

..... Japanese researchers established their first research base for chimpanzees at Kabogo Point, ..... the area was uninhabited; it was made up of lush and beautiful primary forest and Miombo woodland, covering the entire side of the Kabogo Hills. But in this short period of 20 years, the environment has undergone profound changes. ....

..... Age and sex composition of sub-groups is quite diverse. The length of time sub-groups stay together is a function of their size, composition, and perhaps season, with smaller sub-groups enjoying longer periods of togetherness in contrast to the larger ones. The size of sub-groups may be anywhere from two to as many as 30 chimpanzees. When food is easily available, however, sub-groups tend to be larger and the converse generally holds true when it is scarce. Thus, the size of a sub-group is a function of food availability. ....



## Chapter 3

# Park Systems; Research/ Management/ Visitor Services



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# 1. Survey and Research

## 1-1 Research program

### (1) Research on the Ecological System of the Area

Check lists have been already made for mammals, birds, and fish, but they are as yet incomplete. No surveys have yet been made for reptiles, amphibians, and insects, nor for surveys of the flora of the area. The task at hand, therefore, is that of making complete check lists for all the fauna and flora in the entire area, and this will entail the participation of experts.

A long-term task will be to follow up on the recovery of the flora and aquatic fauna that have already been affected by human impact. It will also be necessary to continue research to determine the distribution of individual species of plants and animals, to observe closely of the ecology of the area and behavior of the 8 other species of primates besides the chimpanzees, as well as the birds, fish, and so on. The cooperation of visiting researchers in different fields will be indispensable to such studies and research activities, and this will entail making the necessary arrangements and the provision of research and other facilities, including research premises.

A close study of the ecological system within the area will require observation of the microclimate at certain places within the park which have distinctive topographical features and vegetation. This is already being done at four points, but several additional ones will be required.

### (2) Research on Chimpanzees in the Wild

For groups of chimpanzees from the Kasoge area are to

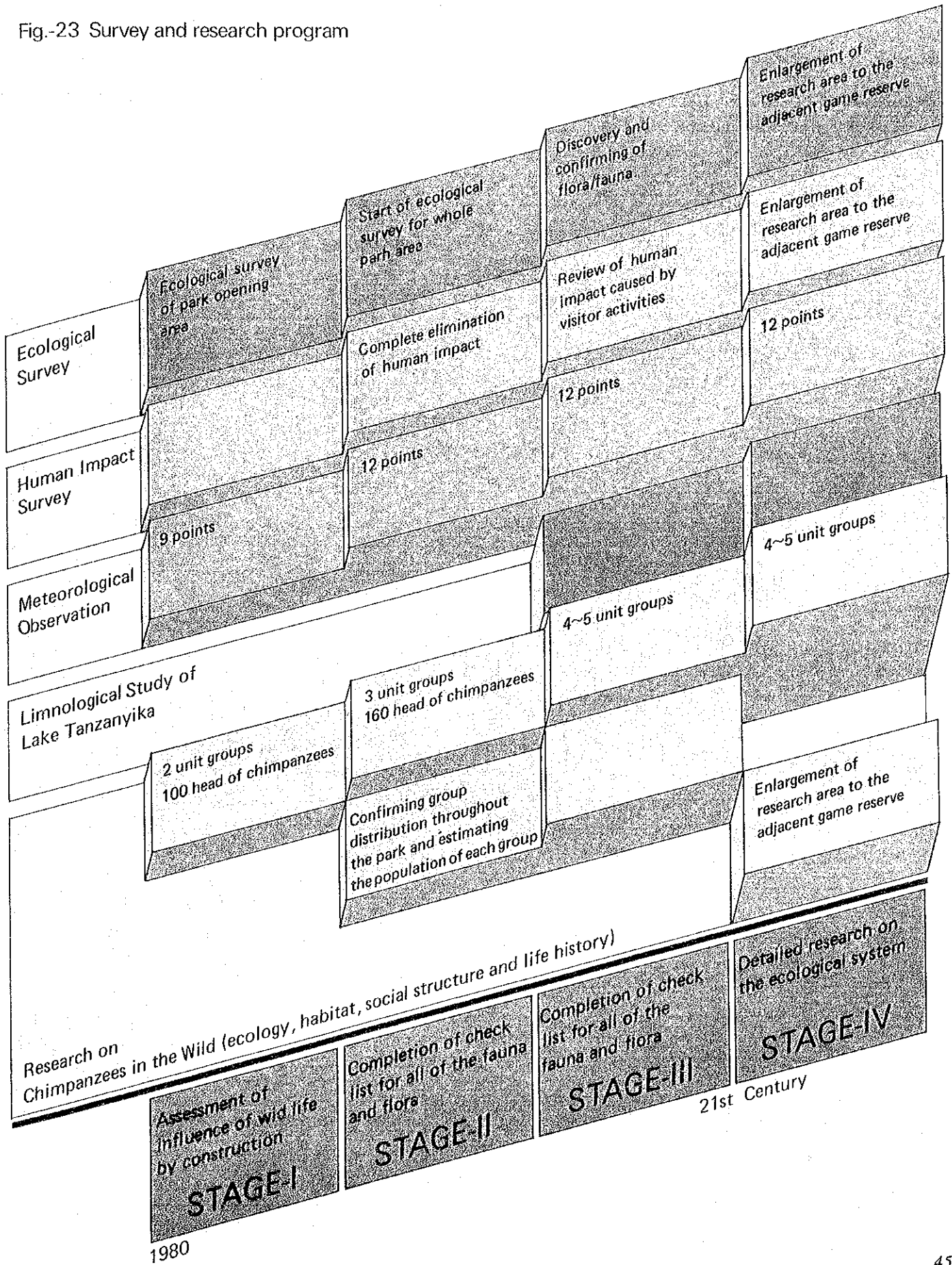
be used for socio-anthropological research and for studying the primates relationship with the ecology. In the case of two of these groups, representing a total of about 100 individuals, all of which have already been identified, the research will entail keeping through records with respect to life histories, including births, deaths, changes in group affiliation, and day-to-day behavior. It will be necessary to study population fluctuations and geographical range of mobility of each group as a whole and the relationship between such group mobility and seasonal fluctuation of food availability.

This research will require improving the functional capability of the four research stations in the area and increasing the number of research trails and improve the existing trail as well. As for confirming group distribution throughout the park and estimating the population of each group, this is to be done in conjunction with the wide-area survey above.

### (3) Integration of Park Management and Research Activities

All study and research are to be carried out systematically so as to make efficient use of personnel and facilities and accomplish the mission of the research division of the park in a satisfactory manner. This will entail the preparation and smooth implementation of annual and monthly activity plans based on short- and long- term goals. Furthermore, it is important that information be kept on the results of such work for active feedback to the park's nature protection and management division. This should be done at Bilenge major field station.

Fig.-23 Survey and research program



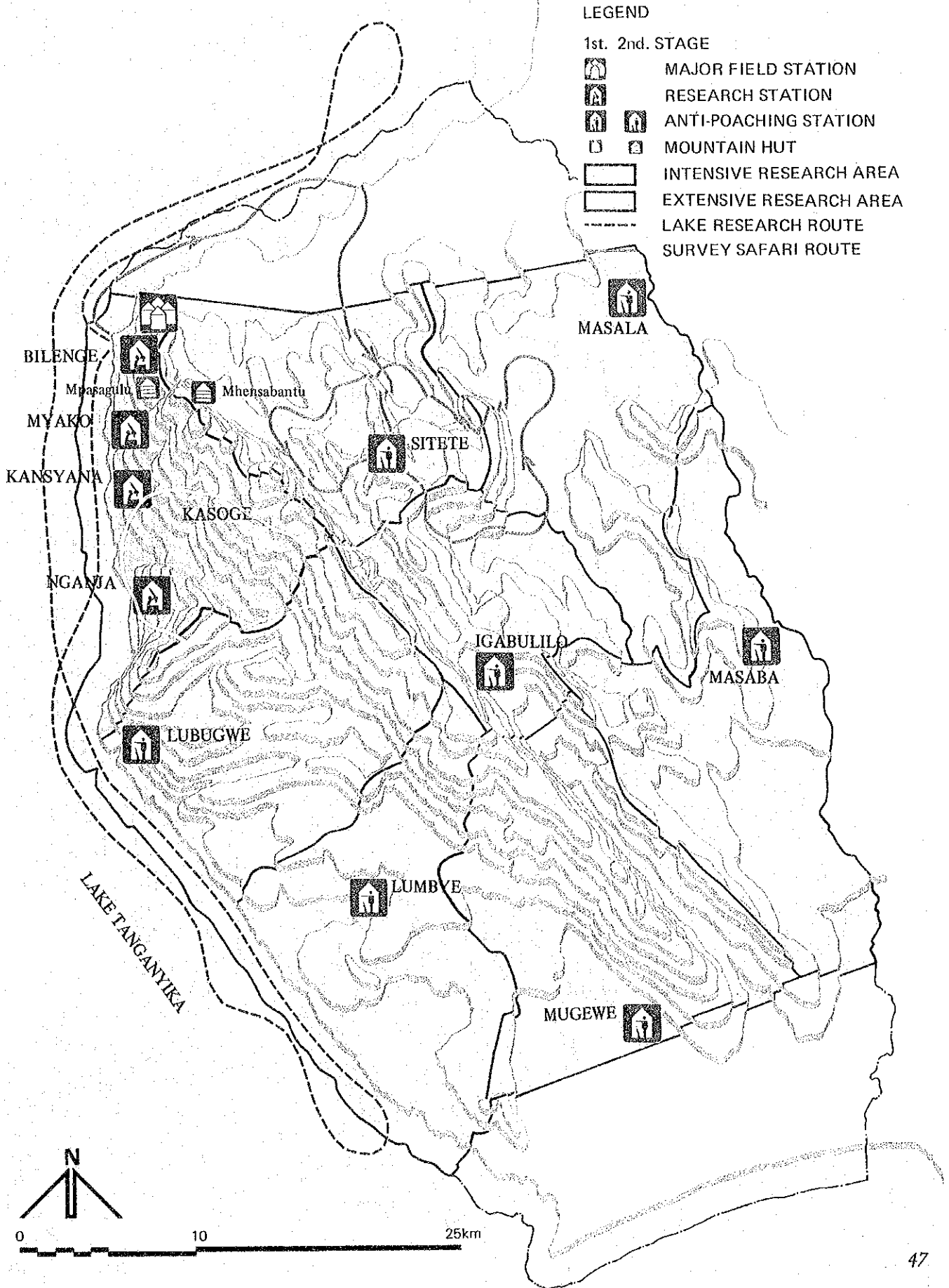
## 1-2 Survey and research system

The survey and research activities in the park mainly concern chimpanzees in the Kasoge area and basic ecological studies in other areas of the park, the latter being carried out intensively by the research section of park major field station and, on a regular basis, by each anti-poaching stations in their respective zone, the former by research stations in conjunction with the major field station.

Table-11 Function of research station

Research stations	Survey / Research area	Staff	Stage		
			1st	2nd	3rd
1) Major Field Station Research Section	Bilenge	M.F.S. researcher	6	6	12
	Whole park (including park waters on lake)	Visiting researcher	3	5	5
2) Research Station	Bilenge	Research ranger	2	2	3
	Myako		2	2	3
	Kansyana		2	2	3
	Nganja		2	2	3
	Kasoge area				
3) Anti-poaching Stations	The area each station is responsible for	To be done by the rangers as part of their job			
4) Mountain Hut	Muhensabantu  (montane forest zone)	Unmanned meteorological observations  Data collection by the major field station			

Fig.-24 Zoning and location of facilities ; survey and research



### 1-3 Survey and research section at Bilenge M.F.S.

This is the true nerve center of all survey and research activities in the park.

