

9.3.2 The Kouregou Village Model Plan (western agriculture, stock raising, and sylviculture promotion zone)

(1) Natural conditions

Kouregou village is located 57 kilometers, or about 2 hours by car, from the city of Tera by way of Doungorou and about 12 kilometers north-west of Kokorou, the Canton city. Two sand dunes extend from east to west in a belt in the south part of the village. During the rainy season, a large pond appears southeast of the village. The land occupied by the villagers was about 85 km² according to the results of using a 1/50,000-scale topographical map and a GPS system to find the boundaries with other villages pointed out by the villagers. According to the national census of 1988, its population is 2,116 people. A survey of tax-paying residents of the village for 1998 reveals that there are 1,188 tax-payers between the ages of 15 and 60, and that a total of 156 households occupy the village (same methods as the other 2 villages).

(2) Society

This village was established in the 17th century. It was founded by Hama Komboti, who was a native of Gao in Mali. The present village chief, who is an eighth generation descendant of its founder, has occupied this position since 1972. Kouregou borders six other villages. It has been in a dispute with Bongou village over the boundary since 1972, but has long enjoyed good relationships with the neighboring village of Kombi. Kombi has transferred its lands to Boungou village under a contract. Bongou has continued a dispute with Kouregou over the border of the land transferred to it by Kombi. In 1974, the district chief gave a decision in favor of Kouregou based on testimony by the villagers of Kombi, but Boungou village did not accept this decision. To resolve this boundary dispute, the National Assembly of Niger confirmed the 1974 decision in during its 1991 session, but Boungou village submitted the case again. Recently, disputes such as these have been common. It is therefore necessary to establish land committees as soon as possible.

The tribal makeup of the village population is almost uniform of Songhai-people who are agriculturists. Two forms of population movement are seen. One is a population flow to surrounding countries (Ivory Coast, Benan, Togo, Nigeria), and to other parts of Niger (river basin areas, Tera, Niamey), while the other is an incoming population flow during rich harvests (Zarma, Nomadic Peulhs, Bella).

(3) Customs

A family's land is inherited by its descendents; it can not be sold to outsiders. But it is possible to give it to another family as a present or to rent it with the agreement of the family or a decision by the elders. Land becomes smaller and smaller as it is inherited by successive generations.

Both villagers and non-villagers are free to let their animals graze on land that is not under cultivation.

Niger law forbids cutting of trees and forest agents observe the forests. The villagers report people who break this law. Both villagers and outsiders are free to gather firewood on village land.

Both villagers and non-villagers are free to use the well water and the pond water that appears during the rainy season, but the owners of the wells have prior rights to the use of well water.

The post of village chief has, since the 19th century, been a hereditary position occupied without close advisors. The chief has the power to govern the village. Village laws are orally transmitted. Every Saturday is a holiday during the growing season, and weddings, funerals, and other rituals are conducted according to Muslim custom. The elders of the village intercede to settle disputes between villagers. When this does not succeed, parties to the dispute ask the chief to resolve the problem.

In addition to hunting wild animals, the hunting families which are the Sekou and Farmo households, have traditional knowledge about the use of plant based medicines and manage tree-planting in the village.

(4) Village organizations

① Youth group

The samaria is an old village organization consisting of all the young men and women of the village. In addition to presenting goumbe (a type of drum) performances that are part of the village's culture, the samaria undertakes activities of common benefit to the village: cleaning public areas and building classrooms, etc. The samaria also entertains visiting administrative officials.

② Religious leadership group:

Regardless of the large number of believers in Islam in the village, there is no Islamic group. But this group leads Friday prayers, and coordinates the village's traditional leaders with other religious leaders.

③ Zima (cult) group:

A cult formed in 1992, it has 18 members. They perform cult rituals to drive out evil spirits.

(5) Records of past development projects

① In 1982, the national government installed three deep wells. Only one of these can now be used. A water fee is collected and used to manage the well and this work has been proceeding well.

② In 1997, one classroom was constructed under a basic educational project (PROSEF) with the support of the IDA. One teacher was assigned to the school.

9.3.2.1 Land use

(1) Present situation

In a sand dune zone on the south side that includes the villages of Kouregou and Bosso Banguie, agricultural land is expanding from low to medium level of the sand dune. A glacia zone centered on the north side and including the village of Ayoga was a land with rich water resources able to support stock raising, but deterioration of its soil is advancing as a consequence of recent low rainfall and overcutting of trees.

The land use classification revealed by remote sensing is shown in Table 9.3.2.1.1 and Figure 9.3.2.1.1. Kouregou village occupies a total of 8,525 hectares of land, with 54% of this land used as farmland.

Table 9.3.2.1.1 Areas for land use classification

(Unit: ha)

Classification	Agricultural land	Grassland	Bare land	Woodland	Marshland	Aquatic zone	Settlements	Total
Area	4,589	1,308	1,180	955	474	0	19	8,525

Source: JICA remote sensing survey commissioned in 1998

Notes: The land use map divides each land classification into sub-classifications. The area of each classification is the total of all sub-classifications (see Table A 9.3.1.1).

(Explanation of land classifications)

- ① Agricultural land: planted land, fallow land
- ② Grassland: land with at least 20% vegetation coverage, used mainly for pasture
- ③ Bare land: land with less than 20% vegetation coverage, mainly exposed base layer or sandy land
- ④ Woodland: land with at least 60% vegetation coverage, with numerous trees
- ⑤ Marshland: marshland formed around the kori
- ⑥ Aquatic zone: rivers, ponds
- ⑦ Settlements: settlements with at least 10 households

Figure 9.3.2.1.1 Map of land use (KOUREGOU)

図 9.3.2.1.1 土地利用図 (クレグー)

0°49'0"E 0°50'0"E 0°51'0"E 0°52'0"E 0°53'0"E 0°54'0"E

14°20'0"N



14°19'0"N

14°18'0"N

Dossa
Bangou

14°17'0"N

14°16'0"N

14°15'0"N

14°14'0"N



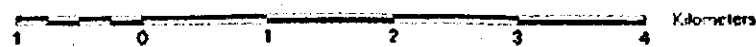
Agricultural land I	Vegetation coverage \geq 70%, Generally used as rainfed field
Agricultural land II	Vegetation coverage \geq 30% and $<$ 70%
Agricultural land III	Vegetation coverage $<$ 30%, Not used so much contemporary
Agricultural land IV	This agricultural land is on dune. Vegetation coverage \geq 50%
Agricultural land V	This agricultural land is on dune. Vegetation coverage $<$ 50%
Grass land I	Vegetation coverage \geq 50%, Generally used as pasture
Grass land II	Vegetation coverage $<$ 50%
Bare land	Sandy land or exposed base layer
Wood land I	Close forest
Wood land II	Open forest
Marsh land	Marshland which is formed by interception of wadi by dune
Aquatic zone	Wadi
Settlements	Consists of more than 10 houses

14°18'0"N

農地 I	被覆率70%以上。天水耕作地として利用。
農地 II	被覆率30~70%。
農地 III	被覆率30%未満。休耕地。
農地 IV	砂丘上の農地。被覆率50%以上。
農地 V	砂丘上の農地。被覆率50%未満。
草地 I	被覆率50%以上。放牧地として利用。
草地 II	被覆率50%未満。
裸地	砂地または基盤露出地。
森林 I	樹間密度高。密林地。
森林 II	樹間密度低。疎林地。
湿地	ワジ川が砂丘で流路を遮断され形成される湿地。
水域	ワジ川。
集落	10戸以上の集落地。

