No.

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National Center for Remote Sensing And Forest Cover Monitoring
Department of Forest and Natural Resources
Ministry of Rural Development
The Republic of Benin

THE STUDY ON CARTOGRAPHY, INVENTORY AND MANAGEMENT OF CLASSIFIED FOREST IN NORTHERN AREA IN BENIN

Forest Management Guidelines

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1. An Overview of the Guidelines

1.1 Guideline Aims

The Study on Cartography, Inventory and Management of Classified Forest in Northern Area in Benin was carried out in three classified forests, the Trois-Rivières Classified Forest, the Ouénou-Bénou Classified Forest, and the l'Alibori Supérieur Classified Forest. However, a Forest Management Plan was only formulated for the Intensive Study Area, which is the area of the Trois-Rivières Classified Forest located to the west of the Bouli River.

These guidelines relate mainly to the content of the survey carried out in the Intensive Study Area of the Trois-Rivières Classified Forest and are designed to be able to complement the content of management plans formulated for the remaining study areas as necessary and act as comprehensive guidelines for the formulation of forest management plans.

1.2 An Overview of Forest Management Plan Formulation Procedures

The forest management plan formulation survey for classified forests is shown in the flow chart in Figure 1-2-1.

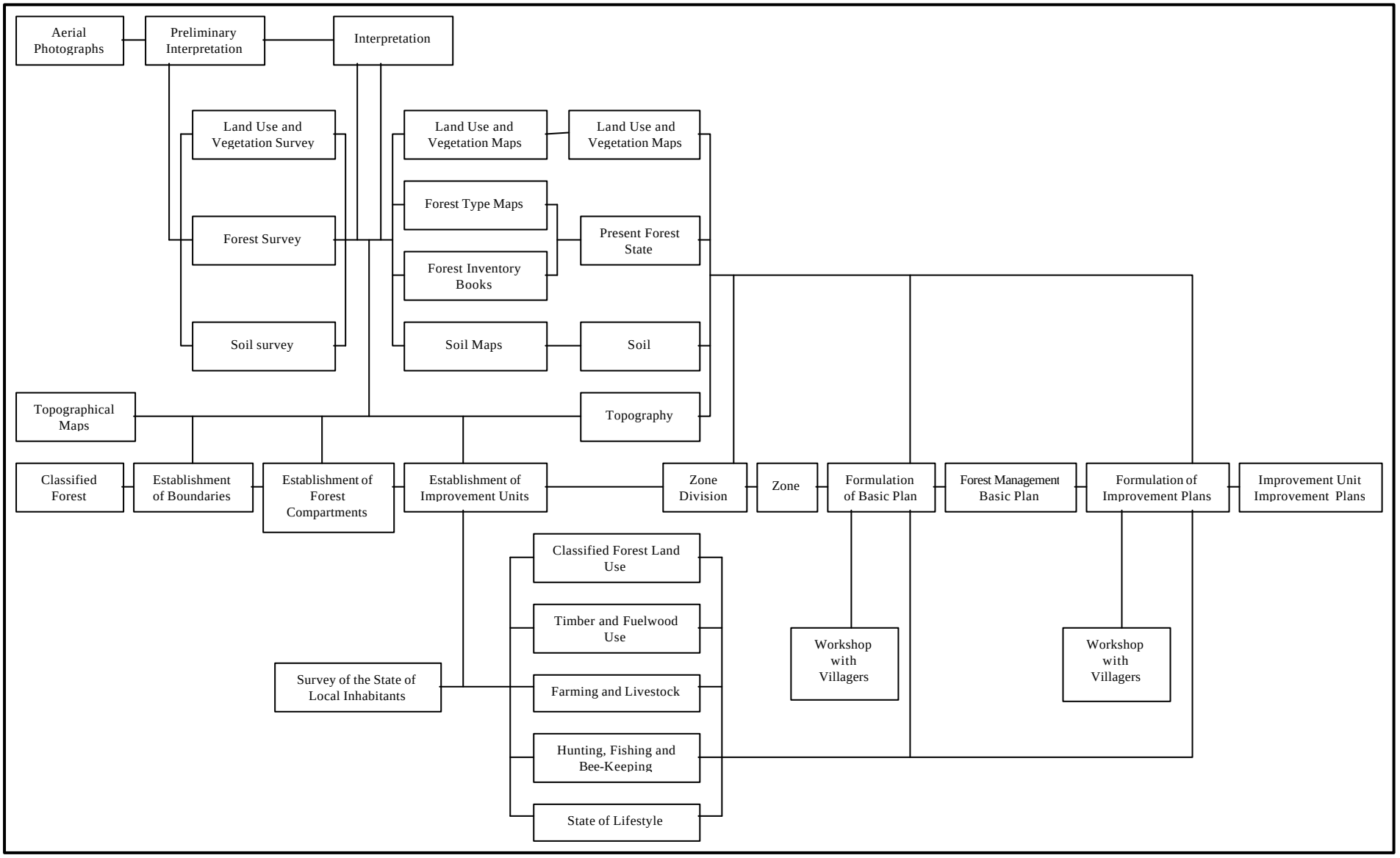
These procedures involve a survey regarding the formulation of management plans, and the procedures for formulating management plans together with a workshop with villagers. These surveys regarding the formulation of management plans can be divided into a survey to ascertain the state of the classified forest and its environmental conditions and a survey to ascertain the state of the local inhabitants. The survey to ascertain the state of the classified forest and its environmental conditions is carried out based on the interpretation of aerial photographs of the area concerned, together with a land-based survey. The survey to ascertain the state of the local inhabitants is carried out based on a socioeconomic survey of population, land use, industry and lifestyle, etc.

Procedures for formulating management plans include the dividing up of the classified forest into zones and the determining of improvement standards and improvement methods for each zone based on the above-mentioned surveys. As these management plans are implemented with the assistance of the local inhabitants, workshops for the local inhabitants shall be held to explain this matter to the local inhabitants right from the management plan formulation stage, in order to ascertain the desires of the local inhabitants and to ensure that forest management plans are formulated and implemented smoothly.

1.3 Guideline Structure

As a rule, guidelines will be structured in accordance with the flow chart shown in Figure 1-2-1. However, with regard to the setting of boundaries and topographical maps, as there are times when these may have already been completed as a prerequisite to forest management plans, when this has not been completed, as these form an essential base for the forest management plans and forest surveys, they shall be dealt with first.

These guidelines contain details of the aims of individual surveys and methods for carrying out such surveys. Results of surveys carried out in the Intensive Study Area are included as examples of how to arrange the survey results.



Figuge 1-2-1 Flow Chart showing Forest Management Plan Formulation

2. Establishment of Boundaries

2.1 Definition of the Establishment of Boundaries

Before formulating forest management plans it is necessary to establish boundaries for the forest. Boundaries are established based on the boundary lines shown on maps and local boundary lines. When verifying boundary lines the consent of neighboring landowners is once more obtained.

2.2 Methods of Establishing Boundaries

The standard methods of establishing boundaries are as follows.

2.2.1 Obtaining the Consent of Neighboring Landowners with regard to Boundaries

Boundaries are established by firstly thoroughly explaining to neighboring landowners existing information regarding the boundary they are seeking to establish and obtaining their approval. Details regarding the matters that have been decided are then put down on paper after which both parties sign the document, thereby establishing the boundaries.

When establishing the boundary between the classified forest and the buffer zone where there are no neighboring landowners, although it is not necessary, of course, to obtain the approval of neighboring landowners, it is still necessary to adequately explain to landowners in the immediate vicinity the significance of the establishment of the boundary and the methods of indicating the boundary.

2.2.2 Establishment of Boundary Markers

Boundary markers are then established on the boundary that both parties have agreed to. These boundary markers are established in the following way.

- Boundary markers are established where boundary lines cross etc. noticeable topography and landmarks.
- Stone pillars, concrete pillars, fixed rocks and boundary posts are to be used as boundary markers.
- Numbers are to be attached to boundary markers and a decay-resistant substance inserted under marker pillars.

2.2.3 Surveying of Boundaries

After boundary markers have been established, the boundaries shall be surveyed, and a boundary map created and stored together with the surveyor's field notebook.

2.2.4 Clarification of Boundaries

When the boundaries have been established, the name of the classified forest together with relevant details, etc. shall be written on a noticeboard and displayed in an easily visible location. Other measures, such as planting boundary trees, erecting fences and the installation of gates, etc. shall then be carried out.

3. Creation of Topographical Maps

In order to formulate a forest management plan maps on appropriate scales are required to use as base maps. Using aerial photographs on a scale of 1:20,000 new topographical maps on a scale of 1:50,000 shall be created.

3.1 Land-Based Surveying

(1) Pricking points shall be plotted using existing topographical maps with a scale of 1:200,000.

(2) Surveying of Pricking Points

Surveying of pricking points shall be carried out by GPS.

(3) Levelling

Leveling shall be carried out for pricking points and existing benchmarks.

(4) On-site Survey

This shall be carried out by selecting a representative photograph area in which almost all types of vegetation are found.

(5) Entries

Entries shall be verified with existing 1:200,000 scale topographical maps and on-site surveys.

3.2 Creation of Topographical Maps

Topographical maps of the scale 1:50,000 are made from aerial photographs and based on the results of a land-based survey. The techniques used to do this are as shown below.

(1) Aerial Triangulation

Using the bundle method, aerial triangulation is carried out using a model photograph covering the area concerned, utilizing the coordinates of pass points and tie points together with the pricking points and benchmarks.

(2) Creating Maps from Data Obtained through Surveys

Based on interpretation standards, expression classifications, acquired standards, and data structure and using the results of aerial triangulation and aerial photographs, an analytical map-making machine is used to give map data, such as topography and landmarks, numerical values and to create digital maps. Contour lines are input at 50m, 10m and 5m intervals. The maps shall be based on the specifications determined by the Republic of Benin.

(3) Digital Editing

Digital data is divided in such a way that it will fit into the 1:50,000 scale topographical maps and attributes edited using an editing machine. Administrative boundaries and notes shall be based on the 1:200,000 scale topographical maps of the Republic of Benin and an on-site surveys, etc.

3.3 Creation of Base Maps

When there is no 1:50,000 scale topographical maps and one will not be made, it is necessary to create the following base maps.

(1) Creation of a 1:50,000 Scale Base Maps

The existing 1:200,000 scale maps shall be enlarged to 1:50,000 scale and changes that have occurred to roads and settlements, etc. over time shall be updated using the latest aerial photographs, etc.

(2) Creating 1:20,000 Scale Base Maps

When 1:20,000 scale topographical maps are necessary to create soil maps and forest type maps or plans, the 1:50,000 scale topographical maps mentioned in (1) above shall be enlarged to make base maps. (Another alternative is to create new 1:20,000 scale topographical maps directly from aerial photographs.)

4. Forest and Site Condition Surveys

4.1 Survey Aim

The aim of this survey is to ascertain the forest resources which will be the foundation of the forest management plan and to create land use and vegetation maps, forest type maps, forest inventory books and soil type maps.

4.2 Survey Method

4.2.1 Survey of Land Use and Vegetation

(1) Interpretation of Aerial Photographs

Aerial photographs are interpreted in order to classify the forest, land use and vegetation of the area in question.

a. Interpretation Items

When interpreting aerial photographs it is important to first determine interpretation categories and standards. These will vary according to the nature of the area being analyzed.

<Results from the Intensive Study Area> ****** ******* ******* ******* ****** ****

Interpretation categories and standards used in the interpretation of aerial photographs of the Study Area and the Intensive Study Area are shown in Table 4-2-1.

Table 4-2-1 Categories and Standards for the Interpretation of Land Use and Vegetation

Classification	Symbol	Category	Interpretation Standards
Forest	Gf	Riparian Forest	Areas of high trees located in narrow belts alongside waterways.
	Fc	High Forest	Areas of trees (>5m) with a crown density of 60~80% where there is little vegetation on the forest floor.
	Sa	Tree Savannah	Areas of trees (>5m) with a crown density of 40~60% where there are also shrubs (<5m) with a crown density of less than 40%.
	Sb	Mixed Savannah	Areas of trees (>5m) with a crown density of 40~60% where there are also shrubs (<5m) with a crown density of more than 40%.
	St	Shrub Savannah	Areas of trees (>5m) with a crown density of less than 40% where there are also shrubs (<5m) with a crown density of more than 40%.
	Pf	Afforestation Area	*Tectona grandis, Eucalyptus*, etc.
	Td	Bare Land	
	Tm	Marshes	
	Cl	Lateritic Cuirasses	
	Ar	Rock outcrop	
Non-Forest	Pr	Orchards	Mangoes, Cashews
	Ch	Farmland	Cotton, Maize, Sorghum, Yams, etc.
	Ja	Fallow land	
	Ag	Settlements	
	Ce	Waterways	Including the banks of waterways.
	Pe	Lakes and Marshes	
	Au	Others	Microwave Stations, Power Pylons

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b. Interpretation Methods

The latest 1:20,000 scale (or enlarged 1:10,000 scale) aerial photographs shall be used for interpretation purposes.

(2) Creation of Land Use and Vegetation Maps

The results from interpreting the aerial photographs shall be transferred to 1:50,000 scale or 1:20,000 scale base maps and land use and vegetation maps created. The scope of the base maps may be changed depending on the area of the survey area.

4.2.2 Creation of Forest Type Maps

(1) Interpretation of Aerial Photographs

This interpretation is used to create forest type maps and to ascertain the state of forest areas. As the interpretation classifications are used to ascertain the state of forest resources for each type of forest and form the basis of the forest inventory books, it is desirable to make it as detailed as possible.

<Results from the Intensive Study Area> ********** ****** ******* ******** ********

Classifications used in the interpretation of land use and vegetation are shown in Table 4-2-2 together with relevant tree heights and crown densities.

Table 4-2-2 Tree Height and Crown Density

Classification	Symbol	Variation
Tree Height	H1	~9m
	H2	10~19m
	H3	20m~
Crown Density	D1	~24%
	D2	25~49%
	D3	50~74%
	D4	75%~

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(2) Creation of Forest Type Maps

The results from interpreting the aerial photographs shall be transferred to 1:50,000 scale or 1:20,000 scale base maps and forest type maps created. The area by forest type shall also be calculated from the map.

4.2.3 Forest Resource Survey

This survey is used to ascertain the state of forest resources throughout the entire target area. When aerial photographs are available, this is carried out by using the sampling method. In order to carry out a forest sampling survey it is normal to carry out a preliminary survey to design the sampling survey, and to then carry out the sampling survey itself.

(1) Preliminary Survey

The preliminary survey is used to collect data such as the forest coefficient of variation, the state of stand, survey processes and the state of access etc., which are necessary to carry out the sampling survey.

Aerial photographs are used to establish areas of forest with different types of forest cover, 0.1ha circular plots established (17.85m radius) in each stand, and the following surveys carried out within each of the plots.

a. State of Land
Commune, Village

Topography, Direction, Slope, GPS

b. State of Forest
Forest Type

Undergrowth

Tree species, DBH (more than 4cm)

Others

Notes
1. When data already exists then it is possible to simplify the preliminary survey.
2. The size of the plot may vary according to the size of the trees.
3. A square or a rectangle may also be selected as the shape of the plot depending on location and conditions.

(2) Main Survey

① Number of Survey Plots

The necessary number of survey plots to be surveyed in the main survey is obtained from the coefficient of variation and the desired error ratio and coefficient of safety of the preliminary survey. When the main survey is carried out, the preliminary sample plots (10 locations) also included.

a. Coefficient of Variation

The variation coefficient (CV) can be calculated in the following way.

$$CV = \frac{\sigma}{\bar{X}}$$

σ : Standard Deviation of Preliminary Survey Samples

$\bar{X}$: Average Value of Preliminary Survey Samples

b. Calculating the Number of Plots

The number of plots can be calculated in the following way.

$$n = \left(\frac{t \times CV}{E}\right)^2 \times S$$

t: Confidence Coefficient (t is set at 2 with a degree of confidence of 95% in the t distribution chart)

E: Standard Error Ratio (set at 20%)

S: Safety Coefficient (set at 1.2)

② Location of Plots

The location of the plots is determined by Sratified Random Sampling method based on the interpretation of aerial photographs. Stratification is to group items of the same nature using interpretation categories such as forest types, tree height, and crown density, etc.

A 100m x 100m grid is established on a separately prepared 1:20,000 scale forest type map and plot sample points established on the intersecting points of the grid. The number of plots for each strata is distributed according to the area of each strata obtained from the forest type maps and sampling of the intersection points carried out using a table of random numbers.

Note: When aerial photographs are not available, systematic sampling will be used as the plot sampling method.

③ Survey Items

a. State of Plot

Commune/Village Name

Topography, Direction, Slope

GPS Data

Others

b. State of Forest

Forest Type

Undergrowth

Tree Species, DBH (≥10cm), Tree Height (Measured in 1m units from ground level to treetop.)

Others

The forest survey (inventory) field not can be found at the end of this volume in Appendix-1.

④ Single Tree Volume Table

The single tree volume table is essential for carrying out the forest resource survey. However, as the creation of a single tree volume table requires a lot of time and effort, in Benin, the following formula is used in Logging Permit applications to determine the single tree volume. (However, V is the single tree volume, D is the DBH, and H is the total tree height.)

$$V = \frac{D^2 H \pi}{4} \times 0.33$$

(3) Estimating Stand Volume

①Estimates Using Stratified Sampling Method

Based on the results of the main survey, it is possible to calculate the overall stand volume of the target area using the formula of the following stratified sampling method.

a. Overall Average

$$\overline{X} = \Sigma X_i \bullet W_i$$

$\overline{X}$: Overall Average (m^3/ha)

X_i: Average Value of Each Strata (m^3/ha)

W_i: Proportional Area of Each Strata

b. Standard Error of Overall Average

$$S_{\overline{x}} = \sqrt{\frac{1}{N^2} \sum \{N_i (N_i - n_i) \cdot \frac{S_i^2}{n_i}}$$

$S_{\overline{X}}$: Standard Error of Overall Average (Standard Deviation)

N: Size of Population ($N = \sum Ni$)

N_i: Size of Population of Each Strata

n_i: Size of Sample of Each Strata

S_i^2: Sample Distribution of Each Strata

c. Confidence Interval of Overall Average

Confidence Interval of Overall Average: $\overline{X} \pm t \cdot S_{\overline{x}}$

(t is set at 2 with a degree of confidence of 95% in the t distribution chart)

t: t is the t value of the degree of freedom (n-h) at a 95% degree of confidence.

n: Number of Samples ($n = \sum n_i$)

h: Number of Strata

d. Confidence Interval of Overall Stand Volume

Confidence Interval of Overall Stand Volume: $N (\overline{X} \pm t \cdot S_{\overline{x}})$

e. Estimated Error Ratio

Estimated Error Ratio $t \cdot S_{\overline{x}} / \overline{X}$

② Estimated Stand Volume of Each Category of Forest Type

a. Creation of Aerial Photograph Stand Volume Table

Aerial photograph stand volume tables are prepared to estimate the stand volume in each forest type. This is calculated from the relationship between the actual stand volume obtained from plot surveys and aerial photo interpretation factors by using multiple regression estimates. The crown density of the upper strata of trees (D),

the average tree height (H), the average crown density ($\overline{CD}$), and the number of standing trees per ha are used as aerial photograph interpretation factors.

The general formulas used to calculate multiple regression estimates are as follows.

$V = a + b\overline{CD} + cH$

$V = a + bD + cH$

$V = a\overline{CD}^{b} \cdot H^{c}$ or $logV = a + b\ log\overline{CD} + c\ log\ H$

$V = aD^{b} \cdot H^{c}$ or $logV = a + b\ log\ D + c\ logH$

<Results from the Intensive Study Area> ****** ********* ********* ******** *******

In the Intensive Study Area, separate aerial photograph stand volume tables were created for riparian forest (Gf) and non-riparian forest (Fc, Sa, Sb, and St).

Ta ble 4-2-3 Aerial Photograph Stand Volume Formula

Forest Type	Regression Formula	Number of Samples	Correlation Coefficient	Standard Error Ratio (%)
Riparian Forest (Gf)	*log*V=1.8482 x *log*D-1.3745	10	0.9097	26.54
Non-Riparian Forest (Fc, Sa, Sb, St)	*log*V=0.9329 x *log*D+0.0359	84	0.8264	29.92

V: Stand Volume (m^3/ha), D: Crown Density of Upper Strata (%)

An aerial photograph stand volume table calculated based on the aerial photograph stand volume formula is shown in Table 4-2-4.

Table 4-2-4. Aerial Photograph Stand Volume Table

Crown Density (%)	Stand Volume (m^3/ha)	
	Riparian Forest	Non-Riparian Forest
5	1	5
10	3	9
15	6	14
20	11	18
25	16	22
30	23	26
35	30	30
40	39	34
45	48	38
50	58	42
55	70	46
60	82	50
65	95	53
70	109	57
75	123	61
80	139	65
85	155	69
90	173	72
95	191	76
100	210	80

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When using the stand volume formula shown in Table 4-2-3 for other classified forests, the following method is used.