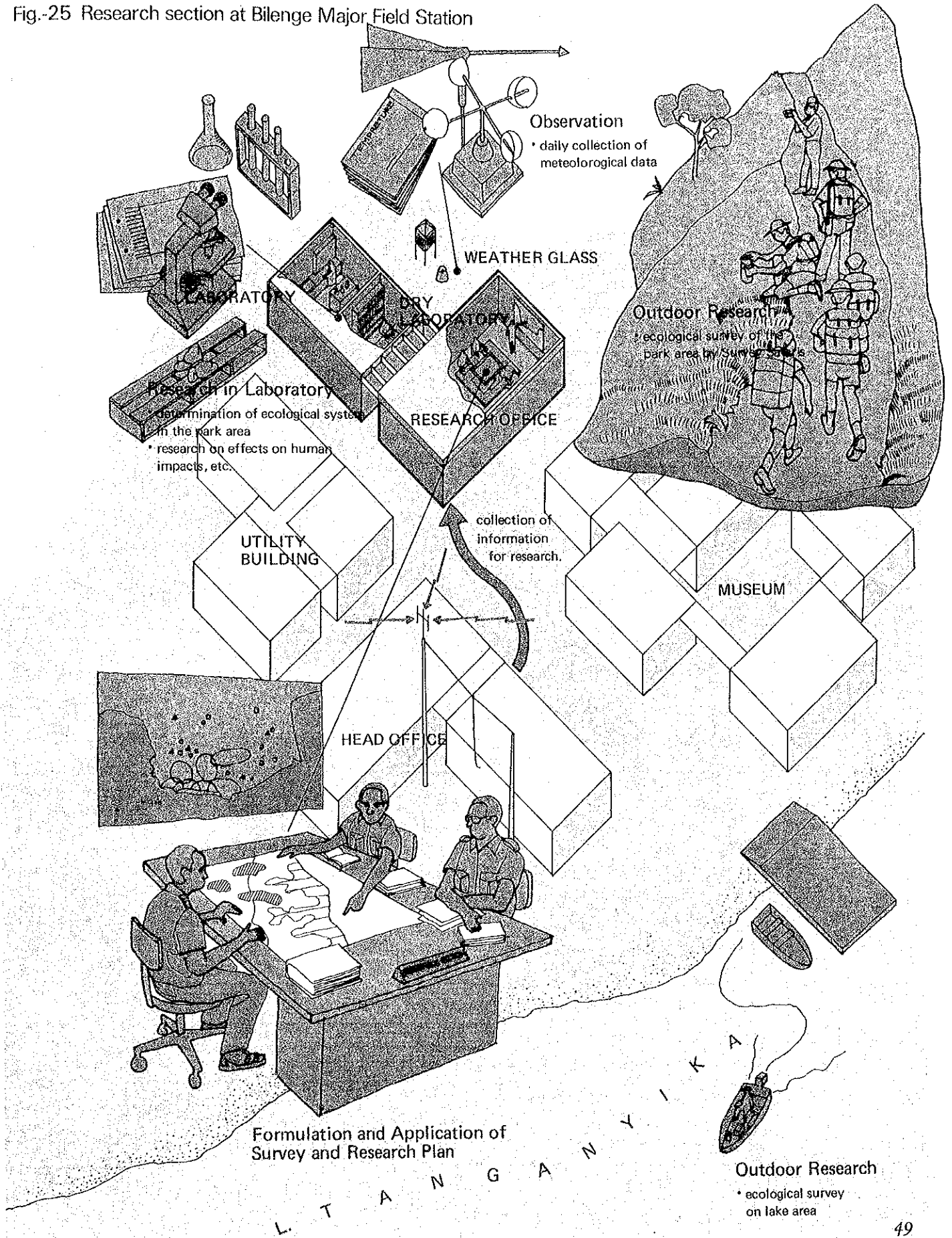
Survey and research guidelines for field management as well as methods are drawn up by the research section and carried out under its supervision, in cooperation with the field management section in matters pertaining to environmental protection and management operations.

Table-12 Function of survey and research section

Task	Description
1) Drawing up+ carrying out survey and research plans	<ul style="list-style-type: none"> <li>● Analysis of information related to survey and research activities, drawing up guidelines annual and monthly policy and methods for implementation, and transmission to station for execution.</li> <li>● Regular collection and sorting of survey results from research stations, submitted anti-poaching stations, and mountain huts in writing and by radiotelephone.</li> <li>● Checking and supervision of research staff performance according to plan.</li> </ul>
2) Survey and research	<ul style="list-style-type: none"> <li>● Determination of ecological systems in the park area (listing of all fauna and flora and ecological, topographical, soil, geological, meteorological and other conditions connected with them).</li> <li>● Research on effect of human and natural impacts (grass fires, poaching, etc.) on ecology.</li> <li>● Socioanthropological research on chimpanzees and their impact on the ecology.</li> <li>● Survey safaris conducted with the anti-poaching stations from general base on L. Tanzanyika.</li> </ul>
3) Support of visiting researchers	<ul style="list-style-type: none"> <li>● Ecologists assigned to the park for general and special surveys and research to help in carry out its survey and research function and work in cooperation with one another.</li> </ul>
4) Reports	<ul style="list-style-type: none"> <li>● Preparation of regular (annual and quarterly) reports and research reports (as required) for submission to the administrative section of the park major field station and forwarding to the Kigoma headquarters.</li> </ul>



Fig.-25 Research section at Bilenge Major Field Station



## 1-4 Research stations

Four stations in the Kasoge area will conduct detailed surveys and research on chimpanzees in the wild and report regularly to the major field station for close coordination with the research section. They will also undertake studies aimed at acquiring a knowledge of the overall ecological system of the area.

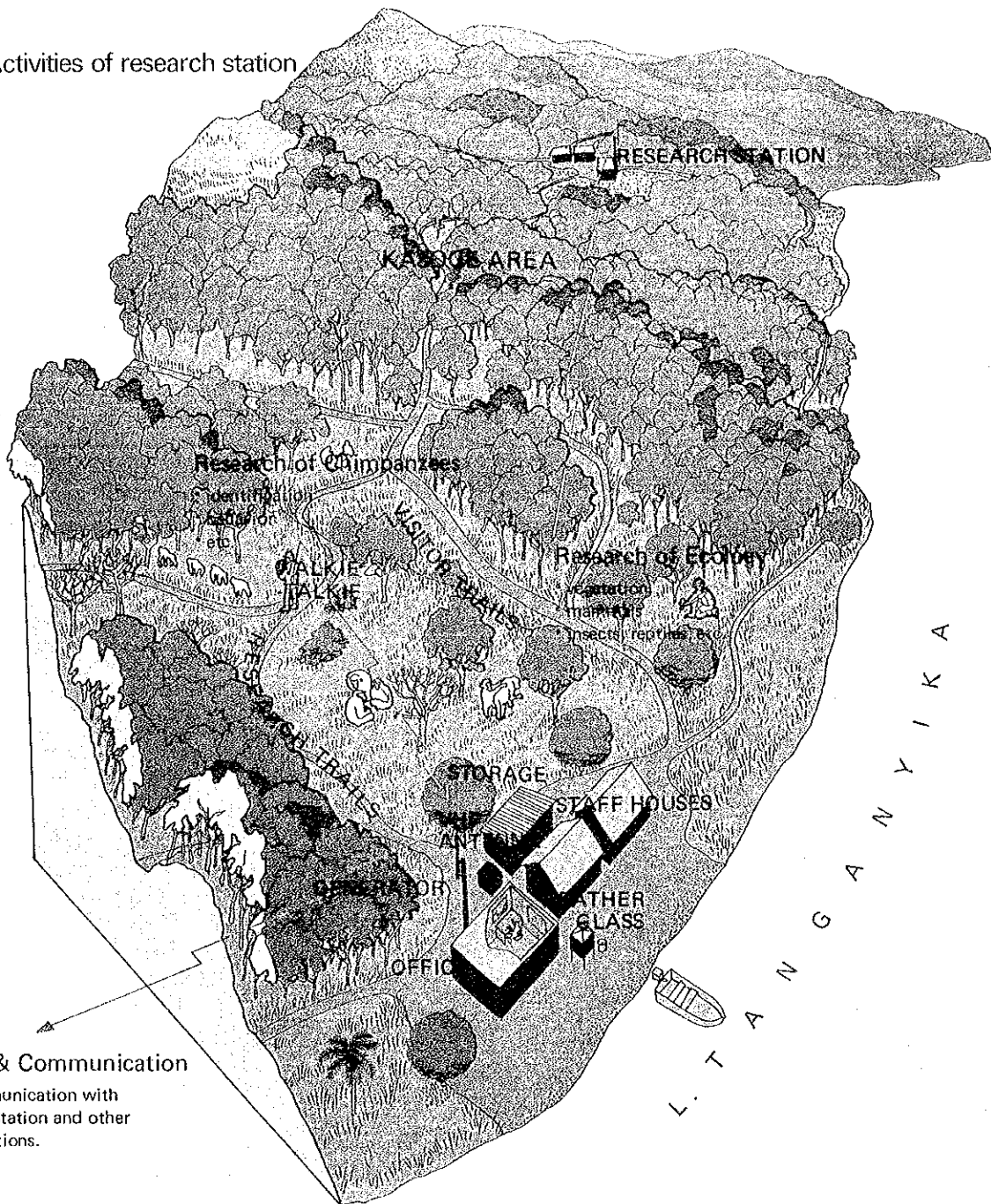
Table-13 Function of research station

Activities	Description
1) Survey and research	<p>On chimpanzees :</p> <ul style="list-style-type: none"> <li>● Identification of each chimpanzee</li> <li>● Life history of each chimpanzee (birth, death, changes in group affiliation)</li> <li>● Area of movement (individual, group, and seasonal movements)</li> <li>● Food (what, where, when, etc.)</li> <li>● Behavior. . .etc.</li> </ul> <p>On ecology :</p> <ul style="list-style-type: none"> <li>● Topography, soil, geology, and type, extent and distribution of fauna and flora.</li> </ul> <p>Meteorological observation :</p> <ul style="list-style-type: none"> <li>● Weather, air temperature, rainfall, humidity, etc.</li> </ul>
2) Reporting	<ul style="list-style-type: none"> <li>● Daily log of survey activities and results.</li> <li>● Daily reporting of these activities to the major field station by radiotelephone.</li> <li>● Monthly written report on survey activities and results for submission to the major field station</li> </ul>

\*Maintenance of observation trails in the course of survey activities (2-4 times a year).



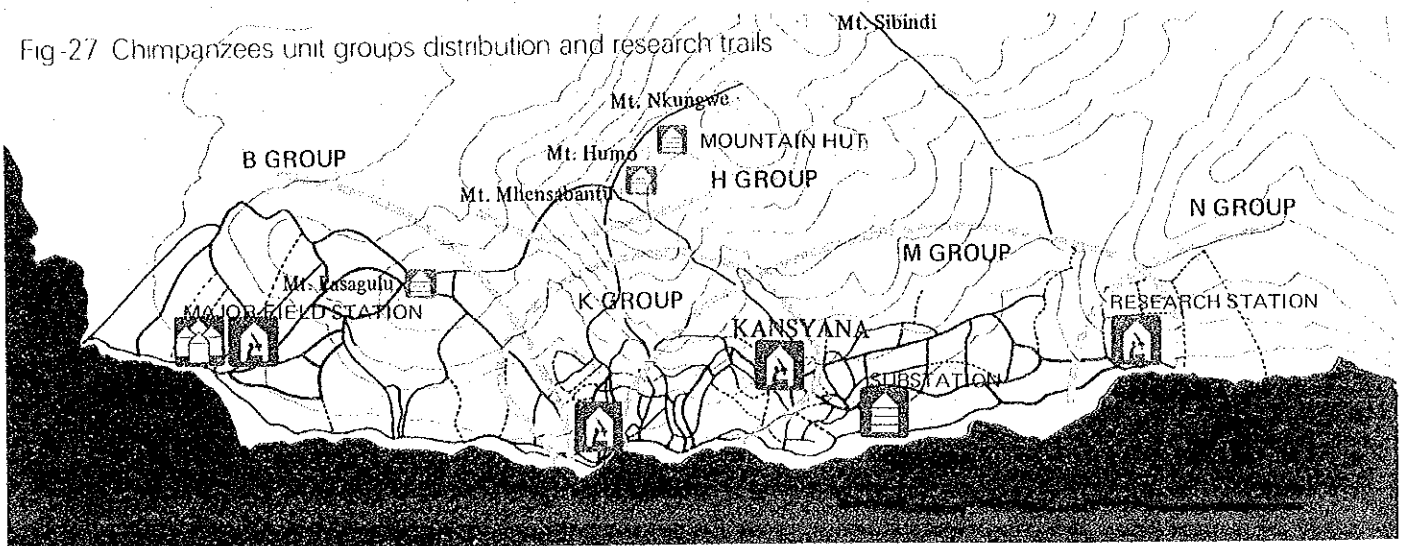
Fig.-26 Activities of research station



Reporting & Communication

- regular communication with Major Field Station and other Research Stations.