Legend	凡例	Colour
Agricultural land I	農地 I	[Pattern]
Agricultural land II	農地 II	[Pattern]
Agricultural land III	農地 III	[Pattern]
Agricultural land IV	農地 IV	[Pattern]
Agricultural land V	農地 V	[Pattern]
Grassland I	草地 I	[Pattern]
Grassland II	草地 II	[Pattern]
Bare land	裸地	[Pattern]
Wood land I	森林 I	[Pattern]
Wood land II	森林 II	[Pattern]
Marsh land	湿地	[Pattern]
Aquatic zone	水域	[Pattern]
Settlements	集落	[Pattern]

Scale



0°49'0"E

0°50'0"E

Figure 1. Map of land use (K. H. 300)
 図1. 土地利用図 (クンゲー)

0°43'0"E 0°50'0"E 0°57'0"E 0°52'0"E 0°53'0"E 0°54'0"E

14°20'0"N

14°19'0"N

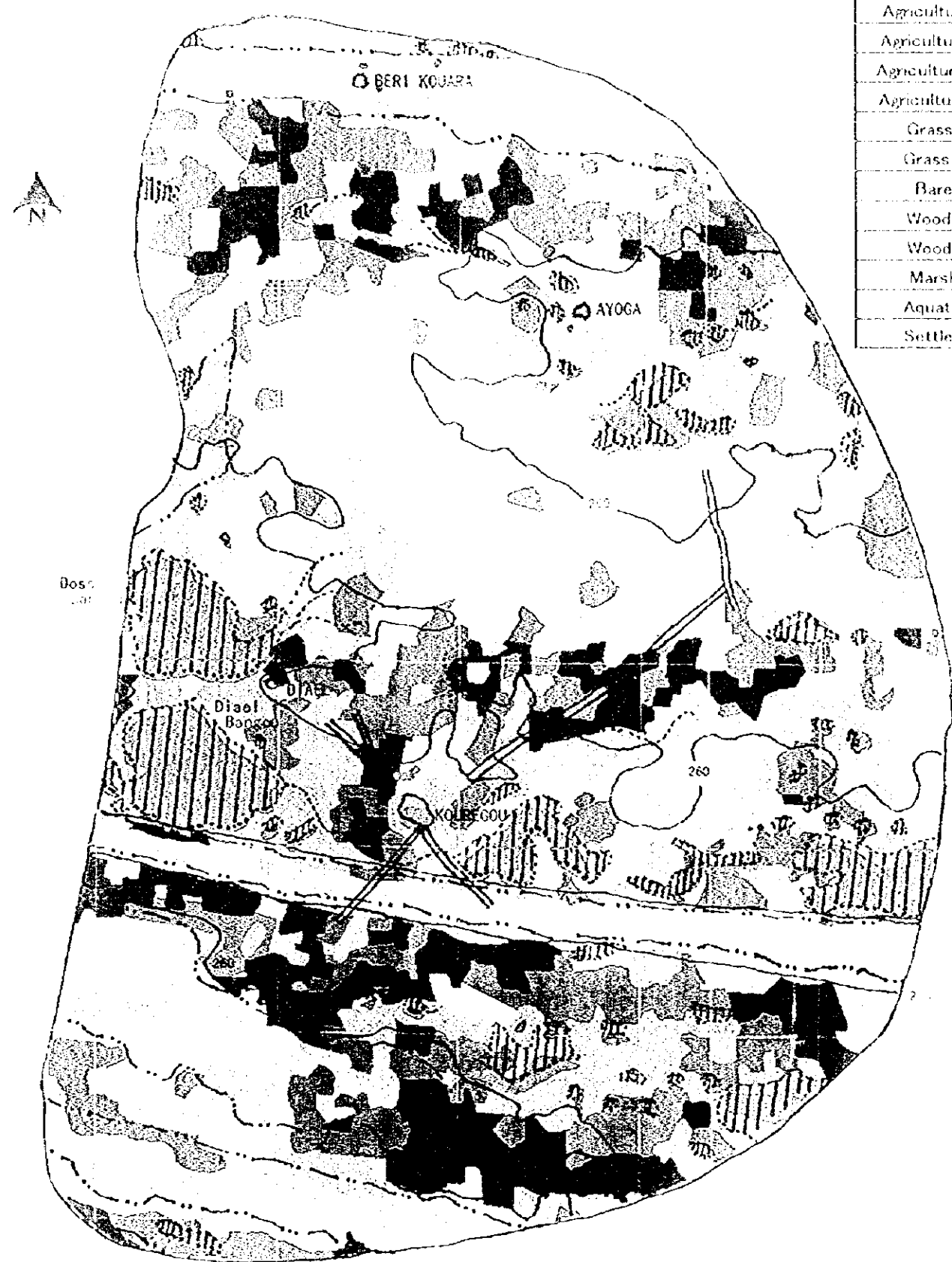
14°18'0"N

14°17'0"N

14°16'0"N

14°15'0"N

14°14'0"N



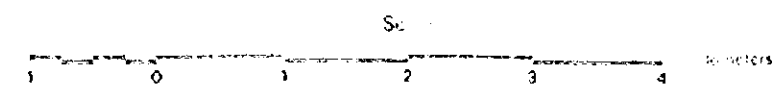
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Wood land I	Close forest
Wood land II	Open forest
Marsh land	Marshland which is formed by interception of wadi by dune
Aquatic zone	Wadi
Settlements	Consists of more than 10 houses

14°18'0"N

農地 I	植生率70%以上。天水耕作として利用。
農地 II	植生率30~70%。
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農地 V	砂丘上の農地。植生率50%未満。
草地 I	植生率50%以上。放牧地として利用。
草地 II	植生率50%未満。
裸地	砂地または基盤露出地。
森林 I	樹間密度高。密林地。
森林 II	樹間密度低。疎林地。
湿地	ワジ川が砂丘で滞留を促され形成される沼。
水域	ワジ川。
集落	10戸以上の集落地。

Legend	凡例	Colour
Agricultural land I	農地 I	[Pattern]
Agricultural land II	農地 II	[Pattern]
Agricultural land III	農地 III	[Pattern]
Agricultural land IV	農地 IV	[Pattern]
Agricultural land V	農地 V	[Pattern]
Grassland I	草地 I	[Pattern]
Grassland II	草地 II	[Pattern]
Bare land	裸地	[Pattern]
Wood land I	森林 I	[Pattern]
Wood land II	森林 II	[Pattern]
Marsh land	湿地	[Pattern]
Aquatic zone	水域	[Pattern]
Settlements	集落	[Pattern]

0°44'0"E 0°50'0"E



(2) Development principle

As the Western agriculture, stock raising, and silviculture promotion zone the development plan for this village is as follows:

- ① Rain-fed agriculture and stock raising will be developed by restoring the soil fertility through the promotion of agricultural land conservation and community forestry.
- ② Rational land use will be promoted to guarantee land productivity in a sustainable manner, without any significant changes in present land use.
- ③ In order to support the activities of the Terroir Management Committee, land committees stipulated in Article 118 of the Rural Code will be organized at the district level, and a rural cadaster stipulated in Article 130 of the Rural Code will be prepared. The registration method will conform to administrative order No. 97-367 (see Annex 9.3.2.1).

