



AN INTEGRATED PACKAGE FOR THE CONSERVATION OF THE KAKAMEGA FOREST

BACKGROUND, APPROACH AND OBJECTIVES

Kakamega Forest is now the only surviving rainforest in Kenya. It is the eastern-most fragment of the Guineo-Congolian rainforest, which once stretched from Kenya across Uganda, East and Central Africa to the West African coast. Situated in western Kenya, 35 km from Lake Victoria, Kakamega Forest provides a unique sanctuary for a remarkable diversity of endemic insects, plants and birds not found anywhere else. Between 10 to 20% of the animal species in the forest are unique to this forest. It is also an important watershed for some of the rivers that flow into Lake Victoria. The forest is invaluable to the people living around it, as a source of timber, fuelwood, herbal medicines, building materials, food, income and new land for agriculture and settlement.

Kakamega Forest is highly threatened, however, largely due to economic and population pressure. The exploitation of the forest has taken place in a haphazard, wasteful and uncontrollable way such that not only is the forest resource steadily diminishing, but its capacity to recover is also being destroyed. In a survey of 15,000 forest-adjacent households, 84% were found to use the forest to provide at least one basic commodity, with grazing and fuelwood collection being the most prevalent activities. The disintegration of the forest has resulted in the breakup of the main forest block into smaller separate forest islands. Only 19,000 ha remain, and there is a real danger that Kakamega Forest could disappear in the next decade at the present levels of exploitation. This situation is illustrative of the fact that forests in Kenya have shrunk to cover less than 2% of the total land area, against an international standard of 10% for ecological sustainability.

The Integrated Project on Conservation of Kakamega Forest, which began in 2000, is a consortium of several organisations, NGOs and CBOs headed by ICIPE. The project aims to contribute to the

conservation of the forest by tackling some of the major factors that contribute to its destruction and loss. The following are specific objectives:

- building awareness about the importance of the forest through community-driven environmental and conservation education;
- reducing human pressure on the forest resources through promotion of alternatives to forest-derived fuelwood and fodder and fuelwood energy-saving technologies;
- promoting alternative income-generating activities, including apiculture and sericulture, cultivation of multi-purpose trees and medicinal plants, and provision of credit facilities for entrepreneurship development;
- improving on existing resource management through categorisation of land-use patterns, inventory and monitoring of selected taxa, training of parataxonomists, reforestation and enhancement of forest protection.

WORK IN PROGRESS

1. Cultivation and processing of medicinal plants

Two medicinal plants, *Ocimum kilimandscharicum* and *Mondia whytei*, which had been previously selected for development were promoted to the rural community adjacent to Kakamega forest for intensive cultivation. The Muliru Farmers Conservation Group, a community group living adjacent to the Kakamega forest, continued to plant *O. kilimandscharicum* during the review period. The community no longer required supervision. The group commissioned eight conservation groups around Kakamega forest as outgrowers. The total acreage under *O. kilimandscharicum* cultivation increased considerably to 6 ha compared to 0.2 ha at the beginning of the Project. The number of community members who participated in its cultivation also increased to 56 from 18 in the year 2000.

Hydrodistillation equipment for the extraction of *O. kilimandscharicum* was handed over to the Muliru Farmers Conservation Group on 10 March, 2002 at Isecheno, adjacent to Kakamega forest. The

ceremony was presided over by the UNDP Resident Representative in Kenya and the Director General of ICIPE and attended by over 300 people including community members, Government representatives and personnel from UNDP and ICIPE. The equipment is used for extraction of the essential oil used for manufacture of Naturub products. Construction of a building for housing the extraction equipment was completed during 2003.

Several commercial products were developed from formulation to market evaluation, labelling, packaging and registration (Figure 1). Pilot and large-scale processing and manufacturing equipment was fabricated and the products were manufactured, marketed and sold (see photos). The participating farmers were paid for the harvested and processed crop of the medicinal plants.

Farmers who cultivated *O. kilimandscharicum* earned increased income from the sale of the crude essential oil, earning Kshs 52,606 (US\$ 658) per hectare per year of the herb. These earnings were better than those from maize, estimated at Kshs 39,882 (US\$ 500) per hectare per year. The community members earned a total of Kshs 629,300 (US\$ 7870) from sale of the herb. The manufacture and sale of Naturub, the product derived from *O. kilimandscharicum* plant extract, continued to rise during 2003, with 76,287 units of Naturub products being sold in more than 62 outlets in Kenya, giving gross returns of Kshs 916,700

(US\$ 11,460). Naturub is now being packaged in a 25-g bottle in addition to the 7-g and 4-g tins.