Fig-27 Chimpanzees unit groups distribution and research trails



## 2. Field Management

### 2-1 Field management program

#### (1) Protection against Detrimental Human Impact

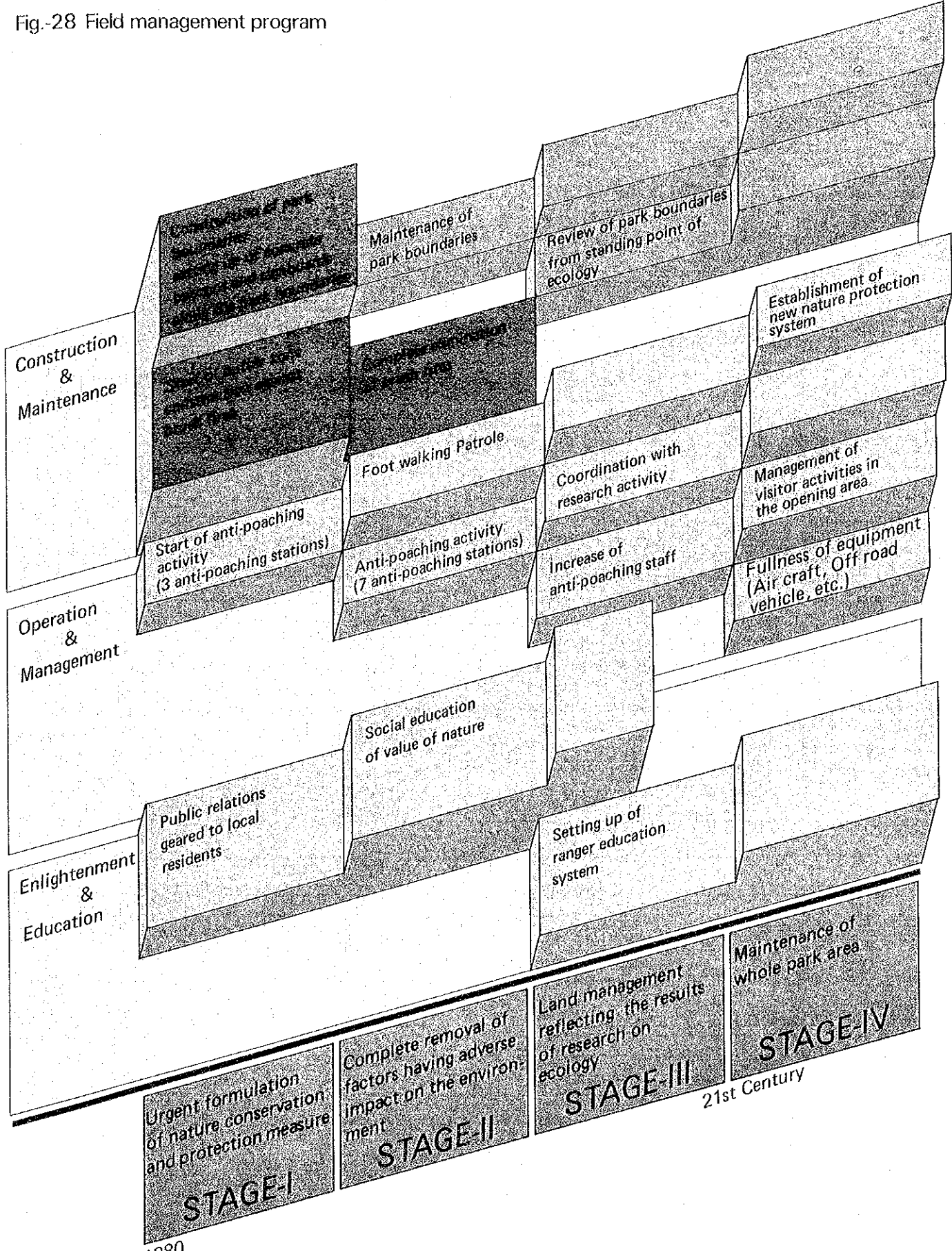
The proposed park area was formerly a part of the territory of the Tongwe. Although it has been almost unpopulated since 1974 as a result of Tanzania's policy of villagization, former low population densities in the area have made it one of the few areas in Tanzania where human impact has remained slight, leaving nature almost unimpaired. There are, however, some localized areas where village sites and slash-and-burn farming have resulted in secondary vegetation growth, and the same thing has happened in parts of the miombo woodland of the area, supposedly, of grass fires. Although the seriousness of the influence of such grass fires is not yet precisely known, miombo woodland is considered to be a type of vegetation that does not recover easily. Considering the tremendous damage done by grass fires to small animals, bird nests, etc. as well, the present policy is to do the utmost to prevent them. Furthermore,

largescale net fishing operations near the lake shores in the vicinity of Kasoge, have been quite detrimental to many species of fish, and tree felling in the vicinity of temporary villages set up by the fishermen has had a adverse impact on the environment.

#### (2) Construction of Border and Public Relations

The boundaries of the park will also have to be clearly marked since the residents of surrounding areas are not to fell any trees in it or even enter it without permission. Since the understanding and cooperation of the residents of surrounding areas is indispensable to the prevention of damage to by human activities and protection and management of nature in the park, public relations in this respect will be a very important activity for the aims of the park to be attained.

Fig.-28 Field management program



1980

21st Century

## 2-2 Field management system

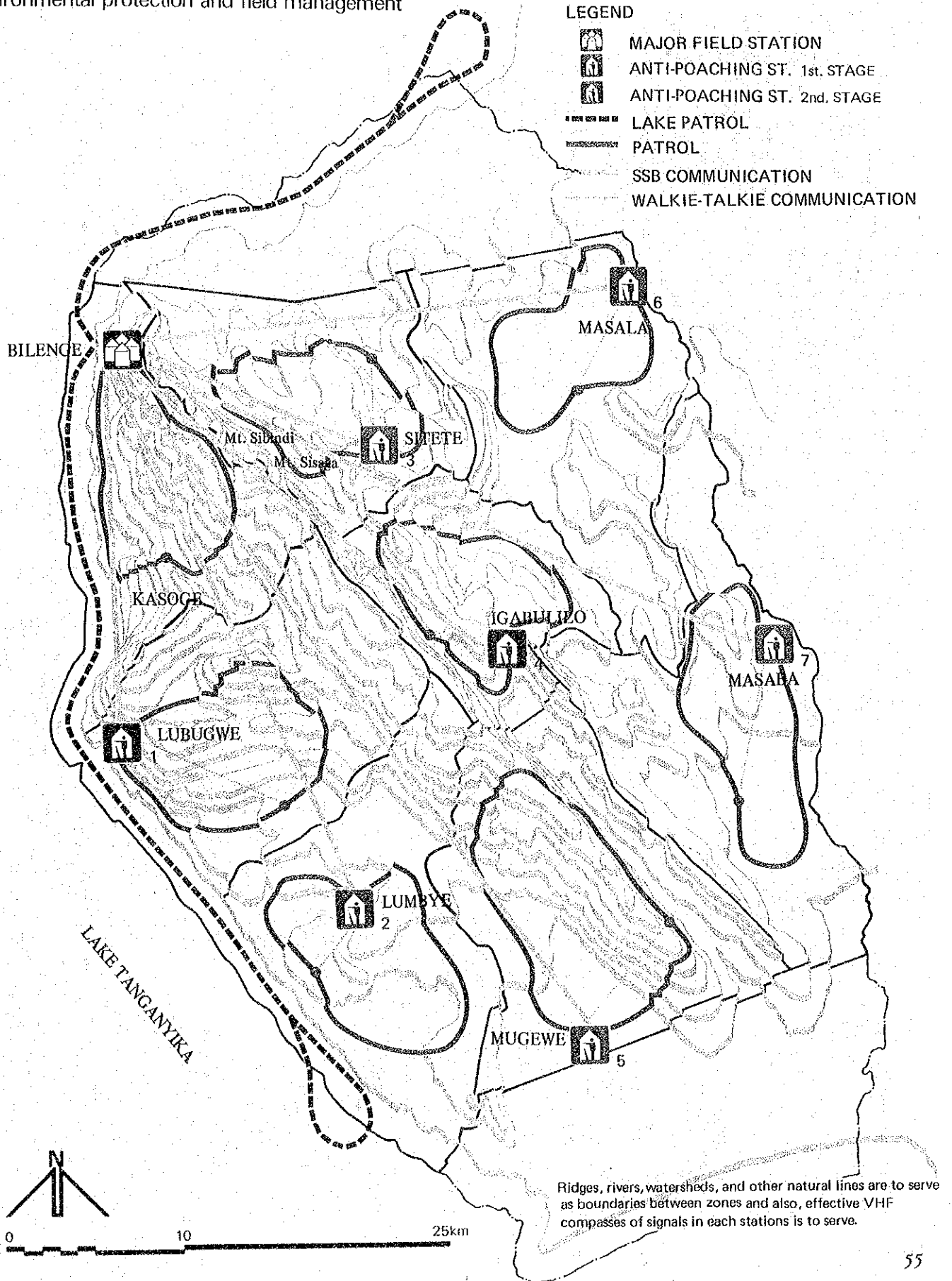
Protection and management of the environment in the park is to be done on a zone basis; there will be seven land zones, which take into account geographical, topographical and other features and one lake zone. Each land zone except the Kasoge zone, the major field station, will have an anti-poaching stations, and two rangers will be assigned to each for surveillance against illegal activities, brush fires and other natural hazards. Radio communications between the major field station and stations and between stations will make for greater coordination and hence better protection and management.

- \* Criteria for selection of location of anti-poaching stations  
Strategic location for surveillance activities.  
Use of vacated village sites minimize damage to the environment.
- \* Criteria for selection of location of M.F.S.  
Optimum accessibility from Kigoma.  
Suitability as the center of park research, maintenance, and visitor activities.  
Use of vacated village site to minimize damage to the environment.

Table-14 Field zoning and location of facilities

Zone	Area (km <sup>2</sup> )	Responsibility of	No. of staff		
			First stage	Second stage	Third stage
1) Kasoge	132	M.F.S.	8	10	15
2) Park waters on lake	96	M.F.S.	3	3	5
3) Lubuguwe	177	A.P.S.-1		2	3
4) Lumbye	180	A.P.S.-2		2	3
5) Sitete	214	A.P.S.-3	2	2	3
6) Igabulilo	143	A.P.S.-4		2	3
7) Mugewe	209	A.P.S.-5	2	2	3
8) Masaba	242	A.P.S.-6		2	3
9) Masaba	220	A.P.S.-7	2	2	3
Total	1,613	8	17	27	41

Fig.-29 Zoning and location of facilities ;  
environmental protection and field management



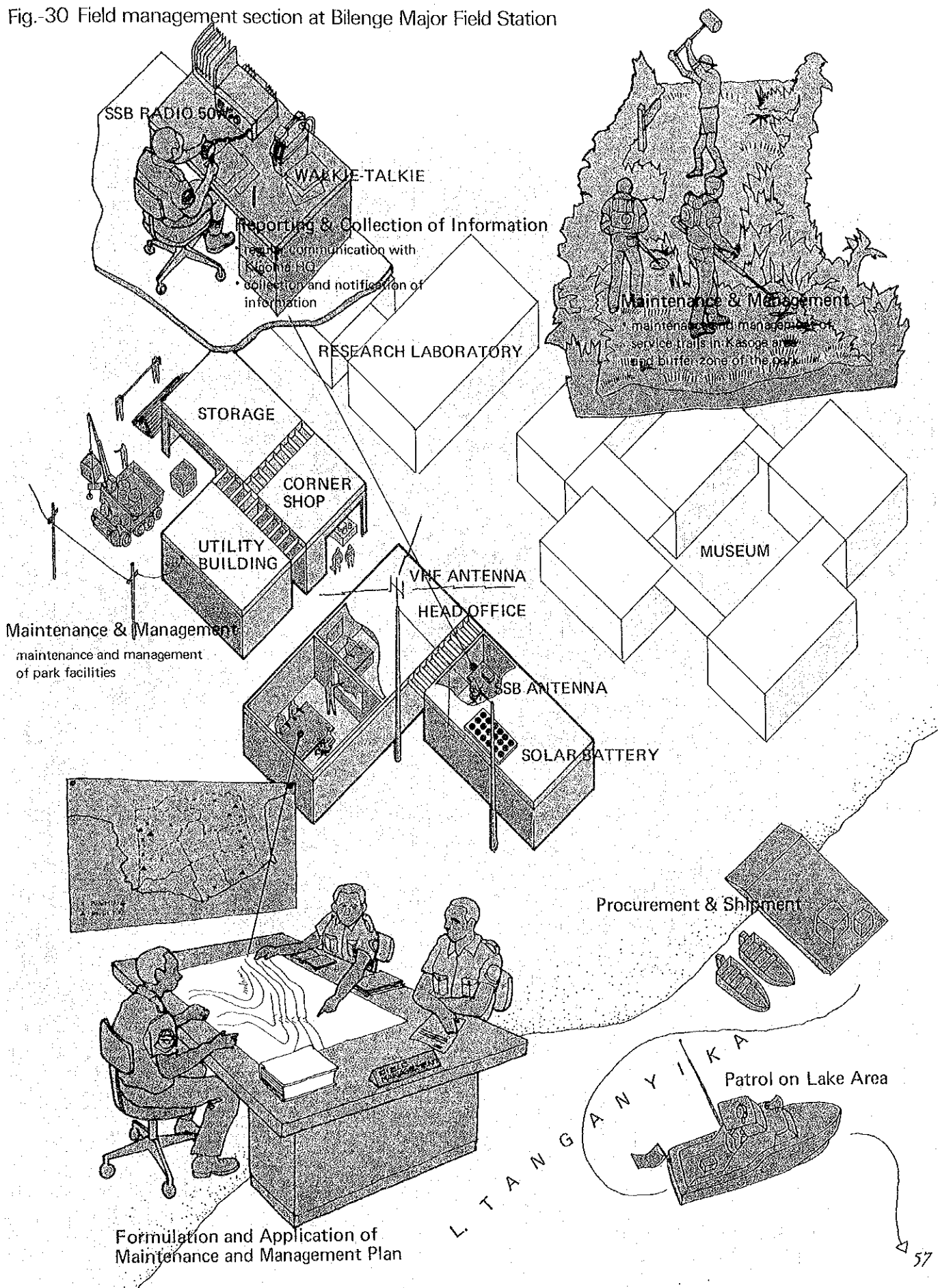
## 2-3 Field management section at Bilenge M.F.S.

The major field station, with direct jurisdiction over the Kasoge area and adjacement waters, will be responsible for the management of the whole park and protection of its environment; this will be done in a planned and systematic manner, based on analysis and study of all pertinent information.