(3) Plan

The land use plan for the Kouregou village is shown in Table 9.3.2.1.2 and Figure 9.3.2.1.2. Agricultural land consists of rotational agricultural land (See “8.1 Land use”) and irrigated agricultural land. The rotational agricultural land is cultivated as rain-fed agriculture based on a 12-year cycle; it is cultivated for 3 years at a planting rate of 25% (in the first year it is cropped, suitable land conservation measures are introduced [see 9.3.2.3 Farming]), then it is not cultivated for 9 years (including a fallow period of 3 years).

Irrigated land will be a vegetable field of one ha around a pond.

Appropriate environmental protection measures will be introduced into non-agricultural land to prevent soil deterioration (see “9.3.2.7 Environmental protection”). To guarantee firewood, a mini-nursery of 0.25 ha will be established.

Table 9.3.2.1.2 Land use plan

(Unit: ha)

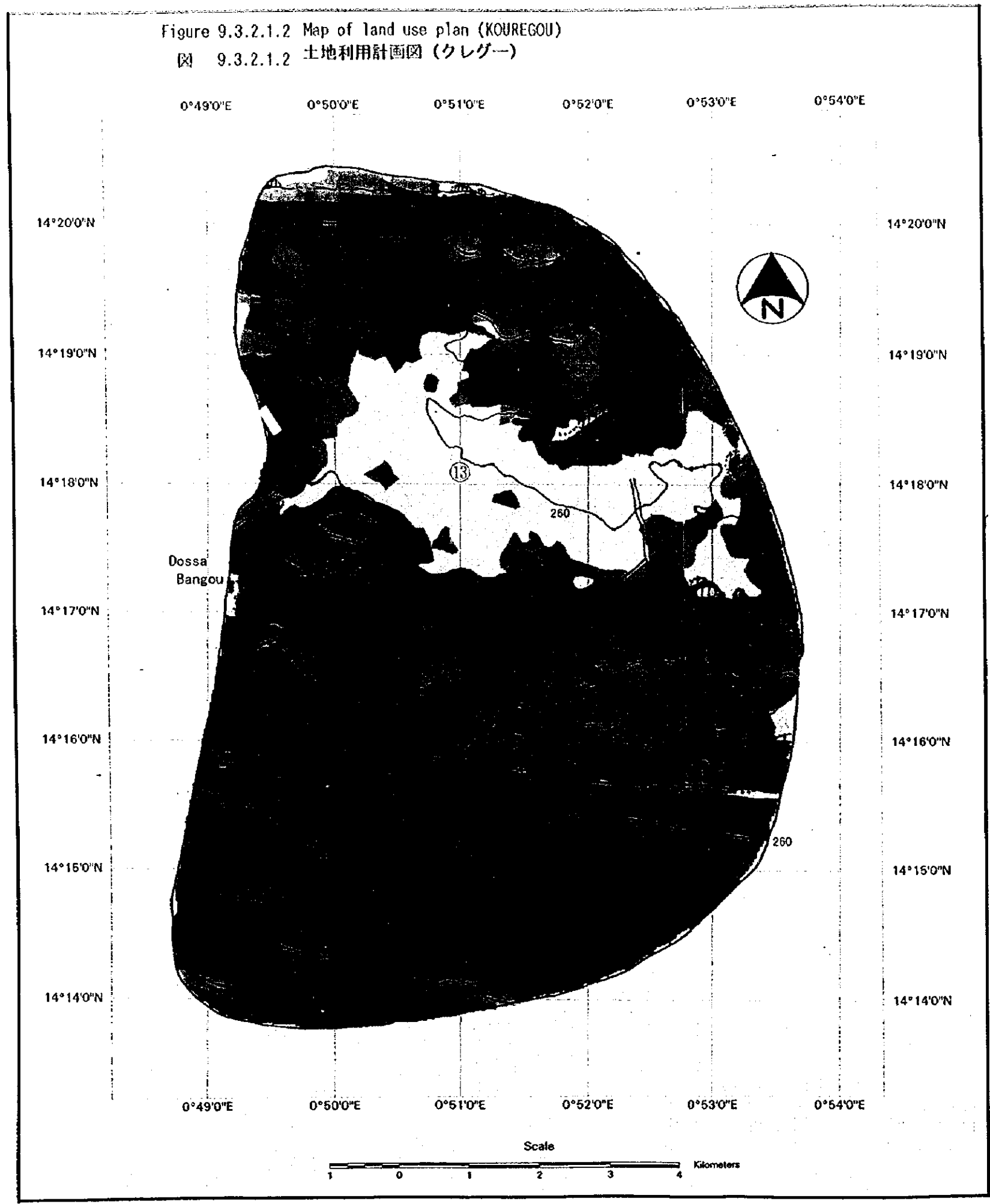
Current classification	Current area	Planned land use									
		Agricultural land					Non-agricultural land				
		Rotational agricultural land			Irrigated agricultural land		Grass-land	Wood-land	Bare land	Marsh-land, aquatic zone	Settle-ments
		Planted land	Non-planted land		Vegetable fields, etc						
Fallow land	Grass-land, etc										
Agricultural land	4,589	4,589	1,147	1,147	2,295						
Grassland	1,308					1,308					
Woodland	955						955				
Bare land	1,180							1,180			
Marshland	474					2			472		
Aquatic zone	0								0		
Settlement	19									19	
Total	8,525	4,589	1,147	1,147	2,295	2	1,308	955	1,180	472	
		100%	25%	25%	50%						

Source JICA remote sensing survey commissioned in 1998

Notes: The 2 ha of irrigated agricultural land are rounded up from 1.25 ha totaled from 1 ha of irrigated agricultural land and 0.25 ha of mini nursery field.

Figure 9.3.2.1.2 Map of land use plan (KOUREGOU)

図 9.3.2.1.2 土地利用計画図 (クレグー)



Colour	Legend	凡例
[Solid Black]	Agricultural land	農地
[Dotted]	Grassland	草地
[White]	Bare land	裸地
[Dark Grey]	Wood land	森林
[Medium Grey]	Marsh land	湿地
[Light Grey]	Aquatic zone	水域
[Dark Grey]	Settlements	集落

①	Bridge dam
②	Well development
③	Small scale irrigation
④	Rehabilitation of ponds
⑤	Installation of dry cheese production facilities
⑥	Development of collecting and shipping facilities
⑦	Fresh milk collecting and shipping facilities
⑧	Crop bank
⑨	Equipment and materials bank
⑩	Mill
⑪	Simple health hut
⑫	Primary school
⑬	Firewood development
⑭	Mini-nursery
⑮	Soil conservation (grassland restoration)
①	潜り橋
②	井戸整備
③	小規模かんがい
④	沼改修
⑤	チーズ製造施設
⑥	農産物集出荷施設
⑦	生乳集出荷施設
⑧	穀物銀行
⑨	資機材銀行
⑩	製粉所
⑪	簡易診療所
⑫	小学校
⑬	薪炭林
⑭	小規模苗畑
⑮	土壌保全 (草地復元)

Map of land use plan (KOURI GPM)
 土地利用計画図 (クレグ)



Colour	Legend	凡例
[Pattern]	Agricultural land	農地
[Pattern]	Grassland	草地
[Pattern]	Bare land	裸地
[Pattern]	Wood land	森林
[Pattern]	Marsh land	湿地
[Pattern]	Aquatic zone	水域
[Pattern]	Settlements	集落