Community-based commercial cultivation of the endangered medicinal plant, *Mondia whytei* continued, with over 40,000 plants being grown in over 350 rural homes around the forest. The Project initiated the development of several commercial product lines from the roots of the plant in order to add value to the *M. whytei* plants (see Figure 1). Processing equipment was purchased for controlled air-drying of the roots. *Mondia Tonic*, a product from the powdered roots of the plant, has been developed by ICIPE, KEFRI and KARI and is currently sold in three large chains of supermarkets in Nairobi.

2. Improved apiculture and sericulture

Through its Commercial Insects Programme, ICIPE trained selected groups of farmers, women's and other groups, community-based extension workers and members of the Kakamega Environmental Education Programme (KEEP) (see below) in income-generating sericulture and apiculture technologies. The trained individuals and groups were subsequently helped to start these activities in their homes and to train others in the community. Over 2400 community members were exposed to efficient, modern methods of beekeeping, honey production and silkworm rearing through training and demonstrations. ICIPE



Figure 1. A, Harvesting and processing of *Ocimum kilimandscharicum* leaves by community members living around Kakamega Forest. B, Packaging developed and produced to hold Naturub products. C, *Mondia whytei* roots sold in towns in Kenya and in other African countries. D, *Mondia Tonic* product developed from *Mondia whytei* roots

also assisted in marketing of their apiculture and sericulture products. An additional 441 Langstroth hives were installed in rural households over the review period. Fifteen carpenters trained in the construction of the beehives have thus far sold more than 500 units.

The two women's groups based at Malava and Ileho continued to serve as models for promotion of silkworm rearing (sericulture) among the community around Kakamega forest. Model silkworm rearing huts were constructed in 2002; the Malava-based group continued to produce silkworm cocoons for trial purposes, while the Ileho group equipped its rearing hut and started to rear silkworms during 2003. Five varieties of mulberry plants (Embu, Thailand, S-36, S-41 and Thika varieties) were introduced in the area to compare leaf quality with that of the Kanva-2 variety that had previously been planted in farmers' fields. More than 200 adult community members and schoolchildren have visited the model silkworm rearing huts.

From the first trials, the Malava CBD group managed to harvest Grade A cocoons (1.5 kg) and Grade B cocoons (3.5 kg). The second trials for silkworm rearing have already been completed by Malava CBD group and the cocoons were brought to ICIPE in October 2002 by a representative of the group. She used the visit to learn about cocoon grading as well as how to maximise the harvest of silk cocoons. By the end of 2003, a total of 51 kg of cocoons had been produced by community groups.

3. Inventory and monitoring

Inventory and monitoring of species in Kakamega forest was initiated by selection of taxa of target flagship species, listing of annotated checklists of the taxa from the literature and establishment of protocols for monitoring. Annotated checklists of various species of Kakamega Forest were drawn up. The checklist for plants, butterflies and moths, snails, hoverflies, ants and mammals were completed by the end of 2003. This exercise was undertaken through consultations with experts on target taxa and in a workshop attended by the participating institutions.

Monitoring of ants was undertaken by hand, involving searching on the ground, on tree trunks, in rotten wood and under objects. Baits were also used in selected sites in the forest. Pitfall traps were used but were found to be no more effective than hand collecting methods. Malaise traps were found to be effective for trapping the winged sexual forms, while black lights were used for the flying nocturnal forms. Many litter samples were collected throughout the forest and the arthropods extracted by means of winker sacks.

More than 180 species of ants were collected and many more remain undiscovered. Of the latter, many will be true arboreal species that live exclusively in the canopy. Some of the larger ant genera (*Camponatus*, *Crematogaster* and *Pheidole*), each with several dozens of species reported from Kenya, have never been subjected to modern revisionary studies.

It was not possible to reliably attach names to most of the species collected from Kakamega forest. Most were from the genera *Monomorium* and *Tetramorium*, and these either had not been previously reported from Kenya or were undescribed new species. In one genus, *Axioidris*, there were five species, three of them undescribed.