The stand volume calculated using the stand volume formula is designated X(average value: $\overline{X}$), the actual measured stand volume is Y (average value: $\overline{Y}$), and the number of samples is n.

$$Y = a + bX$$

If a = 0 at a significant level of α% and if b = 1, then this stand volume formula can be applied. In other words, the following values for t_a and t_b can be calculated by comparing the degree of freedom (n-2) value (α%) on the t distribution chart.

$$t_a = \frac{|a-0|}{\sigma_a}$$

$$t_b = \frac{|b-1|}{\sigma_b}$$

$$\sigma_a = \sqrt{\frac{\sum X^2}{n\sum (X-\overline{X})^2}} \cdot S_{y\cdot x}$$

$$\sigma_b = \sqrt{\frac{1}{\sum (X-\overline{X})^2}} \cdot S_{y\cdot x}$$

$$S_{y\cdot x} = \sqrt{\frac{\sum (Y-\overline{Y})^2 - b\sum (X-\overline{X})(Y-\overline{Y})}{n-2}}$$

Calculation Results

a = 0 and b =1	→	Application of existing stand volume formula.
A ≠ 0 or b ≠ 1	→	① New stand volume formula created. ② Existing stand volume formula adjusted using the above-mentioned formula.

b. Stand Volume by Forest Type

The stand volume of forest type is estimated by applying the aerial photograph stand volume table to each forest type block.

c. Forest Stand Volume Estimates

The stand volume obtained for each forest type block is arranged and if it can be verified that the total falls within the confidence interval for the entire stand volume obtained using the previously mentioned stratified sampling method, then the stand volume for the individual forest cover type blocks can be calculated.

<Reference: Simple Stand Volume Table> ********** ********* ********** ******** *****
A simple stand volume table is a table that is created in order to simply estimate the stand volume for areas where it is not possible to obtain aerial photographs. Although it is created in the same way as aerial photograph stand volume tables, it is calculated based on the average diameter, average tree height and number of trees per ha for stands where it is possible to carry out land-based surveys. The relationship between these factors and the actual stand volume can then be discovered.

The following regression formula was established for the Intensive Study Area based on data obtained from surveys of the area.

Table 4-2-5. Simple Stand Volume Formula

Forest Type	Regression Formula	Number of Samples	Correlation Coefficient	Standard Error Ratio (%)
Riparian Forest (Gf)	V=0.4268xDxH+0.2036xN-88.6658	10	0.9214	31.25
Others	V=0.2329x DxH+0.0529xN-21.3767	85	0.908	27.24

V: Stand Volume (m^3/ha), D: Stand Average Diameter (cm), H: Stand Average Height (m), N: Number of Trees per ha

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4.2.4 Soil Survey

(1) Aim of Soil Survey

"The right land and the right trees" is the golden rule of forestry. Although there are various factors involved in the natural environment surrounding the forest, including topography, geology, climate and vegetation, etc., from among all these factors the soil is created by a number of complicated factors. Therefore, by investigating the soil, to a certain degree it is possible to predict environmental condition. Therefore, when determining how to handle the forest, it is important to ascertain what the soil is composed of in the area in question. In order to discover the state of the soil, although it is possible to use a soil map if one has already been created, when such a map does not exist, forest operations policy should only be determined after a survey of the soil has been carried out.

(2) Soil Survey Method

The soil survey method is shown below. The soil survey field note can be found as Appendix-2 at the end of this volume.

① Soil Survey Method

Methods of carrying out soil profile surveys and soil classification are pursuant to the FAO/UNESCO Soil Classification Standards (FAO/UNESCO, World Soil Resources Report 60, Soil Map of the World, Revised Legend by the Food and Agriculture Organization of the United Nations-Rome, 1990).

② Soil Profile Survey

a. Soil Profile Survey

The soil profile survey should be carried out on soil profiles as close as possible to the forest survey plots. The survey items are shown below.

a) Classification of Soil Horizons

Soil horizon shall be classified into A horizon, B horizon, and C horizon, etc. and the thickness of each horizon measured.

b) State of Soil Transition

The transition of each horizon of soil is classified as follows.

Abrupt:	0~2cm
Clear:	2~5cm
Gradual:	5~15cm
Diffuse:	More than 15cm.

c) Soil Color

Soil color is determined based on the Munsell Soil Color Chart. The color of dry soil should be determined after it has been made appropriately wet.

d) Organic Matter in Soil

Soil is classified by the volume of decomposed vegetation is as mentioned below.

Very Rich:	A blackish brown or black color, with a luminosity and chroma of less than 2 and relatively soft and light (carbon content of approximately 15%).
Rich:	A blackish brown or light brown color with a luminosity and chroma of around 3 and relatively smooth (carbon content of approximately 8%).
Common:	A slightly dull color with a luminosity and chroma of around 4 (carbon content of approximately 4%).
Few:	Bright color with a luminosity and chroma of more than 5 (carbon content of less than 2%).

e) Soil Texture

Soil is classified as shown below depending on the size of grains. Soil containing an adequate amount of water is rolled between the fingers to determine its classification by how it feels.

Clay:	Feels mainly like sticky clay.
Clay Loam:	Feels like sticky clay with sand.
Loam:	Contains approximately 1/3 sand or less.
Silty Loam:	Consists mainly of non-sticky clay.
Sandy Loam:	Contains approximately 1/3 to 2/3 sand.
Sand:	Feels mostly like sand.

f) Soil Texture

A large clump of dirt is extracted, gently divided up and observed in its natural state.

Platy:	Large horizontal layer, thin vertical layer.
Loose Granular:	grainy or powdery soil loosely clumped together by hypha. Common in dry soil.
Granular:	Rounded grains with a squarish structure of approximately 0.5mm or less and relatively fine.
Subangular:	Angular with a slightly smooth surface. Grains of approximately 1-2mm. Relatively fine and hard blocks.
Single Grain:	Single independent grains not clumped together.
Massive:	A single clump with few cracks.

g) Hardness and Density

Classification is based on inserting the thumb into the cross-section.

Hard: Soil particles are closely joined together and only a slight imprint is left when the sample is pressed by the thumb.

Medium: Although soil particles are relatively close together, when the sample is pressed by the thumb a deep imprint is left.

Soft: Although soil particles are loosely clumped together when the sample is pressed by the thumb it breaks up immediately.

h) Moisture Content

Classified based on the feeling when touched with the fingers or the palm of the hand or how water seeps out.

Dry: No moisture remains on the palm of the hand even when the soil is squeezed hard.

Moderately Moist: Moisture remains on the palm of the hand when the soil is squeezed hard.

Wet: Drops of water remain on the palm of the hand after the soil is touched and water seeps out when soil is squeezed between the thumb and index finger.

Over Wet: Water falls from the palm of the hand naturally after the soil has been touched.

i) Gravel

Soil particles larger than 2mm are referred to as gravel. Classified according to the proportion of gravel appearing on the surface of the sample.

a. Size

Fine: Less than 2cm

Coarse: 2~6cm

Stones: 6~20cm

Boulders: More than 20cm

b Shape

Angular: Gravel with sharp edges.

Subangular: Gravel with slightly sharp edges.

Rounded: Gravel with rounded edges.

j) Root Structure

Root structure is classified as follows according to the state of root development.

Very Fine: Less than 0.5mm

Fine: 0.5~2mm

Medium: 2~20mm

Coarse: More than 20mm

k) Other (depletion or concentration of certain soil content, mycorrhiza and hypha, mottling and nodule, spring water and ground water, gley, or the topography and parent rock of the area to be surveyed.)

b. Soil Distribution Survey

The soil distribution survey shall be carried out using a simple pit cross-section at the site of the detailed survey as well as at certain other points to determine the distribution scope of the soil unit.

③ Soil Group Characteristics

Soil shall be classified according to FAO/UNESCO standards for soil type and soil unit and the characteristics of each soil group surveyed.

(3) Soil Conditions and Land Use

Soil groups are ranked according to the degree of compatibility with forestry operations and land use. Although many methods of soil classification exist, as these have already been explained in the survey report and soil map of the Intensive Study Area, those documents shall be used as reference.

The following items are considered common sense with regard to forestry operations.

- Place of deep soil are good and trees grow well.
- In areas of soft soil, the physical characteristics of the soil is good and trees wil grow well.
- In areas where the roots of trees have grown deep into the ground, it is common to obtain good results from planting.
- When areas of bluish white soil strata (Gley soil) appear, this shows that there is an underground water strata which in many cases is undesirable for obtaining good tree growth.
- In areas where layers of laterite with a reddish brown color or plain laterite can be found, the soil has clumped together meaning that in many cases good tree grow can not be expected.

<Results from the Intensive Study Area> ******* ******* ******* ******* *********

Points for consideration when carrying out operations in each rank.

Rank I: Distributed mainly along waterways. Planting of most varieties of forest trees is possible and this area provides the best possibility of growth. However, as this area is expected to flood during the rainy season, it is necessary to verify flood levels before planting species that are susceptible to flooding.

Rank II: Ferralsols is the main type of soil with small areas of Eutric Gleysols and Podzsols. It is possible to grow both native species and exotic species. Although trees can be expected to grow moderately, short cutting cycles should be avoided.

Rank III: Soil in areas of exposed gneiss granite or iron rock or in rather shallow positions. These are difficult conditions for trees to grow in. While in some areas of Leptosols exotic species are hardy enough to cope with the poor soil conditions, generally this type of soil is not good for growing. Planting should be confined to the smallest extent possible.

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4.2.5 Forest Classification

(1) Forest Classes

Based on the records of the results of forest surveys, implementation and verification, etc., forest classification is an essential item in forest management plan surveys. Large forests areas are classified using the following two steps.

① Compartments

Compartments clarify the location of the forest and are fixed divisions that help in the management and operation of the forest. Compartments are typically established along fixed topographical and geological features, such as administrative borders, obvious ridgelines, waterways, and permanent roads, etc. The size of a compartment ranges from approximately 500~1,000ha. The classified forest is divided into compartments in the following way.

- Administrative boundaries (District boundaries).
- Roads.
- Landmarks, such as waterways, etc.

The buffer zone is divided into compartments in the following way.

- Administrative boundaries.
- Roads

② Sub-Compartments

Compartments are divided into smaller sub-compartments in order to clarify the differences in types of land use, forest state, and forest management.

4.2.6 Creation of Forest Inventory Books

The forest inventory books are books containing records of the state of the forest by sub-compartment. When carrying out this survey, inventory books were prepared separately for the classified forest and the buffer zone based on forest type maps. The items recorded in each are as shown below.

① Classified Forest

a. District (administrative division)
b. Improvement Unit
c. Compartment Number
d. Sub-compartment Number
e. Zone
f. Land Use and Vegetation
   - Gf: Riparian Forest
   - Fc: High Trees
   - Sa: Tree Savannah
   - Sb: Mixed Savannah
   - St: Shrub Savannah
   - Pf: Afforestation Area
   - Td: Bare Land
   - Tm: Swamp
   - Cl: Lateritic Cuirasses
   - Ar: Rock Outcrop
   - Pr: Orchard
   - Ch: farmland
   - Ja: Fallow land
   - Ag: Settlement

Ce: Waterways

Pe: Lakes and Marshes

Au: Others

g. Area (ha)

(Forest Condition)

h.Tree Height Class

H1: ~9m

H2: 10~19m

H3: 20m~

i. Tree Crown Density (%)

j. Tree Crown Density Class

D1: ~24%

D2: 25~49%

D3: 50~74%

D4: 75%~

k. Stand Volume per ha (m^3/ha)

l. Stand Volume (m^3)

(State of Land)

m. Altitude (m)

n. Direction (9 directions)

o. Slope

P1: 0~9 °

P2: 10~19 °

P3: 20~29 °

P4: 30 ° ~

p. Topographical Features

q. Soil Type

FL-GL: Fluvisols/Gleysols

GLd: Dystric Gleysols

GLe: Eutric Gleysols

LPd: Dystric Leptosols

LPe: Eutric Leptosols

LPu: Umbric Leptosols

REd: Dystric Regosols

PZh: Haplic Podzols

PZg: Gleyic Podzsols

FRh: Haplic Ferrasols

FRx: Xanthic Ferrasols

FRr: Rhodic Ferrasols

r. Comments

② Buffer Zone

a. Management Unit (District)

b. Compartment Number

c. Sub-Compartment Number

d. Land Use and Vegetation Categories

e. Area (ha)

f. Tree Height Class

g. Crown Density Class

h. Altitude (m)

i. Direction (9 Directions)

j. Slope Classes

k. Topographical Characteristics

l. Soil Type

m. Comments

Note: It is possible that the items to be recorded in the forest inventory books may vary according to the state of the area in which the survey is to be carried out.

5. Survey to Ascertain the State of the Local Inhabitants (1)

5.1 Survey Aim

The aim of this survey is to ascertain the socioeconomic conditions, such as the lifestyle of local inhabitants living in the classified forest and buffer zone for which the forest management plan is to be formulated through direct contact with the local inhabitants in order to supplement incomplete base data and existing material.

5.2 Survey Method

Survey methods include an analysis of existing material, obtaining the opinions of the village chief, village representatives, primary school staff and other related people, and passing out a questionnaire to the heads of households and household members. A questionnaire survey shall be carried out of target settlements in order to classify their degree of dependence on the forest, settlement scale, and main production activities, taking care to ensure that the survey remains balanced. Sample households in each target settlement shall be the square root of the total number of households. Target households for the questionnaire survey are selected by means of random sampling.

5.3 Survey Items

Items included in the survey are shown below.

(1) State of Settlements

a. Boundaries and location of settlements.
b. Population Composition
c. Population Distribution by Ethnic Group
d. In-migration
e. Traditional Social Structure
   Family Structure
   Social Composition of Related Tribes
f. Land Use Structure

(2) Lifestyle of Local Inhabitants

a. Family Size
b. Level of Education
c. Income and Expenditure
d. Living Conditions
   Drinking Water
   Fuel
   Food
   State of Housing
e. Main Economic Activities
   Agriculture
   Livestock Farming
   Fresh Water Fishing
   Commerce
   Farm Products/Processing of Forestry Products
f. Forest Use (the classified forest, forest other than the classified forest, and plantations)
g. Gender (Division of work such as water-carrying, cooking, washing, sewing, cultivation, seed-sowing/planting, weeding, etc. on gender.)

Questionnaires are shown in the Appendix-4.

6. Survey to Ascertain the State of the Local Inhabitants (II)

6.1 Survey Aim

The aim of this survey is to ascertain the lifestyle of people in settlements directly related to the classified forest for which the forest management plan is to be formulated, based on the results of the Survey to Ascertain the State of the Local Inhabitants (1).

6.2 Survey Method

The survey method to be used is the Rapid Rural Appraisal (RRA survey method) through which quality information is acquired through the actual participation of local inhabitants. The RRA survey items and survey methods are shown in Table 6-2-1.

Table 6-2-1. RRA Survey Items and Survey Methods

Survey Items	Survey Method	
• Land and Forest Ownership and Use • Forest-related rights and their state. • Customs	Key Informant Interview	To ascertain the settlement's traditional ownership and use of land and forest, utilization of wildlife resources, forest-related rights, division system and customs.
	Field investigation and Mapping of Settlements	To ascertain the state of the land (by land category) and forest (including the location and boundaries of the buffer zone and cultivated land, etc.) and awareness by walking through the settlement with the local inhabitants and to record the information on mosaic photographs.
	Group Discussion	Group discussions will be held regarding the state of the land and forest based on the mosaic photographs in order to analyze and ascertain differences in awareness among the group (by gender, etc.) and customs regarding the state of land use and forest use.
• Outline of settlement structure, state and problems. • Structure of traditional social system.	Key Informant Interview	To ascertain the political system, settlement structure, the structure of the traditional social system, and communication methods within the settlement.
	Group Discussion	Verify the state of settlement structure based on matters ascertained from key informant interviews.
• Socioeconomic activities. • Lifestyle problems and the needs of local inhabitants. • Gender roles.	Survey of Lifestyle Schedule	To ascertain the lifestyles of sample households, community activities, the division of labor among husband and wife and their respective roles, and to carry out a survey of the family schedules in both the wet and dry seasons (results from the questionnaire survey will also be referred to).
	Preparation of a Seasonal Labor Calendar	To ascertain the importance of agriculture and prepare a seasonal labor calendar.
	Group Discussion	To carry out a group discussion using the mosaic photographs of the settlement, the intensity of agriculture, and seasonal labor calendars, etc. and analyze and ascertain the problems and needs in the lifestyles of the local inhabitants.
• The state of controlled burning and livestock grazing. • The influence of forest deterioration. • Awareness, present state and needs regarding forest preservation and creation (agroforestry). • Group participation in forest management plan and implementation structure.	Key Informant Interview	To ascertain the state of burned fields (controlled burning times and methods, crops and rotations, etc.), the state of grazing, the division between nomadic grazers and settled people, the effect of forest deterioration on villages life, etc., and awareness regarding forest preservation and planting (agroforestry) and the appropriate use of the forest together with its state and needs. To survey the possibility of group participation in forest management, the scope of such participation, and implementation structures, etc.
	Group Discussion	To enhance awareness of the effect of the deterioration of the forest among the local inhabitants and the importance of forest preservation and appropriate use through group discussion, etc., and to endeavor to obtain participation in the forest management plan and to establish an implementation structure.

The actual survey using RRA shall be carried out using the following four methods.

① Settlement Mapping

When aerial photographs are available, either aerial photographs or a mosaic of such aerial photographs shall be used with the local inhabitants drawing in the boundaries of the settlement on the photograph.

② Key Informant Interviews

Interviews shall be carried out to survey the traditional chiefs, political representatives, and related group representatives with regard to the culture, social customs, the existing socioeconomic conditions, and problems, etc., among people groups, etc.

Interview survey forms are shown in the Appendix-5.

③ Preparation of a Seasonal Labor Calendar and a Survey of Family Finances

A designated number of couples will be selected from each target settlement and a seasonal labor calendar created in order to survey the state of the division of labor among men and women (for survey forms on this survey refer to the Appendix-8). At the same time, interviews will be carried out regarding household income and expenditure. As some women have their own sources of income, it is important that the scope of the survey is broad enough to include this. When carrying out the survey of household income and expenditure, as it is difficult to obtain quantitative information, it may be necessary to change the nature of the questions in order to obtain the desired information.

④ Group Discussions

In each settlement, a group discussion will be held to obtain the participation of the traditional chiefs, political representatives, farming organization representatives, and the local inhabitants in general. Questions from the local inhabitants themselves will be presented, an order of priority established, and existing and future solutions presented. It is important that group discussions are not confined to the topic of forest improvement but include problems regarding the whole spectrum of life.

6.3 Arrangement of Survey Results

6.3.1 Settlement Mapping

It can be said that there are almost no settlements with clear boundaries that have been established on legal grounds. Based on the boundaries of land for cultivated use in each settlement as presented by the local inhabitants, consideration shall be given to clear topographical landmarks, such as waterways and roads, etc. with these being established as temporary boundaries.

6.3.2 Key Informant Interview

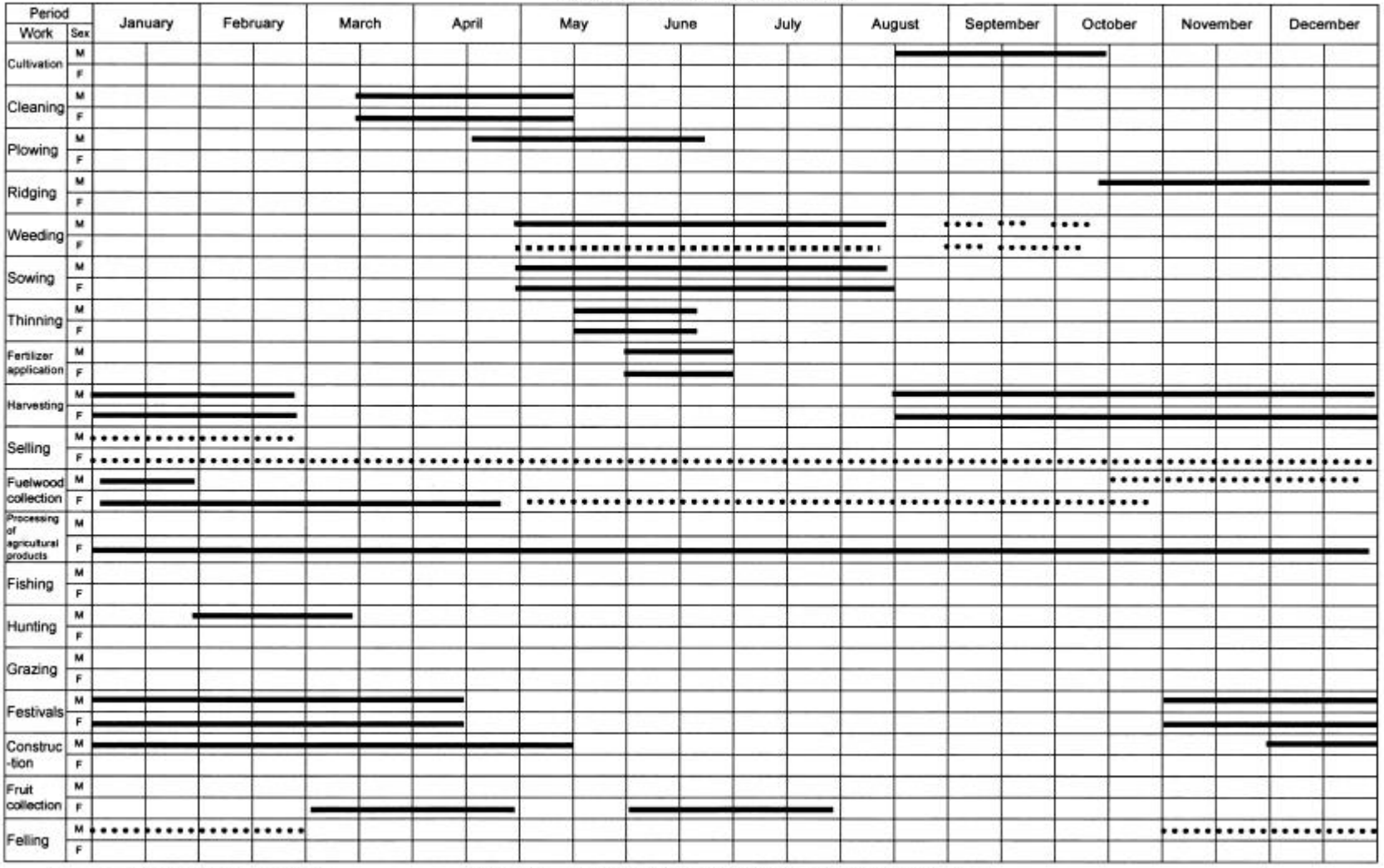
The origins, traditions, customs and local organizations of the settlement are ascertained and arranged.