Table-15 Function of field management section

Activities	Description
1) Formulation and execution of maintenance and management plans for whole park.	<ul style="list-style-type: none"> <li>● Monthly and annual management and maintenance guidelines and implementation plans to be formulated based on analysis of relevant information and communicated to the stations for execution.</li> <li>● Collection of information on progress and results of management of anti-poaching and research stations, in the form of written reports and radiotelephone communications.</li> <li>● Supervision of job performance of park management staff.</li> </ul>
2) Reporting	<ul style="list-style-type: none"> <li>● Preparation of annual and quarterly reports at Arusha head office to be submitted to the administrative section.</li> </ul>
3) Maintenance and management of Kasoge area and park waters	<ul style="list-style-type: none"> <li>● Maintenance of trails other than research trails in Kasoge area including (notice boards, etc.) 2-6 times a year.</li> <li>● Weekly patrols of park waters to prevent poaching and other illegal activities.</li> <li>● Emergency rescue service throughout the park area.</li> </ul>
4) Maintenance and management of special areas	<ul style="list-style-type: none"> <li>● Maintenance of buffer zones once a year with team specially equipped for this purpose.</li> <li>● Maintenance of service trails twice a year with team specially equipped for this purpose.</li> </ul>
5) Guidance	<ul style="list-style-type: none"> <li>● Guidance of local residents and visitors to enlist their cooperation in the park's nature conservation and management efforts.</li> </ul>

Fig.-30 Field management section at Bilenge Major Field Station





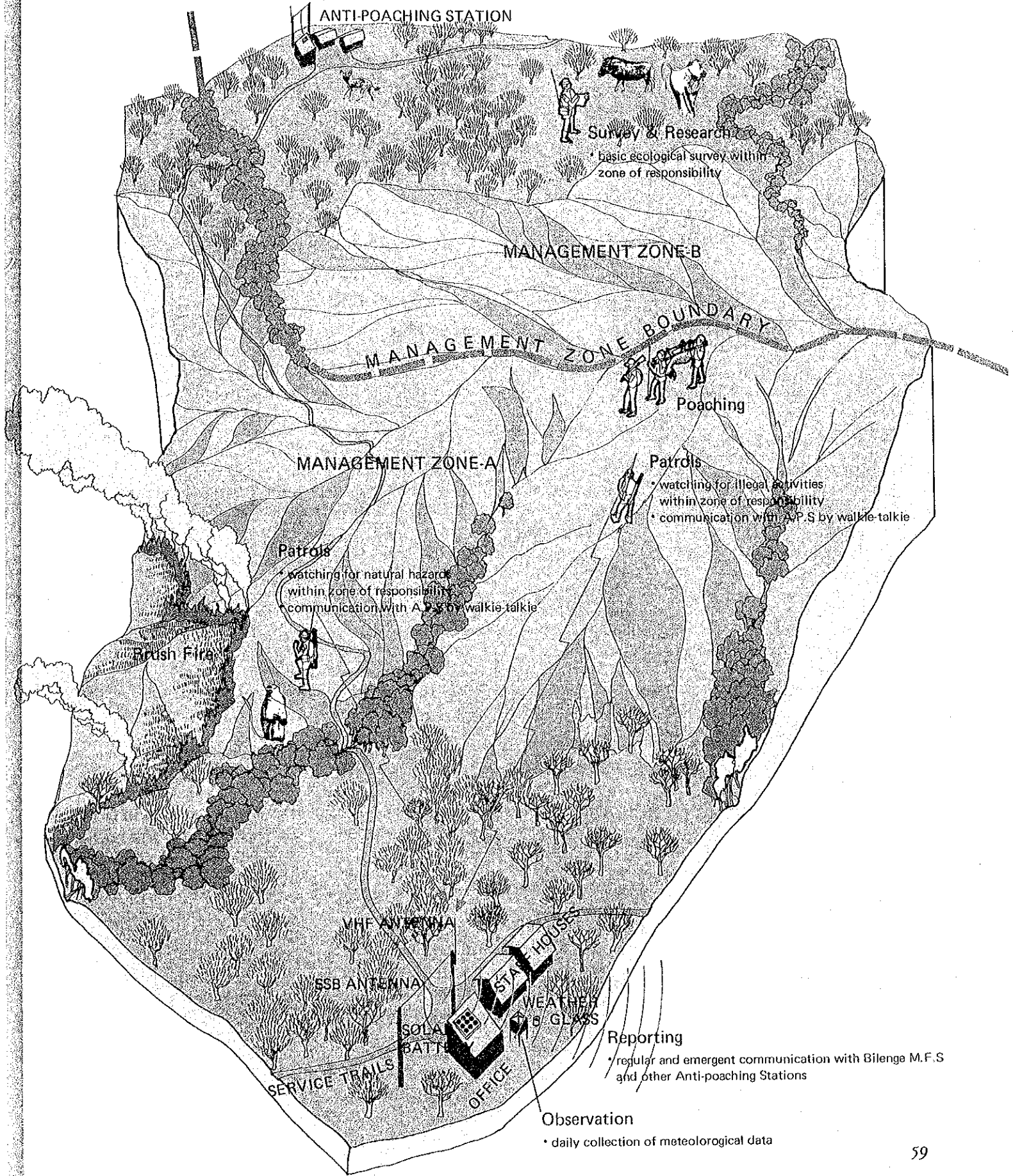
## 2-4 Anti-poaching stations

Each of the seven anti-poaching stations will be responsible for an average zone of about 200km<sup>2</sup>, where they are to watch for illegal activities and natural hazards and report to the major field station at regular intervals, maintaining close radiotelephone contact for greater efficiency.

Table-16 Function of anti-poaching station

Activity	Description
1) Patrols	<ul style="list-style-type: none"> <li>● Watching for illegal activities (poaching, unauthorized entry, felling of trees), changes in terrain, etc. within zone of responsibility.</li> <li>● Watching for natural hazards (land-slides, pestilences, bush fires, etc.)</li> <li>● Emergency rescue operations.</li> <li>● Guidance for prevention of disasters</li> </ul>
2) Reporting	<ul style="list-style-type: none"> <li>● Keeping daily log on conditions in zone of responsibility and management activities.</li> <li>● Daily reporting to headquarters by radiotelephone on conditions in zone of responsibility.</li> <li>● Submittal of daily written reports on state of management, survey results, etc. to the major field station (including meteorological and other survey reports)</li> </ul>
3) Maintenance and management Surveys	<ul style="list-style-type: none"> <li>● Maintenance of notice boards, beacons and other park facilities in zone of responsibility.</li> <li>● Daily collection of meteorological data, including rainfall, air temperature, and humidity.</li> <li>● Basic ecological surveys of distribution, etc. of flora and fauna in course of patrol activities.</li> </ul>

Fig.-31 Activities of anti-poaching station



### 3. Visitor Services

#### 3-1 Facilities for nature sight-seeing

That will be a "Foot Walking Park", allowing visitors to freely wander around, will undoubtedly be one of the main attractions of Mahale. There are no animals presenting any danger to man in the vicinity of the major field station and sub-station and chimpanzees, the main host, can be seen everywhere. The sex, blood and social relationships of the chimpanzees, not to mention individual characteristics and life history, are already known: this makes it possible for researchers and park employees to offer interesting explanations to visitors. The park will also be the only one to offer visitors who can stay for several days a chance to become familiar with some chimpanzees and observe their daily activities. Five of the eight other species of primates, besides the chimpanzees, can easily be seen around the major field station and sub-station. The same is true for 34 of the 49 species of mammals who inhabit the site. As for birds, some 80%, out of a total 120 species, can be observed at various spots in the park. It is assumed that opportunities for the observation of nature can be expanded through the consolidation of visitor trails selected from the present research trails. Sign boards at particular spots should further facilitate this.

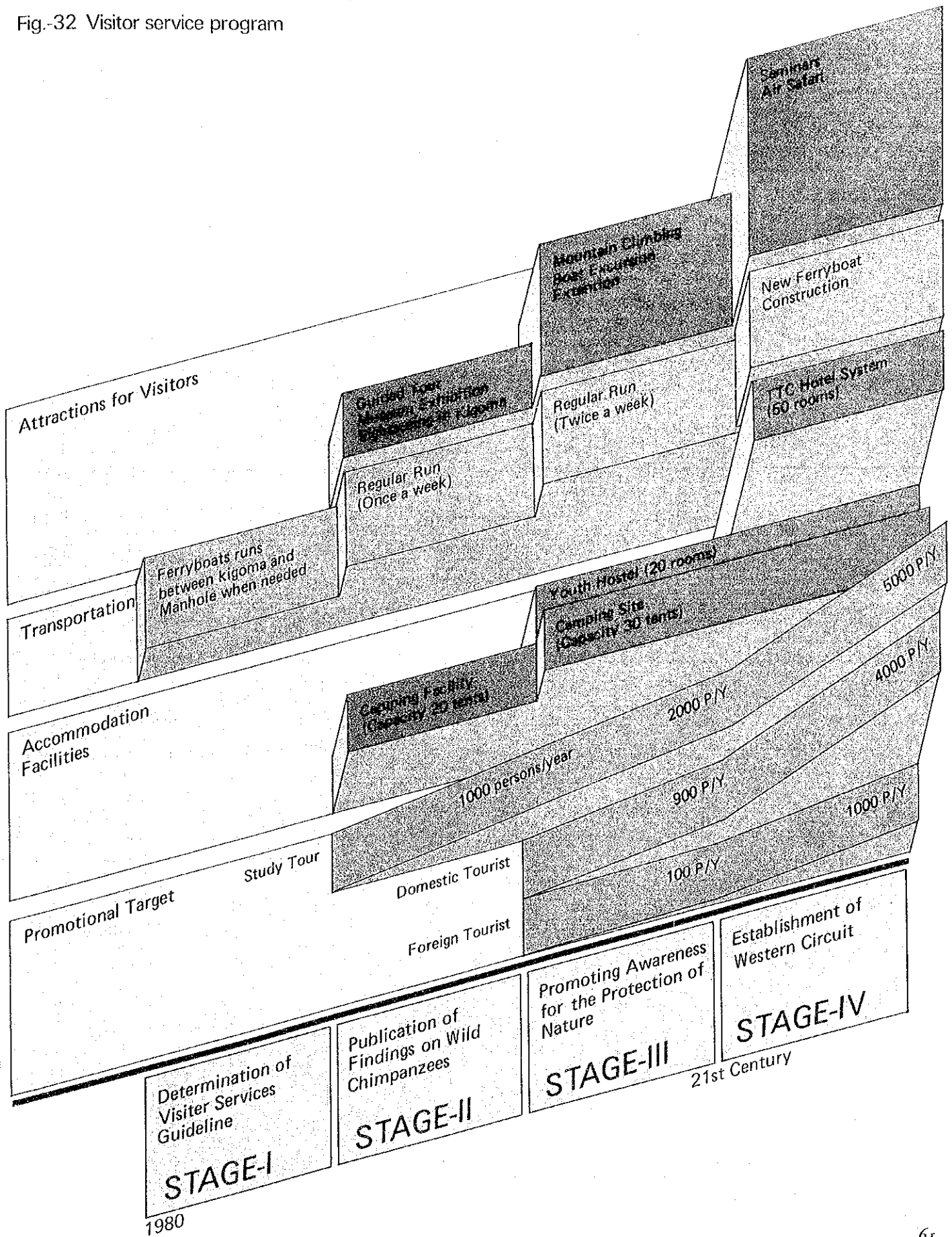
Mt. Nkungwe is the highest peak of the Mahale range, and Mts. Muhensabantu and Pasagulu raise to 2,000-2,400m. The mountains will provide added interest for visitors, who will have a chance to observe the gradual changes in the flora and fauna at various altitudes. The fact that these mountains are close to the field will make mountain-climbing possible once paths and several cottages along them are consolidated. The proposed museum and library will help exposing the visitors to the academic aspect of the environment in Mahale. The museum will let them learn about the fish and other animals of the area, which would be difficult otherwise; it will also make observation in the field more meaningful for them. The library, which should hold books on animals inhabiting the whole African continent, should definitely be of great interest to visitors as well as researchers.

#### 3-2 Visitor services and precautionary measures

The provision of well-planned services and facilities for visitors is of utmost importance to the proper operation of the park. Since most diseases caused by bacteria carried by human or by chimpanzees can be contracted by the other, it is imperative that thorough consideration be given to the matter and that proper preventive measures be taken. Special measures must also be taken against endemic diseases such as cholera, malaria, sleeping sickness, amoebic dysentery, etc., and against poisonous snakes and scorpions. As for other measures and actions to be taken prior to the opening, the following can be considered: accommodations for visitors, consolidation of medical care facilities, sanitary facilities, appropriate transportation means between Kigoma and Mahale; and provision for information and booking service in Kigoma. Moreover, sufficient field personnel will have to be properly trained to help in accordance with the park's visitors operational guidelines.

The park will be opened to the general public upon the completion of facilities, including accommodations for visitors. Study tours are considered to be in the main some time after the opening. Since an increase in the number of visitors from foreign countries as well as from Tanzania is expected to the area in the future, as the park becomes a strategic point in Tanzania's Western Circuit, tourist facilities such as hotels, will be constructed to meet those requirements. As a prerequisite, however, no decision will be made as to the size and location of these facilities without due consideration to their probable environmental impact. Study tours are considered to be in the main for some time after the opening. Since development of the area as an important point of the Western Circuit, however, is assumed in the future, an increase in number of the visitors from foreign countries as well as those from Tanzania is expected. The size and the selection of the sites for tourism facilities as hotels, etc., which should in accordance with number of visitors, shall be constructed to meet the requirements of considered with full realization of nature conservation being a prerequisite.