Attempts to monitor population fluctuations were in most cases futile, mainly due to the continuing severe degradation of the forest, especially through gathering of firewood and continued illegal cutting of trees. These practices open up the undisturbed areas to colonisation by 'weedy' ants, thereby driving out the normal component of the fauna.

Selected members of the community around Kakamega forest were trained by scientists from the National Museums of Kenya in trapping, collection, sorting and preservation of specimens. The trained parataxonomists trained other members of the community, participated in inventory and monitoring in Kakamega forest and assisted schools and institutions around the forest in taxonomy.

4. Environmental education

The Project worked with the Kakamega Environmental Education Programme (KEEP), a local voluntary community-based environmental group, to support KEEP's efforts. The education covers the following areas: aspects on the importance of forest biodiversity, its conservation, consequences of its destruction and alternative activities that could reduce the pressure on the forest. The Project continued to improve KEEP's facilities and helped KEEP and the community-based Project extension workers in all the nine locations around the Forest to undertake their activities.

More than 15,644 children and 5454 adults attended lessons at the KEEP Resource Centre, visited by 306 schools, 72 university groups and 143 community groups. KEEP conducted environmental and conservation awareness activities at 70 public and eight church meetings. Over 46 demonstrations, 162 nature walks for children and adults and 166 video shows were conducted by KEEP.

5. Energy conservation

Promotion of energy-saving methods and technologies was coordinated by the Intermediate Technology Development Group (ITDG) and ICIPE. ITDG provided training to selected members of community groups, community-based Project extension workers and local leaders in acceptable fuelwood energy-saving methods of cooking and in production and installation of fuelwood energy-saving and associated devices in rural homes. The Project then facilitated the trained individuals and groups to undertake demonstrations of the techniques. In total, 53,800 people were sensitised on the various aspects of fuelwood energy-saving technologies. As a result, 14,113 cooking devices such as improved charcoal stoves and ovens and 5689 kitchen improvement devices were installed in rural homes around the forest by end-2003.

Table 1. Types and numbers of fuelwood energy-saving cooking devices installed in rural homes around Kakamega Forest in 2002 and 2003

Type of device	Description	Number	
		2003	2002
<i>Upesi</i> liner	A moulded ceramic clay liner for conserving heat during cooking	1245	2630
<i>Upesi</i> portable	A portable <i>upesi</i> liner fixed in a clad metal shell	70	180
Shielded fire	A traditional three-stone cooker that is improved by covering the sides leaving only one opening for firewood	38	89
Mud stove	A fuelwood energy-saving stove made out of any sort of clay	2910	5924
Jiko sanifu	Same as mud stove but has two firebox chambers and a chimney	111	276
Sawdust metal jikos	A metal device that uses only sawdust for cooking	7	18
Clay food warmers	A device attached to a mud stove or made separately to keep food warm for a long time	200	415

Some community members and groups were also trained and assisted in initiating business enterprises for the production and installation of the energy-saving devices and marketing them for income generation. The community-owned centre that was established for the Valonji Women's Group during the previous reporting period produced and sold a total of 1610 stoves.

6. Agroforestry and reforestation

Promotion of on-farm agroforestry among community members living around Kakamega Forest was coordinated by ICIPE, ICRAF and KEFRI. This involved selection and prioritisation of indigenous tree species on the basis of potential uses, ease of cultivation and acceptability by the community. Selected community groups were trained in agroforestry techniques, and these groups in turn trained and distributed seedlings for on-farm planting. A total of 486,000 seedlings of multipurpose trees were raised and planted by the local community members in their farms in 2003. This was an increase of four times compared to the number in 2001.

A deforested area in Kakamega forest was acquired for use in a model reforestation programme and seedlings of indigenous tree species selected for reforestation were raised in a nursery and planted and maintained by local community groups.

A total of 192 community groups were further facilitated to raise seedlings of their choice for distribution and sale, with 62,000 seedlings being raised. The seedlings included *Grevillea robusta*, *Eucalyptus* spp., *Markhamia lutea*, *Jacaranda mimos*a, *Calliandra calliformis* and *Sesbania sesban*. The seedlings were sold for US\$ 1760 which was used for purchase of farm inputs for the group members.