6.3.3 Seasonal Labor Calendars and Household Finances

(1) Seasonal Labor Calendars

Labor is first divided into that which is carried out every day (A) and that which is carried out every 2~3 days (B) after which the state of the work of men and women is shown by work content on a 12 month chart.
<Results from the Intensive Study Area> ********** ********* ********* ********* The seasonal labor calendar is shown in Table 6-3-1.

Table 6-3-1 Seasonal Labor Calendar



********** ********* ********** ********** ********** ********* ********* *****

(2) Household Finances

The average income, farming income, and average expenditure are calculated.

6.3.4 Group Discussion

The main problems presented by the local inhabitants during the group discussion are divided into categories.

<Results from the Intensive Study Area> ********* ********* ********** *********

Results from the group discussion are shown in Table 6-3-2 and classified into one of four categories: forest resources, farming, livestock grazing and infrastructure development.

Table 6-3-2. Past and Present Settlement Problems and Solutions

Problem Type	Problem	Present Solutions	Future Solutions (wishes)
Forest	Decrease in wild animals for hunting.	Supplement animal protein with bought food.	No basic solution.
	Logging of timber by people from outside with chainsaws.	Objections by the local inhabitants.	Introduction of a monitoring and control system for logging by neighboring people.
	Deterioration of the natural environment (shrinking forest/land deterioration).	• Planting (shortage of cashew seedlings). • Planting of beans.	Promotion of planting for forest restoration.
	Decreased productivity of useful species (*Vitellaria paradoxa, Parkia biglobosa*).	No solution.	No solution.
Farming	Decreased yields from cultivated land and a shortage of cultivated land.	• Leaving land fallow long-term. • Use of chemical fertilizers and pesticides. • Utilization of land within the classified forest. • Utilization of cultivated land from other settlements.	• Public consent to land use within the classified forest. • Introduction of an intensive farming system.
	Crops (especially cotton) ravaged by pests.	• Early seed planting. • Burning of kerosene to remove insects with smoke.	Provision of effective pharmaceuticals.
	Lack of loan systems for production activities other than cotton (difficult to obtain CLCAM loans).	Supplementary income from the sale of livestock, etc.	• Search for a source of loans other than CLCAM. • Desire to make it easier to make use of loans. • Expansion of the finance system.
Livestock Grazing	Shortage of water holes for livestock.	Move livestock to the Bouli River during the dry season.	Development of more water holes (reservoirs) for livestock.
	No paths for the passage of livestock and decreased land for grazing.	• Pass through fields. • Grazing on hilltops and exposed rocks. • Utilization of cultivated land of absent farmers.	Official establishment of grazing zones and paths for the movement of livestock.
	Disease among livestock (especially cows and chickens).	• Call a veterinarian. • Use pharmaceuticals (not really effective).	• Development of appropriate treatment methods. • Implementation of a disease-prevention campaign.
Infrastructure Improvement	Shortage of drinking water.	Drill both deep and shallow wells (paid for by local inhabitants).	Construction of a water supply facility by the government.
	Road construction and improvement.	Local inhabitants bear the costs of the construction and improvement of roads and temporary bridges.	Construction and improvement of roads and bridges by the government.
	No Health Center	Go to the health center in the large settlement alongside State Highway 2.	Establishment of a health center (midwifery) by the government and the allocation of staff.
	Shortage of schools (shortage of teachers).	Construct schools and employ teachers at the expense of the local inhabitants.	Construction of schools and the employment of staff by the government.

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7. Initial Environmental Survey

7.1 Initial Environmental Survey

The initial survey of the environment is carried out to clarify environmental preservation items within the plan at the time that the plan is formulated and reflects preservation measures within the plan. This survey will be carried out using the Environmental Impact Evaluation Policy (Proposed) for forest improvement plan prepared by the Environment Agency of Benin (ABE) as reference.

7.2 Survey Method

(1) Legal Matters regarding the Environment

Administrative institutions involved in the environment include the Environment, Housing and Urban Planning Ministry and the Rural Development Ministry. There are also six laws involving domestic laws and four international treaties.

(2) Natural and Social Environmental Conditions of the Study Area

The survey is carried out using existing material and general on-site surveys. The survey topics are as follows.

① Social Environment

a. Ownership and Use of Land
b. Economic Activities
c. Customs
d. People of the Local Area
e. Health
f. Population
g. Others

② Basic Characteristics of the Natural Environment

a. Climate
b. Hydrology
c. Topography
d. Geology
e. Vegetation
f. Endangered Species
g. Others

(3) Hypothetical Content of the Plan

A list shall be prepared showing the estimated types of activities and the main structures, etc. occurring should the individual forest improvement plans formulated on the basis of this plan be implemented.

<Results from the Intensive Study Area> ********* ********** ********** *****

The content of the plans involved in this survey is shown in Table 7-2-1 as reference.

Table 7-2-1 Content of Plans

Plan	Activities	Main Structures
Land Use	• The establishment of the Village Forestry Zone, the Silvi-Pastoral Zone and the Forest Zone. • Prohibition of the expansion of farm land. • Forestation of fallow land, etc., agroforestry. • Turning part of the future forestry zone into production forest.	
Logging	• Initial prohibition of logging. • Clear cutting and selective logging of the site of the future production forest.	Work Roads Work sites
Regeneration	• Planting of desirable species of trees. • Creation of fuelwood forest. • Planting of trees that are sources of nectar.	Plantations
Forest Protection	• Establishment of firebreaks or belts of fire-resistant trees. • Prohibition of controlled burning.	Firebreaks Belts of Fire-resistant Trees
Social Forestry	• Promotion of charcoal production. • Improvement of bee-keeping techniques. • Establishment of village nurseries. • Agroforestry.	Charcoal Kilns Small Scale Nurseries
Forest Roads	• Development of a network of forest roads. • Maintenance and improvement of forest roads.	Forest Roads Riverbed Roads

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(4) Evaluation of Environmental Items

Measures of effectively diminishing the impact and load on the environment of individual environmental elements should the plan be implemented based on the content of the plans estimated in (3) above are summarized in the checklist shown in Table 7-2-2.

(5) Matters requiring Environmental Consideration

Based on the checklist mentioned in (4) above, matters that should be given consideration in the formulation of the plan shall be consolidated. Preservation measures shall be established, especially when there are animals and plants, etc. requiring preservation.

Results from the Study Area are shown in Appendix-3 at the end of this volume.

Table 7-2-2. Environmental Item Checklist (1)

Environmental item	Degree of Environmental Impact					Effect on the Environment		Positive Measures to Reduce the Detrimental Effect on the Environment
(Main item) (Medium item) (Elementary item)	A	B	C	D	P	Detrimental Effect	Positive Effect	
1. Social lifestyle								
(1) Lifestyle of the Local Inhabitants								
1. Planned migration								
2. Non-Voluntary Migration								
3. Changes in Lifestyle								
4. Friction among the Local Inhabitants								
5. Native Inhabitants, Minorities and Nomads								
(2) Population								
1. Population increase								
2. Population Composition and Rapid Changes								
(3) Economic Activities of the Local Inhabitants								
1. Changes in the Foundation of Economic Activities								
2. Conversion of Economic Activities and Unemployment								
3. Widening of the Gap in Income between Rich and Poor								

A. Serious Detrimental Effect B. Thought to have a Serious Detrimental Effect C. No Serious Detrimental Effect D. Unclear P. Positive Effect

Table 7-2-2. Environmental Item Checklist (2)

Environmental item	Degree of Environmental Impact					Effect on the Environment		Positive Measures to Reduce the Detrimental Effect on the Environment
(Main item) (Medium item) (Elementary item)	A	B	C	D	P	Detrimental Effect	Positive Effect	
(4) Systems and Customs								
1. Readjustment of Forest Use Rights								
2. Changes in Social Structure, such as Organizations, etc.								
3. Reformation of Existing Systems and Customs								
2. Health and Hygiene								
1. Increase in the Volume of Pesticides Used								
2. Transmission of Infectious Diseases								
3. Increase in Waste and Excrement								
3. Historical Sites, Cultural Assets and Scenery								
1. Damage and Destruction of Historical Sites and Cultural Assets								
2. Loss of Important Scenery								
4. Areas of Important Wildlife and Ecology								
1. Change in Vegetation								
2. Effect on Animal Habitats								
3. Effect on Endangered Species and Native Wildlife and Vegetation								
4. Decrease in Bio-diversity								
5. Influx and Breeding of Harmful Living Organisms								

A. Serious Detrimental Effect B. Thought to have a Serious Detrimental Effect C. No Serious Detrimental Effect D. Unclear P. Positive Effect

Table 7-2-2. Environmental Item Checklist (3)

Environmental item	Degree of Environmental Impact					Effect on the Environment		Positive Measures to Reduce the Detrimental Effect on the Environment
(Main item) (Medium item) (Elementary item)	A	B	C	D	P	Detrimental Effect	Positive Effect	
5. Soil and Land								
(1) Soil								
1. Soil Erosion								
2. Decrease in Soil Fertility								
3. Soil Contamination								
(2) Land								
1. Land Devastation								
2. Decrease in Wind Resistance, Sand Resistance, and Fire Resistance, etc.								
6. Hydrology and Water Quality, etc.								
(1) Hydrology								
1. Changes in the Flow of Surface Water and Ground Water								
2. Occurrence of Droughts and Floods								
3. Sediment Deposition								
(2) Water Quality and Water Temperature								
1. Contamination of Water and Decrease in Quality								
2. Changes in Water Temperature								
(3) Atmosphere								
1. Atmospheric Pollution								
2. Release of CO_2								

A. Serious Detrimental Effect B. Thought to have a Serious Detrimental Effect C. No Serious Detrimental Effect D. Unclear P. Positive Effect

8. Farming and Stock Raising Survey

8.1 Survey Aim

It is thought that the underlying cause of the illegal land use in the classified forest and the devastation of forests is careless farming and stock raising in land other than the classified forest. This survey is designed to reveal the state of farming and stock raising in light of such problems and to find ways of improving the efficient improvement of the classified forest in such a way as to alleviate such problems.

8.2 Survey Method

In addition to making use of existing reference material, this survey shall be carried out using comments from related institutions, surveys of the state of the local inhabitants and other local surveys.

8.3 Survey Items

8.3.1 Scale of Ownership of Farmland

A survey of the state of local inhabitants shall be used to ascertain the scale of farmer ownership of farmland.

8.3.2 Cultivated Land Area Trends

A survey shall be carried out to determine the area of crops cultivated in each of the regions, including the target area, over the past 10 years.

8.3.3 Estimated Land Area for Food Grown for Personal Consumption

A survey shall be carried out of related settlements mentioned in statistical data to determine the area used for growing food for personal consumption per farm for the average number of people per household. The area used for growing food for personal consumption per farm shall also be calculated from data from the survey to ascertain the state of the local inhabitants.

8.3.4 Farming Population

The farming population ratio and the population per farm shall be obtained from the farming population of related settlements using the results of the Benin National Census.

8.3.5 Farming Production

(1) Unit Yield and Production Volumes

A survey shall be carried out to ascertain the most recent crop area, unit yields and production volumes of the main crops in related settlements.

(2) Present Crop Growing Systems

A survey of largely the main crops shall be carried out to ascertain the growing systems currently being utilized.

(3) Present Crop Rotation Systems

A survey of largely the main crops shall be carried out to ascertain the crop rotation systems currently being practiced.

(4) Farming Calendar

A farming calendar shall be created based on the present crop rotation system.

(5) Commercial Farming and Production Materials

A survey shall be carried out to ascertain expenses related to seeds, seedlings, fertilizer, stock strength and farming machinery, farm labor, and crop production, etc.

8.3.6 Village Farming

A survey shall be carried out with the aim of obtaining more detailed information regarding settlements with an especially deep relationship to the improvement of the classified forest. Survey items shall be as shown below.

(1) Farming Area

Land use and vegetation maps and forest type maps created using aerial photographs shall be used to ascertain the area of farmland utilized by each settlement within the classified forest (including both cultivated land and fallow land). When aerial photographs are not available, this information shall be obtained based on the boundaries of the settlement obtained through a survey to ascertain the state of the local inhabitants.

(2) Management Scale

A survey shall be carried out to determine the management scale of the classified forest.

(3) Farming Economic Income and Expenditure

Interviews shall be carried out to ascertain farming income and expenditure.

8.3.7 Stock Raising

(1) Numbers of Major Livestock

A survey shall be carried out to ascertain the numbers of major livestock, such as cows, sheep, goats, and poultry, such as chickens and guinea fowl.

(2) Stock Feeding Systems

A survey shall be carried out to ascertain breeding, feed management, and nomadic grazing systems, and stock feed sources, etc.

9. Forest and Forestry Survey

9.1 Survey Aim

This survey shall be carried out in order to collect necessary general information regarding the forest and forestry to enable the formulation of forest management plans for the classified forest. Examples of such information are shown below.

- The history and present state of forest management.
- Public systems regarding the public functions of the forest.
- The state of growth of trees in the forest.
- The relationship between the forest and the occupations of the local inhabitants.
- The state of transportation in the local area.
- The state of forestry in the local area.
- The state of the forest product industry in the local area.
- The state of the forest product market in the local area.
- Forest management techniques.
- Forest product processing techniques.

9.2 Survey Method

This survey shall be carried out by collecting existing material, listening to the opinions of related institutions, and carrying out on-site surveys, etc.

9.3 Survey Items

9.3.1 The State of Forest Resources

A survey of the state of forest resources of the Trois-Rivières Classified Forest, the Ouénou-Bénou Classified Forest, and the l'Alibori Supérieur Classified Forest shall be carried out by interpreting aerial photographs, as aerial photographs of all these places exist.

9.3.2 The State of Tree Growth (Increment) in the Forests

When considering the state of growth of the trees in the forest, it is important to consider both the growth of single trees and the growth of stands of trees. In order to ascertain the state of growth of single trees, for trees where the planting dates are known, measurements shall be taken of the DBH and the tree height, etc. and a tree growth curve and DBH growth curve plotted from the results.

Note: Methods of determining the state of growth of trees that do not have growth rings on account of the environment in which they are located are extremely limited. It is desirable to create stand yeild tables through the establishment of a large number of fixed experimental plots or through a survey of man-made forests in which the planting dates are known.

9.3.3 Age at Maturity and Cutting Cycle

Although the age at maturity is not determined, when applying for logging permits the DBH is set for tree type and tree group. The Forestry Corporation (ONAB) uses a cutting cycle of 40-50 years for saw timber for areas of man-made *Tectona grandis* forest. In private forests, a cutting cycle of 5-10 years is used for post production.

There are few examples of cutting cycles. Under the improvement plan of the Toui Kilibo Classified Forest, the age at maturity is 50 years and the cutting cycle is set at 25 years. In the plan for the Intensive Study Area, the age at maturity is 30 years and the cutting cycle is set at 20 years.

9.3.4 Afforestation

Although regeneration is used in natural forests, enrichment is being carried out. Surveys shall be carried out regarding replanting techniques, especially artificial regeneration through the planting and raising of seedlings.

9.3.5 Forest Use

(1) Use of Logged Trees

A survey shall be carried out to ascertain the state of use of general timber, such as timber and general timber for construction, etc., posts and fuelwood.

(2) Other Forest Use

A survey shall be carried out to ascertain the state of use of the classified forest and the buffer zone by the local inhabitants for timber production, such as fuelwood and posts, etc., farming, and grazing, as well as for hunting, bee-keeping, freshwater fishing, and fruit picking, etc.

9.3.6 Forest Protection

A survey shall be carried out regarding forest fires as forest fires are the greatest threat when it comes to protecting the forest.

10. Workshops with Villagers

10.1 The Aim of Workshops with Villagers

Workshops with villagers have the following aims.

- To present the basic concept proposal of the forest management plan to the local inhabitants, obtain their opinions, and formulate a forest management plan proposal.
- To help the local inhabitants to become aware of the importance of forest preservation through discussions and to help them understand that they themselves are important entities from the standpoint of future forest management.
- To explain the subsequently formulated forest management plan proposal to the people of the area, obtain the opinions of the local inhabitants through discussions and seek to deepen their understanding of the proposal.
- To incorporate necessary factors from discussions with the local inhabitants and formulate the forest management plan.

10.2 Method of Carrying Out the Workshop with Villagers

A workshop for the local inhabitants shall be held from the very first stages of the formulation of the management plan in order to involve the local inhabitants in the development of the classified forest, obtain their opinions and reflect them in the plan. The workshop shall not be held a set number of times but shall be held as many times as necessary, depending on the state of the classified forest and the state of participating settlements. A facilitator with approach skills as a participant, such as a PRA, etc., shall be utilized.

(1) Target Settlements

Target settlements are those settlements which are directly related to the target classified forest for which the forest management plan is to be formulated and which shall benefit from the forest.

(2) Participants

Participants shall include government representatives from the Forest and Natural Resource Department DFRN, the Forest Department (DFPRN), the Forest Officer, and a representative from the regional branch of the Agricultural Administration Bureau. Participants from among the villagers shall include traditional chiefs, village chiefs, village council members, representatives from village organizations, such as GV, etc., representatives from related tribes, and ordinary villagers.

(3) Presentation of the Basic Concept

① Explanation of the necessity of Forest Management Plans

a. The Usefulness of Trees and Forests

- Use of Forest Resources by Local Inhabitants
- CO_2 Absorption Function
- Shade

b. The Detrimental Effect of Shrinking Forests

- Changes in the Ecosystem
- Decrease in Water Holding Capacity

c. Verification of the Necessity of Forest Management Plans

② Explanation of the Basic Concept

a. Land is Limited

b. The Balance between Forest Preservation and the Lifestyles of Local Inhabitants

c. Verification of the Illegality of Land Use within the Classified Forest

d. Points for Consideration with regard to the Implementation of the Displayed Basic Concept

(4) Explanation of the Forest Management Plan Proposal

a. Zoning

b. Improvement standards for each Zone

c. Utilization of the Village Forestry Zone

d. Community Organizations

(5) Points for Consideration regarding Implementation

・Gaining the Trust of Local Inhabitants

・Joint Ownership of Information with Local Inhabitants

・Clarification of What Is and Is Not Possible

10.3 Compiling the Results of Workshops with Villagers

A chart shall be made for each of the items discussed at workshops with villagers showing the opinions of the local inhabitants and the views of the Study Team and Forest Department (DFPRN). Consideration shall then be given regarding to what degree the local inhabitants have understood the necessity of forest management and regarding what kind of problems they are facing. The results of this shall be taken into consideration when formulating the forest management plan.

<Results from the Intensive Study Area> ******* ******* ******** ******* ******** ***

The results of two workshops with villagers carried out for the forest management plan formulation survey with the Intensive Study Area as the target area are shown below.

(1) Local Inhabitants Understanding of the Basic Concept

It was discovered that most of the basic concepts and background of the forest management plan presented at the workshop with villagers was understood by the local inhabitants.

(2) Content of Discussions

Although the local inhabitants understood the forest management plan, as this concept requires a change in the long-standing attitudes of the local inhabitants with regard to the classified forest, there was much debate. The main points of discussion arising during the first workshop with willagers have been arranged into 14 items and are shown in Table 10-1-2.

During the second workshop with villagers, there was much debate regarding the future schedule of the forest improvement plan formulated on the basis of the management plan and problems accompanying detailed changes, etc. made to the management content of the classified forest. The main points of discussion arising during the second workshop with villagers have been summarized and are shown in Table 10-1-3.