Fig.-32 Visitor service program



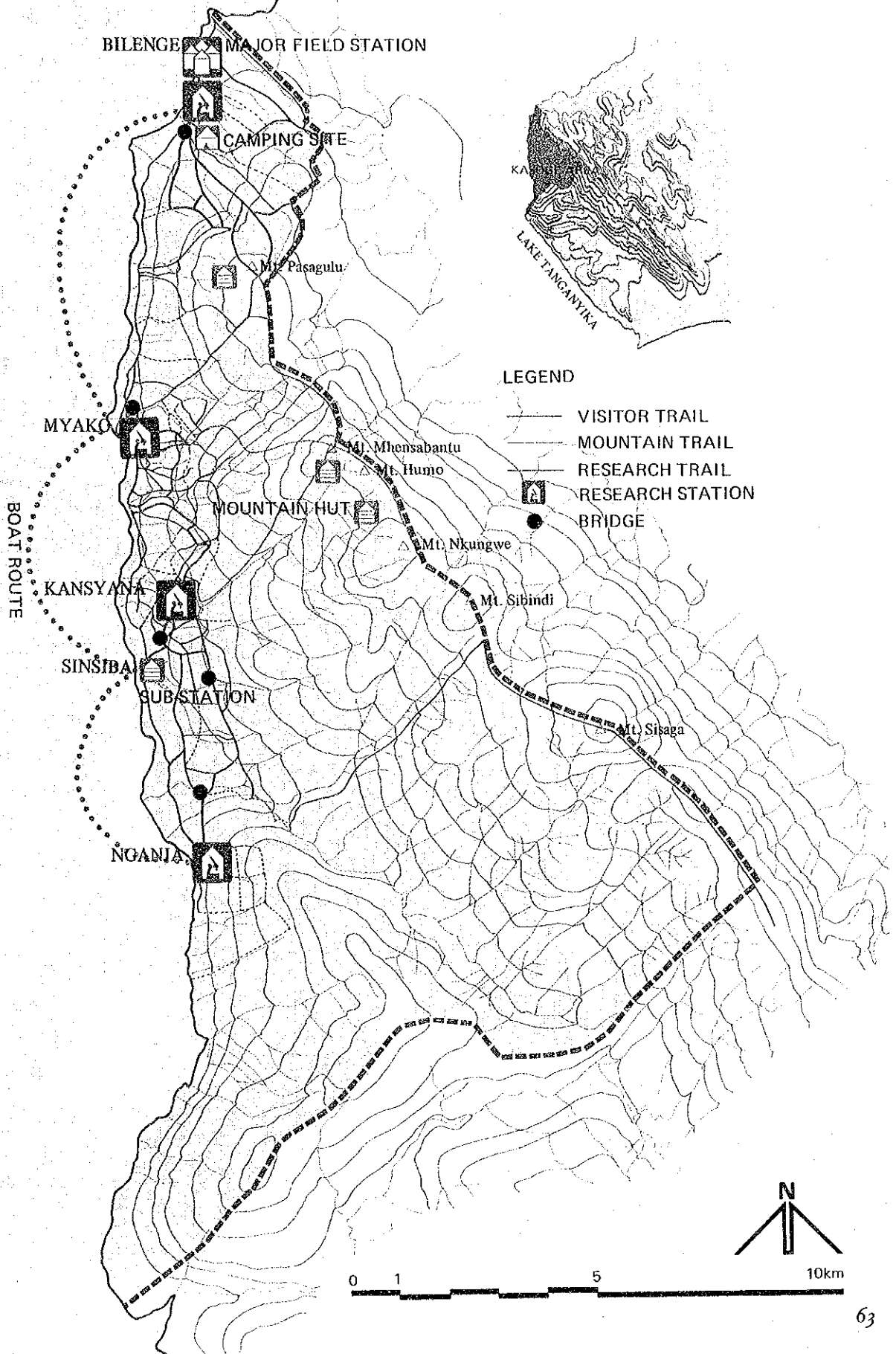
### 3-3 General description of visitor services plan

Kasoge will be the area of the park opened to visitors since it has the most interesting natural conditions and is the most suitable for provision of the necessary facilities. However, public access will be limited, in order to minimize the impact of visitors on the ecological system of the area. "Foot Walking" trails considered suitable in view of the above conditions, will be provided for the enjoyment of nature in the area. There will also be a museum, mountain huts for mountain climbing, accommodations, as well as the necessary service personnel.

Table-17 Description of visitor service facilities

Items		Extent (phase)				Staff required (phase)			Description of the provision
		First	Second	Third		First	Second	Third	
1) Trails	Visitor trails	41km			Trail keepers	5	5	8	<ul style="list-style-type: none"> <li>● Widening of some existing research trails for visitor use.</li> <li>● Use of some research trails as mountain trails as well.</li> <li>● For this route, which will enable visitors to appreciate the park waters on the lake, small boats will be used.</li> <li>● Diversified excursion courses will be established by combining their three kinds of trail/route.</li> <li>● Provision of trail signboards and signboards giving information concerning the fauna and flora for the convenience of visitors.</li> <li>* Everywhere other than these designated routes will be off limits to visitors.</li> </ul>
	Mountain trails	37km		30km		3	3		
	Lake Route (small boats)		about 20km		Boat crew	3	3	5	
	Mountain huts	3							
2) Museum		182m <sup>2</sup>		91m <sup>2</sup>	Museum attendant(s)	1	1	3	<ul style="list-style-type: none"> <li>● Easily understood displays and exhibitions of the fruits of the various kinds of survey and research activities in the park (panels, specimens, models).</li> <li>● Books, documents, literature, films, slides, video, equipment, etc. to enhancement visitor interest.</li> </ul>
3) Accommodations	Camping site	1600m <sup>2</sup>		1400m <sup>2</sup>					<ul style="list-style-type: none"> <li>● Since mainly only domestic and study tourists are expected to visit the park at the beginning, minimal accommodation facilities in the form of camping facilities will suffice. Later on, when the number of visitors increases, the number of tents will be increased, and eventually a lodge will be built.</li> </ul>
	Tents	20		10					
	Hostel			481m <sup>2</sup>					
4) Visitor Services	Guidance				Visitor attendants		3	6	<ul style="list-style-type: none"> <li>● For a more significant, safe, and pleasurable visit the following services are to be provided : a guidance program, furnishing of appropriate information and guidance regarding manners in the park, information regarding park trails, and emergency rescue service.</li> </ul>
					Rescue personnel		2	4	
5) Transportation	Ferryboat between Kigoma and Bilenge	Gross tonnage 65 ton 30 passengers			Ship crew	4	4	4	<ul style="list-style-type: none"> <li>● At first runs only when they are needed, and later regular runs between these two points when the demand so justifies.</li> </ul>
		* Ferryboat for visitor service will be cruised at second stage.							

Fig.-33 Zoning and location of facilities ; visitors area in Kasoge

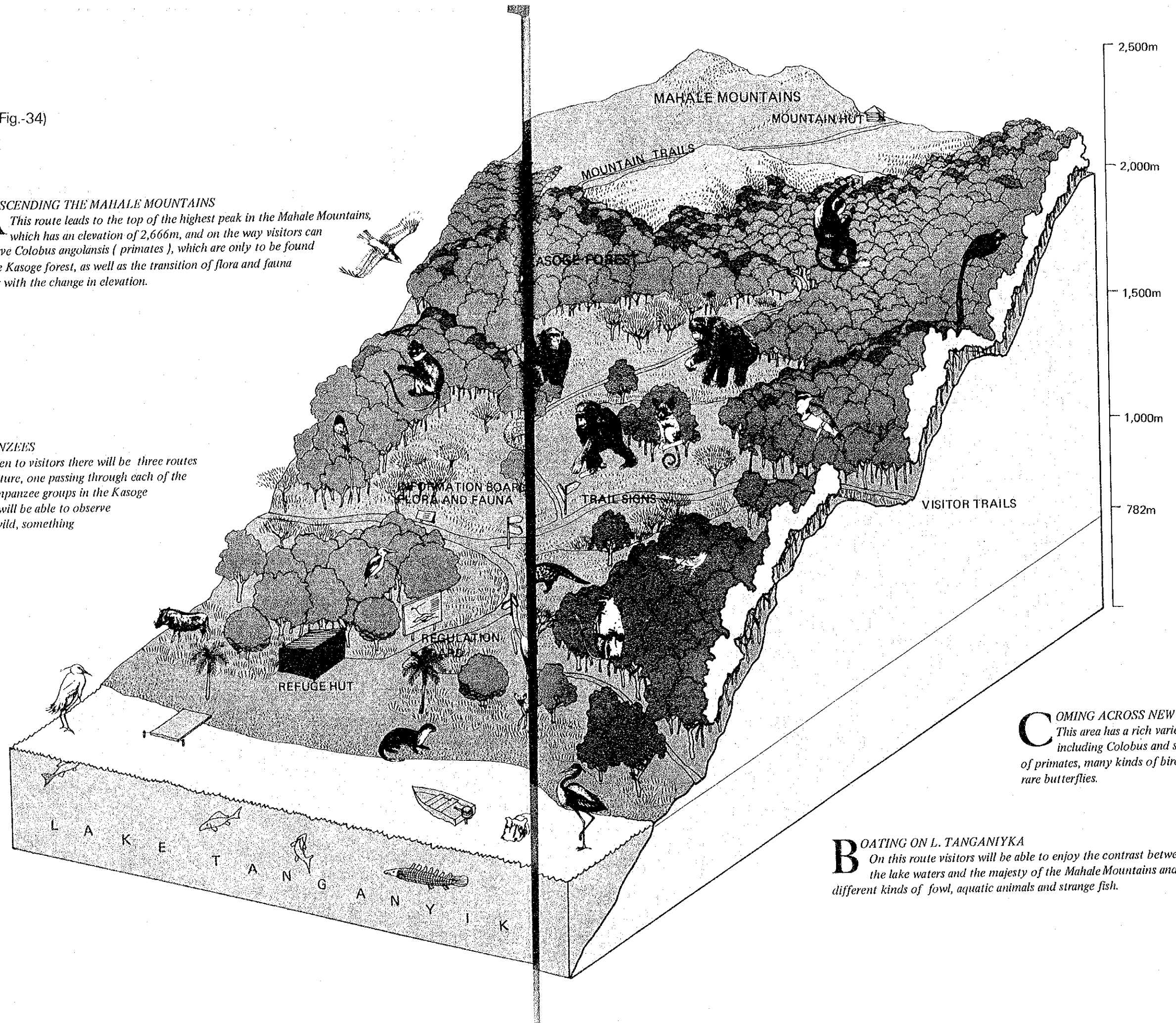




3-4 Sinsiba substation (Fig.-34)

**A**SCENDING THE MAHALE MOUNTAINS  
 This route leads to the top of the highest peak in the Mahale Mountains, which has an elevation of 2,666m, and on the way visitors can observe *Colobus angolans* ( primates ), which are only to be found in the Kasoge forest, as well as the transition of flora and fauna along with the change in elevation.

**S**EARCHING FOR CHIMPANZEES  
 In the area of the park open to visitors there will be three routes for the observation of nature, one passing through each of the habitats of three of the four chimpanzee groups in the Kasoge area. Along these routes visitors will be able to observe the way chimpanzee live in the wild, something which is not possible elsewhere.



**C**OMING ACROSS NEW ANIMALS  
 This area has a rich variety of animal life, including *Colobus* and seven other kinds of primates, many kinds of birds, and rare butterflies.

**B**OATING ON L. TANGANYIKA  
 On this route visitors will be able to enjoy the contrast between the expand of the lake waters and the majesty of the Mahale Mountains and see different kinds of fowl, aquatic animals and strange fish.



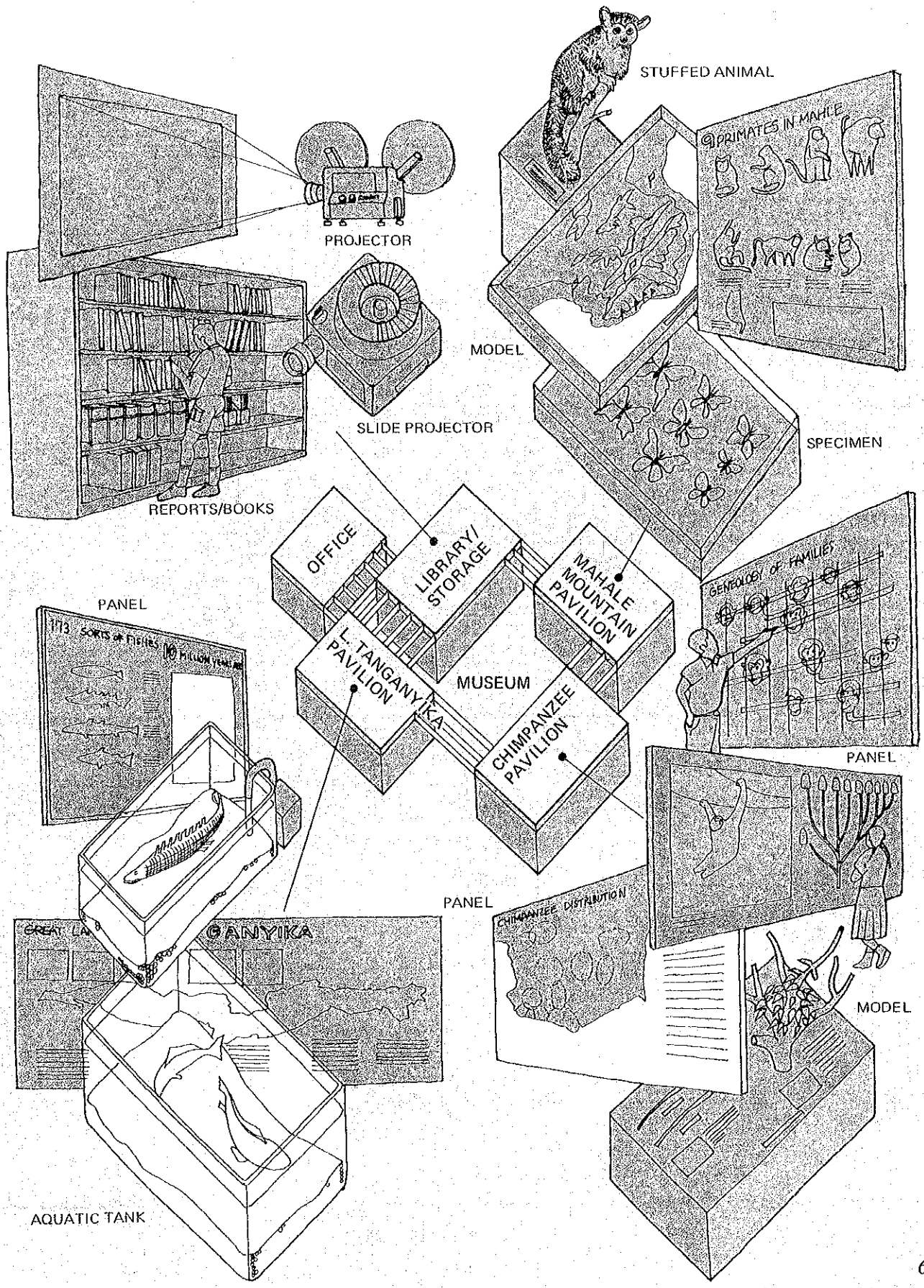
### 3-5 Museum and exhibition plan at Bilenge M.F.S.