[Symbol]	Bridge dam	橋りす
[Symbol]	Well development	井戸整備
[Symbol]	Small scale irrigation	小規模かんがい
[Symbol]	Rehabilitation of ponds	沼改修
[Symbol]	Installation of dry cheese production facilities	チーズ製造施設
[Symbol]	Development of collecting and shipping facilities	産物集出荷施設
[Symbol]	Fresh milk collecting and shipping facilities	生乳集出荷施設
[Symbol]	Crop bank	穀物銀行
[Symbol]	Equipment and materials bank	資機材銀行
[Symbol]	Mill	製粉所
[Symbol]	Simple health hut	簡易診療所
[Symbol]	Primary school	小学校
[Symbol]	Firewood development	薪炭林
[Symbol]	Mini-nursery	小規模苗圃
[Symbol]	Soil conservation / grassland restoration	土壌保全 (草地復元)

9.3.2.2 Water use

(1) Present situation

① **Rainfall:** According to documents covering the past thirty-one years (1967 to 1997, observation point: Tera city), rain only falls from March to October, and the annual rainfall is 389.2 mm. A Study of changing average annual rainfall at 10 year intervals reveals that the annual average was 386.8 mm from 1967 to 1976, 338.2 mm from 1977 to 1986, and 427.2 mm from 1987 to 1997. The average did not fall below 300 mm between 1967 and 1976, but between 1977 and 1986 and between 1987 and 1997 it was below this level four times and twice respectively.

② **Rivers:** None.

③ **Ponds:** There are no permanent ponds. During the rainy season, large ones at five locations and small ones at 19 locations in the village can be used. Their primary use is as drinking water for domestic animals, and people living nearby also drink this water. Around the ponds that form boundaries with other villages, animals enter fields to drink water, causing occasional disputes between farmers and herders with members of other villages. The lack of fences and wells obstructs the use of the water in these ponds for vegetable cultivation, but peanut cultivation on lots surrounded by hedges is practiced as decreasing water cultivation. Water resources are gradually disappearing as a result of declining rainfall and the soil sediment in the ponds.

A rainy season pond that forms about 3 km south-west of the village (Diael Bangou) has a relatively large volume of water and a maximum depth of about 3 m when filled and its water is used for small-scale irrigated vegetable cultivation and for drinking water for domestic animals. But water use facilities are not installed to take full advantage of its waters. In order to extend the period of water provision to livestock and the stability of vegetable cultivation, there is high demand for improvement of ponds.

④ **Wells:** Two of three tube wells installed in 1982 have malfunctioned and have been unusable for several years. The one that is usable is located about three kilometers from the center of the village. Users of the water from this well are charged either 5 FCFA or one ear of millet for 20 liters. Two-thirds of the money collected is used for the maintenance and the other one-third is paid to the well guardman as a salary.

The villagers have manually dug many shallow wells in the remains of the old wadi. Those that are dry are abandoned and new wells are dug nearby. The water is drawn by using plastic buckets with ropes manually. The water is used for both drinking water and as water for animals, but it is turbid, contains suspended matter, and is unsanitary. The depths are between 3 m and 5 m at locations about 500 m from the hamlet.

(2) Development principle

① Tube wells will be constructed to provide potable water of good quality.

② Ponds will be effectively utilized on a long term basis.

(3) Plan

- ① Wells: Because the present population of the village is 2,116 people, the construction of 8 tube wells will be planned as a way to supply adequate good quality drinking water to support the people's livelihood and maintain sanitary conditions (the salt concentration will be carefully noted when planning its location).
- ② A small-scale irrigated field (for land preparation standards, see "9.3.1.2 Water use") of 1 ha will be constructed and a hedge with thorns will be planted so that it can be shared by livestock. A mini nursery will be created together.
- ③ The Daiel Bangou pond will be improved to provide water for small-scale irrigation and to extend the period of holding water.
- ④ A new deep well will be constructed to guarantee water for livestock.
- ⑤ To prevent repeated restoration of traditional manually excavated shallow wells, a shallow well will be constructed to a depth of about 10 m.

9.3.2.3 Farming

(1) Agriculture

1) Present situation

(a) Agriculture

The results of a survey at the site reveal that the average area of farmland per household is 8.3 ha. In recent years, water and wind erosion have progressed as a consequence of declining rainfall, the expansion of agricultural land, and excessive cutting of trees.

The mainstay of agriculture is rain-fed farming, and in addition to millet (54.7%: "%" represents the cropping acreage rate; same applies below) and sorghum (12.8%) which are the principal grains, others grown are their companion crops, cow peas (41.2%) and cock sorrel (24.8%), and corn (0.1%) or peanuts (0.3%), etc. During the dry season, gourd, potato, watermelon, and jujube are grown in small quantities around the ponds.

Almost all the millet and sorghum species grown are local species grown from seed raised by the farmers themselves; no improved seed varieties have been introduced.

(b) Agricultural land conservation

Sand dunes crossing the village from east to west have blocked the flow of ground water. Attempts to deal with a shortage of food by the cultivation on the sand dune formerly not used for farming has caused spreading water and sand erosion. Although the inhabitants of the village are aware of the spreading damage, they have introduced no measures to preserve the land.

(c) An overview of individual farm practices

The principal crops cultivated are the grains, millet and sorghum, with cow peas and cock sorrel serving as companion crops. And although the villagers grow small quantities of dry season vegetables such as potatoes and gourds, their cultivation technology is backward, the productivity is low, and almost none of the crop is sold. Fallow system used to be maintained in relatively large quantities of land, but have little practiced in recent years.

Stock raising is primarily sedentary type performed jointly with crop agriculture. The average numbers of animals kept by each farm household is three head of cattle, 6 sheep, and 6 goats. A survey on 100 farm households revealed that 15% of the households were UBT 10 or higher. As in the case of crop production, stock raising is practiced under a traditional style with animals sold only when the family needs cash.

The average non-agricultural income per farm household is 50,000 FCFA earned through outside work.

2) Development principle

(a) Agriculture

- ① To overcome the problem of low productivity of the principal grains, millet and sorghum, ameliorated seeds developed by INRAN or ICRISAT will be introduced to boost productivity and quality.
- ② The percentage of agricultural land in crop rotation is 25%.
- ③ Dry season vegetables will be cultivated to expand the supply of vegetables to the village so as to improve their nutritive conditions.
- ④ Because the village is self-sufficient in live-stock feed, the herds of animals will successively enclosed for penning in the millet fields in the village.

(b) Agricultural land conservation

- ① Small basin agricultural land conservation group activities: Because the village area is divided into three small basins by the two sand dunes acting as the dividing ridge, agricultural land conservation measures will be implemented by each group organized in each small basin (see Figure A 9.3.2.3.1).
- ② Agricultural land conservation measures: Combined use of zai and either stone ridge or contour planting of Andropogon. (see b- below for characteristics of measures by group)
- ③ Soil fertility improvement measures: As an agricultural land conservation measure referred to in paragraph ② above, the combined use of three land fertility improvement measures selected according to land and farmer's conditions. (Either the systematic introduction of penning (enclosure), intercropping of cow peas and other legumes, or production of manure and its utilization in zai).
- ④ Introduction of measures to prevent the agricultural land from being covered by sand blown from the nearby sand dunes (see "9.3.2.7 Environmental protection").