Table 10-1-2(1) Main Points of Discussion from the First Workshop with Villagers

Points of Discussion	Opinions of the Local Inhabitants	Replies (Questions) and Suggestions of the Study Team
The Meaning of the Workshop	As the forest management plan has already been created, isn't it meaningless to give opinions at the workshop?	If the forest management plan has already been formulated then why would a study team come all the way from Japan? Surveys are currently being carried out in order to formulate a plan and the workshop is being held to obtain the opinions of the local inhabitants and to then reflect them in the plan.
The Prohibition of Cotton Growing within the Classified Forest	• It is too severe to prohibit the growing of cotton as this makes up a large proportion of cash income. Are there any other cash crops? • If it is OK to grow food crops why can't the growing of cotton be permitted? • If the growing of food crops in place of cotton is being promoted, then we want you to organize sales routes for maize, for example.	• We know that cotton growing is the main source of cash income for the local inhabitants. However, as long as cotton growing is being continued as it is at present with extensive shifting cultivation, the forest will always be used to provide new land for cultivation. With that method, no matter how much land there is there will never be enough. Therefore, we'd like you to prohibit the growing of cotton in at least the classified forest, and try to make the transition from shifting cultivation to established cultivation for food crops. You can continue to grow cotton outside the classified forest. • With maize, etc., if fields are scattered around all over the place then it is difficult for agents to get involved. However, if the fields are in one place and a certain volume is able to be supplied, then the sales route will appear by itself.
The Transition from Shifting Cultivation to Established Cultivation	• Are there techniques that prevent production volumes from falling even though the same field is being cultivated? • If improved techniques are available for commercial farming, we want you to teach us about them. We are always ready to adopt such technical innovation.	• By introducing rotational cropping and organic fertilizers and by growing Leguminosae crops, etc., it is possible to maintain the fertility of the soil without relying solely on chemical fertilizers. • The Agriculture Administration Bureau is already involved in the extension and instruction of these techniques.
The Planting of Fruit Trees and Forest Trees	• Although we want to plant forest, there is a shortage of seedlings. • Although we have mango plantations, it is difficult to store mangoes and in many cases we have to throw them out because they go rotten.	• Please discuss the supply of seedlings with the Forest Officer. Seedling supply is given adequate consideration under the forest management plan. • There are already ways of preserving mangoes. Please contact the Agriculture Administration Bureau for details.
The Planting of *Vitellaria paradoxa* and *Parkia biglobosa.*	• If the men won't destroy them, then we'll (women) plant them anytime. • We find the idea of planting *Vitellaria paradoxa* and *Parkia biglobosa* seedlings on the boundaries of the fields and then cutting them down once they bear fruit acceptable.	• We are of the opinion that planting of *Vitellaria paradoxa* and *Parkia biglobosa* should be carried out more enthusiastically. What are your thoughts on this matter?
Controlled Burning	Indiscriminate controlled burning is being carried out not just by outsiders but by people from the Baatombu and Fulbe tribes. Please help us to stop this.	• Under present regulations, early controlled burning is encouraged as a second-best measure. Indiscriminate controlled burning is not something that can be prevented by the appropriate government departments alone, but is something that we would like the local inhabitants themselves to make countermeasures for when they come to realize the detrimental effect of controlled burning. There are examples of villages where the local inhabitants themselves have already placed a complete ban on controlled burning.
The establishment of Paths for the Passage of Livestock	People of the Fulbe tribe desire to establish paths for the passage of livestock.	• A pathway for the passage of livestock shall be established from outside the classified forest to inside the classified forest.

Table 10-1-2(2) Main Points of Discussion from the First Workshop with Villagers

Points of Discussion	Opinions of the Local Inhabitants	Replies (Questions) and Suggestions of the Study Team
The Securing of Waterholes for Livestock	We'd like you to establish reservoirs as waterholes for livestock.	This shall be given adequate consideration when the management plan is formulated.
The Apportioned Area of the Zone for Cultivation	• We'd like you to include the land from the Bouli River as part of the zone for which cultivation is permitted within the classified forest. • It is necessary to ensure that the area of the zone for cultivation is sufficiently large for cultivation bearing in mind increases in population.	Although details have not as yet been decided, it is not possible to allow the cultivated zone to extend as far as the Bouli River.
Improvement of Village Infrastructure	There does not appear to be any solution to the problems concerning the imprvement of infrastructure presented during the group discussion. If you can't show us a solution, then what was the point of having us mention the problems in the first place?	It is true that it is not possible to include all of the requested developmental infrastructure within the forest management plan. However, with regard to the formulation of the forest management plan, it is necessary to ascertain all of the needs of the local inhabitants. We are of the opinion that it is necessary to clarify just what can and what cannot be done.
Logging of Forest Trees	People from outside are logging the trees in the forest, and they even have the consent of the Forest Officer to carry out such logging.	Present regulations are very clear regarding logging. Although it cannot be said that all logging is illegal, if you have doubts about this matter we would appreciate it if you would contact the Forest Officer immediately. If you have doubts regarding the involvement of the Forest Officer in illegal logging, then we would appreciate it if you would contact his/her superiors immediately.
Boundaries of the Classified Forest	As the boundary of the classified forest is not clear, there is no way of knowing whether or not we are using land within the boundaries of the classified forest.	Although the boundaries of the classified forest are already established on maps, at present they have yet to be displayed in a detailed way on-site. At the time when the plan is implemented they shall be clearly shown.
Organization of Local Inhabitants for the Management of the Classified Forest	• We would like to form a committee of representatives from the village to bear the responsibility of forest preservation in the area. • We would like to establish a committee consisting of a number of people from the village to monitor indiscriminate logging, malicious burning and development of forest land.	We are of the opinion that community organizations are essential in the implementation of the forest management plan. What do you think?
The Concept of Zoning	• We agree with the concept of dividing the area within the classified forest into three zones and using them for different purposes. • As leaders of the Fulbe tribe we agree with the concept of zoning.	

Chart 10-1-3 (1). Main Points of Discussion from the Second Workshop with Villagers

Points of Discussion	Content of the Proposed Plan	The Response of the Local Inhabitants	Replies of the Study Team and Forest Department (DFRN)
The Aim of the Forest Improvement Plan	The aim of the forest improvement plan is to endeavor to preserve the classified forest which has a variety functions that are in the interests of the general public, and to endeavor to improve the lifestyle of the local inhabitants while endeavoring to carry out sustainable use of the classified forest.	We don't really understand the purpose of the forest improvement plan.	The aims of the forest improvement plan are to endeavor to improve the lifestyles of the local inhabitants in the area neighboring the forest while preserving the functions of the classified forest as a forest. That is why we are proposing the zoning of the classified forest and utilization plans that are appropriate for each zone.
The Zoning of the Classified Forest	The classified forest shall be divided into the Forestry Zone, the Silvi-Pastoral Zone, and the Village Forestry Zone.	Although we agree with the concept of zoning, we would like you to make the area of both the Village Forestry Zone and the Silvi-Pastoral Zone as large as possible.	In the first part of the workshop the local inhabitants agreed to the concept of zoning. More detailed zoning was presented during the latter stage of the workshop. If we consider the preservation of the forest and the necessity of use, it will be impossible to satisfy the desires of the farmers and stock farmers.
The Separation of Dwellings and Cultivated Land	Dwelling and cultivation within the classified forest are prohibited by law.	We would like you to clarify just which v illages must move outside the classified forest.	We know that there are settlements within the classified forest where people have been living for more than 10 years and the scale of the settlement has grown. As a rule, although all of these villages and settlements must be removed to an area outside the classified forest, the final decision will be made by the government and at this stage it is impossible to clearly say either way.
The Allocated Area of the Village Forestry Zone	The allocated area of the Village Forestry Zone is 2ha per household (6 adults and 8 children) for cultivated land to grow food for personal consumption and 2ha for planting fruit trees, fuelwood, and trees for post production.	• As Africans in general eat a lot and the population is increasing, there is no way that 2ha (per household for growing food) will be enough. We would like you to greatly increase the size of the allocated area. • Although it is impossible to grow enough for personal use on 2ha, it is also necessary for us to have a certain level of stock for celebrations such as festivals, etc. This fact has not even been taken into consideration.	• We surveyed the food consumption volumes of a village in the Intensive Study Area. The necessary area for growing sufficient crops for self-sufficiency was calculated based on those figures. However, in order to produce the necessary volumes to be self sufficient, it is necessary to make the transition from the traditional extensive cultivation to intensive cultivation. • It is necessary to sell products from within the forestry area to obtain cash with which to buy necessities apart from those things you grow yourselves and to become aware that only necessities need to be purchased.
The Beneficiaries of the Village Forestry Zone	The beneficiaries of the Village Forestry Zone are those people who were growing crops within the classified forest at the time that the aerial photographs were taken in November 1998.	We would like you to clarify in detail just who is and who is not going to be able to use the Village Forestry Zone.	The beneficiaries of the Village Forestry Zone are limited to those people who were cultivating the classified forest at the time at which the aerial photographs were taken. Those people who started cultivating after that time are not eligible to use the Village Forestry Zone.

Chart 10-1-3 (2). Main Points of Discussion from the Second Workshop with Villagers

Points of Discussion	Content of the Proposed Plan	The Response of the Local Inhabitants	Replies of the Study Team and Forest Department (DFRN).
The Prohibition of Cotton Growing in the Village Forestry Zone	Although it is permitted to grow food crops for personal use in areas of cultivated land within the Village Forestry Zone, the growing of cotton is prohibited.	Cotton accounts for the majority of our cash income and it's thanks to cotton that our lifestyles have improved. Why can't we grow cotton?	We know that cotton growing is your main source of income. However, as cotton growing uses large amounts of pesticides and chemical fertilizers, it is feared that the Bouli River, which is an important source of water for the local inhabitants, may become contaminated. That is the reason we want to prohibit cotton growing in at least the classified forest.
The Improvement of Commercial Farming	Once the forest improvement plan has been implemented the development of new land will not be permitted. Therefore it will be necessary to make the transition from extensive shifting farming to intensive farming in fixed fields.	How on earth can you cultivate the same field continuously?	• Rotational cropping of yams, maize (2 species), sorghum and peanuts can be carried out. • Things that were previously throw away, such as livestock manure and hay from sorghum, etc., can be used to make fertilizer which can then be used on the soil to maintain its fertility. • Related departments and bureaus will provide necessary technical support for improving commercial farming.
The Diversification of Sources of Income	The diversification of sources of income should be encouraged rather than relying solely on one individual crop. Examples of possible sources of income include the following. • The planting of fruit trees and timber production (posts and fuelwood) in the 2ha planting area within the Village Forestry Zone. • Bee-keeping. • Paid positions for various types of work related to the improvement plan.	• We will plant mainly cashews in the planting area. • We would like you to give preference to employing local inhabitants for various kinds of work related to the improvement plan. • We would like to breed fish in the reservoirs.	• The Agriculture Administration Bureau also wants to encourage the planting and commercialization of cashews as a product. • Preference will be given to employing local inhabitants for various kinds of work related to the improvement plan. • The Forest Department (DFPEN) and Agriculture Administration Bureau will provide as much technical support as possible with regard to activities such as planting, etc.
The Commercialization of Products Other than Cotton	In order to commercialize farm products, and fruit and forestry products, it is first essential to organize the products and establish a shipping system.	At present, there are no products, apart from cotton, for which sales routes are established and for which there is a stable price. We are doubtful that the commercialization of other products will succeed.	• There is a great demand forfuelwood in northern areas, such as Malanville, etc., making them potential markets. • There is expected to be a demand for posts in urban areas, such as Parakou, etc. • The is a demand for honey is urban areas, such as Parakou and Cotonou, making them potential markets. There is already a producer's cooperative in Parakou.

Chart 10-1-3 (3). Main Points of Discussion from the Second Workshop with Villagers

Points of Discussion	Content of the Proposed Plan	The Response of the Local Inhabitants	Replies of the Study Team and Forest Department
Prevention of Disputes between Farmers and Stock Raisers	Paths for the passage of livestock shall be established in the Village Forestry Zone.	How will paths for the passage of livestock be clearly indicated?	Paths for the passage of livestock will utilize areas of retained forest and existing roads within the Village Forestry Zone.
No-Grazing Zone	Grazing shall be prohibited in the Forest Zone and the Village Forestry Zone.	Can grazing be carried out within the classified forest?	Grazing within the Forest Zone and Village Forestry Zone shall be prohibited and Silvi-Pastoral Zone established between these zones.
Silvi-Pastoral Zone	A Silvi-Pastoral zone shall be established within which reservoirs and wells, etc. for livestock shall be established. Furthermore, pasture shall be improved and feed trees planted, etc. in this zone to ensure that there is not a shortage of feed during the dry season.	As there is a shortage of water for livestock especially during the dry season, we would like to be allowed to graze as far as the Bouli River.	Although it is not possible to graze within 3.5km of the Bouli River as this is a conservation forest area, it is still possible to pass through the buffer zone. We are aware of the water shortage during the dry season and water holes, such as reservoirs and wells, etc. shall be established within the Silvi-Pastoral Zone.
Improvement of Stock	Improvement of livestock is not merely concentrated on increasing the number of livestock by using extensive feed methods, but on making the transition to intensive feeding techniques and achieving appropriate stock numbers.	• To the stock farmers, their stock are their assets and they only sell their animals when it is absolutely necessary. To say that livestock should be sold regularly and the number of stock reduced makes us feel extremely uneasy. • As there are established stock farmers with many stock they have raised themselves and stock that have been brought in from outside, we are of the opinion that the size of the land allocated to them in the Silvi-Pastoral Zone will be too small. We would like you to expand this area.	Although it may be difficult to change the "my livestock are my assets" type of thinking that has been around for generations, from now on it will be necessary to adopt the thinking that "livestock are merchandise." From now on, on account of the improved pasture and the water holes to be established, it will be possible to raise stock that has previously taken you six years to raise in three years, which means that you will be able to sell them regularly. This means that you will be able to prevent the diseases arising from the long-term raising of stock and that you will be able to maintain appropriate herd sizes.
Forest Zone	Land within 3.5km of both banks of the Bouli River shall be classified as conservation forest areas and the area from the boundary of the conservation forest area to the boundary of the Silvi-Pastoral Zone shall be classified as production forest. fuelwood and timber production is planned for the production forest.	Does that mean that we have to abandon areas of cultivated land located within the Forest Zone?	While it goes without saying that you will have to abandon areas of cultivation within conservation forest areas, areas of cultivation within the production forest will also have to be abandoned. Cultivation is only permitted within the Village Forestry Zone.

Chart 10-1-3 (4). Main Points of Discussion from the Second Workshop with Villagers

Points of Discussion	Content of the Proposed Plan	The Response of the Local Inhabitants	Replies of the Study Team and Forest Department (DFRN)
Boundaries of the Classified Forest	The boundary of the classified forest will be clearly shown in detail by noticeboards and boundary stones, etc. established at the time when the plan is implemented.	• We don't know where the boundary of the classified forest lies, which means that we may well have entered the classified forest. • How will the boundaries of each zone be shown?	The boundaries of each zone will be made clear by planting boundary trees, etc. For example, trees which are a source of nectar shall be planted along the boundary of the Village Forestry Zone and bee-keeping carried out.
Community Organizations	Should the forest improvement plan be implemented, local inhabitants will participate in the improvement and management of the classified forest and bear a certain degree of responsibility. Therefore, a forest improvement committee for each of the improvement areas shall be developed, which means that local inhabitants will have to perform those activities.	Will the members of the forest improvement committee receive any payment? If so then how much will that be?	At this stage, it has not yet been decided whether members of improvement committees will be paid and if so how much that will be. What we can say at this stage is that the Forest Improvement Fund will be established as a source of funds for the improvement and management of the forest.
Payments to the Forest Improvement Fund	The beneficiaries of the Village Forestry Zone and the Silvi-Pastoral Zone shall make a payment to the Forest Improvement Fund.	We can accept the idea of making a payment to the Forest Improvement Fund for the Village Forestry Zone and the Silvi-Pastoral Zone, but we do not wish to make any payment for the Forest Zone.	Funds are necessary in order to improve and maintain the forest. As not just the beneficiaries but the local inhabitants will participate in the management of the forest and bear a certain level of responsibility, we would like the people of the area themselves to bear the cost of payments to the fund.
Land Problems in the Buffer Zone		If the improvement plan is implemented, it may be necessary for us to return to the areas we possessed in the buffer zone. However, we have let other people have this land or it has been taken without warning by other people, making it impossible for us to return. We would like the government to formulate some kind of measures for the return of this land.	There is nothing that the government can do to return the fields you had previously in the buffer zone. Therefore, all you can do is talk with the parties concerned and try to come to some kind of an agreement.

Chart 10-1-3 (5). Main Points of Discussion from the Second Workshop with Villagers

Points of Discussion	Content of the Proposed Plan	The Response of the Local Inhabitants	Replies of the Study Team and Forest Department (DFRN).
Clarification of the Time of implementation of the Improvement Plan		• It will take 2-3 years for cultivated land within the present classified forest to become part of the buffer zone. We would like you to clarify whether or not there will be a grace period before the implementation of the improvement plan. • We would like you to clarify when the improvement plan will be implemented from. We would like you to clarify whether or not it is OK for us to plant yams in the mounds we have already made. • Despite the fact that they're talking about the participation of the local inhabitants, etc., the reason that the date of implementation of the improvement plan has not being clarified is that the Forest Department is trying to remove the local inhabitants from the classified forest. The explanations offered by the study team and the Forest Department are nothing more than fantasy.	• At present we are still in the survey stage and as large amounts of money are still necessary in order to implement these plans, and as yet the method of obtaining such funds is unclear, at this point in time it is not possible for us to clearly state when these plans will be implemented. In any case, we will be having discussions again with local inhabitants at the time when the implementation plan is being formulated and at which time a contract will also be signed. At that stage we will clarify any grace period. The improvement plan will not be implemented without warning. • As any cultivation within the classified forest by local inhabitants is clearly illegal, no new yam cultivation using new land from the forest can be permitted. Only when the improvement plan has been implemented shall cultivation within the classified forest be permitted.
Nomadic Grazing		Under the improvement plan, we would like you to give some consideration to the problem of stock farmers from outside roving into the area for grazing.	Local inhabitants involved in the improvement of the forest will control stock farmers from outside who are roving into the area for grazing.
Improvement of Settlement Infrastructure		We would like you to construct schools, health centers, and roads between villages, etc.	With regard to village infrastructure, as there are things which can and things which cannot be included directly in the forest improvement plan, we will include all of the desires of the local inhabitants with regard to village infrastructure in the final report of the study and convey these desires to related government agencies.

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11. Forest Management Plan

11.1 Process for the Formulation of the Forest Management Plan

After obtaining the results from each of the surveys necessary for forest management, in order to formulate the forest management plan, it is necessary to arrange these results in a certain order in order to put together the forest management plan. Although this order varies depending on the conditions selected, generally they are classified in the following categories.

- Selection of Prerequisites
- Selection of Problems
- Selection of Policies to Solve Problems
- Selection of Various Measures to Actualize Policies
- Integration of the Forest Management Plan

11.2 Prerequisites and Problems of the Forest Management Plan

11.2.1 Prerequisites of the Forest Management Plan

Although forests generally have an economic function and a public benefit function, with the classified forest, the public benefit function especially needs to be managed to ensure that it functions correctly. On the other hand, in order to promote the improvement of the classified forest through the participation of the local inhabitants it is important to achieve a balance between the economic function and the public benefit function. In addition, these functions must continue to operate.

In the future, the forest management plan will form the basis of a government proposal for a forest improvement plan to be carried out by means of a contract with the local inhabitants and therefore it is necessary to maintain adequate communication with the local inhabitants of the area right from the forest management plan formulation stage.

11.2.2 Problems of the Forest Management Plan

The most important problems facing planned management, as obtained from the prerequisites of the forest management plan and the state of the forest, etc. as obtained from the results of the surveys, are determined by analyzing them systematically. The problems of the forest management plan should be determined by the present state of the management of the target forest, the present state of forest resources, the environment in which the forest is located, and the state of the local inhabitants, etc.

The problems of the forest management plan in the Intensive Study Area were determined under four categories.

- The preservation of forest in areas of water resources.
- Maintaining and increasing forest productivity.
- The transition from extensive stock farming to intensive stock farming.
- The transition from shifting farming to intensive established farming.

11.3 Jurisdiction over Forest Management and Forest Improvement Units

11.3.1 Jurisdiction over Forest Management Unit

The relationship between the state of distribution of the classified forest within each administrative unit and the state of the classified forest management organization must be considered and the forest management of the classified forest established in such a way as to

make the management of the classified forest easier. Therefore, although the conditions are set with a certain degree of flexibility, generally, it is thought wise to place the management of the classified forest under the jurisdiction of the district within which it lies.

11.3.2 Jurisdiction over Forest Improvement Unit

Jurisdiction over the improvement of the classified forest lies with those who have formulated and implemented the forest improvement plan. Therefore, the management organization of the classified forest shall be established with consideration being given to both the historical and socioeconomic conditions of the settlement using the classified forest, and natural conditions, such as forest distribution, etc.

11.4 Classified Forest Plans

11.4.1 Improvement Goals

The improvement goals of the classified forest shall be determined based on the previously-mentioned prerequisites and problems of the forest management plan. Under the forest management plan of the Intensive Study Area, the improvement goals were determined as follows.

- To develop the classified forest in such a way as to display the public benefit function of the forest.
- To create a production forest in order to achieve full and sustainable use of forest resources.
- To establish an area within the classified forest for local inhabitants to use in order to preserve the forest through coexistence with the local inhabitants.

11.4.2 Zoning

(1) The Zoning System

In order to achieve the above-mentioned improvement goals, the land use of the classified forest shall be divided up into zones based on the improvement goals of the classified forest and the relationship of the local inhabitants with the classified forest.