The museum will increase the visitors' interest in the natural beauty of the park and enhance their understanding of it. This will not only make people more aware of the need to protect nature but also will have a social and educational value. Using the invaluable findings of long years of research, exhibits can be made concerning the ecology, the social structure of chimpanzee society, the inner working and mysteries of nature that people do not normally have an opportunity to appreciate.

Table-18 Exhibition program

Pavilion	Theme	Description			
1) Mahale Mountains pavilion	Overall view of nature in the park	<ul style="list-style-type: none"> <li>● Flora &amp; Fauna</li> <li>● Environment &amp; Ecology</li> </ul>	Mammals Birds Insects Plants  Topography Geology / Soils Vegetation Wildlife distribution Meteorology	* Examples from other parks as well for comparison	Stuffed animals Stuffed animals Specimens Panels  Models Panels Panels Panels Panels
2) Chimpanzee pavilion	Overall view of the chimpanzees and research on them	<ul style="list-style-type: none"> <li>● Display on the results of the research of KCRS</li> <li>● Primate evaluation chart</li> <li>● Significance, purpose, and methods of research.</li> </ul>		Distribution Ecology Sociology Behavior	Panels & Photographs Panels & Photographs Panels & Photographs Panels & Photographs Panels & Photographs
3) Lake Tanganyika pavilion	Probing the secrets of this third deepest lake in the world	<ul style="list-style-type: none"> <li>● Exhibition of living fish and shellfish</li> <li>● Formation of lake (Great Rift Valley)</li> <li>● Topography of lake</li> </ul>			Aquariums Models Panels
4) Library	For finding in answers to questions that may arise often visiting the pavilions	<ul style="list-style-type: none"> <li>● Perusal of results of research, literature, and books on chimpanzees.</li> <li>● Slides, movies, and other video presentations of particular sights, etc.</li> <li>● Illustrated and other books on the fauna and flora of all of Africa.</li> </ul>			

Fig.-35 Museum



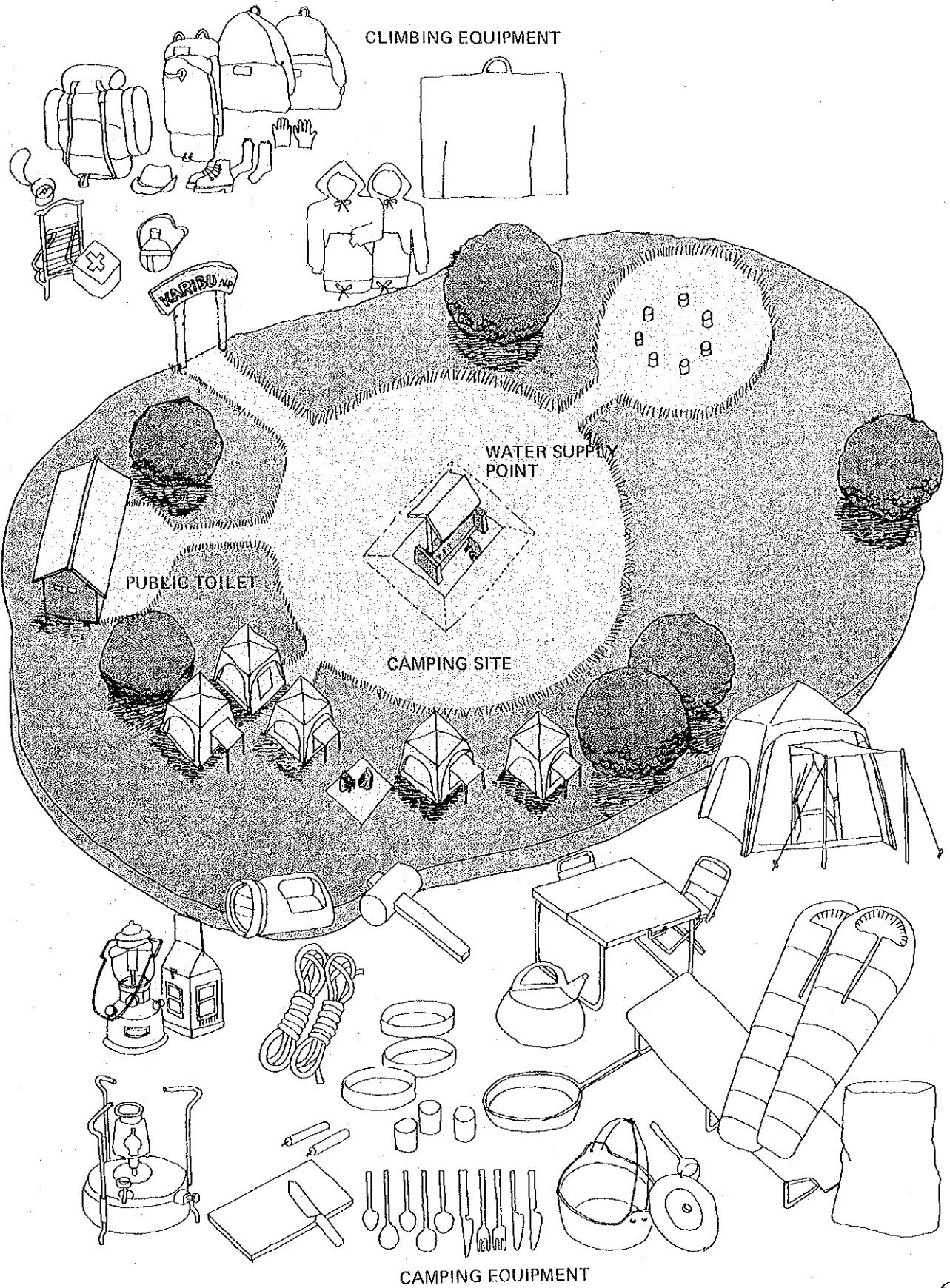
### 3-6 Camp sites at Bilenge M.F.S.

Since only a limited number of visitors will be admitted to the park at first, tents will be adequate for their accommodation. Moreover, living in tents is the best way to get closer to nature and understand it in the park. The camping facilities will be minimal, and visitors will be expected to bring their own food with them, the park stores being primarily for supplying park employees with food and other daily necessities. For safety and convenience the camp site will be near the major field station. However, need arises, number of tents will be increased and eventually a lodge will be built, but due attention will be paid to the necessity of protecting nature in the park from the adverse effect of human impact.

Table-19 Camping facilities at Bilenge M.F.S.

Facilities	Stages		Description
	First	Second	
1) Camp Site	1,600m <sup>2</sup>	3,000m <sup>2</sup>	Ten tents will form a tent group; the initial camp site will be large enough for two groups. Later this will be enlarged to accommodate three groups.
(Building Area)	(20m <sup>2</sup> )	(33m <sup>2</sup> )	In the middle of the site will be an open space, latrines, water supply, and other amenities.
2) Camp Tents	20	30	Tents for tow will be rented to visitors to be erected singly or by pairs so as not to be cramped they will be stored in a warehouse when not in use.
3) Camp Equipment	enough for 30 visitors		Cooking stoves, eating and, cooking utensils, and other camp kitchen equipment, cots, sleeping bags, lamps, fuel tanks, etc.
4) Climbing Equipment	enough for 15 visitors		Back packs, waterproof jackets, first aid kits, water canteens, compasses, etc.
5) Hostel		481m <sup>2</sup>	Meeting room, Toilet, shower room, Bedrooms, Kitchen

Fig.-36 Camping in Bilenge



..... That such drastic deterioration of ecosystem could have taken place in such a short period is certainly deplorable. But it is expected that the establishment of a new national park will help protect the nature in Mahale for the benefit of future generations. ....

..... By 11 a.m., a number of chimpanzees will be satiated. They often rest directly on the ground during the dry season, or in bed in a tree during the rainy season. Mutual grooming or younger chimpanzees engaged in playing takes places during this resting period, which lasts nearly until 3:00 clock in the afternoon. ....



## Chapter 4 Implementation Program



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# 1. Outline of Implementation Works

The implementation works of the Mahale National Park are divided into the following four categories, and an implementation schedule and a cost estimate are presented.

## (1) Park Urgent Implementation Works

Ship Construction	Construction Phase
Construction of ferryboat	1
Construction of barge	1
<b>Park infrastructural works</b>	
Construction of boundaries	1, 2
Construction of airstrip	1
Signboards	1, 2
Construction and maintenance of trail	1, 2
<b>Provision of urgent park facilities</b>	
Kigoma headquarters	1
Tentative field station at Mahale	1
Anti-poaching stations	1
Staffhousing in Kigoma	1
<b>Establishment of radiotelephone system</b>	
Long distance networks	1
Inside park networks	1

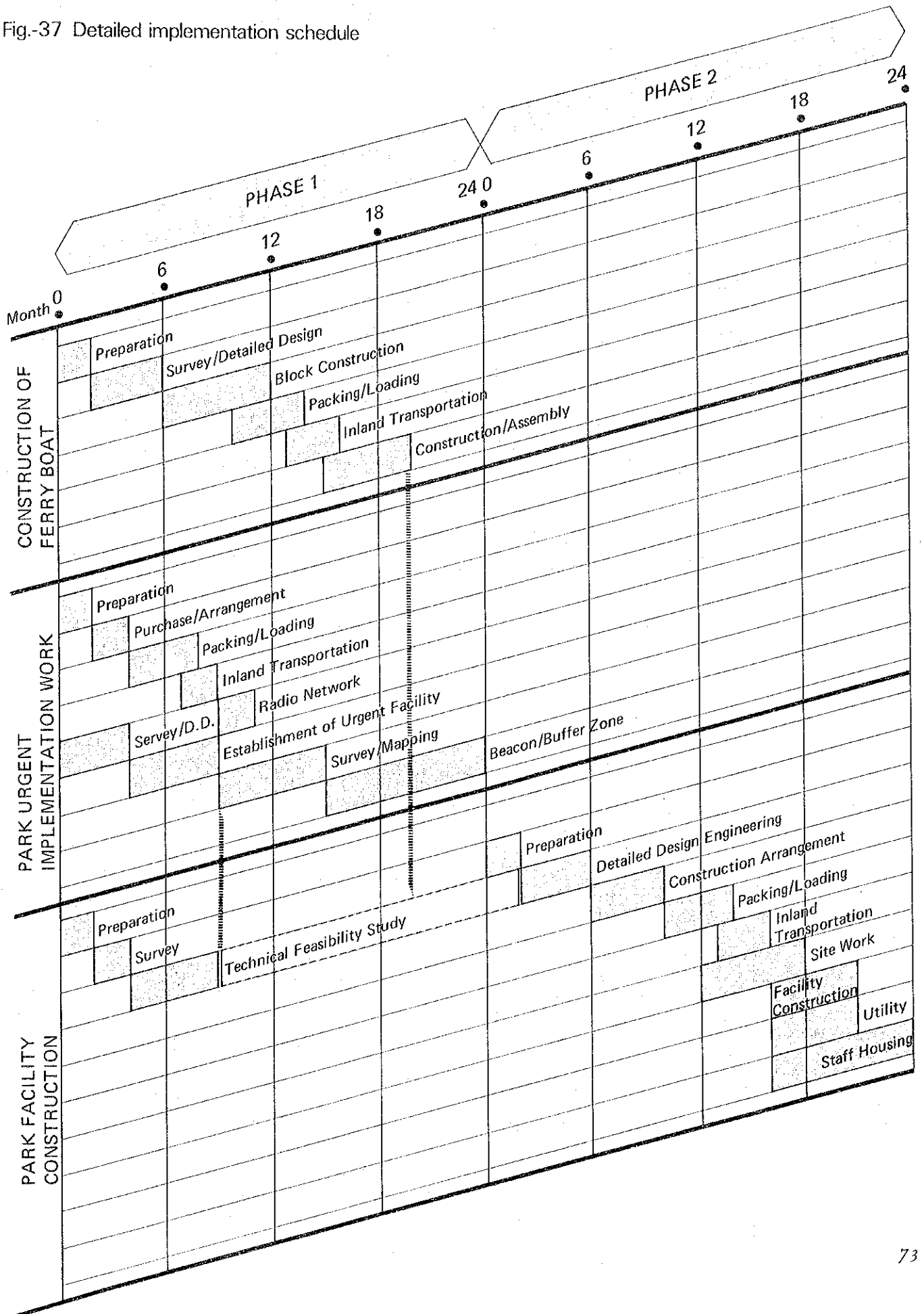
## (2) Construction of Bilenge Major Field Station

Facilities	Construction Phase
Head office	2
Research laboratory	2
Museum	2
Utility building	2
<b>Utility</b>	
Water supply system	1, 2
Electric supply system	1, 2
Site work	1, 2

## (3) Construction of Staffhousing

Staffhousing at the Major Field Station	
Upper staffhouses	2
Middle staffhouses	2
Lower staffhouses	2
Guest staffhouses	2
Public W.C.	2
Research station houses	2

Fig.-37 Detailed implementation schedule





## 2. Approximate Cost Estimates

### 2-1 Outline of construction cost

The contents of park implementation works in three categories are assessed for its approximate cost estimates.