(c) Individual farming

Policies of farming and stock raising management are same as those of the Dyabou with the exception of promotion of dry season vegetable cultivation (see 9.3.1.3 Farming).

3) Plan

(a) Agriculture

① Main cereal crop production increase plan

The philosophy concerning planning production increase is the same as in Dyabou. Calculations of the effectiveness at increasing production of the measures are shown in Table 9.3.2.3.1..

Table 9.3.2.3.1 Yield increase by introducing ameliorated seeds

Item	Planted Area (ha)*		Unit Yield (kg/ha)*		Yield (t)		Yield Ratio (%)	Yield Increase (t) (b)-(a)	** Sale Price (FCFA/kg)	Sales Amount of Increased Yield (thou. FCFA)
	Present	Planned	Present	Planned	Present (a)	Planned (b)				
Millet	1,171	1,135	743	1,115	870	1,266	146	396	155	61,380
Sorghum	136	132	497	746	68	98	144	30	148	4,440
Cow peas	499	484	151	181	75	88	117	13	221	2,873
Total	1,806	1,751	-	-	1,013	1,452	143	439	-	68,693

Notes: * Present figures are the averages for three years from 1991 to 1995 excluding the highest and lowest years; planned figures are predictions based on remote sensing analysis.

** Average prices at the Petite Marché market in Niamey, 1996-1997.

② Dry season vegetable cultivation plan

Product items that can be stored to provide stable supplies will be selected, systematically produced, and jointly shipped. See Table 9.3.2.3.2 for calculations of the planned production and sale of the introduced vegetables.

Table 9.3.2.3.2 Calculations for introduced vegetable production/sales plan

Item	Planted Area (ha)*	Unit Yield (kg/ha)*	Yield (kg)	Sale Price (FCFA/kg)**	Value sold (FCFA)
Onions	0.5	24,294	12,147	315	3,826,305
Melons	0.5	16,026	8,013	600	4,807,800
Total	1.0	-	20,160	-	8,634,105

Note: * Unit yield in the Magou village (JALDA verification Study)

** Sale price is the price at the Niamey Market (1996-1997)

(b) Agricultural land conservation

a) Rationale on small basin divisions and characteristics of each division

① Group I (Northern part)

The division between the north edge of the village and the next sand dune. On the north side of the sand dune that is the boundary with Group II, land where the soil has slightly deteriorated is expanding.

② Group II (Central part)

In the division including the center of the village, land with soil that has deteriorated because of continuous cropping exists in a mosaic pattern. And the boundary with Group III to the south is a clear sand dune.

③ Group III (Southern part)

The southern division in the village, it lies to the southern side of a sand dune that forms the boundary with group II. Therefore, measures to provide protection from flying sand are necessary here. And because the southern part of the region is a gentle slope made of sandy soil, soil erosion prevention measures are particularly important there.

b) Characteristics of measures by group

① Group I

- Land with deteriorated soil has spread throughout the southern part of this division, where the village people want counter-measures to deal with the problem. And around hameaus, intensive agricultural land conservation measures can be taken.
- Suitable measures will be mainly zai and stone-ridge. Because the quarry where the rock for the stone ridge is obtained is far from the village, assistance with its transport will be offered.

② Group II

- Because there is a central hamlet, stone-ridge work and zai will be executed as intensive agricultural land conservation measures centered on the land near the residential area.
- Because the quarry where the rock for the stone ridge is obtained is far from the village, assistance with its transport will be offered.

③ Group III

- Measures will be implemented to protect sand blowing from the sand dune that is the boundary between this division and Group II (see "9.3.2.7 Environmental protection").
- On the gentle slopes that lead to the sand dune, stone ridge or contour planting of andropogon will be done to prevent erosion of the sandy soil.

c) Protection Plan

Table 9.3.2.3.3 Agricultural land conservation plan (Annual)

Contents	Implementation area (ha)	Materials, etc.
① Stone ridge construction	76	Stone 988 t
② Zai	96	Compost 192 t
③ Contour planting of andropogon	57	
④ Penning (Enclosure)	477	Livestock excrement 2,385 t
⑤ Intermediate planting of pulse crops	574	
Total of agricultural land conservation measures	229	①+②+③
Total of soil fertility improvement measures	1,147	③+④+⑤

Note: 1. Part of the zai will be combined with stone-ridge constructions or contour planting of andropogon.
2. Zai has been added to the total area of counter measure for both agricultural land conservation and for soil fertility improvement.

(c) Farm management by type

The two typical types of farm management practiced here are identical to those in Dyabou.

- ① Only rain-fed agriculture
- ② Rain-fed agriculture + stock raising (sedentary type).

Table 9.3.2.3.4 ① Exclusively rain-fed agriculture

Category	Average Farm Land Area	Planted Land			Corresponding Households		
Present	8.3 ha	11.2 ha			40%		
Planned	7.4 ha	14.7 ha					
	Category	Millet	Sorghum	Cow peas	Cock sorrel	Others	Totals
Present	Planted Area ha	4.5	1.1	3.4	2.1	0.1	11.2
	Unit yield kg/ha	433	429	80	33	500	
	Total production kg	1,949	472	272	69	50	
	Unit price FCFA	136	122	251	150	76	
	Gross production value FCFA	265,064	57,584	68,272	10,350	3,800	405,070
	Operating expenses FCFA	4,266	743	1,353	139	367	6,867
	Farming income FCFA	260,798	56,842	66,919	10,211	3,433	398,203
Planned	Planted Area ha	5.9	1.4	4.5	2.8	0.1	14.7
	Unit yield kg/ha	650	644	96	40	750	
	Total production kg	3,848	902	432	111	75	
	Unit price FCFA	136	122	251	150	76	
	Gross production value FCFA	523,328	110,044	108,432	16,650	5,700	764,154
	Operating expenses FCFA	6,399	1,114	2,030	208	550	10,301
	Farming income FCFA	516,929	108,930	106,402	16,442	5,150	753,853

"Others" are represented by peanuts. The unit yields of principal crops are based on Table 9.3.2.3.1. Operating expenses are expected to rise 50% from present.

Table 9.3.2.3.5 ②Rain-fed agriculture + stock raising (Sedentary type)

Category	Average Farmland Area	Planted Area	Average Number of Livestock			Corresponding Households		
Present	8.3 ha	9.0 ha	4 cattle, 6 sheep, 6 goats			60 %		
Planned	7.4 ha	11.8 ha	6 cattle, 12 sheep, 12 goats					
Item	Crops			Stock Raising			Total	
	Millet	Sorghum	Cow peas	Cattle	Sheep	Goats		
Present	Planted Area ha	4.5	1.1	3.4	4 (heads)	6 (heads)	6 (heads)	---
	Unit Yield kg/ha	433	429	80	---	---	---	---
	Total Production kg	1,949	472	272	---	---	---	---
	Unit Price FCFA	136	122	251	39,210	10,380	7,110	---
	Gross Production Value FCFA	265,064	57,584	68,272	156,840	62,280	42,660	652,700
	Management Expenses FCFA	4,266	743	1,353	22,230	9,340	6,400	44,332
	Farming Income FCFA	260,798	56,842	66,919	134,610	52,940	36,260	608,368
Planned	Planted Area ha	5.9	1.4	4.5	6 (heads)	12 (heads)	12 (heads)	---
	Unit Yield kg/ha	650	644	96	---	---	---	---
	Total Production kg	3,848	902	432	---	---	---	---
	Unit Price FCFA	136	122	251	63,760	12,000	7,710	---
	Gross Production Value FCFA	523,328	110,044	108,432	382,560	144,000	92,520	1,360,884
	Management Expenses FCFA	6,399	1,114	2,030	81,950	21,670	13,880	127,043
	Farming Income FCFA	516,929	108,930	106,402	300,610	122,330	78,640	1,233,841