① Forest

The classified forest shall be used as a conservation forest to realize the public benefit functions of the forest and for forestry use as a production forest. This area shall be classified as the Forest Zone.

② Grazing Community Forest

The people of the area shall use this part of the forest for high productivity sustainable grazing and forestry. This zone is known as the Silvi-Pastoral Zone.

③ Mixed Agriculture and Forestry Use

The people of the area shall use this part of the forest for the production of food for themselves and for the production of cash crops. This zone is known as the Village Forestry Zone

(2) Zoning Content

① Forest Zone

a. Conservation Forest Zone

This area of forest is for the purpose of fostering water resources and preserving areas of forest land for public benefit.

(a) Conservation Forest I

Areas of forest within the conservation forest, especially areas of protected forest.

(b) Conservation Forest II

Forest within the conservation forest other than conservation forest I.

b. Production Forest Zone

This area of forest is for the production of timber and fuelwood, etc. However, even though it is within the production forest it shall be operated for public benefit as Conservation Forest II. The following forest shall be classified as Conservation Forest II.

- Areas of forest within 50m either side of waterways.
- Areas of forest located on residual relief and tectonic relief.
- Areas of forest where soil conditions are bad and existing vegetation should be retained.

c. Silvi-Pastoral Zone

This is an area where grazing is carried out and it is located between the Forest Zone and the settlement zone. It also acts as a buffer for the Forest Zone. However, it is operated for public benefit as Conservation Forest II. The following forest shall be classified as Conservation Forest II.

- Areas of forest within 50m either side of waterways.
- Areas of forest located on residual relief and tectonic relief.
- Areas of forest where soil conditions are bad and existing vegetation should be retained.

d. Village Forestry Zone

This is the area in which the local inhabitants carry out farming and forestry activities. It is located on the boundary of the Classified Forest and adjoins the Buffer Zone. However, forest being used for public benefit shall be designated as Conservation Forest II. The following areas within the Production Forest shall be part of Conservation Forest II.

- Areas of forest within 50m either side of waterways.
- Areas of forest located on residual relief and tectonic relief.
- Areas of forest where soil conditions are bad and existing vegetation should be retained.

(3) Mapping of the Zones

Surveying for zoning shall be carried out and the results shown in each district and settlement. It shall also be shown on maps of a suitable scale. Furthermore, details regarding the area of forest cover, etc. shall also be shown for the Forest Zone to serve as improvement standards and as a foundation for plans.

11.4.3 Improvement Standards

The basic policy regarding forest improvement is that improvement standards shall be established for each zone. Those determined as improvement standards shall be divided as follows.

- Actions prohibited in each zone.
- Measures that should be undertaken in each zone in order to realize the aims established for each zone.

The improvement standards of the Intensive Study Area are as follows.

(1) Forest Zone

① Conservation Forest

a. Conservation Forest I

- Logging and the removal of branches and leaves shall be prohibited.
- Controlled burning shall be totally prohibited.
- Grazing and the passage of livestock shall be prohibited.
- Planting, enrichment and direct sowing of native species of trees shall be carried out in areas of cultivated land or fallow ground and areas of devastated forest in an endeavor to achieve rapid forest recovery.

b) Conservation Forest II

- Controlled burning shall be totally prohibited.
- Grazing and the passage of livestock shall be prohibited.
- New planting shall be carried out in cultivated land and fallow ground in order to realize rapid forest recovery. Mixed planting shall be carried out of native species of trees.
- Enrichment shall be carried out in areas of devastated forest using native species of trees in order to help the forest to recover.
- Although thinning, improvement cutting and sanitation cutting may be carried out in order to help foster the forest, all other logging and the removal of branches and leaves shall be prohibited.
- Dense planting shall be carried out on the boundary with other zones in order to eliminate *Gramineae* plants which act as fuel for forest fires.

② Production Forest

- Controlled burning shall be totally prohibited.
- Grazing and the passage of livestock shall be prohibited.
- Timber forest shall be created through new planting and direct sowing in cultivated land, fallow ground. In addition to the planting of native species, such as *Khaya senegalensis*, *Milicia excelsa*, *Pterocarpus erinaceus*, *Isoberlinia spp*., etc., species of trees, such as *Tectona grandis*, *Gmelina arborea*, and *Cassia siamea*, etc., shall also be planted.
- Land being cultivated at the time of the implementation of the plan may continue to be cultivated until after crops have been harvested, at which time the timber production forest shall be created.
- Planting and regeneration by natural seeding shall be carried out in areas of natural forest where soil conditions, etc, are excellent so that they can be used as selective logging production forests in the future.

(2) Silvi-Pastoral Zone

- Grazing techniques in the Silvi-Pastoral Zone shall be improved through formulating various grazing-related techniques, such as planned early controlled burning and the improvement of grazing capacity.
- Although the growth of trees is not good as the A horizon of the soil is shallow, in areas suitable for growing grass and shrubs, pasture improvement and the planting of feed trees shall be carried out.
- Man-made pasture shall be created in small areas of returned cultivated land and fallow ground scattered throughout the zone, and feed produced for the dry season.
- Areas of early controlled burning shall be determined in each improvement unit and carried out in a planned manner. The area around those areas where early controlled burning is to be carried out shall be cut back to serve as firebreaks to prevent fire from spreading to the surrounding area.

- Grazing areas for the rainy season and the dry season shall be determined and grazing carried out according to the season.
- in order to provide water for livestock during the dry season, dams shall be made on the Bouli River or waterways in the Silvi-Pastoral Zone as a means of storing water. The drilling of wells within the Silviculture-Pastoral Zone shall also be planned.
- The local people shall make payments to the Forest Improvement Fund according to the number of livestock using the zone.

(3) Village Forestry Zone

- Cultivated land in this zone shall be used for growing food for personal consumption and the growing of cotton shall be prohibited.
- As a rule, people using the land for cultivation within this zone shall be those people possessing land within the existing classified forest (based on aerial photographs taken in 1998).
- Each household shall be allocated the use of 2.0ha of land for cultivation and 2.0ha of land for fruit growing, fuelwood production and post production, making a total of 4ha.
- Accompanying the prohibition of cotton growing within the Village Forestry Zone, organic fertilizer, the planting of *Leguminosae*, and the introduction of new species shall be carried out to establish fixed cultivation.
- Agroforestry (Toungya) may be carried out in the 2.0ha of land allocated for tree-planting.
- *Vitellaria paradoxa* and *Parkia biglobosa*, etc. shall be planted around each area of cultivated land.
- Logging shall be prohibited in areas of forest designated as Forest II within this zone. However, authorized early controlled burning may be carried out.
- Paths for the passage of livestock (50m wide) shall be established in the Village Forestry Zone from areas within the classified forest to areas within the Silvi-Pastoral Zone and such areas of forest designated as Conservation Forest II. It is possible to log trees, etc. in order to make way for the use of the area as a path for the movement of livestock. Authorized early controlled burning is the only kind of controlled burning that shall be permitted.
- Belts of trees shall be planted on the Village Forestry Zone's boundary with both the Silvi-Pastoral Zone and the Forestry Zone, both to mark the boundary and prevent the spread of fires. Species to be planted include *Khaya senegalensis*, *Acacia auriculiformis*, *Vitellaria paradoxa*, *Pterocarpus sp.*, *Parkia biglobosa*, and *Daniellia oliveri*, etc., which are trees that are a source of nectar for bee-keeping. The planting of such species will help to develop the beekeeping industry for the local inhabitants.
- The local inhabitants shall make payments to the Forest Improvement Fund according to the area of cultivated land that they use.

11.4.4 Improvement Plans

Improvement plans consist of detailed methods and work plans for achieving the improvement standards of each area of forest where zoning has been carried out. An outline of improvement plans is shown below. However, these may vary depending on the conditions of the target area.

(1) Improvement Plan for Conservation Forest I

① Forest Restoration and Recovery Area

New planting shall be carried out in areas of returned cultivated land and fallow land and enrichment planting carried out in areas of devastated forest (crown density less than 50%). The necessary area for forest restoration and forest recovery shall be displayed.

② Trees

The following native species shall be planted.

Khaya senegalensis, Pterocarpus erinaceus, Isoberlinia spp., Vitellaria paradoxa, and Parkia biglobosa.

③ Planting Method

The following planting methods shall be used.

- The planting of seedlings for rapid forest restoration and recovery.
- Mixed planting of native species of trees.
- Planting density for areas of cultivated land and fallow land shall be 625 trees/ha (4m x 4m).
- Planting density for the enrichment planting areas of devastated forest shall be 100 trees/ha (10m x 10m).

④ Tending

The following tending methods shall be used.

- Supplementary planting and brush cutting depending on the state of survival and the growth of planted trees.
- Supplementary planting after one year and brush cutting after 2~3 years for newly planted areas. Supplementary planting shall be carried out after one year if the survival rate is less than 80%.
- For areas of enrichment, supplementary planting shall be carried out after one year and brush cutting carried out one year after planting depending on the state of the undergrowth. Supplementary planting shall be carried out after one year if the survival rate is less than 80%.
- Brush cutting shall consist only of spot weeding around trees.

⑤ Forest Restoration and Recovery Period

Forest restoration and recovery shall be carried out for the following period.
Replanting, supplementary planting and brush cutting shall be carried out for a period of five years.

⑥ Annual Work Plans

Annual work plans must be prepared and shown as a table based on the forest restoration and recovery area and the implementation period involved.

(2) Improvement Plan for Conservation Forest II

① Forest Restoration and Recovery Area

New planting shall be carried out in areas of returned cultivated land and fallow land and enrichment planting carried out in areas of devastated forest (crown density less than 50%). The necessary area for forest restoration and forest recovery shall be shown as a table.

② Trees

The following native species shall be planted.
Khaya senegalensis, Pterocarpus erinaceus, Isoberlinia spp., Vitellaria paradoxa, Parkia biglobosa and *Milica excelsa*. Other species mentioned in the attachments of the Washington Treaty which it is possible to plant for forest creation or species that can be direct planted may also be planted.

③ Planting Method

The following planting methods shall be used.

- Planting of seedlings shall be carried out. However, direct sowing or Planting of cuttings shall be carried out of species that can be directly sown or their cuttings can be planted.
- Mixed planting of native species of trees.
- Planting density for areas of cultivated land and fallow land shall be 625 trees/ha (4m x 4m).

- Planting density for the enrichment of areas of devastated forest shall be 100 trees/ha (10m x 10m).

④ Tending

The following tending methods shall be used.

- Supplementary planting shall be carried out in areas of new planting and enrichment after one year in areas where the survival rate is less than 80%.
- Brush cutting shall be carried out after 2~3 years after planting for newly planted areas and one year after planting for enrichment areas.
- Thinning, improvement cutting and sanitation cutting shall be carried out as necessary.

⑤ Forest Restoration and Recovery Period

Forest restoration and recovery shall be carried out for the following period.

Replanting, supplementary planting and brush cutting shall be carried out for a period of five years. Thinning, improvement cutting and sanitation cutting shall be carried out as necessary depending on the state of planted trees and depending on the effect of planted trees on other trees and whether or not they are hindering growth.

⑥ Annual Work Plans

Annual work plans must be prepared and shown as a table based on the forest restoration and recovery area and the implementation period involved.

(3) Improvement Plan for the Production Forest

① Further Division of the Production Forest

Although timber production will be carried out in the production forest, when more than two operating methods are being employed in the production forest, it is necessary to further divide up the production forest and show in a table forest cover and area, etc.

- Logging shall be carried out for timber production in areas of Gf, Fc, Sa, Sb, and St.
- Fuelwood production shall be carried out in cultivated land, fallow land and in remaining areas of natural forest within the timber production forest.

② Timber Production Forest

a. Logging Operations

In order to carry out sustainable systematic logging operations it is necessary to have a forest with a certain structure. The most basic data regarding such structure is target stand volume, growth (increment) rate, cutting cycle and logging ratio. In logging forests where it is possible to carry out sustainable systematic logging operations, the following basic relationship must be established.

$$\text{Logging Ratio} = \frac{(1+\text{growth rate})^{r}+1}{(1+\text{growth rate})^{r}}$$

$$\text{Logging Volume} = \text{Post Logging Volume} \times (1+\text{growth rate})^{r} \times \text{Logging Ratio}$$

However, r = cutting cycle.

Therefore, when planning logging operations, this must first be clarified. Under the forest management plan of the Intensive Study Area, the following was estimated from available data.

- The target stand volume was set at $100m^3$/ha.
- The growth rate was set at 2%.

・The cutting cycle was set at 20 years with a logging ratio of 33%.

Most species reach maturity in 30 years.

b. Operations in the Immediate Future

An examination of the present state of the production forest revealed a dramatic decrease in forest cover making the carrying out of systematic logging impossible. Therefore, the following operations shall be carried out in the immediate future.

- The recovery of native species through enrichment planting.
- Planting of *Khaya senegalensis, Milicia excelsa, Isoberlinia spp., Pterocarpus sp., Afzelia sp., and Prosopis sp.*, etc. which can be used within Benin and which are able to be planted. Mixed planting of all of these species shall be carried out.
- Spacing for planting shall be 5m x 5m, 6m x 6m, 8m x 8m or 10m x 10m depending on the crown density of the forest involved.
- Although logging shall be carried out of trees that should be removed in order to improve forest content, when planting is carried out, trees of a usable girth shall be used.

②Fuelwood Production Forest

a. Operations of thefuelwood Production Forest

Clear cutting shall not be carried out in the fuelwood production forest but gradual logging shall be carried out of trees with a DBH of at least 7cm. Replanting of the area shall be carried out mainly through natural regeneration with supplementary planting being carried out as necessary.

The above-mentioned operations shall be carried out as follows.

- After cultivated land and fallow land have been prepared, planting of seedlings and direct sowing of seeds shall be carried out.
- Species of trees to be planted shall include *Detarium microcarpum*, *Combretum glutinosum*, *Crossopteryx febrifiga*, and *Piliostigma thonningii*, etc.
- Planting shall be carried out with a spacing of 2m x 2m, 2m x 2.5m and 2m x 3m.
- Logging shall be carried out of standing trees and dead trees with a DBH of more than 7cm with replanting being carried out by planting of seedlings and direct sowing of seeds.

b.Fuelwood Production

Fuelwood production shall be carried out by village organizations in each improvement unit. The areas of fuelwood forest within each improvement unit shall be distributed according to the overall number of households in the target settlement. The cutting cycle is 7 years, each block shall be 10ha, and planning of the distribution area, number of blocks and annual logging area, etc. shall be carried out beforehand.

On the basis of these, the annual work area of each improvement unit, the annually required number of seedlings, and the annual production volume, etc. shall be calculated.

(4) Silvi-Pastoral Plan

① Goals of the Silvi-Pastoral Plan

Under the Silvi-Pastoral Plan, artificial pasture shall be created, natural pasture improved, feed trees planting depending on the state of the forest and the state of land use in the area targeted for improvement, and the grazing capacity clarified. Waterholes shall also be created for use during the dry season.

② Outline of Land Plot Establishment Plan

- Cultivated land and fallow land shall be made into artificial pasture.

- Artificial pasture shall be created by sowing pasture seed in formerly cultivated land and fallow land. Controlled burning and fertilizing of this area shall be carried out once every three years.
- Stock fences shall be erected in areas of artificial pasture to prevent stock from entering.
- Shrubs in areas of Sa, Sb and St shall be used for fuelwood, feed trees planted and natural pasture improved in those areas.
- In addition to planting feed trees in rows, they shall also be planted alongside stock fences in areas of artificial pasture.
- The improvement of natural pasture shall be carried out through direct sowing of seeds in pasture and by removing weeds so that they are not used for feed.
- Waterholes shall be created through damming waterways or digging out low areas of land alongside waterways.

③ Pasture Improvement Plan

As the goal of stock farming is to improve stock weight by 200kg within three years, it is necessary to produce enough feed for this purpose. The *Leguminosae* (*Stylosanthes hamata)* and the *Gramineae (Barchiaria ruziziensis)* shall be introduced into areas of artificial pasture and natural pasture. In addition to the feed trees already existing in areas of natural pasture, new feed trees shall also be introduced.

④ Stock Improvement Plans

Traditional stock raising techniques shall be improved by improving breeding techniques, improving feed management techniques and by improving economic management techniques.

(5) Village Forestry Plans

① An Outline of Village Forestry Plans

Based on aerial photographs taken in December 1998, people cultivating land within the classified forest at that time shall be allocated 4.0ha of land per household within the Village Forestry Zone. One of the important points of the plan is the creation of land for use by such people and the improved utilization of such land for commercial farming. The content of the Village Forestry Plan is shown below. The content of such plans may change depending on the conditions of the target area.

② Land Plot Establishment Plan

a. Land for Cultivation and Tree-Planting

As a prerequisite to the creation of land for cultivation and tree-planting, the size of the land necessary for cultivation and tree-planting by each target settlement shall be calculated and the reason for such together with the figures used to obtain such figures shall be shown in a table.

Zoning is carried out as follows.

- An area measuring 100m x 400m with a total land area of 4.0ha (2.0ha for cultivation and 2.0ha for tree-planting) shall be allocated to each household.
- Trees shall be planted at 5m intervals around the area.
- The land allocated to 10 households shall make up one block. The land for cultivation and land for tree-planting shall then be prepared.
- Roads with a width of 4m shall be established around the perimeter of five plots for the transportation of farm products and forestry products.
- In order to improve transportation efficiency, cultivated land and land for tree-planting shall be grouped together alongside the road.

Such zoning is illustrated in Figure 11-4-1 and Figure 11-4-2.

When the plan is implemented, the land will be arranged in the actual shape of the land for cultivation.

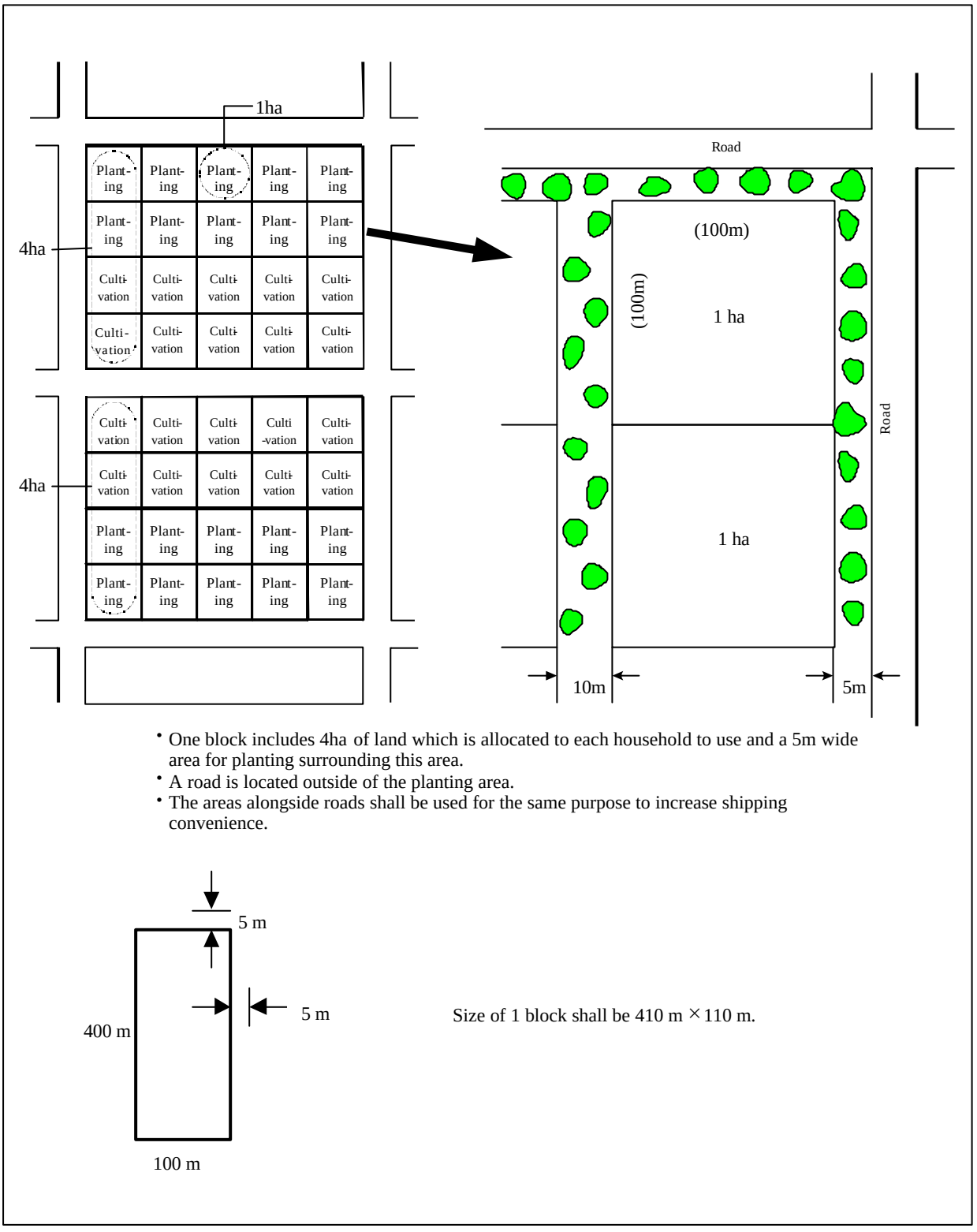
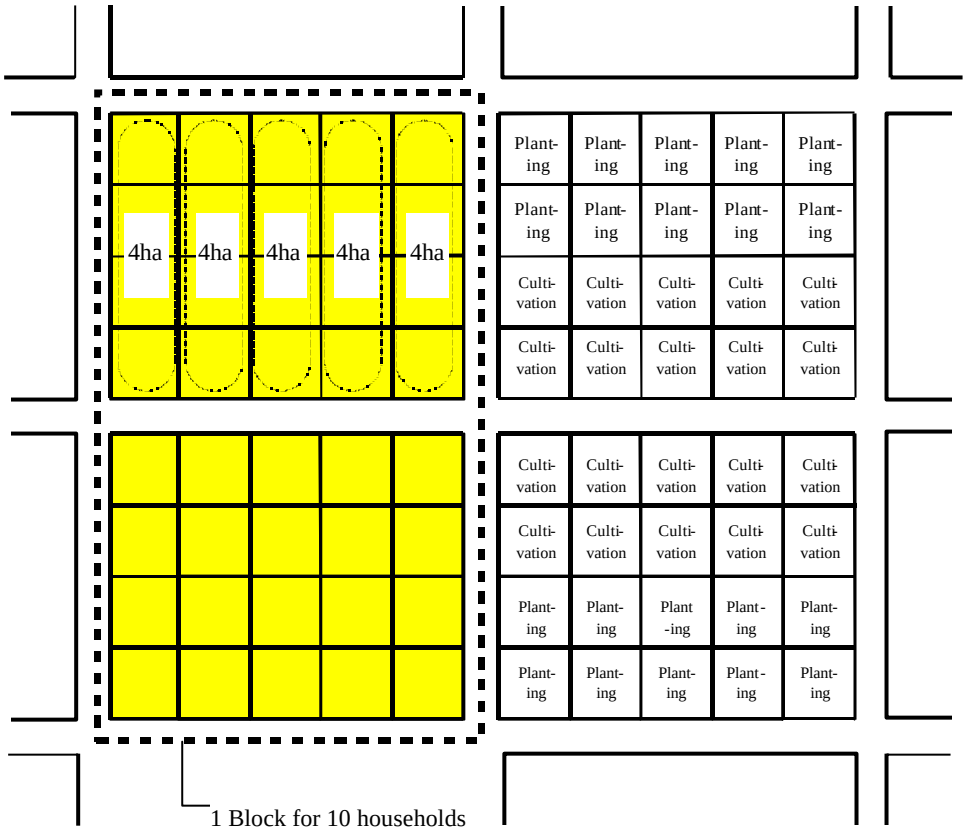
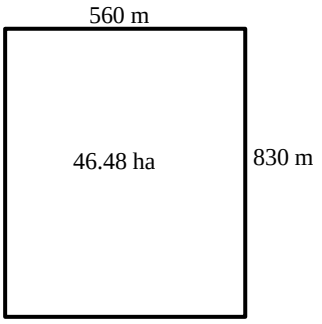


Figure 11-4-1 Location of Land for Cultivation and Planting



1 block is for 10 households.