(1) Cost Items (Fig.-38)

(2) Condition for Cost Estimation

Date of approximate estimate	Oct., 1979
Exchange rate: 1.0 Tanzania shs . . . . .	27.3 Yens
1.0 US Dollar	225.0 Yens
Import tax:	disregarded
Contingency:	Ditto

Materials	Equipment	Packing	Inland	Overseas	Domestic	Foreign	Supervise	Survey d/d	LABOUR	CONSULTING		
											Ferryboat	SHIP
											Barge	CONSTRUCTION
											Facilities	PARK URGENT
											Equipment	IMPLEMENTATION
												WORK
											Facilities	CONSTRUCTION
											Equipment	OF MAJOR FIELD
												STATION
											Facilities	CONSTRUCTION OF
											Equipment	STAFF HOUSING

Legend  
 Items of included in cost estimates      Items of not included in cost estimates

Table-20 Project cost estimate by items

	Phase 1		Phase 2		Total
	Construction cost	Survey, design cost	Construction cost	Survey, design cost	
Park urgent implementation works (including ship construction)	13,909 (1,688)	1,475 (179)			15,384 (1,867)
Major facility construction		1,510 (183)	8,306 (1,008)	3,601 (437)	13,417 (1,628)
Staff housing construction	232 (28)	32 (4)	3,667 (445)	478 (58)	4,409 (535)
Total	14,141 (1,716)	3,017 (366)	11,973 (1,453)	4,079 (495)	33,210 (4,030)

Unit : × 10<sup>5</sup> Tanzanian SHS (× 10<sup>5</sup> U.S. Dollars)

## 2-2 Outline of the management and maintenance costs of the park

Management and maintenance costs are classified into the following three categories, based on information obtained from other existing parks:

### (1) Personnel Expenditures

Senior staff salaries  
Subordinate staff salaries

### (2) Maintenance and Administration Cost

Fuel  
Maintenance of buildings  
Fees for business trips  
Maintenance for trails boundaries and flora  
Others: contingencies

### (3) Operation of Ship

Fuel  
Maintenance and operation of ship

Note: This item is unique to this park.

Personnel expenditures and maintenance/administration costs of (1) and (2) are calculated according to the manpower plan in the park's administrative organization and the size of the site. The cost for the operation of the ship has been calculated by assuming one round-trip between Kigoma and Mahale once a week—50 round-trips per year.

Table-21 Operation and maintenance costs of the park

	Phase 1	Phase 2
Personnel expenditures	330 (40.0) 44%	420 (51.0) 45%
Maintenance administration cost	270 (32.8) 36%	330 (40.0) 36%
Operation & maintenance cost of ferryboat	150 (18.2) 20%	180 (22.0) 19%
Total (yearly)	750 (91)	930 (113.0)

Unit:  $\times 10^3$  Tanzania SHS ( $\times 10^3$  U.S. Dollars)

## 2-3 Manpower planning for implementation works

Manpower planning has been grouped under the categories of Specialist (A), Specialist (B) and native laborers on a man-month basis.

### (1) Specialists (A)

Man-month calculation have been calculated using the minimum number of specialists as supervisors and engineers for field assembly, construction and installation of prefabricated and block-processed materials to be imported.

### (2) Specialists (B)

The assessment is made only for the construction of staff housing and cost of supervision from an ecological point of view.

### (3) Concerning the Park's Urgent Implementation Work

Man-month calculations for laborers and supervising engineers for airstrip, boundaries and trail construction have not been assessed.

As to the execution of this plan, deeply consideration is necessary on such matters as necessity of survey, planning and supervising by foreign specialists.

Table-22 Manning schedule for park construction

	Specialist (A)	Specialist (B)	Native labor	Total	Duration of construction (months)
Construction of ship	50		40	90	4
Construction of major field station					
Building	18	6	270	294	6
Utility	6		48	54	4
Construction of staff housing	50	50	1,080	1,130	24
Construction of Kigoma HQ			269	269	12
Setting of radiotelephones & solar batteries	6		10	16	2
Total	80	56	1,717	1,853	

Figure shows the number of man-months

### 3. Whole Implementation Works

#### 3-1 Construction of ferryboat and barge

##### (1) Ferryboat

Passenger transportation between Kigoma and Mahale, a distance of 140km, will be provided by a high-speed single dark steel ferryboat, to be built expressly for the park. Equipped with a in 2-axial diesel engine, it will tow a barge for transporting large machinery or other bulky cargo. It is to be built in several separate blocks in Japan and shipped by sea to Dar es Salaam and then on to Kigoma by railway, to be assembled there.

##### (2) Barge

The barge will also be built and shipped in the same manner, except that shipment will be in the form of panels since internal loss capacity would be too great with blocks.

##### (3) Principal Dimensions

Table-23 Principal dimensions of ferryboat and barge

Items	Catamaran type	Barge
Size : Displacement	45tons	
Gross tonnage	65tons	
Principal dimensions :		
Length (overall)	21.8m	16.0m
Length (p.p.)	20.0m	---
Breadth (M.L.D)	6.5m	8.0m
Depth (M.L.D)	2.0m	2.0m
Draft (Designed)	1.1m	---
Service speed (approx.)	16knots	
Main engine (Diesel)	450 <sup>PS</sup> × 2	550 <sup>HP</sup> × 2
Capacity : Passenger	30persons	---
Baggage	1ton	150tons

3knots when towed by ferryboat

Fig.-39 Catamaran type ferryboat

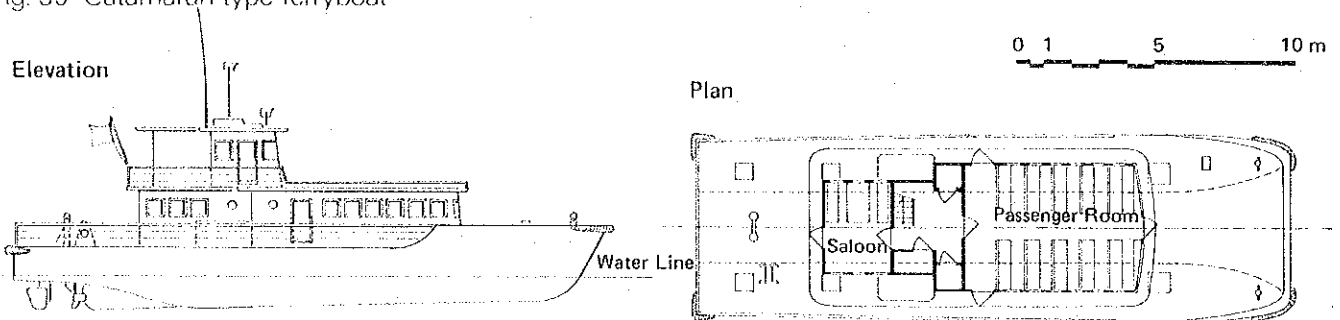


Table-24 Construction schedule of ferryboat

Work	Duration	Place	Notes
1) Detailed design	3 months	Japan	Survey and design
2) Construction arrangements and manufacture of blocks	6 months	Japan (in dock)	Both ferryboat and barge
3) Packing and loading	2 months	Japan	12×3×3.8m containers ; cargo load 10 tons ; assembly equipment (truck crane, welder, working tools, construction deck are included)
4) Shipment by sea	1 month	Japan - Dar es Salaam	By cargo ship
5) Overland shipment	2 months	Dar es Salaam - Kigoma	By Tanzania Railway
6) Assembly	4 months	Kigoma (in dock)	Specialists, Labor,
7) Trial runs	1 month	Kigoma - Mahale	

### 3-2 Urgent park facilities

#### (1) Kigoma Headquarters

Headquarters are urgently needed in Kigoma, as described below, both during and after park construction:

##### During construction:

Park operation and management  
Purchase, and shipment of locally procured supplies for Mahale National Park.  
Procurement and shipment of equipment materials.  
Making arrangements for construction workers and supervisors.

##### After park opening:

Park operation and management  
Regular communications with the national parks head office in Arusha.  
Ferryboat operation and maintenance, passenger reservations, and ticket sales.  
Park information and visitor services.  
Procurement and shipment of food and other supplies for the park.

##### Facilities:

To be provided by National Parks Corporation	
Office	140m <sup>2</sup>
Storage room	30m <sup>2</sup>
Parking area	30m <sup>2</sup>

##### Staff:

Administrative section	8
Ship transportation section	4

##### Equipment:

4-wheel drive jeeps	2
For supply procurement and liaison in Kigoma.	
SSB 150 receiver-transmitter	
For communications with Arusha, Mahale, and ferryboat.	

#### (2) Mahale Tentative Field Station

This office is to be used as a construction supervision office during park construction and as temporary park stations until completion of the permanent major field station.

##### Purposes:

Supervision of park construction work.  
Communications with Kigoma headquarters and ferryboat.  
Management of locally procured supplies and materials

and equipment.

Taking over research and management functions of KCRS.

##### Facilities:

Use of facilities of existing Kansiyana camp.

Staff: Taking over KCRS staff.

Administration	4
Field management	10
Research	9
(Construction manpower discussed elsewhere.)	

##### Equipment:

Off-road vehicle  
For use during construction of park infrastructure and transport of major field station equipment and materials.  
Civil engineering and surveying equipment  
For works for provision of park infrastructural works and for construction of major field station.

##### Equipment presently under KCRS management:

Wooden boats with outboard engines.  
Binoculars, cameras, and other observation equipment.

#### (3) Anti-poaching Stations

Three of the seven anti-poaching stations proposed in the master plan should be set up with other urgent facilities.

##### Facilities:

2 x 36m<sup>2</sup> per family at each of 3 stations = 216m<sup>2</sup>

##### Staff:

2 rangers at each of 3 stations =  
6 rangers, with their family.

##### Equipment:

Transceivers  
For communication with headquarters and with station during patrols.  
Solar batteries  
For operation of transceivers.  
Auto-recording thermometers, hygrometers, rain gauges, and other meteorological equipment.  
Binoculars  
Camping equipment: Tents, bags, clothings, etc.

### 3-3 Radiotelephone system

The radiotelephone system described below has been chosen for the park, taking into account the distances, purposes and conditions of use and after a through study of radio waves propagation in such areas.

Table-25 Radiotelephone system

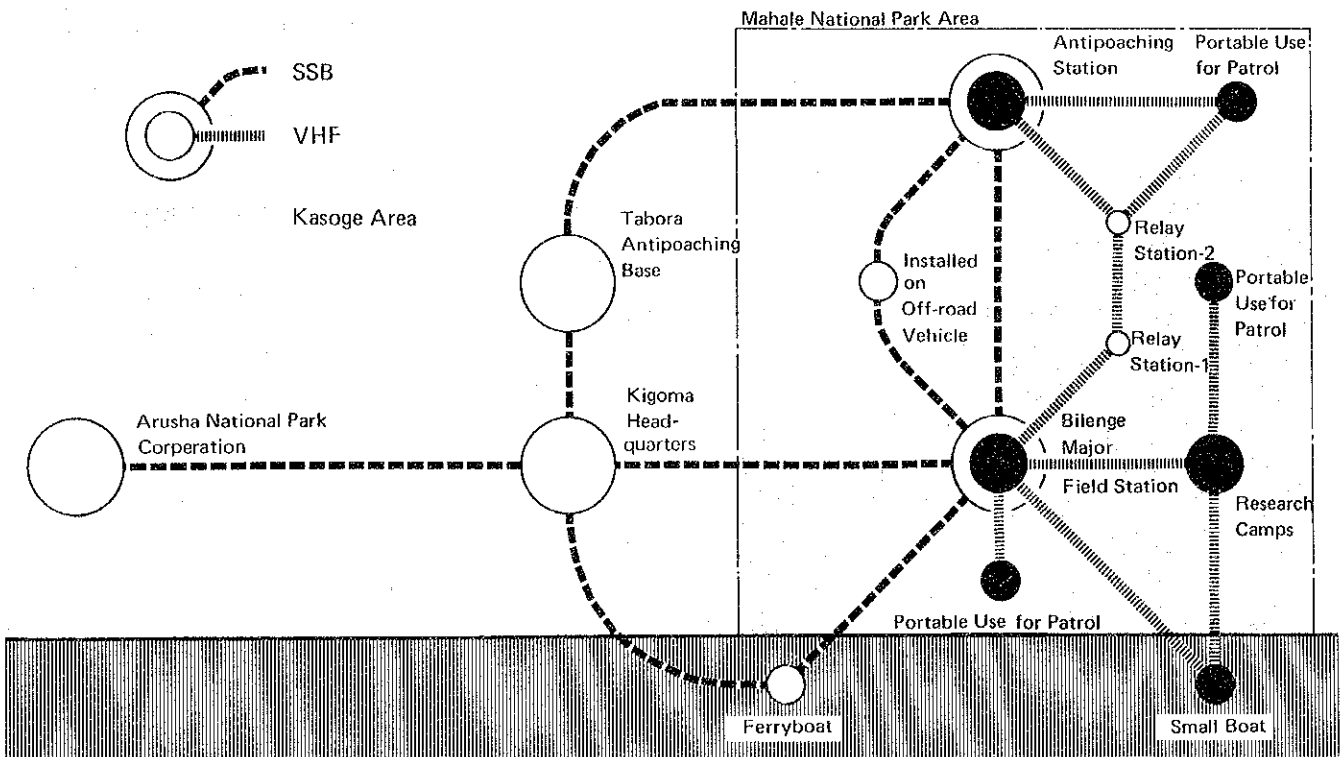
Range of communications	SSB SYSTEM (Single side band of short wave)		VHF SYSTEM (Very high frequency)	
	Base station use	Mobile station use	Base station use	Mobile station use
Long distance use	For regular communications between Bilenge and Arusha between Bilenge and Kigoma.	For communications with ferryboat during runs.		
Inside park uses	For regular communications between Bilenge and anti-poaching stations.	For communication with off-road vehicles while in operation.		For communications between Bilenge and speed boat on patrol. For communications between anti-poaching stations and rangers on patrol. For direct communications between rangers on patrol and Bilenge during emergencies.
Kasoge area use			For regular communications Bilenge and research station.	For communications between research station and rangers on field surveys.