(2) Stock raising

1) Present situation

Stock raising is positioned as an activity secondary to crop cultivation. But 83% of the farm households have domestic animals. They obtain feed for the animals from 2,800 ha of natural grasslands and woodlands in the village and about 1,900 ha of crop residue from the fields. Nomadic stock raising is not practiced. Domestic animal management is done two ways: either directly by the family members or by contracted breeders. Shepherds who specialize in taking care of livestock live in the village, and their rates for taking care of other's animals are set. For cattle, the rate is between 1,500 and 2,000 FCFA per month for up to 20 head. For more than 20 head, an annual fee of one calf is given to the shepherd. As sheep and goats are easier to tend, the rate is settled through negotiation. Families that have livestock, practice penning (enclosure). Families that do not own livestock let them graze on their fields in exchange for millet. The number of domestic animals kept by the villagers has declined under the effects of repeated droughts. There are two reasons why this has happened: incorrect predictions of supply and demand for feed and families keeping too many animals to boost their status in the community. For this reason, it is necessary to have the herders recognize that rather than increasing production by increasing herd size, it is necessary to increase productivity per head in order to combat desertification. The numbers of animals kept at this time are shown in Table

9.3.2.3.6. Most fresh milk is consumed by the owners of the cattle. The surplus is given to neighbors and a little is sold in the village.

Stock raising in the village faces several problems.

- ① The animal corridor that forms the border with Bongou village must be confirmed.
- ② The fodder production infrastructure is not stable.
- ③ The consumption places are far.
- ④ There is a shortage of facilities to supply water to livestock.
- ⑤ Because of the decline in the number of animals under the effects of droughts, there are insufficient numbers for penning (enclosure).

2) Development principle

Because the village is located in a stock raising region, both agriculture and stock raising will be encouraged. Through a tie-up with the forestry industry, the fodder supply infrastructure will be strengthened by planting more trees that provide fodder. And guidance will be given to help the villagers improve their natural grasslands along with their grazing and fodder storage technologies so that they can provide animals with fodder in a balanced manner from season to season. To boost agricultural productivity, penning (enclosure) will be aggressively implemented by restoring the size of the villagers' herds. The livestock productivity per head will be improved by introducing superior improved breeds. Productivity will be boosted by feeding nutritional bricks to livestock to improve their nutrition.

3) Plan

(a) Stock raising plan

The village has more fodder than its demand as a consequence of the starvation of many animals during the droughts of the 1980s. The plan calls for a 50% increase in the cattle population and a doubling of the number of sheep and goats. Management guidance will be provided to clarify the balance between the fodder resources and the animal population. The planned numbers of livestock are shown in Table 9.3.2.3.6.

The standards for introduction of breeding bulls is the same as for Dyabou and 7 head will be introduced. 17 sets of stock nutritional block construction tools will be introduced.

Table 9.3.2.3.6 Livestock raising numbers plan

Kind of livestock	Present		Planned		Remarks
	Number	UBT	Number	UBT	
Cattle	410	328	600	480	
Sheep	690	97	1,400	196	
Goats	720	101	1,400	196	
Camels	2	2	2	2	
Donkeys	170	85	200	100	
Horses	20	20	20	20	
Totals		632		994	

(b) Fodder supply and demand plan

Because the village is self-sufficient in fodder, its inhabitants have experienced a shortage of fodder only in drought years, and fodder trees such as *Piliostigma reticulatum*, *Bauhinia rufesens*, *Ziziphus mauritiana*, and other drought resistant species will be planted. The grassland will be improved by introducing the hoof cultivation method. The stock raising families will be taught how to prevent over-grazing by replacing set grazing with rotational grazing. The fodder supply and demand plan is shown in Table 9.3.2.3.7. (For the grounds for the calculations, see Table A 9.3.1.3.1 to 6).

Table 9.3.2.3.7 Calculation of fodder supply and demand

Category	UBT	Required Dry Matter	Estimated Quantity Available			Supply/demand balance
			Grassland etc	Crop Residue	Total	
Present	632	1,500	1,841	648	2,489	989
Planned	994	2,358	1,957	702	2,659	301

(c) Livestock product production plan

Fodder resources are limited, so productivity per head will be improved more by improving the livestock, its nutrition, and fodder production rather than by increasing the number of head. The stock production plan is shown in Table 9.3.2.3.8. The quantities of livestock excrement that will be available under the execution of penning (enclosure) are estimated to be 2,400 tons for cattle, 980 tons for sheep and 980 tons for goats.

Table 9.3.2.3.8 Livestock product production plan

Category	Kind of livestock	Number Raised	Of which, Number of adult females	Production (t)			
				Meat (male)	Meat (female)	Waste meat	Milk
Present	Cattle	410	143	6.01	2.00	3.17	47.19
	Sheep	690	327	3.92	1.95	0.79	16.35
	Goats	720	145	2.62	1.94	0.24	10.15
	Total			12.55	5.89	4.20	73.69
Planned	Cattle	600	192	16.63	8.45	5.25	96.00
	Sheep	1,400	626	9.12	4.88	1.85	37.56
	Goats	1,400	261	5.70	4.31	0.52	20.88
	Total			31.45	17.64	7.62	154.44

(3) Community forest

1) Present situation

Formed by three types, sand dunes, a glacia plain, and a plateau, the vegetation seen in the village is characteristic of each type, with the general form of vegetation consisting of sparse isolated stunted trees or herbaceous plants.

- ① Sand dunes: The principal trees seen in this zone are *Guiera senegalensis*, *Combretum glutinosum*, *Acacia seyal*, *Acacia albida*, *Balanites egyptiaca*, and *Bauhinia rufescens*, and the herbaceous plants include the grasses, *Andropogon gayanus*, *Panicum letum*, *Sida cordifolia*, and so on.
- ② Glacis plain: The principal trees are *Adansonia digitata*, *Acacia scorpioides*, *Mitragena inersis*, *Tamarindus indica*, and *Combretum nigricans*, while the herbaceous plants include *Sida cordifolia*.
- ③ Plateau: The same trees seen on ① and ② are found mixed together in groves in this section. The principal trees are *Acacia*, *Ziziphus mauritiana*, *Balanites egyptiaca*, etc.
The challenges that must be faced to establish a community forest are the same as in Dyabou.

2) Development principle

The development principles are the same as in Dyabou, but in Kouregou the following activities are particularly necessary.