Area of 1 Block : 46.48 ha

Breakdown

Land for Cultivation and Planting	:	40.00 ha
Surrounding Area	:	5.10 ha
Road (4 m wide)	:	1.38 ha

Figure 11-4-2 Location of Blocks

b. Paths for the Passage of Livestock

As a rule, existing paths and forest shall be used as paths and where such paths pass through cultivated land and land for tree-planting, a 50m wide strip of forest shall be retained.

② Plans for Commercial Farming

a. On the basis of comprehensive consideration given to natural conditions, commercial farming conditions, and distribution conditions regarding introduced crops, it was decided that yams, maize, and sorghum shall be grown as the main crops and peanuts and cowpeas grown as intercrops. Improved varieties of maize with different growing times shall also be introduced.

b. Improving Crop Growing Systems

Traditional crop growing systems shall be improved in order to maintain soil productivity and optimize the distribution of labor.

c. Improving Cultivation Techniques

Irrigation ditches shall be created, farming machinery improved, animal-powered cultivation and farm production improved, cultivation and breeding techniques improved and disease and pest prevention methods improved as part of cultivation improvement techniques.

d. Improving Post-Harvest Processing

Post-harvest processing shall be improved through the joint-purchasing of threshing machines and joint storage, etc.

e. Improving Distribution

Distribution shall be improved by formulating production plans to match demand, joint production and shipping, the introduction of value-added products, and the expansion of selection.

f. Support for Farming and Stock Raising

Support for farming and stock raising shall include the improvement of existing extension and guidance structures and the establishment of a pilot farm.

(6) Social Forestry Plans

a. Planting Plans

Planting shall be carried out of fruit trees and plantations for post andfuelwood production in the 2.0ha allocated to users of the classified forest for that purpose. In areas of post and fuelwood production forest, stamp planting shall be carried out of *Tectona grandis*-the tree of choice-spaced at 2m x 2m. The cutting cycle shall be set at 5 years with replanting and logging of 0.2ha being carried out per year. The Taungya system shall be introduced two years after planting. Cashews are the tree of choice for fruit trees and planting shall be carried out at a spac ing of 10m x 10m.

b. Fuelwood Forest Plan

The fuelwood forest is created for the production of fuelwood for sale in cultivated areas and fallow land other than those used by local inhabitants. Trees to be planted are *Prosopis sp.*, *Albizia lebbeck*, *Azadirachta indica*, *Terminaria spp*., and *Gmelina arborea*, etc. Planting shall be carried out at a spacing of 2m x 2m.

c. Bee-Keeping

Trees which are a source of nectar shall be planted around cultivated land and along the boundaries, etc. of neighboring land, and improved bee-keeping techniques introduced.

d. Planting of *Vitellaria paradoxa* and *Parkia biglobosa*, etc.

These shall be planted around cultivated areas.

(7) Forest Roads

Forest roads shall be created for production forest operations and the management of conservation forests. The access road shall run from the state highway to the classified forest. Within the classified forest, main forest roads and minor forest roads shall be established. The specifications of the forest roads are as shown below.

- Forest road specifications.
- Creation of a roadway cross-section map.
- Map showing the location of proposed forest roads.

(8) Nurseries

Village nurseries shall be established in each of the target settlements in order to produce seedlings for the improvement of production forests and for conservation forests, and for planting alongside boundaries to clarify their location, etc.

(9) Forest Protection

Firebreaks shall be established and evergreen fire-resistant species of trees shall be planted on boundary lines to form belts of fire-resistant trees. Watchtowers shall also be established for fire-prevention purposes according to the size of the classified forest.

(10) Forest Improvement Center

Forest Improvement Centers shall be established in each settlement to serve as a base from which forest management can be carried out with the participation of the local inhabitants. They shall also be used as a training facility.

11.5 Buffer Zone Management Plan

(1) According to the Forest Law, at the request of the local inhabitants, a forest improvement plan may be formulated for forest within the buffer zone together with the classified forest improvement plan. As it is thought that one of the causes of illegal land use within the classified forest is extensive land use within the buffer zone, it is thought that a management plan for the buffer zone will be useful in the management of the classified forest.

A 7km wide buffer zone shall be established around the classified forest based on the management plan of the classified forest, and a management plan formulated containing only the barest essentials. The main points of the management plan are as follows.

(2) The Establishment of Forest Handled in Accordance with Conservation Forest

The following forests shall be handled as conservation forest within the Buffer Zone.

① Forest Handled as Conservation Forest I

Forest preserved as sacred forest by the villagers.

② Forest Handled as Conservation Forest II

Bands of forest 50m wide on the banks of waterways. (25m either side)

Forest on residual relief and tectonic relief.

Forest on shrub savannah and laterite terraces.

Forest in areas where soil conservation is necessary.

(3) Agroforestry in Cultivated Land and Fallow land

① 2.0ha Cultivated Land

Food for personal consumption shall be cultivated in this area. Trees which are required to be left in cultivated land may be logged when *Vitellaria paradoxa* and *Parkia biglobosa*, etc. are planted and they grow to the point where they can be harvested. Furthermore, trees for fuelwood shall be planted in between the surrounding trees to prevent livestock from entering.

② 2ha ~5ha Cultivated Land

2ha shall be used for growing food for personal consumption with the rest being used for agroforestry.

- Trees such as *Vitellaria paradoxa* and *Tectona grandis*, etc. shall be selected for planting.
- Cash crops, such as peanuts and maize, etc. shall be selected for planting as intercrops.

③ 5ha~ Cultivated Land

This shall be mainly used for forest trees while the rest is used for the production of food for personal use. *Tectona grandis* shall be planted with yams being used as intercrops.

(4) Bee-Keeping

Trees that are a source of nectar for bee-keeping shall be planted around cultivated land and areas of forest retained around land that is unsuitable for cultivation. Such trees shall also be planted in pasture and areas of low shrubs. Improved bee-keeping techniques shall also be introduced.

(5) Charcoal Production

Simple charcoal kilns shall be established in each settlement, the production of charcoal carried out for personal use, and the use of charcoal as a fuel encouraged.

11.6 Lising Environment Improvement Plans

One of the reasons for the illegal use of land in the classified forest is thought to be the economic activities of local inhabitants in the area and the lack of improved living environment. It is thought that the improvement of such living environment will indirectly have a positive effect on the conservation of the classified forest. Although this does not have a direct relationship with the forest management plan of the classified forest, it is thought that the improved living environment may indirectly help the conservation of the classified forest through the development of the local economy.

(1) Facilities for Livestock

① Waterholes for Livestock

Waterholes shall be established in the buffer zone near the north and south boundary of the classified forest by damming the Bouli River or by digging reservoirs, etc.

② Health Facilities for Livestock

Facilities to carry out livestock health clinics shall be established and veterinarians hired.

(2) Regional Promotion Facilities

① Roads

Roads shall be established from State Highway 2 to each settlement.

② Storage Facility for Farm Products

A facility for storing surplus food and cash crops produced in accordance with the forest improvement plan shall be constructed.

③ Wells

Wells shall be constructed in settlements with no wells.

④ Health Centers

Health Centers shall be expanded.

⑤ Schools

Construction of schools and the employment of teachers shall be carried out by the government.

11.7 Management, Operation and Maintenance Plans

(1) An Outline of Plans

Management, operation and maintenance plans for the forest improvement plan, to be implemented when the improvement plan is brought into effect through the signing of a contract with the local inhabitants and after the creation of community organizations to implement such plans include the following.

(2) An Outline of the Process from the Management Plan through to the Implementation of the improvement plan

An Outline of the process from the management plan through to the implementation of the improvement plan is shown below.

- Completion of the management plan.
- Formulation of the framework of the Improvement Plan by the Forest Department (DFPRN).
- Community organizations.
- Settlement of problems with the local inhabitants through workshops.
- Determining of the content of activities of each committee in the implementation of the improvement plan and the formulation of plan proposals.
- Display of plan proposals to the local inhabitants, adjustment, and the formulation of new plan proposals.
- Submittal of Forest Improvement Plan Proposal to the cabinet.
- Conclusion of contract after cabinet approval has been obtained.
- Effectuation of the forest improvement plan.

Although the management body of the classified forest is the Forest Department (DFPRN), the implementation of the effectuated Forest Improvement Plan shall be carried out by community organizations. These community organizations are extremely important. A list of these kind of organizations is shown below.

(3) Community Organizations

① Forest Management Communication Council

This shall be established at the provincial (departmental) level and shall administer the classified forest.

② Forest Management Council

This shall be established on the district level and shall administer the forest management unit and manage the Forest Improvement Fund.

③ Forest Improvement Unit Committee

This shall be established on the settlement level and shall propose, manage and evaluate plans for the forest improvement unit. This committee shall also collect payments to the Forest Improvement Fund.

④ Forest Improvement Community Groups

These groups manage and coordinate various on-site operations. Examples of such groups include the Conservation Forest Group, the Livestock Group, the Village Forestry Group and the Forest Improvement Group, etc. but this can vary from settlement to settlement.

<Results from the Intensive Study Area> ********** ********* ********** ********

The following community groups were established in the Intensive Study Area.

a. Forestry Zone Group

This group oversees timber production and the implementation of various activities, such as planting and tending, etc., hunting, and controlled burning in the Forestry Zone.

b. Silvi-Pastoral Zone Group

This group manages livestock improvement activities, monitors grazing, and manages early controlled burning and waterholes for livestock.

c. Village Forestry Zone Group

This group develops land for use by local inhabitants, improves commercial farming, plants fruit trees, and creates fuelwood forest.

d. Buffer Zone Group

This group manages conservation forest within the buffer zone and carries out commercial farming improvement activities, etc.

********** ********** ********** ********** ********** **********

(4) Forest Improvement Fund

The local inhabitants form the main body for carrying out forest improvement in the classified forest and do so in cooperation with the Forest Department (DFPRN). In order to carry out these activities, funds are obtained from the following sources.

a. Income from the production of timber.

b. Income from timber production through growing trees.

c. Income from payments by villagers.

- Income from the use of cultivated land in the Village Forestry Zone.
- Income from the use of land for grazing in the Silvi-Pastoral Zone.
- Income from the use of land for hunting.
- Income from the use of waterways, etc. for freshwater fishing.
- Income from the use of land for bee-keeping.
- Income from the sale of fuelwood in the Village Forestry Zone.
- Income from the sale of charcoal in the Village Forestry Zone.
- Income from the production of fruit in the Village Forestry Zone.

11.8 Extension and Training Plans

Extension and training regarding the introduction of new techniques shall be carried out through community organizations for forest improvement. Methods of extension include direct personal training of local inhabitants by the Forest Department (DFPRN) and Extension Bureau through Extension Officers (Type 1) and the initial selection by the Forest Department (DFPRN) or Extension Bureau of model producers with an interest in new technology which are then given priority training, after which they in turn train the local inhabitants (Type 2).

With regard to nurseries, bee-keeping and charcoal production, as the number of people and the area involved is somewhat limited, Type 1 training is mainly used. However, with commercial farming and livestock, due to the large number of people involved and the fact that the introduction of new techniques is essential for the preservation of the forest, which is the main

purpose of these plans, training is carried out using both types of training. The basic types of extension and training are shown in Figure 11-8-1.

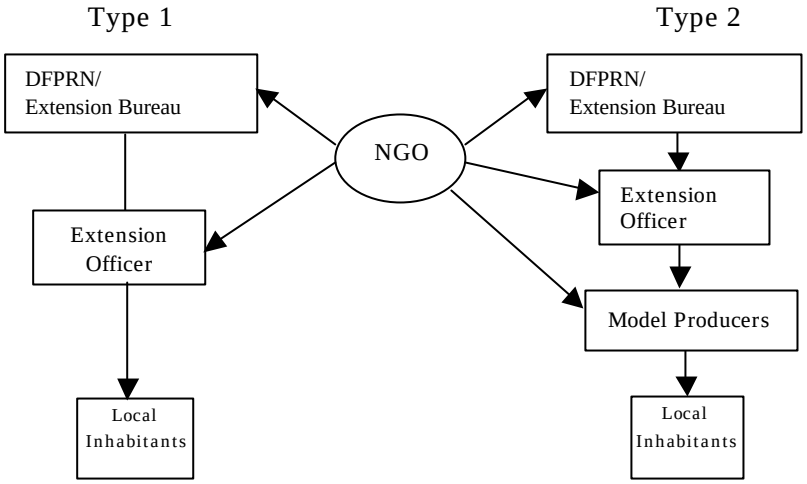


Fig. 11-8-1 Types of Extension and Training

In order to overcome the shortage of staff in the Forest Department (DFPRN) and the Extension Bureau, Extension Officers will be trained in various types of new technology. Extension Officers will train community organizations and model producers after which the community organizations and the model producers will become the direct means of extension to the next generation.

11.9 Operating Plans

When the implementation period for each improvement unit is clarified, each year annual work plans will be formulated.

The items included in the formulation of work plans include the following.

1. Forest Management Units
2. Location and Area
3. General Conditions
   3.1. Natural Conditions
   3.2. Socioeconomic Conditions
4. Forestry Divisions
   4.1. Forest Compartment
   4.2. Sub-Compartment
5. Improvement Aims
6. Zoning
7. Forestry Land Use Divisions
8. Operation Standards
9. Improvement Plans
   9.1. Plan Duration
   9.2. Management Plans
10. Extension and Training Plans
11. Infrastructure Improvement Plan
12. Buffer Zone Management Plan

APPENDIXES

Appendix-1 Forest Survey (Inventory) Field Note

Appendix-2 Soil Survey Field Note

Appendix-3 Matters requiring Consideration for the Environment

Appendix-4 Questionnaire of Survey to Ascertain the State of the Local Inhabitants (1)

Appendix-5 Survey to Ascertain the State of the Local Inhabitants (2)
Key Informant Interview Questionnaire

Appendix-6 Seasonal Labor Calendar Preparation Form

Appendix-1 Forest Survey (Inventory) Field Note

THE STUDY ON CARTOGRAPHY, INVENTORY AND MANAGEMENT
OF CLASSIFIED FOREST IN NORTHERN AREA IN BENIN

FOREST INVENTORY FIELD NOTE

Plot No.: (Circlar plot: 1,000m2; r=17.84m)

Date:	Commune:	Village:	
Topography:	Direction:	Gradient:	
Forest type:			
Undergrowth:			
GPS data: N, E		Photo:	
Observation:			

No.	Species	DBH (cm)	TH (m)	Note	No.	Species	DBH (cm)	TH (m)	Note
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
0					0				
1					1				
2					2				
3					3				
4					4				
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9					9				
0					0				

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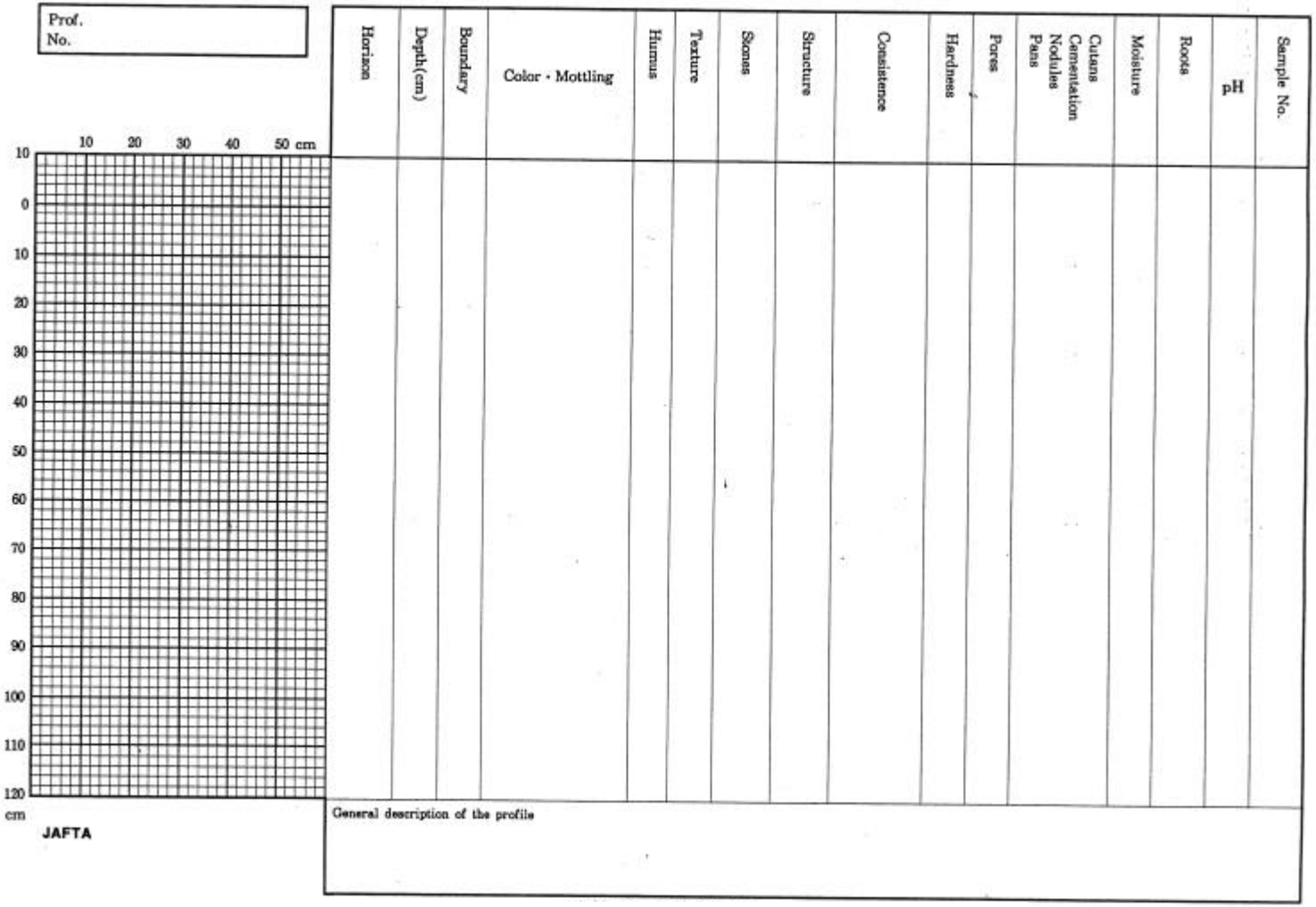

