project staff and local administration, exploiting the theme of the day. Sketches, skits and songs presented by different cultural groups were carrying messages about protecting biodiversity in Lake Tanganyika. The messages were addressed to the local population, to the administration and to political decision makers. In order to encourage fishermen (an important target group in environmental education matters) to widely participate, the project also organised a boating competition on Lake Tanganyika. This was also meant to demonstrate to the population that the lake can be used for recreation. Prizes were distributed to the best boatmen.

In his welcome address, the administrator of Muhuta Commune, Province of Bujumbura Rural, expressed his thanks to the Ministry for Land Planning in general as well as the Lake Tanganyika Biodiversity Project and the National Institute for the Environment and Conservation of Nature (INECN) in particular, for having celebrated World Environment Day in his commune. He also asked for many education sessions for the local population on environmental themes in general and on topics regarding the protection of Lake Tanganyika in particular, as most of the population living in Muhuta Commune make their living from the exploitation of the lake’s resources.

In his speech, the Minister for Land Planning and Environment first clarified the intended objective in organising the celebration under the theme “The Earth is our future: save it!” He then described the major threats facing biodiversity in Lake Tanganyika. He also explained to the population how they can contribute to the protection of Lake Tanganyika in using appropriate mesh sizes, controlling erosion in the hills surrounding the lake and in controlling all forms of pollution. He ended his speech by inviting everyone to become active in the protection of the lake for sustainable use.

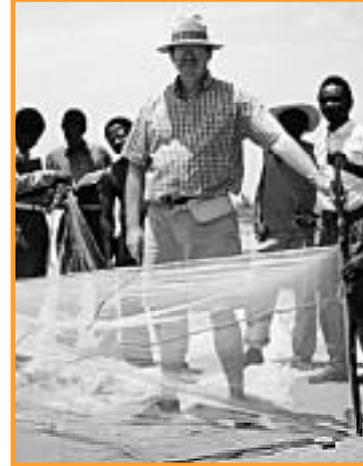
Groups of dancers, drummers and schoolchildren from the commune continued to perform songs, dances and skits with environmental messages for the guests throughout the morning.

Cécile Gakima is the Director of the Environmental Education Department of INECN and the LTBP Training, Education and Communications Co-ordinator for Burundi.

LTBP News



Karen Zwick



Robert H. Lindley

LTBP is pleased to welcome two new field-based facilitators to its team. Ms. Karen Zwick joins us from Uganda, where she worked on an environmental project for Frontier. She is based in Bujumbura, Burundi and will be co-ordinating field activities for the Socio-economics special study. With considerable experience documenting fishing practices around the world, Mr. Robert H. Lindley will be co-ordinating field activities for the fishing practices special study. He is also based in Bujumbura, Burundi.

Keith E. Banister 1941-1999

It is with great sadness that we report that Dr. Keith Banister died on 27 June 1999 after a prolonged illness. Keith was the LTBP Scientific Liaison Officer from August 1995 to July 1997. All who knew him on the project will recall his engaging personality and his boundless enthusiasm for the lake and its inhabitants, especially the fishes! Our sincere condolences to his family.



Calendar of Progress & Upcoming Events

01-04 March 1999	LTBP hosts an environmental education workshop led by Monique Trudel in Kigoma, Tanzania.	20 June 1999	Ms. Karen Zwick joins LTBP as the Socio-economics facilitator. She is based in Bujumbura, Burundi.
08-18 March 1999	Intensive taxonomic training course for the regional BIOSS teams in Kigoma.	30 June - 12 July 1999	IWACO, a Dutch environmental consulting company, completes a clean-up and environmental impact assessment of TANESCO, the Tanzanian power station, in Kigoma.
19 March 1999	Renovation of the Centre de Recherche (CRH) Uvira, DR Congois reinitiated after delays due to insecurity in the region.	05 July - 13 August 1999	Twelve African students (three each from Burundi, DR Congo, Tanzania and Zambia) participate in the Nyanza Project, an intensive training course for university students designed to give classroom, laboratory and field training in the geology, limnology and biology of large tropical lakes.
22 March - 08 April 1999	Regional BIOSS teams survey Mahale Mountains National Park, Tanzania.		
15-16 April 1999	Project management meeting in UK to discuss the recommendations of the Mid-Term Evaluation.	07 July - 17 July 1999	LTBP hosts a "Training of Trainers" workshop in Bujumbura. Led by Ms. Rachel Roland and Ms. Monique Trudel, four participants from each riparian country, attended, representing NGOs and national institutions charged with environmental education.
18-21 May 1999	Vicki Cowan represents LTBP at the LTR Project meetings in Lusaka, Zambia.		
25-27 May 1999	LTBP holds its Tripartite Review (riparian countries, NRI consortium and donor/executing agencies) in Nairobi, Kenya	22 August 1999	LTBP celebrates the completion of renovations and the installation of new equipment in the Centre de Recherche en Hydrobiologie in Uvira, DR Congo.
28-29 May 1999	UNOPS representatives, Mr. Ingolf Schuetz-Mueller and Ms. Margaret Chi, visit Bujumbura and meet with the Minister of Land Planning and the Environment, the National Co-ordinator for Burundi, and members of the LTBP Bujumbura Station.	24 August 1999	Mr. Robert H. Lindley joins LTBP as the Fishing Practices Facilitator. He is based in Bujumbura, Burundi.
28 May - 05 June 1999	David Silverside, LTBP Project Manager for NRI, visits Bujumbura and Uvira Stations.		
05 June 1999	Ms. Cecile Gakima in Burundi and Mr. Bartholomew Tarimo in Tanzania co-ordinate activities in their respective countries to commemorate World Environment Day.		
01-18 June 1999	Alan Mills, GIS specialist, visits Bujumbura, Kigoma, Dar es Salaam and Lusaka in a mission to evaluate existing GIS capacity in the region and prepare for the transfer of the LTBP GIS to the region.		