	SSB System	VHF System
1) Wave characteristics	Most suitable for the range of 40~50km by ground wave under the complex land form. Long distance communications. Little influence from topographical conditions.	Short distance communications (30~40km at most on flat land). Not suitable under the complex land form. But, it is possible to communicate between each station, if setting the relay station on the highest place where visible from each station.
2) Facilities	Large & heavy transmitters and receivers. Large antennas. Considerable power consumption.	Small, light transmitters and receivers. Simple antennas. Small power consumption.
3) Conclusions	Most suitable for stationary use. (Can also be used if installed in vessels and vehicles.)	Suitable for portable walkie-talkies. (For patrols, rescue operations, and field surveys.)

Table-26 Detailed description of radiotelephone

Type of communication	Code	Station	Linking	Equipment	Power source	Remarks
1) SSB : Long-distance	(≅ 1)	Kigoma Headquarters	- Arusha - M.F.S. - Ferryboat	150W SSB	town electric	Manned relay stations Stationary
	(≅ 2)	Bilenge Major field station	- HQ - Ferryboat	50W SSB	solar batteries 12V, 39.2W	Stationary
	(≅ 3)	Ferryboat	- HQ - M.F.S.	50W SSB	batteries on boat	
2) SSB : Inside park	(≅ 4)	Anti-poaching stations	- M.F.S. - Other A.P.S.	50W SSB	solar batteries	Stationary
	(≅ 5)	Off-road vehicle	- M.F.S. - A.P.S.	50W SSB		
3) VHF : Inside park	(≅ 6)	Anti-poaching stations	- M.F.S.	10W VHF	solar batteries	Patrols
	(≅ 7)	Mahale mountains relay station	HQ - A.P.S. A.P.S. - A.P.S.	10W VHF Duplex	solar batteries	Unmanned relay station
	(≅ 8)	Speed boat	- M.F.S.	10W VHF	batteries on boat	For use on patrols of park waters.
4) VHF : Kasoge area	(≅ 9)	Bilenge Major field station	- A.P.S. - R.S.	10W VHF	generator	Walkie-talkie in pairs, one stationary and the other mobile.
	(≅ 10)	Research station	- M.F.S.	10W VHF	generator	

Fig-40 Radiotelephone network



### 3-4 Work on the park's infrastructure

Prior to construction work for Mahale National Park itself, the work below must be carried out as soon as possible.

In view of the area's remoteness from urban and the fact that there are hardly any people living in it, the supply of construction manpower will be difficult, and logistics will be a big problem. Accordingly, in order to keep manpower requirements to a minimum and make it possible to complete park in a short period of time, considerable use should be made of simple machinery such as power mowers, chain saws, rock drills, winches, and off-road vehicles.

(1) Field Surveying

Surveying of 55.5km of park boundaries on the north and south sides.

Surveying of proposed site of airstrip and collection of navigation data.

Surveying of proposed site of park major field station.

(2) Boundary Delimitation

Construction of 15m wide buffer zone along 55.5km of park boundaries on north and south sides for protection against bluish fires.

Setting up concrete beacons along the 104km of the northern, eastern, and southern boundaries of the park.

(3) Airstrip Construction

A simple emergency runway is to be built to the north at Bilenge just outside the boundary. The exact site

cannot be determined, however, until detailed data is obtained regarding terrain in the rainy season and navigational conditions.

The length is to be at least 750-1,000m and the width 30m, to accommodate the types of aircraft owned by the National Park Corporation (Cessna 206 and 210) and the size of other national park runways.

(4) Signboards

Signs designating the limits of the park are to be set up at 5km intervals all along the total length of the park boundaries (167km)

(5) Trail Signs

Signs giving the name of the trail and where it leads to are to be set up at key points and forks of all of the park trails. (total length; 604km)

(6) Notice Boards for Visitors

Signs are to be set up along visitor trails to indicate the layout of the park and give explanations on trees, plants, and wildlife, in order to enhance their enjoyment of the park.

(7) Construction and Maintenance of Trails

At present there are approximately 300km of research trails in the area that is to be designated as a national park. With construction of the park and provision for new facilities, 175km of trails will be widened, and another 305km newly provided. Chain-saws will be used to work more efficiently. Simple ropeways will also be provided at six points where valleys are hard to negotiate in the rainy season along research and visitor trails.

Table-27 List of trail construction

Types	Proposed width (m)	Existing	Extention	Newly construction	Total
Service trails	1.0 ~ 2.5		110.0	258.0	368.0
Mountain trails	1.0	36.6			36.6
Research trails	1.0 ~ 2.0	87.3	25.7	44.6	157.6
Visitor trails	2.5		39.3	2.1	41.4
Total		123.9	175.0	304.7	603.6

Unit : Kilometer

Table-28 Maintenance schedule

Name	Number of times of maintenance/year	Trail keeper work capability(M/D)	Manpower requirement (person) (day)
Service trails	2	250	50 × 60
Mountain trails	2	150	8 × 60
Research trails	2-4	250	6 × 300
Visitor trails	4-6	250	3 × 300



### 3-5 Construction of the major field station

- (1) The following facilities are to be provided at Bilenge, north of Kasoge as a major field station for overall park operation, management, and maintenance.

Each of the four research stations will have a 53m<sup>2</sup> prefabricated building for use as office, laboratory, and storage space for more efficient survey and research activities. Cost of those facilities are included in major field station estimate.

#### (2) Construction Schedule (Table-29)

Type of work	Duration	Place	Remarks
1) Detailed design	5.5 months	Mahale+ Japan	Local technical field surveys and site surveying Design work in Japan
2) Manufacture of prefabricated building/purchase of equipment and materials	4.5 months	Japan	
3) Packing and loading on ship	2.0 months	Japan	
4) Shipment by sea	1.0 month	Japan Dar Es Salaam	
5) Overland shipment	2.0 months	Dar Es Salaam By Tanzanian Kigoma	Central Railway
6) Shipment on lake	2.0 months	Kigoma Mahale	By new ferryboat and barge (or by chartering other vessel)
7) Site earthwork	2.0 months	Mahale	
8) Assembly of prefabricated buildings	4.0 months	Mahale	Panel assembly using small crane on off-road vehicle

#### (3) Building Specifications

##### Foundation:

Continuous footing basement

##### Buildings:

Assembly and fixation of roof, wall, and floor panels.

Doors, windows, and partitions:  
To be provided with wall panels.

Wiring and piping:  
To be provided with wall panels.

#### (4) Basic Consideration with Respect to Construction

As a general rule, prefabricated modules will be used to save manpower, in view of the difficulty of recruiting and maintaining workers in such a remote area.

In the course of construction work, care must be taken, through proper work supervision, so as not to harm the park's environment due to movement of earth, felling of trees, pollution of lake waters, etc.

In as much as possible, construction materials should be made of steel, in view of the damage done by termites to wooden structures. Furthermore, water piping should be laid above ground because of possible damage that would be caused to it underground by moles and other earth digging animals.

Minimal non-polluting electric supply, water supply, and sewerage systems, that can be easily maintained should be provided.

Table-30 Facility list of Bilenge M.F.S.

Facility	Site area (m <sup>2</sup> )	Building floor area (m <sup>2</sup> )	Stall	Main equipment and fixtures
1) Head office	600	153	24	Transceiver, Office equipment and fixtures, First-aid and basic medical care equipment, etc.
2) Research laboratory	620	147	11	Survey, and investigation apparatus, dark room equipment, specimen equipment, etc.
3) Museum	750	187	2	Exhibition panels and shelves, projector, etc.
4) Utility building	200	51	6	Incinerator and maintenance tools and equipment.
5) Visiting researcher's hostel	380	91	5	Beds and other furniture
6) Camping site	1,600	20		Tents, camping equipment, binoculars, etc.
Total	4,156	649	48	

### 3-6 Construction of utilities and on-site work

#### (1) Water supply

##### Daily volume assessment

A standard volume of 150 liters per day for the park major field station and the staffhousing has been set for the assessment.

##### Water supply system

The amount of water required for a single day will be obtained from the source and stored in the water tank, to gravity-fed to the individual buildings. It is hoped that the water supplying system relies as little as possible on mechanical devices: future feasibility studies (survey, measurement) on the use gravity are recommended.

##### Water source

The following requirements should be met: that it does not dry up during the dry season; that it be located close to the construction site; and, if possible, that it be located at an altitude that will permit gravity-supply of water to the tank.

##### Reservoir and pump

The reservoir should be designed to hold 2--3 times the volume of the water tank. The pump will be motor-powered.

#### (2) Electric Supply

##### Standards for the assessment of power generation

The amount of electricity to be supplies is based on the assumption that one lighting appliance will be installed in each room of major field station and staffhousing.

##### Electric supply system

Three diesel powered generators will be installed as follows:

- No. 1 Major field station and camp site
- No. 2 Staffhousing
- No. 3 Power supply; auxiliary power

All three will be identical in type, supplying 30KVA, enabling exchange of parts in case of a breakdown. Fuel will be supplied from barrels to the service tanks by manual wing pumps, later by gravity.

##### Distribution system

Electric supply to each building will be through overhead supply lines.  
Poles will be of the steel type.  
Period of service will be for four hours after sun-set.

##### Outside lighting

Lights will be installed around the major field station, staffhousing and the camp site.  
Several 200W lights will be installed near the Jetty.

##### Emergency and daytime power generation

In case of emergency or when the service is sought during the day, the 0.5KVA electric power generator will be used.

#### (3) Sewage

##### Drainage assessment

A maximum of 120 liters (60% of which or 70 liters, being toilet drainage) has been calculated per person per day for the major field station and staffhousing.

##### Drainage system

Drained water will be directed to a purification tank attached to each compound, then filtered. Other sewage water will be directed through the filtration inlet; rain water will be directed to the lake through an open ditch around the site.

##### Important note

In order to maintain the sanitary conditions of the major field station and staffhousing a sewage purification system is most import. When filtering water, extra attention should be paid so as not to pollute the lake. This is of paramount importance because of the sandy nature of the soil, which means that the rate of infiltration is high.

#### (4) Site Work for Major Field Station

Park major field station and staff housing will be constructed in the now deserted region of Sinsiba: siting work for this purpose will be done during Phase I.

Table-31 Facility list of research station

Camp	Staff housing	Research base	Electric supply
Kansyana	existing	52m	Power generator (0.5kVA)
Myako	existing	52m	Power generator (0.5kVA)
Nganja	36m x 2 units = 72m	52m	Power generator (0.5kVA)
Bilenge	existing	52m	Power generator (0.5kVA)
Total		208m	

### 3-7 Staffhousing

#### (1) Staffhousing at the Major Field Station

##### General description of facilities

They are designed to accommodate the staff working at the major field station and their families. A guest house is planned for visiting V.I.P.'s staffhousing will be classified according to their occupants: senior park wardens, upper, middle and lower level staff.

##### Construction methods

Basically, construction will be done according to local standards and domestic materials will be sought. In the case of the major field station building, because of the difficulty of recruiting manpower in such a remote area and also because of transportation, construction should not be expected to be completed in a short time.

#### (2) Research Stations

##### General description of the facilities

This facility is meant to carry out the continuous research/study on chimpanzees. The present four KCRS bases will be transferred and maintained. Therefore, the facilities for the staff will be used for their expected

duration (about 5–10 years). However, since the Nganja station lacks housing facilities for its staff, the construction for this will be considered under the present plan in order to further improve the research conditions and the living environment on the base. Pre-fabricated research facilities to those planned for the major field station will be built for the research station. Their cost is included in the construction of the major field station building.

##### Equipments

###### Measuring instrument screen:

For collection of climate data of the site.

###### Small boat, engine:

When water route must be used to reach

###### Radiotelephone equipment:

For communication with the major field station and with other stations from the field.

###### Mobile electric power generator:

For lighting at night and for recharging to the radio-telephone equipment.

###### Daily necessities:

For the use of research staffs.

Table-32 Staffhousing at Bileng M.F.S

	Building floor area (m <sup>2</sup> )	Number of building	Total building floor area (m <sup>2</sup> )
Upper staff houses	60	2	120
Middle staff houses	48	9	432
Lower staff houses	36	30	1,080
Guest house	60	1	60
Public WC	30	2	60
Total			1,752

Table-33 Area list of site work

Site name	Area (m <sup>2</sup> )
Major field station	1,806
Visitor services	2,350
Staff housing	11,160
Roads	300
Jetty	200
Total	15,816