Appendix-2 Soil Survey Field Note

Prof. No.	Classification(Higher) (Lower)	Surveyor	Date

Location	Land use・Vegetation
Land-form	
Elevation(m) Slope Direction	
Climate	
Parent material	
Drainage・Ground water table(m)	
Erosion・Human influence	

Appendix-2 Soil Survey Field Note (continue)

JAPAN FOREST TECHNICAL ASSOCIATION (JAFTA)

Appendix-2 Soil Survey Field Note
<Legend>

1. Soil classification/Soil unit
   - FL : Fluiviosols
     - FLd : Distric Fluviosols
     - Flu : Umbric Fluviosols
   - RG : Regosols
     - RGd: Dystric Regosols
   - LP : Leptosols
     - LPd : Distric Leptosols
     - LPu : Umbric Leptosols
   - LV : Luvisols
     - LVx : Chromic Lusvisols
     - LVh : Haplic Lusvisols
     - LVa : Albic Lusvisols
   - FR : Ferralsols
     - FRh : Haplic Ferralsols
     - FRx : Xanthic Ferralsols
     - FRr : Rhodic Ferralsols
     - FRu : Humic Ferralsols
   - GL : Gleysols
     - GLu : Umbric Gleysols
     - GLd : Dystric Gleysols
   - PZ : Podzols
     - PZh : Haplic Podzols

2. Topography
   1) Landform
      - H : Hilly
      - P : Plain
   2) Position
      - HI : Higher part
      - IN : Intermediate part
      - LO : Lower part
      - BO : Bottom (drainage line)
   3) Form
      - S : Straight
      - C : Concave
      - X : Convex
      - s : Steep
      - g : Gentle

3. Vegtation/Land use
   - Gf : Galerie forestiere
   - Fc : Foret claire
   - Sa : Savane arboree
   - Sb : Savane boisee
   - St : Savane arbustive
   - Pf : Plantation forestiere
   - Td : Terrain denude
   - Tm : Terrain marecageux
   - Cl : Cuirasse lateritique
   - Ar : Affleurement rocheux
   - Pr : Plantation fruitiere
   - Ch : Champ
   - Ja : Jacheres
   - Ag : Agglomerations
   - Ce : Cours d'eau
   - Pe : Plan d'eau
   - Au : Autres

4. Parent material
   - Sr : Sadimentary rock (Sanstone/Conglomerate)
   - Gg : Granite gneiss

5. Mode of slope
   - Re : Residual
   - Cr : Creeping
   - Co : Colluvial
   - Tp : Transportation

6. Horizon
   1) Master horizons and layers
      - H : Organic materila at the soil surface
      - O : Organic material, undecomposed litter as leaves, needles, twigs, moss and lichens
        - O
          - L : Fallen leaves, undecomposed
          - F : Decomposed leaves, originals tissue is distinct
          - H : Humus, Organics are decomposed completely
      - A : A_1, A_2, A_3 ; Mineral horizons, , accumulation accumulation of organic matter (humus)
      - E : Ea, Eb ; Leaching and loss of clay mineral
      - B : B_1, B_2, B_3 ; Mineral horizons are formed below H, O or A horizon
      - C : C_1, C_2 ; Mineral horizons, parent material of soils originated from be rock or sediments
      - R : Bedrock

   2) Suffixes of symbolic letters of subordinate characteristics with master horizons
      - c : Concretions or nodules
      - f : Frozen soil
      - g : Gleying
      - h : Accumulation of organic matter
      - j : Jarosite mottles
      - k : Accumulation of carbonates
      - m : Cementation or induration
      - n : Accumulation of sodium
      - o : Residual accumulation of sesquioxides
      - p : Ploughing or other disturbance
      - q : Accumulation of silica
      - r : Strong reduction
      - s : Illuvial accumulation of sesquioxides
      - t : Accumulation of silicate clay
      - v : Occurrence of plinthite
      - w : Development of colour or structure

7. Distinctness of horizon boundary
   - A : Abrupt (0 - 2 cm)
   - C : Clear (2 - 5 cm)
   - G : Graduel (5 – 15 cm)
   - D : Diffuse (> 15 cm)

8. Humus content
   - V : Very rich
   - R : Rich
   - C : Common
   - F : Few
   - N : None

9. Rock fragment (gravels)
   1) Content
      A : Abundant
      M : Many
      C : Common
      F : Few
      V : Very few
      N : None
   2) Size
      F : Fine (< 2 cm)
      C : Coarse (2 - 6 cm)
      S : Stones (6 - 20 cm)
      B : Boulders (> 20 cm)
   3) Shape
      A : Angular
      S : Subangular
      R : Rounded
   4) Weathering
      F : Fresh (not recorded symbo letter)
      W : Weathered

10. Texture
      C : Clay
      CL : Clay loam
      L : Loam
      SiC : Silty clay
      SiCL: Silty caly loam
      Sil : Silt loam
      Si : Silt
      SC : Sandy clay
      SCL : Sandy clay loam
      SL : Sandy loam
      LS : Loamy sand
      S : Sand

11. Hardness
      H : Hard (> 21 mm)
      M : Medium (11 - 18 mm)
      S : Soft (< 10 mm)

12. Structure
      PL : Platy
      LG : Loose granular
      GR : Glanular
      SA : Subangular
      N : Non structure
      NS : Non structure, single grain
      NM : Non structure, massive

13. Moisture condition
      D : Dry
      M : Moderately moist
      W : Wet
      S : Slightly
      O : Over wet

14. Mycorrhiza and Mycelium
   1) My : Mycorrhiza
      Mm : Mycelium
   2) Development level
      N : None
      + : Very few
      ++ : Few
      +++ : Medium
      ++++ : Many

15. Root
   1) Size
      V : Very fine (< 0.5 mm)
      F : Fine (0.5 - 2 mm)
      M : Medium (2 - 20 mm)
      C : Coarse (> 20 mm)
   2) Development
      N : None
      V : Very few
      F : Few
      C : Common
      M : Many

16. Leaching/Accumulation
    Mottling/Nodule
   1) Kind
      Lea : Leaching
      Acc : Accumulation
      Mot : Mottling
      Nod : Nodule
         Content
            A : Abundant
            M : Many
            C : Common
            F : Few
            V : Very few
            N : None
         Size
            V : Very fine
            F : Fine
            M : Medium
            C : Coarse
   2) Mineral
      Fe : Iron
      Al : Aluminium
      Mn : Manganese

Appendix-3 Matters requiring Consideration for the Environment

The result of the initial survey of the environment carried out in the study area and matters requiring consideration with regard to the environment in this area are shown below.

① Lifestyle

Although there is no forced relocation of the local people in this forest management plan, this is under the understanding that the land being used for farming in the classified forest shall be maintained in its present state and that new land development within the classified forest is prohibited. Furthermore, it is expected that the allocation of the land within the classified forest, the transition to fixed cultivation, the prohibition of cotton growing, and the restriction of grazing land will have an effect on both the lifestyle and economic activities of the local inhabitants. Therefore, it is important to ease the effect of such changes by explaining them to the local inhabitants beforehand, and to involve them in the planning, implementation and management of the forest management plan since the participation of the local inhabitants is, in fact, a requirement for the formulation of the forest management plan.

Furthermore, the securing of new sources of cash income in place of cotton, and Dissemination and guidance regarding intensive commercial farming and stock farming methods is essential.

② Health and Hygiene

Although the prohibition of cotton growing will reduce the overall use of pesticides, the use of residual type pesticides at the nurseries to be newly established in the settlements should still be avoided.

③ Historical Sites, Cultural Assets and Scenery, etc.

There are no historical sites, cultural assets and scenery, etc. requiring consideration.

④ Areas of Important Wildlife and Ecology

Although there are no areas of important wildlife and ecology requiring special protection, in order to ease the rapid changes in vegetation and the effect on the habitats of animals, large-scale clear-felling should be avoided and isolated stands of trees should not be left standing.

⑤ Soil and Land

When creating farmland, pasture, and production forests, detailed soil surveys shall be carried out beforehand in order to avoid development in areas of poor soil, such as Leptosols. Furthermore, when considering operations, as only a thin layer of soil exists throughout the area, the topsoil should not be unduly disturbed. After logging has been carried out, regeneration should be carried out as soon as possible to minimize the length of time that the soil is uncovered.

⑥ Moisture Content and Water Quality, etc.

As rainfall is concentrated in the rainy season, the construction of forest roads, etc. the topography of the land should be left unchanged as far as possible and the drainage of rainwater given adequate consideration.

Appendix-4 Questionnaire for Survey to Ascertain the State of the Local Inhabitants (1)

Household QUESTIONNAIRE

Echantillon n°

ENQUETE MENAGE

Jour Mois Année

Date : ___/_____/_____/
Numéro : _____ Superviseur : _____
Village :
Groupe ethnique : **(voir code)**

Code du groupe ethnique
1. Bariba 2. Peulh 3. Boo 4. Autres (à spécifier)

SECTION I : INFORMATION GENERALE

1-1 Nom de l'enquêté _____ Sexe : (M/F) _____ Age : _____

1-2 Nombre total des membres du ménage : _____ personnes

1-3 Membres du ménage vivant dans la même maison y compris l'enquêté et les absents temporaires (3-9 mois)

Sexe	Age	Education (voir code)	Travail (Oui/non)	Occupation (voir code)	Organisation (voir code)
1. M/F	___	_____	_____	_____	_____
2. M/F	___	_____	_____	_____	_____
3. M/F	___	_____	_____	_____	_____
4. M/F	___	_____	_____	_____	_____
5. M/F	___	_____	_____	_____	_____
6. M/F	___	_____	_____	_____	_____
7. M/F	___	_____	_____	_____	_____
8. M/F	___	_____	_____	_____	_____
9. M/F	___	_____	_____	_____	_____
10. M/F	___	_____	_____	_____	_____
11. M/F	___	_____	_____	_____	_____
12. M/F	___	_____	_____	_____	_____

Code pour l'éducation :

1. Aucun
2. Ecole primaire
3. Diplôme obtenu au primaire
4. Ecole secondaire
5. Diplôme obtenu au secondaire
6. Ecole supérieure (université)
7. Diplôme obtenu à l'université
8. Etude post universitaire
9. Autres

Code pour l'occupation :

1. Salarié
2. Main d'œuvre salariée
3. Entreprise privée
4. Paysan
5. Etudiant/Elève
6. Enfant (< âge de scolarisation)
7. Sans travail
8. Ménagère
9. Eleveur
10. Autres

Code pour l'organisation :

1. Association des femmes
2. Organisation des jeunes
3. Groupe des adultes (aînés)
4. Association des utilisateurs d'eau
5. Comité de village
6. Organisation ethnique
7. Groupe religieux
8. Autres associations d'utilisateurs (à préciser)
9. GV
10. GF
11. Non membre
12. Autres (à préciser)

(Stratification des ménages, nombre de personnes par ménage plus de 30 ; entre 15 et 30 ; moins de 15)

Sexe	Age	Education (voir code)	Travail (Oui/non)	Occupation (voir code)	Organisation (voir code)
13. M/F	___	_____	_____	_____	_____
14. M/F	___	_____	_____	_____	_____
15. M/F	___	_____	_____	_____	_____
16. M/F	___	_____	_____	_____	_____
17. M/F	___	_____	_____	_____	_____
18. M/F	___	_____	_____	_____	_____
19. M/F	___	_____	_____	_____	_____
20. M/F	___	_____	_____	_____	_____
21. M/F	___	_____	_____	_____	_____
22. M/F	___	_____	_____	_____	_____
23. M/F	___	_____	_____	_____	_____
24. M/F	___	_____	_____	_____	_____
25. M/F	___	_____	_____	_____	_____
26. M/F	___	_____	_____	_____	_____
27. M/F	___	_____	_____	_____	_____
28. M/F	___	_____	_____	_____	_____
29. M/F	___	_____	_____	_____	_____
30. M/F	___	_____	_____	_____	_____
31. M/F	___	_____	_____	_____	_____
32. M/F	___	_____	_____	_____	_____
33. M/F	___	_____	_____	_____	_____
34. M/F	___	_____	_____	_____	_____
35. M/F	___	_____	_____	_____	_____
36. M/F	___	_____	_____	_____	_____
37. M/F	___	_____	_____	_____	_____
38. M/F	___	_____	_____	_____	_____
39. M/F	___	_____	_____	_____	_____
40. M/F	___	_____	_____	_____	_____
41. M/F	___	_____	_____	_____	_____
42. M/F	___	_____	_____	_____	_____
43. M/F	___	_____	_____	_____	_____
44. M/F	___	_____	_____	_____	_____
45. M/F	___	_____	_____	_____	_____
46. M/F	___	_____	_____	_____	_____
47. M/F	___	_____	_____	_____	_____
48. M/F	___	_____	_____	_____	_____
49. M/F	___	_____	_____	_____	_____
50. M/F	___	_____	_____	_____	_____

Echantillon n°

1-4 Source de revenu liquide du ménage

(SVP indiquez par ordre décroissant le montant du revenu 1,2,3…) Moyens de transport **(voir code)**

1. Vente des produits récoltés	____	_____
2. Vente des légumes	____	_____
3. Vente de fruits	____	_____
4. Vente d'animaux	____	_____
5. Vente de poissons	____	_____
6. Vente de bois de chauffe	____	_____
7. Vente de bois de service	____	_____
8. Vente des produits forestiers	___	_____
9. Vente de produits artisanaux	____	_____
10. Salaire d'un travail permanent	____	_____
11. Revenu de travail occasionnel	____	_____
12. Entreprise privée	____	_____
13. Contribution financière d'un membre de la famille	____	_____
14. Vente de produits transformés	____	_____
15. Autres (à préciser)		

Code pour les moyens de transport : 1- Homme 2- Vélo/Moto 3- Charrette 4- Camionnette 5- Camion 6- Tracteur 7- Autres (à préciser)

1-5 Quand-est-ce que votre ménage s'est installé dans le village ? **(voir code)**

Code de réponse :

1. Entre les 10 dernières années
2. Entre 10 et 20 ans passés
3. Entre 20 et 30 ans passés
4. Au-delà de 30 ans passés

1-6 Maladies principales (SVP listez les maladies principales dont la famille a souffert l'année passée)

Code de réponse

1. _____
2. _____
3. _____

0. Pas de maladie
1. Fièvre
2. Paludisme
3. Maladies respiratoires
4. Dysenterie
5. Autres maladies diarrhéiques
6. Fièvre typhoïde
7. Fièvre jaune
8. Maux d'yeux
9. Maladie de la peau
10. Autres (à préciser)

Echantillon n°

SECTION II : CONDITIONS DE VIE

II-1 Eau de boisson

	Source principale (choisir un des codes)	Temps (aller et retour)	Quantité (voir code)
Saison sèche	_____	_____ mn	_____
Saison pluvieuse	_____	_____ mn	_____

Code pour la source : 1- eau de pompe 2- Sources naturelles 3- Rivières 4- Réservoir 5- Puits 6- Forage 7- Eau de pluie 8- Autres

Code pour la quantité : 1- Suffisant 2- Juste moyen 3- Peu 4- Très peu

II-2 Source d'énergie de cuisson/chauffage
(choisir jusqu'à 3 principales sources et répondre aux disponibilités)

	Importance de (1,2,3) disponibilités (voir code)
1. Bois de chauffe	_____
2. Charbon	_____
3. Résidus de récolte (sous produits agricoles)	_____
4. Gaz	_____
5. Pétrole	_____

Code pour la disponibilité : 1- Facilement disponible 2- Difficile à obtenir 3- Très difficile

II-3 Ramassage du bois de chauffe

Fréquence (code) __	Distance (code) __	Le chargé M/F	Quantité (code) __

Code pour la fréquence	**Code pour la distance**	**Code pour la quantité**
1. Chaque jour	1. Moins d'un km	1. Suffisant
2. Moins de 3 fois/semaine	2. 1 à 4 km	2. Juste moyenne
3. Une fois par semaine	3. Plus de 4 km	3. Peu
4. Moins d'une fois par semaine		4. Très peu

II-4 Consommation journalière du bois de chauffe par source (dimensions)

1. Propre récolte :	_____/jour Charge s'il y en a _____ CFA
2. Achat :	_____/jour Prix _____/jour
3. Total :	_____/jour

II-5 Distance des principaux endroits pour la recherche du bois de chauffe
Source-1 : _____ mn (dans les forêts)
Source-2 : _____ mn (dans les environs)

II-6 Temps (heures) exigé pour le ramassage du bois de chauffe par semaine _____ heures/semaine

Echantillon n°

II-7 Situation/disponibilité alimentaire du ménage (pour vos propres récoltes)

	Disponibilité (voir code)	Mois de pénurie dans l'année
1. Céréales	_____	_____ mois/an
2. Légumes	_____	_____ mois/an
3. Viande	_____	_____ mois/an
4. Poisson	_____	_____ mois/an
5. Produits végétaux forestiers	_____	_____ mois/an

Code pour la disponibilité

1. Propres récoltes supérieures à la demande du ménage
2. Propres récoltes justes suffisantes pour couvrir la demande du ménage
3. Achat ou troc pour couvrir la demande du ménage
4. Don

SECTION III : PRODUCTION AGRICOLE

III-1 Surface totale emblavée pour la production agricole 1996/1997

	Champ en propriété	Champ en location	Métayage	Prêt
Champ cultivé en permanence	___ ha	___ ha	___ ha	___ ha
Surfaces défrichées et brûlées	___ ha	___ ha	___ ha	___ ha

Echantillon n°

III-2 Production agricole

Surface champêtre	**(code pour la culture)**	**(code pour la culture)**	**(code pour la culture)**
Saison pluvieuse	_____	_____	_____
Saison sèche	_____	_____	_____

(SVP répondez pour les cultures importantes que vous avez cultivées dans vos champs)

	Culture 1	Culture 2	Culture 3
a) Nom de la culture	____	____	____
b) Surface plantée	____	____	____
c) Production totale	____	____	____
d) Production vendue	____	____	____
e) Prix de vente	____	____	____
f) Production donnée aux autres	____	____	____
g) Importants dégâts sur les cultures s'il en a eus	____	____	____

Code pour la culture : 1- Coton 2- Maïs 3- Sorgho 4- Petit mil 5- Arachide
6- Igname 7- Gombo 8- Oseille de Guinée 9- Piment 10- Autres (à préciser)

Code pour les dégâts : 1- Sécheresse (manque d'eau) 2- Maladies 3- Insectes
4- Animaux (à préciser) 5- Vent 6- Terrain glissant/érosion 7- Inondation
8- Autres (à préciser) 9- Rien

Echantillon n°

SECTION IV : ELEVAGE (Animaux/Poissons)

IV-1 Elevage et alimentation

	Nombre	Saison pluvieuse		Saison sèche	
		Principaux Aliments (sélectionner le) plus important	Quantité	Principaux Aliments (sélectionner le) plus important	Quantité
1. Vaches	____	____	____	____	____
2. Bœufs	____	____	____	____	____
3. Moutons	____	____	____	____	____
4. Cabris	____	____	____	____	____
5. Chevaux	____	____	____	____	____
6. Anes	____	____	____	____	____
7. Porcs	____	____	____	____	____
8. Volaille	____	____	____	____	____
9. Poissons	____	____	____	____	____

Code pour les aliments importants :

1. Herbe
2. Fourrage aérien
3. Résidus agricoles
4. Grain
5. Autres

Code pour la quantité :

1. Suffisant
2. Juste moyen
3. Peu
4. Très peu

SECTION V : FORET

V-1 Quel type de forêt utilisez-vous **Code** _____

Code pour la réponse :

1. Forêt nationale
2. Forêt communautaire (y compris celle du village)
3. Forêt privée
   (si la réponse est 2 ou 3, précisez la superficie en ha)

V-2 Objectifs pour l'utilisation de la forêt

(choisir 2 points du code) **Code** _____

Code pour les réponses

1. Ramassage du bois de feu
2. Coupe du bois d'œuvre
3. Fabrication du charbon
4. Ramassage des produits forestiers
5. Récolte du miel
6. Chasse (précisez la fréquence, le nombre et espèces des animaux)
7. Autres (à préciser)

Echantillon n°

V-3 Quelles espèces d'arbres utilisez-vous ?