7. Survey of land use patterns

Existing land use information was reviewed to obtain current land use patterns around Kakamega Forest. The land use classes were overlaid in a GIS system and periodic change detection determined. Ground truthing was undertaken and soil types, climate, population and land use and land cover data was overlaid to establish land use practices and their impact on the sustainability of forest

resources. Infrastructural features were digitised, the tenure system computerised and the relationships between land use and land cover and geological and population patterns documented. The following maps were developed by the Project in collaboration with the Department of Resource Surveys and Remote Sensing (DRSRS):

- Human population density for the year 2000
- Eco-tourism trekking routes
- Soil map of Kakamega forest

These maps update existing information on the ecological status of the forest and demonstrate the human population dynamics and infrastructure in the surrounding area. More detailed interpretation of the maps indicated the following: 11 land cover classes were recognised, namely bare/quarry, built area, forest glades (bushed), forest glades (grassland), natural forest, non residential agriculture, open forest/shrubs, plantation (hardwood), plantation (softwood), residential agriculture and tea zone. Natural forest was the predominant cover, taking over 50% of the total area. Agriculture and plantations showed a definite geographical pattern in location. They were situated along the forest roads within the forest and on the western and southern edges of the forest that had dense population and a good communication network. Open forest was distributed along the edges whereas forest glades were randomly distributed within the forest.

The statistics analysed from 1975–2003 (see Table 2) showed drastic fluctuations in area of individual cover types over the years. Natural forest was the largest class throughout the years but it showed a decline of about 18% from 16,142.4 ha in 1975 to 13,995.5 ha in the year 2000.

8. Credit provision

Credit provision for communities around Kakamega Forest was coordinated and implemented by K-REP, ICIPE and community members through the establishment of community-owned and managed Financial Service Associations (FSAs) or 'Village banks'. Through the FSAs, rural communities have access to a comprehensive range of financial services, including credit (both consumptive and productive loans), savings facility, money transfers, etc.

Table 2. Changes in area of individual cover types in Kakamega Forest 1975–2000

Year	1975		1986		2000	
	Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)
Bare/quarry	15.6	0.1	12.3	0.1	10.4	0.0
Built area	–	0.0	6.4	0.0	5.3	1.8
Forest glades (bushed)	–	0.0	–	0.0	421.6	1.8
Forest glades/grassland	1491.9	6.3	1860.1	7.8	688.7	2.9
Natural forest	16,142.4	68.1	13,306.5	56.1	13,995.5	59.0
Non-residential agriculture	1368.2	5.87	3750.1	15.8	3518.8	14.8
Open forest/shrubs	1068.5	4.5	1836.9	7.7	858.3	3.6
Plantation (hardwood)	2308.4	9.7	1403.8	5.9	3165.8	13.4
Plantation (softwood)	938.5	4.0	968.1	4.1	637.0	2.7
Residential agriculture	375.0	1.6	346.1	1.5	375.0	1.6
Tea zone	–	0.0	218.0	0.9	31.7	0.1
Total	23,708.3	100.0	23,708.2	100.0	23,708.0	100.0

The Shinyalu FSA, established in the year 2000, had increased its share equity to US\$ 6152 by 2002. The total savings increased to US\$ 34,320 and total loans given out was US\$ 17,641 in 2002 (Table 3). A second FSA is under establishment at Ikhuywa Trading Centre. Identification and equipping of the operating premises for this FSA was completed. Outreach and sensitisation of community members was also done and shareholders were recruited. These shareholders have been mobilised to elect their FSA officials, including the Board of Directors.

9. Outreach in Uganda

In 2001, a project similar to the Kakamega Forest activity on community-based commercial cultivation of *Ocimum kilimandscharicum* for alternative income generation was initiated at Budongo Forest in Uganda. During 2003, 24 farmers were already cultivating *O. kilimandscharicum*. A steam distiller was purchased and installed at Nyabyeya near Budongo Forest for extraction of the plant material for manufacture of Naturub products.

A new product line of Naturub for relief of muscular pain, arthritis and lumbago in the form of an ointment that incorporates lemongrass oil, was formulated. Design of packaging for this new product line has been done.