- ① CES/DRS activities intended to expand agricultural production will restore the soil of the glacis.
- ② Sand dunes covering large areas of land will be anchored.
- ③ Anti-sediment measures will be introduced into water resource spot and cultivated land.
- ④ The following species of seedlings will be planted.
 - Trees with economic value: *Adansonia digitata*, *Ziziphus mauritia*, *Guiera senegalensis*, *Acacia senegal*, *Acacia seyal*
 - Trees with nutritional value and value as fodder trees: *Adansonia digitata*, *Lamlea acida*, *Tamarindus indica*, *Acacia albida*, *Acacia seyal*
 - Trees that will improve the fertility of fields: *Acacia albida*, *Acacia nilotica*
 - Shade trees, sources of firewood: *Azadirachta indica*, *combretacees*
 - Hedges for gardens: *Prozopis juriflora*

3) Plan

The plans related to the community forest are as follows,

- ① Teach the villagers that it is necessary to plant trees on their dry fields, in orchards, along roadsides, and in village forest (to produce firewood).
- ② Provide representatives of the village with training in seedling production technology.
- ③ Within the Terroir Management Committee, establish an organization to manage and to follow-up the mini-nursery.
- ④ Establish a mini nursery and produce seedlings of trees with economic value.
- ⑤ Plant trees to restore soil, anchor sand dunes, and to reforest wasteland.
- ⑥ Maintain and manage the young trees that have been planted.
- ⑦ In order to secure fodder in times of drought, fodder trees must be harvested.

9.3.2.4 Agriculture, stock raising, and sylviculture support system

(1) Present situation

Promotional staff in charge of agriculture, livestock raising, and the environment in the Directorate of the Agriculture of the district of Tera only come to the village to provide guidance concerning agricultural dissemination once or twice a year. This support activity is insufficient for farmers who face many problems concerning the improvement of agricultural, soil deterioration, the elimination of diseases and insect pests, and so on.

Only the youth organization that exists in the village is the traditional but no longer effective group known as Samaria that has existed since colonial times. It has never played a role in agricultural support.

(2) Development principle

- ① Because the primary activity is rain-fed agriculture that is susceptible to droughts, guaranteeing a stable supply of food is a vital issue. Consequently a cereal bank (36 tons) will be established to loan millet during food shortages then recover the at a fixed rate (return of the quantity borrowed plus 20%) at harvest time.
- ② Other development principles are the same as in Dyabou.

(3) Plan

- ① A grain bank will be established to prevent food shortages.
- ② Other plans are the same as in Dyabou.

9.3.2.5 Market distribution

(1) Present situation

Kourégou village is about 30 kilometers north of the city of Téra along national highway. It is linked to Doungouro village by an 11 km unimproved road.

Cash crops such as cock sorrel and peanuts are cultivated within the village, and when a surplus of these crops is available, merchants come to the village to purchase them. Because the village is far from consumption places, it is necessary to produce onions and other durable crops and to dry them where they are produced.

Four livestock markets are located in Kokorou, Tera, Zani, and Mehana. Of these the Kokorou market is the closest to Kourégou. Meat is shipped on the hoof and milk is completely consumed in the village. In Téra district, milk is processed to make butter which is then sold. Surplus milk produced by expanding production should be sold at higher added value by processing it in the village.

Turning to forestry product distribution, within the village, there are no national forests where tree cutting is authorized, and firewood produced in the village is completely consumed by the villagers, with none available for distribution outside the village.

The following problems hamper the distribution of products.

- ① The connecting road to the national highway is in poor condition.
- ② The livestock product processing and storage infrastructure is inadequate.
- ③ Transport methods are backwards: limited to mules and carts.

(2) Development principle

- ① Priority repair work will be performed on koris that have been eroded on the 11 km section between Doungouro village and Kourégou village where there are unmaintained roads. This work will guarantee distribution of materials immediately after rainfall.
- ② Milk will be processed to make cheese, mainly by groups of women. There are dry cheese markets in Tera and Kokorou.

(3) Plan

1) Agricultural roads

Because most use of the road from the branch with the national highway to the village will be for agriculture/stock raising/sylviculture related economic activities, this plan calls for the repair of part of the agricultural road. Crossing works will be constructed at three locations.

2) Processing

The village will produce 154 tons of milk. It is predicted that the villagers will consume about 100 tons of milk. The approximately 54 tons not consumed will be processed to make dry cheese. Plans call for this processing to be done by four processing facilities installed in the homes of villagers. See Table 9.3.1.5.3 for the equipment that will be used for this purpose. Because the inhabitants have no experience in producing dry cheese, the project will include studying in areas where such production is more advanced.

9.3.2.6 Living environment improvement

(1) Present situation

1) Health and hygiene

Health care and sanitation conditions are extremely poor and intolerable. Dispensaries in the neighboring villages of Canton Kokorou village and Foneko village are both about 12 kilometers away. Medical teams rarely visit the village. And because modern medicine is unavailable in the village, the people rely on traditional medicine and faith healers. There is one midwife and one medicine salesman, but they have no medicine.

Almost all diseases characteristic of tropical regions are found in the village. Diarrhea, influenza, measles, and encephalitis are particularly serious problems. Communicable diseases are widespread because of a lack of good sanitary measures. In other words, poor housing (animals are usually kept in the yards of people's homes) and a shortage of water (for cooking, toilet use, washing dishes) creates unsanitary conditions.

2) Education

Regardless of the long history and size of the village, it had no school until 1996, with the only accessible school located in Canton Kokorou village 12 km distant. Education is, therefore, extremely backward in this village. But an elementary school was established in 1997 with IDA financing. The villagers constructed a thatched roof classroom and mud hut to serve as the teacher's residence. The classroom is 300 m from the hamlet. There are many school age children in the village, and more than 100 applied to attend, but only 60 can be accommodated in the classroom, and 29 of these are girls. All the children in the village want to attend, but the single classroom limits the accommodation number to 60.

(2) Development principle

1) Health and hygiene

Under present conditions, the minimum health care and sanitary facilities are not provided, and the villagers cannot obtain the medical care they want. To improve conditions, a system providing the minimum required initial treatment will be provided. The plan calls for the construction of a simple health hut and the provision of an emergency use medicine box. The village will select one person to manage the emergency medicine box and to provide initial treatment. In the beginning, the medicines will be provided through the project, but these will be replaced by income obtained selling the medicines. Before beginning this management task, the manager will receive about two weeks training in initial treatment and medicine box management at a hospital in Téra.

2) Education

Because the classroom space is too small to accommodate all the children of school age, two new classrooms will be constructed. A school farm will be constructed and used to teach the children cultivation techniques. Trees will be planted at the boundary of the school yard to teach them the importance of forest conservation. To improve the literacy of young people and women who have had no chance to attend school, education facilities will be provided.

3) Information

Located 60 km from Téra and isolated by bad roads, the village has poor access to information or instructions from the national government or regional governments. A single TV set will be provided in order to give the villagers access to government information and increase their awareness of French: the official language of Niger. This will be managed by the terror management committee.

(3) Plan

- ① A simple health hut will be constructed at one location and equipped with a complete set of emergency medications. One member of the village will be selected for two weeks of training needed to handle initial medical treatment and to manage the medical supplies.
- ② Two new classrooms and a 0.01 ha school farm will be provided (including construction of new wells). Trees (approx. 400 m x 2) will be planted along the boundary of the school yard. These will be used to teach the children simple vegetable cultivation techniques and the importance of forest conservation.
- ③ A TV set and an accompanying solar cell generator and battery will be installed. This will be managed by the terror management committee.

9.3.2.7 Environmental protection

(1) Present situation

Within the village, there are 4 dunes which stretch from east to west. These dunes consist mainly of flowing sand and there is no plant life on them. For this reason, due to windborne sand particles, farmland and water resources become buried in sand.