	Nom des espèces (sélectionner 3 espèces)
1. Bois de chauffe	_____
	_____
	_____
2. Bois de service	_____
	_____
	_____
3. Arbres fourragers	_____
	_____
	_____
4. Arbres fruitiers	_____
	_____
	_____
5. Autres (à préciser)	_____
	_____
	_____

V-4 Avez-vous participé aux activités de plantation d'arbres ? **Code** _____

Code pour la réponse :

1. Dans les forêts nationales
2. Dans les forêts communautaires (du village)
3. Dans les forêts privées
4. Aucun

V-5 Etes-vous membre du groupe de reboisement (Oui/non) ____

SECTION VI : DEPENSES DU CHEF DU MENAGE

VI-1 SVP estimez vos dépenses mensuelles par rubrique (sans les produits du ménage)

1. Nourriture (y compris huile, sucre, riz, poisson, etc.)	____ CFA/mois
2. Habits	____ CFA/mois
3. Education	____CFA/mois
4. Cérémonies	____ CFA/mois
5. Autres	____ CFA/mois
6. Total	____ CFA/mois

QUESTIONNAIRE for Household Member

Echantillon n°

ENQUETE MEMBRES MENAGE

Date Jour Mois Année ___/_____/_____/

Numéro : _____ Superviseur : _____

Répondant : _____

Sexe (M/F) _____ Age _____

Village : _____

A. Participation et engagement des membres du ménage

Activités domestiques	Participation (voir code)	Quelles activités souhaiteriez-vous voir alléger (choisir jusqu'à 5 activités entre 1-50)
1. Recherche d'eau à boire	1 _____	
2. Cuisine	2 _____	
3. Lessive	3 _____	
4. Nettoyer (balayer la maison)	4 _____	
5. Petites réparation de maison	5 _____	1er _____
6. Garde enfant	6 _____	2ème _____
7. Jardinage	7 _____	3ème _____
8. Couture – tricotage	8 _____	4ème _____
9. Emplettes au marché	9 _____	5ème _____
Activités champêtres		
10. Labour	10 _____	
11. Semis/plantation	11 _____	
12. Sarclage	12 _____	
13. Fertilisation	13 _____	
14. Récolte	14 _____	
15. Défrichage	15 _____	
16. Brûlure	16 _____	
17. Nettoyage	17 _____	
18. Clôture	18 _____	
19. Buttage	19 _____	
20. Traitement	20 _____	
21. Transport/ramassage	21 _____	
Elevage (bétail, volaille)		
22. Pâturage	19 _____	
23. Alimentation	20 _____	

Code de réponse : (1) Souvent (2) Quelques fois (3) Jamais

Echantillon n°

	Participation (voir code)
24. Abreuvement	21 _____
25. Ramassage / production de fourrage	22 _____
26. Balayage des étables du bétail	23 _____
Activités de pêche	
27. Pêche en rivière	24 _____
28. Pêche dans les bassins / étangs	25 _____
Activités forestières	
29. Collecte des bois de chauffe	26 _____
30. Collecte des produits forestiers	27 _____
31. Bois de service	28 _____
32. Production du charbon	29 _____
Post récolte et activités de marketing	
33. Egrenage des céréales	30 _____
34. Transformation des produits animaux (fromage)	31 _____
35. Transformation des produits forestiers	32 _____
36. Vente des produits agricoles	33 _____
37. Vente des produits d'élevage (bétail, volaille)	34 _____
38. Vente des poissons et des produits de pêche	35 _____
39. Vente des produits forestiers	36 _____
40. Vente des bois de chauffe / charbon	37 _____
Métiers	
41. Moulin	38 _____
42. Commerce	39 _____
43. Boutique	40 _____
44. Artisanat	41 _____
Communication	
45. Assister aux réunions communautaires	42 _____
46. Résolution des conflits au sein du village	43 _____
47. Obtenir l'information de la radio	44 _____
48. Obtenir l'information de la TV	45 _____
Religion / activités culturelles	
49. Parties de danse	46 _____
50. Faire la musique	47 _____
52. Activités sportives	48 _____
53. Prières	49 _____

Code de réponse : (1) souvent (2) quelquefois (3) jamais

Echantillon n°

B- Préoccupations actuelles et actions collectives relatives

	Degré d'importance	Actions/participation dans le passé (Oui/non ?)	Volonté des membres de prendre des initiatives ou actions/ participations (Oui/non ?)
1. Disponibilité alimentaire	1 _____	_____	_____
2. Disponibilité du fourrage	2 _____	_____	_____
3. Disponibilité du bois de chauffe	3 _____	_____	_____
4. Disponibilité de la terre agricole	4 _____	_____	_____
5. Disponibilité du pâturage	5 _____	_____	_____
6. Surface défrichée et brûlée	6 _____	_____	_____
7. Disponibilité en matière de pêche sur étang	7 _____	_____	_____
8. Disponibilité des ressources forestières	8 _____	_____	_____
9. Maladie du bétail	9 _____	_____	_____
10. Disponibilité en eau de boisson	10 _____	_____	_____
11. Production agricole	11 _____	_____	_____
12. Revenu liquide	12 _____	_____	_____
13. Grandes routes	13 _____	_____	_____
14. Irrigation	14 _____	_____	_____
15. Existence d'électricité	15 _____	_____	_____
16. Education des enfants	16 _____	_____	_____
17. Auto-éducation	17 _____	_____	_____
18. Santé	18 _____	_____	_____
19. Système sanitaire	19 _____	_____	_____
20. Terrain glissant et érosion du sol	20 _____	_____	_____
21. Inondation	21 _____	_____	_____
22. Sécheresse	22 _____	_____	_____
23. Incendie forestier	23 _____	_____	_____
24. Dégradation de la fertilité du sol sur surface défrichée et brûlée	24 _____	_____	_____
25. Disponibilité en main d'œuvre	25 _____	_____	_____
26. Conflit au sein des villageois	26 _____	_____	_____
27. Développement communautaire	27 _____	_____	_____
28. Crainte d'être évacué de la zone	28 _____	_____	_____

Code de degré d'importance :

1. Fortement important
2. Important
3. Légèrement important
4. Pas important
5. Pas d'avis (pas de réponse)

C- (Cette question s'adresse seulement à ceux qui ont répondu important ou fortement important pour la question B12 relative au revenu liquide)

Quel type de source de revenu voudriez-vous améliorer ou développer dans votre village pour l'augmentation de chaque revenu ?

(choisir jusqu'à 3 points par ordre décroissant d'importance) 1._____

2. _____

3. _____

Code pour réponse

0. Non applicable ou pas de réponse
1. Production agricole
2. Production végétale
3. Production fruitière
4. Elevage (bétail, volaille)
5. Pisciculture
6. Production de charbon
7. Bois d'œuvre
8. Production des produits forestiers
9. Artisanat
10. Commerce
11. Fabrication d'articles
12. Autres

D- (Cette question s'adresse seulement à ceux qui ont répondu important ou fortement important pour la question B23 relative à l'incendie forestier)

Qu'est-ce que vous préconisez pour prévenir ou stopper l'incendie forestier ?

(choisir jusqu'à 3 points par ordre d'importance) 1._____

2. _____

3. _____

Code réponse

0. Pas applicable au pas de réponse
1. Faire des régions tampons avant de brûler
2. Surveiller les feux
3. Considérer la direction du vent avant de brûler
4. Autres (à préciser SVP)

Echantillon n°

E- Importance des forêts et mesures pour les améliorer

Importance	Mesures/idées pour les améliorer
(choisir jusqu'à 5 sujets)	(choisir le mieux approprié)
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

Code d'importance

0. Non réponse
1. Source du bois de chauffe
2. Source du bois d'œuvre
3. Source de fourrage/pâturage
4. Source des produits forestiers
5. Source des plantes médicinales
6. Zones de chasse
7. Fonction de conservation de l'eau
8. Fonction de conservation des sols
9. Autres (à préciser)

Code pour les mesures d'amélioration

0. Non réponse
1. Plantation d'arbres sur les terrains défrichés ou brûlés
2. Plantation d'arbres en communauté forestière
3. Détermination des limites des forêts protégées
4. Développement de nouvelles parcelles agricoles
5. Croissance des produits/productions animaux dans le système de production existant
6. Création de nouvelles sources de revenus
7. Utilisation d'autres moyens de préparation afin de réduire la consommation du bois de chauffe
8. Utilisation d'autres sources d'énergie (gaz...)
9. Autres (à préciser)

Appendix-5 Survey to Ascertain the State of the Local Imhabitants (2)

Key Informant Interview Questionnaire

GUIDE D'ENTRETIEN

"SYSTEME DE GESTION DU TERROIR PAR LES POPULATIONS RIVERAINES DE LA FORET CLASSEE DES TROIS RIVIERES"

I- Questions s'adressant au chef traditionnel ou chef de terre

1- Système traditionnel d'occupation (propriété) de la terre ?

1.1- A qui appartient la terre traditionnellement ?

1.2- Comment acquiert on traditionnellement la terre au niveau de :
Village ☐ Famille ☐ Etranger ☐

1.3- Y a-t-il un changement ? Si oui, lequel ?

2- Système d'héritage ou de distribution traditionnelle de terre

2.1- Dans quelles circonstances hérite-t-on de la terre ?

2.2- Qui hérite de la terre ?
Homme ☐ Femme ☐ Position sociale .....

2.3- Comment hérite-t-on de la terre ?

2.4- Les transferts des droits

3- Formes traditionnelles d'utilisation de la terre

3.1 Quel est le système traditionnel d'exploitation des terres ?
Durée d'exploitation d'une nouvelle terre ☐☐ années
Techniques culturales :
Brûlis ☐ Culture extensive ☐ Rotation ☐

4- Formes traditionnelles d'utilisation des forêts

4.1- Existe-t-il une forêt dans les environs de votre village ?

4.2- Quelle est la législation traditionnelle pour l'exploitation de cette forêt ?

4.3- Comment appréciez-vous cette manière d'exploiter la forêt ?

4.4- Quelles sont les formes traditionnelles d'exploitation de la forêt ?
Cueillette ☐ Chasse ☐ Pêche ☐ Cultures ☐

Pâturage ☐ Culte religieux ☐ Autres ☐

4.5- Existe-t-il des interdits dans l'utilisation des ressources de cette forêt ?

4.6- Comment cette forêt est-elle gérée aujourd'hui ?

5- Divers droits sur l'utilisation des terres

5.1- Description du droit coutumier

5.2- Qui détient le droit d'occupation et d'exploitation de la terre dans le village ?

5.3- Quelles sont les limites de ce droit ?

5.4- Devient-on définitivement propriétaire de la terre ?

6- Méthodes traditionnelles de prise de décision et mode de transmission à la population

6.1- Qui prend des décisions par rapport à l'utilisation ou à l'occupation de la terre ?

6.2- Quels sont les changements observés de nos jours ?

6.3- Quels sont les différents modes de transmission des décisions à la population ?

7- Tradition particulière et coutumes

7.1- L'acquisition de la terre est-elle liée à une divinité ?

7.2-Quelles sont les différentes croyances liées à l'exploitation de la faune, de la flore et de la terre ?

7.3- Y a-t-il des interdits liés à cette exploitation ?

8- Existence de lieu ou de forêt sacrée

8.1- Existe t-il des forêts ou lieux sacrés
Situation géographique Rôle

II Questions adressées au représentant administratif

1- Identification

- Nom du village
- Nombre de quartiers / hameaux
- Nom de l'enquêté
- Fonction de l'enquêté

1.1- Par ordre hiérarchique, qui sont les représentants politico-administratifs du village
(titre, nombre, attributs) ?

1.2- Quel est le mode de désignation de chacun d'eux ?

2- Organisations villageoises et leurs activités

2.1- Organisations villageoises existantes

Types	Nom	Effectif des membres	Différents organes	Mode de désignation	Activités	Difficultés
Traditionnels						
Modernes						
Liés aux projets						
Autres						

NB :

3- Situation agricole dans les forêts classées et la zone tampon

3.1- Avez-vous des problèmes de terres cultivables dans le village ?
Oui ☐ Non ☐

Pourquoi ?

3.2- Y a-t-il des terres cultivables disponibles dans la forêt ?

Oui ☐ Non ☐

Pourquoi ?

3.3- Y a-t-il des terres cultivables disponibles dans la zone tampon

Oui ☐ Non ☐

Pourquoi ?

3.4 A qui appartiennent les grandes fermes dans la zone ?

3.5- Quelles sont les principales cultures ?

Principales cultures	Forêt	Zone tampon
Coton		
Igname		
Maïs		
Sorgho		
Manioc		
Haricot		
Arachide		
Autres		

3.6- Pendant combien d'années la terre est exploitée avant sa mise en jachère ?

3.7- Quelle est la rotation des cultures après défrichement d'une nouvelle terre ?

3.8- Quelle est la durée de la jachère ?

Temps ancien ☐

Actuellement ☐

3.9- Quelles sont les périodes de feux de brousse

De..... (mois) à..... (mois)

3.10- Y a t-il des difficultés d'installation des cultures dans la forêt ?

3.11- Y a t-il des difficultés d'installation des cultures dans la zone tampon ?

4- Conflits liés à la gestion des terres

4.1- Y a-t-il de conflits liés à l'exploitation des terres ?

Entre agriculteurs ☐

Entre agriculteurs et éleveurs ☐

Entre éleveurs ☐

Entre fermiers (agriculteurs + éleveurs) et l'Etat ☐

Autres ☐ (à préciser)

4.2- Nature ?

Ampleur ?

Mode de résolution de ces problèmes ? (selon les cas)

5- Utilisation de la forêt

5.1- Quelles utilisations faites-vous de la forêt ?

Agriculture	☐	Pâturage	☐	Chasse	☐	Pêche	☐
Cueillette	☐	Bois de chauffe	☐	Bois d'œuvre	☐	Culte	☐
Autres	☐	(à préciser)					

5.2- Existe-t-il des champs de coton à l'intérieur de la forêt ? Si oui, depuis quand ?

6- Dégradation de la forêt ?

6.1- Quelle distance sépare le village de la forêt il y a :

Plus de 20 ans ☐	20 ans ☐	10 ans ☐	5 ans ☐
..... km	..... km	.....km	.....km

6.2- Quelle est la distance des exploitations par rapport au village ?

6.3- Observez-vous des changements négatifs dans l'évolution de la forêt ?
Si oui, lesquels ? Quelles en sont les causes ?

6.4- Y a-t-il des étrangers qui s'installent pour l'agriculture ?
Si oui
Leur provenance
Leur nombre

7- Effet de la dégradation des forêts sur les conditions de vie

7.1- Quelles sont les conséquences de la dégradation de la forêt sur la vie des populations ?

8- Gestion rationnelle des ressources naturelles

8.1- Qu'est-ce que vous faites actuellement pour préserver la forêt ?

9- Méthodes appropriées de la gestion rationnelle

9.1- Selon vous, qu'est-ce qu'on devrait faire pour que les générations futures jouissent de la forêt ?

10- Principaux acteurs de la gestion forestière

11- Diverses requêtes (demandes) du village
(école, centre de santé, électrification, puits, constructions de routes, etc.)

11.1- Quels sont les principaux besoins du village en matière d'infrastructures communautaires ?

Ecoles	☐	Puits/pompe	☐	Centre de santé	☐	Pistes	☐
Marché	☐	Barrage	☐	Ponts	☐	Boucherie	☐
Magasin	☐	Autres à préciser	☐				

III Questions relatives aux leaders fulbe

1- Droits coutumiers à la réserve en pâturage

1.1- Où allez-vous souvent en pâturage ?

1.2- Existe t-il des zones de pâturage dans les environs du village ?

1.3- Les pâturages sont-ils disponibles ?

1.4- Quelles sont les conditions d'accès à ces zones ?

2- Situation réelle du cheptel (espèces, effectif en stock, période de transhumance, terre en pâture, etc.) (aide du vétérinaire)

2.1- Combien de camps peulhs y a-t-il dans la zone ?

2.2- Quel est le nombre d'habitants dans chacun d'eux ?

2.3- Quelles sont les espèces animales élevées ?

Espèces	effectif
Bovins	
Moutons	
Cabris	
Porcs	
Pintades	
Poulets	
Autres	

2.4- Quel est le mode d'élevage pratiqué ?
(Conduite Soins Transhumance Embouche, etc.)

2.5- Quelles sont les espèces végétales appétées par saison ?

Espèces végétales	Saison pluvieuse	Saison sèche

Voir tableau ci-joint

2.6- Quelle est la période de transhumance pendant l'année ?

2.7- Combien de temps dure le séjour des transhumants ?

2.6- Quelle est la provenance des transhumants ?

2.7- Quelle est la destination des transhumants ?

2.8- Quelles sont les raisons de la transhumance ?

2.9- Quels sont les impacts sur :
l'agriculture ?
l'élevage ?
la vie sociale ?

2.10- Nature ?
Ampleur ?
Mode de résolution des conflits éventuellement engendrés ?

3- Comment obtenir de la terre pour la construction quand on désire y vivre en permanence ?

3.1- Quel est le mode d'acquisition des zones d'habitation ?
Pour un autochtone ?
Pour un étranger ?

3.2- Quelles sont les limites des droits sur ces terres ?

4- Comment obtenir la terre pour la culture quand on désire faire des activités agricoles ?

4.1- Quel est le mode d'acquisition des terres agricoles ?

4.2- Quelles sont les limites des droits sur ces terres ?

5- Conflits avec les populations sédentaires

5.1- Quels sont les problèmes liés à la cohabitation entre agriculteurs et éleveurs ?

6- Conflits avec les éleveurs de passage

6.1- Quels sont les problèmes liés à l'élevage et à la vie des éleveurs ?

7- Quels sont les principaux besoins du village en matière d'infrastructures communautaires ?

Ecoles ☐	Puits/pompe ☐	Centre de santé ☐	Pistes ☐
Marché ☐	Barrage ☐	Ponts ☐	Boucherie ☐
Magasin ☐	Autres à préciser ☐		

N°	Nom scientifique	Nom local Peulh	Nom local Baatonou
	Savane arborée		
1.	Vitellaria paradoxa		Sombu
2.	Pterocarpus erinaceus		Tona
3.	Anogeissus leiocarpus		Kakara
4.	Isoberlinia doka		Gbagba
5.	Parkia biglobosa		Dombu
	Savane arbustive		
6.	Combretum spp		Takunta
7.	Terminalia spp		Bèro
8.	Detarium microcarpum		Bessè gonu
9.	Terminalia avicennioides		Bèro gèmu
	Savane boisée		
10.	Isoberlinia doka / daleielii		Gbagba
11.	Anogeissus leiocarpus		Kakara
12.	Prosopis africana		Soba
13.	Vitellaria paradoxa		Sombu
14.	Burkea africana		Aginru
15.	Afzelia africana		Gbébu
	Forêt galerie		
16.	Syzgium guineense		Wuoba
17.	Berlinia grandiflora		Aklo
18.	Pterocarpus santalinoides		
19.	Daniellia oliveri		Nyaburu
20.	Raphia sudanica		Kosi
21.	Mariscus cylindristachyus		
	Jachères anciennes		
22.	Detarium microcarpum		Bessè gonu
23.	Burkea africana		Aginru
24.	Terminalia spp		Bèro
25.	Chloris pilosa		
26.	Parkia biglobosa		Dumbu
27.	Vitellaria paradoxa		Sombu
	Jachères jeunes		
28.	Combretum spp		Takunla
29.	Detarium microcarpum		Bessè gonu
30.	Burkea africana		Aginru
31.	Terminalia spp		Bèro
32.	Chloris pilosa		
	Zone de pâturage		
33.	Loxodera ledermannii		
34.	Hyparrhena involucrata		
35.	Pennisetum polystachion et Spermacoce stachydea		Saka wenu
36.	Pennisetum unisetum		
37.	Andropogon pseudapricus		
38.	Andropogon gayanus var bisquamulatus		
39.	Cochlospermum tinchorium		kombosu
40.	Annona senegalensis		Kpararu
41.	Spermacoce stachydea		
42.	Pennisetum pedicellatum		
43.	Khaya senagalensis		Gbiribu
44.	Afzelia africana		Gbébu
45.	Autres		

Appendix-6 Seasonal Labor Calendar Preparation Form

TABLEAU DES OCCUPATIONS JOURNALIERES SELON LES HORAIRES D'UN MENAGE (MARI / FEMME)

Jours \ Heures		SAISON SECHE						SAISON PLUVIEUSE					
		01h à 5h	05h à 08h	08h à 12h	12h à 16h	16h à 20h	20h à 24h	01h à 5h	05h à 08h	08h à 12h	12h à 16h	16h à 20h	20h à 24h
Lundi	♂												
	♀												
Mardi	♂												
	♀												
Mercredi	♂												
	♀												
Jeudi	♂												
	♀												
Vendredi	♂												
	♀												
Samedi	♂												
	♀												
Dimanche	♂												
	♀												

L : lessive
B : balayage
C : cuisine
G : garde des enfants
RE : recherche d'eau
M : mouture
Ma : marché
RB : recherche bois de chauffe
J : jardinage
V : vaisselle
P : prière
PD : petit déjeuner
D : déjeuner
OC : obligations conjugales
R : repos
PC : petit commerce
T : travaux champêtres

CALENDRIER ANNUEL DES TRAVAUX D'UN MENAGE (HOMME / FEMME)

Tâches \ Période		Janvier		Février		Mars		Avril		Mai		Juin		Juillet		Août		Septembre		Octobre		Novembre		Décembre	
Défrichage	♂																								
	♀																								
Semis	♂																								
	♀																								
Sarclage	♂																								
	♀																								
Buttage	♂																								
	♀																								
Sarclo-buttage	♂																								
	♀																								
Nettoyage	♂																								
	♀																								
Labour	♂																								
	♀																								
Fertilisation	♂																								
	♀																								
Démarrage	♂																								
	♀																								
Recherche bois	♂																								
	♀																								
Transformations	♂																								
	♀																								

Pêche	♂																								
	♀																								
Chasse	♂																								
	♀																								
Cérémonies	♂																								
	♀																								
Pâturage	♂																								
	♀																								
Construction	♂																								
	♀																								
Cueillette	♂																								
	♀																								
Abattage	♂																								
	♀																								
Commercia-lisation	♂																								
	♀																								

_____ Travail permanent

_ _ _ _ _ _ _ _ Travail temporaire