ICIPE continued to assist a women's conservation group at Ntungamo in western Uganda in commercial cultivation and processing of lemongrass, which also helps to promote soil conservation on terraces and contour bunds in farms. ICIPE has assisted the women's group to generate income through distillation of essential oils from the lemongrass. A hydrodistillation equipment has been purchased and installed at Ntungamo for the community group to extract the essential oil. The Project was commissioned in December 2002 by the First Lady of Uganda. The oil will be used in manufacture of various commercial cosmetic and medicinal products and food supplements, while some will be sold to manufacturing industries. (See also the following report on the Echuya Forest and the section on bioprospecting in the Behavioural and Chemical Ecology Department report.)

CAPACITY BUILDING

Six graduate and three technical students were trained or attached to various components of the Project. The Project trained 9 youth members of the community in handling and preparation of *O. kilimandscharicum* plant material for distillation, operation and maintenance of the hydrodistillation equipment, safety procedures and data recording and

Table 3. Progress of the Shinyalu Financial Services Association ('village bank')

Item	2003	2002	2001	2000
Share equity (US\$)	5878	6152	5431	2662
Total savings (US\$)	27,551	34,320	21,076	4961
Total loans given out (US\$)	16,872	17,641	12,583	2287
Highest loan (US\$)	592	563	324	352
Lowest loan (US\$)	16	17	17	14
Number of women shareholders	104	103	93	69
Number of men shareholders	227	225	212	156
Number of community groups	56	55	48	28
Total number of shareholders	387	383	353	253
No. of institutions using the transfer service	2	1	1	1

management. The Project also continued to enable training of young Kenyans in various other aspects (Table 4). The trainees included:

- Two graduate Agricultural Economists from Egerton University.
- One graduate in Agricultural Engineering from Egerton University.
- Three technicians from local technical colleges.

MSc students

Lucas Ongeri (Kenya) Phytochemical analysis of *Mondia whytei*. Jomo Kenyatta University of Agriculture and Technology.

Paul Njihia (Kenya) Nutrition and animal feed evaluation of *Mondia whytei* products. Jomo Kenyatta University of Agriculture and Technology.

IMPACT

The Project has brought greater awareness to the forest adjacent community about the importance of the Kakamega forest and the need for its conservation with over 20,000 people contacted with environmental and conservation education. The increase in number of farmers cultivating medicinal plants is indicative of acceptance of the Project by the community largely due to the ease of cultivation of the plant, minimal farm inputs and higher income per unit area as compared to other crops cultivated. Adoption of energy-saving technologies by the locals was very high with over 14,000 devices installed. In addition, the new income-generating activities will in the long run provide alternative income and reduce the economic dependency of the community on forest resources.

Table 4. Training in agro-enterprises development and conservation in the project 'Integrated Package for Conservation of the Kakamega Forest'

Training activity	Number trained to end-2003
Cultivation of <i>O. kilimandscharicum</i> by Muliru Farmers Conservation Group	56 farmers
Outgrowers contacted by the above	8 conservation groups
<i>Ocimum</i> processing (hydrodistillation)	9 youth
Naturub formulation and packaging	2 technicians
Technician training	3 technicians
Postgraduate researchers	13 MSc, 3 PhD scholars
Applied business economics	2 graduate agricultural economists
Agricultural engineering applications	1 graduate agricultural engineer
Community-based project extension workers	10 high school graduates
Beekeeping and honey processing	2020 farmers from 420 groups
Hive construction	8 carpenters
Silkworm rearing	2 women's groups of 89 farmers
Parataxonomists	2 school teachers, 7 pupils, 3 adult community members
Energy-saving stoves fabrication and installation	1675 community members
Agroforestry techniques	Members of 314 community groups

OUTPUT

Books and chapters in books

Rogo L. M., Lwande W., Chapya A., Herren H. and Miller S. E. (2001) An integration conservation initiative to conserve Kakamega Forest and its biodiversity, pp. 56–60. In *Tropical Ecosystems: Structure, Diversity and Human Welfare (Supplement): Proceedings of the International Conference on Tropical Ecosystems* (Edited by K. S. Bawa and R. Uma Shaanker). ATREE, Bangalore.

Reports

Annual scientific and financial reports on the Integrated Project on Conservation of Kakamega Forest, presented to the John D. and Catherine T. MacArthur Foundation for the years 2002–2003.

Publicity

Project activities which were covered in international and national media including the following:

- CNN International television Network covered the Project's efforts to conserve medicinal plants at Kakamega forest and to promote alternative income-generating activities for the community (February 8 and 9, 2003).
- Reuters Television News Agency in their Television documentary, *Africa Journal*, covered the Project's efforts to conserve medicinal plants at Kakamega forest and to promote alternative income-generating activities for the community. The coverage was aired on various television channels in most countries in Africa including the following networks in Kenya: Nation TV (7 February, 2003) and TV Africa (2 March, 2003).
- Some aspects of the Project were covered by a World Bank television crew from Washington DC on 9–11 September, 2002.
- Okwemba A. (2002) Local impotency herb to flavour yogurt. *Daily Nation*, Kenya. October 17, 2002.
- Mwangi E. (2002) Community extraction of essential oils from a local plant in Kakamega forest, Shinyalu Location, pp. 1–5. In *UNDP/GEF-Small Grants Programme, Kenya—Promoting Forest Biodiversity*. Booklet No. 1. ICIPE Science Press, Nairobi.
- *Kakamega Environmental Education Programme (KEEP) Newsletter* (2002) Vol. 1, No. 1, ICIPE Science Press, Nairobi.
- Donisthorpe J. (2003) Saving Kakamega Forest by poverty eradication. *Travel News*, January, p. 30.

Conferences and papers presented

Presentation at the World Bank on the Kakamega Forest Conservation Project as part of a panel presentation on traditional medicine and rural development issues in Africa, Washington, DC, USA. 10 September 2002. S. Miller.

Presentation at the Second International Roundtable for Agribusiness in Natural African Plant Products (ASNAPP) on the theme: From Research and Development to Commercialization. 24–27 September 2001, Accra, Ghana. W. Lwande.

Presentation at the Symposium on Medicinal Plants, Nyabyeya Forestry College, Masindi, Uganda. 26 April 2002. W. Lwande.

Presentation to the MacArthur Foundation Board of Directors on progress of the Kakamega Forest Conservation Project, 8 October 2002, Nairobi, Kenya. W. Lwande.

Presentation at the Pan-African Malaria Conference, Arusha, Tanzania, 17–22 November 2003. W. Lwande

Presentation at the commissioning of the Ntungamo Womens' Effort to Conserve the Environment (NWESE) community-based Project on lemongrass use, presided over by the First Lady of Uganda, Ntungamo, Uganda. 3 December 2002. H. Herren.

Presentation to the First Lady of Uganda on the ICIPE activities in the promotion of community-based beekeeping, Kampala, Uganda. 17 December 2002. H. Herren.

Project proposals

Commercialisation of community-based cultivation of the medicinal plant, *Ocimum kilimandscharicum* and its products, as a means to reduction of human pressure on Budongo Forest, Uganda. Funded—First phase.

Commercialisation of lemongrass cultivation and processing as a means to sustainable control of land degradation by the community in Ntungamo District, Uganda. Funded—First phase.

Commercialisation of community-based cultivation of the medicinal plant, *Ocimum kilimandscharicum* and its products, as a means to reduction of human pressure on Kakamega rainforest in Kenya. Concept note. Funded.

Participating scientists: W. Lwande (Project Leader), S. Miller, L. Rogo, R. Bagine, K. W. Mukonyi

Assisted by: A. Chapya, L. Moreka, E. Ndenga, B. Omolo, N. Onyimbo, M. Ndwiga, D. Mbuvi, M. Nelima, M. Lumbasi

Collaborators:

Institutions: Kenya Wildlife Service (KWS); Kenya Forestry Research Institute (KEFRI); Forest Department (FD), Kenya; Smithsonian Institution (SI), (USA); Intermediate Technology Development Group of East Africa (ITDG-EA); Department of Resource Surveys and Remote Sensing (DRSRS), Kenya; National Museums of Kenya (NMK); Kenya Rural Enterprise Programme (K-REP); University of Nairobi; Kisumu Medical and Education Trust (KMET); World Agroforestry Centre (ICRAF); Kenya Ministry of Agriculture; Kenya Agricultural Research Institute (KARI)

Community-based groups: Kakamega Environmental Education Programme (KEEP); Muliru Farmers' Conservation Group (MFCG); Community-based distributors women's groups of Malava, Shamakhubu, Shikusa, Kambiri, Kuvasali, Kakamega Forest, Ileho, Sabatia, Shiru, Mang'uliro; Virhembe Youth Development Group

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Home page: <http://www.icipe.org>

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