(2) Development principle

Degradation of the environment in the area is the major factor and windborne sand particles will be reduced.

(3) Plan

In addition to the promotion of education with regard to the effects of windborne sand particles on agricultural production and life, the dune area will be stabilized with plants.

9.3.3 The Tidani Village Model Plan (northern stock raising promotion zone)

(1) Natural conditions

Tidani village is located around 20 km north of Filingué City where the district capital is located. The village land consists of village proper and two enclaves. The total area including the enclaves is 75.6 km². The Dabaga enclave located 20 km east of the village is newly acquired land. Cultivation is mainly executed on round trips. The enclaves have highly fertile sandy soil and are very important in farming and stock-raising. The other enclave Banguir located 10 km west of the village has two marshes and the soil is sandy.

The Banguir enclave is separated from Tidani village by the Garin Bongage territory. It faces Garin Bongage to the east, Tarkasso to the north, Chiki Mate to the south, and its western section is surrounded by a vast laterite plateau. During the rainy season, 3/4 of the enclave

becomes submerged due to the water inflow from the plateau. Millet, sorghum, cowpeas, sesame, peanuts and okras are cultivated on non-submerged land. On the submerged land, trees and gourds are cultivated during the dry season.

(2) Society

Tidani village is inhabited by 224 families and 1,240 persons. The ethnic is entirely Haoussa. Its founders are the three persons of Goga, Zonga and Labbo of the same family who came from Filingué City around 1940 in search of farmland. Around 1955, the village status was raised from a hamlet (*hameau*) to an administrative village headed by Danbagi Goga. As a result, it had to secure its own tax income.

There are no major conflicts between Tidani and its surrounding villages. However, the problem of damage to field crops due to livestock is occurring frequently. In such cases, the village chief is intervening.

The village is divided into four districts (Gaicha, Barke Chekarao, Hamidou Alfari and Elhadji Ali Gouno). Each of these is headed by a district chief. The district chief is designed to consolidate the villagers and the village chief. The district chief's jobs are to inform the residents of joint activities and collect taxes.

Working away is carried out by all households. The reasons include shortage of agricultural production, job shortage during the dry season and poverty. The village's bread winners go away for work after harvesting millet, and return to the village at the beginning of the rainy season. The work-away destinations are mainly Burkina Faso, Cote D'Ivoire and Saudi Arabia. In Niger, the villagers go to work in large towns. The cash earned is used to buy food which is short or to buy livestock as a means of saving.

(3) Customs

The village chief's descendants have the qualification to become candidates for the chief. The chief is selected by household heads living in the village. The first chief served for 24 years. The second served for 21 years and the present third chief is an Islamic leader (Marabout) serving for the third year in 1998. The village regulations are prescribed based on traditional customs, particularly Islam.

Ceremonies such as marriage, funeral and naming are carried out according to the Islamic practices. The amount of dowry is determined by the bride's father.

Many of the disputes inside the village are those inside the family over field subdivision, those between farmers and herders due to wandering of livestock and those between the husband and wife over household affairs. Disputes inside the village are solved through talks between the concerned parties, judgment by the elders and village chief.

In principle, land is owned by individuals. It can be transferred or sold to others by notifying the village chief. Tidani does not have unowned land. The Dabaga enclave does have

unowned land. This enclave however is rapidly being turned into owned land by Tidani villagers as newly developed land and as pastures during the rainy season.

As for use of pastures by non-villagers, excluding those that are made completely open, the user must obtain the land owner's approval after the harvest and manage with due diligence.

It is free to use wood. Such use however is monitored by the land owner and the village. This monitoring however does not prevent felling.

The pond and well water is managed by village members. Non-villagers may also use it freely.

(4) Village organizations

① Islam group

This group was organized in 1971 to propagate Islam to the villagers. It consists of five marabouts including the present village chief. Its activities consist of preaching and holding of ceremonies such as marriage, naming and funeral. The group's problems are lack of Islamic textbooks and funds.

② Cooperative association

The cooperative association was organized in 1962 to supply agricultural materials and sell products. Through administrative initiative, in 1986, it was reorganized into one made up of farmers and herders. It is made up of the three villages of Tidani, Boutaye and Kafougue. Their Secretariats consist of five, four and three persons, respectively. The important matters are determined in the meeting of all producers. The association head is selected through democratic voting in the village's all-producer meeting. In 1986, to improve the farmers' living, a loan was extended for agricultural equipment through the UNC which guides the sale of farm products. Three persons purchased wagons and two of them have completed the repayment. The remaining one has repaid 60%. The association's problems are suspension of activities due to fund freeze and insufficiency of education for members. The CLUSA (Cooperative League of the United States of America) which is an American NGO guided association members on adult literacy education and commercial activities.

③ Youth group

The youth group was organized in 1962 by covering all youth in the village. It was reorganized in 1975. Its main activities are well-digging and development of common farmland. It also carries out activities related to interests common to the village carried out by the administration.

④ Women's group

The women's group was organized in 1975 through administrative initiative to mobilize and develop women by covering all women in the village. The activities consist of village cleaning every week, mutual help with house decoration and others, and those for the village's common

benefits. The group's problems are shortage of funds for carrying out income-generating activities and lack of means to reduce women's overwork.

⑤ Students' parents group

The parents group was organized in 1982 through administrative initiative in relation to school construction. Its purpose is to develop children's education. The activity contents were schoolyard cleaning and parents' education. The activities however have been stopped since 1990.

(5) Records of post development projects

① Inauguration of an emergency medical team (1990)

The activities are being carried out by midwives and ambulance men. The midwives are medically examining children with the help of the visit to the village once a month by a traveling medical team of a mother-child protection institution however medical supplies are not sufficient.

② Fattening of sheep

This project was implemented by covering the cooperative association through CLUSA aid. It succeeded and the loan repayment was completed in 1988. There is much demand for this type of financing.

③ Joint store (1986)

Also implemented by covering the cooperative association through CLUSA aid. The association was financed FCFA 600,000 by CLUSA to operate the store. This amount has been repaid entirely. It is hoped that the terror management committee will handle cooperative purchasing of daily goods.

④ Adult literacy education (1986)

Education on the Hausa language was implemented by covering the cooperative association through CLUSA aid. There were many participants, but the class was closed when the payment of salaries to instructors by CLUSA was terminated and has not resumed. Adult literacy is not a necessity.

⑤ Construction of an OFFEDES well (1987)

This project was implemented through Saudi Arabian financial aid and operation and management by the GTZ. The residents saved up a fund of FCFA 50,000 for well maintenance. The village's well management committee carried out sanitary management. However, the well has partially collapsed and provides little water. It eventually will have to be abandoned.

9.3.3.1 Land use

(1) Present situation

The village consists of the village proper and the enclaves of Banguir to the southwest and Dabaga to the northeast.

Millet fields are distributed widely in the village proper. The soil is sandy and relatively fertile. However, soil deterioration has been progressing due to decrease of precipitation and excessive cropping in recent years. The Banguir enclave that has a large pond which is used as a livestock watering place is marked with water and wind erosion and its soil is deteriorating markedly. The Dabaga enclave is relatively highly fertile. It has a great potential for developing stock raising.

Table 9.3.3.1.1 and Figure 9.3.3.1.1 show the state of land use through remote sensing. Tidani village's total area is around 7,559 ha. The ratio of farmland is around 36%.

Table 9.3.3.1.1 Areas for land use classification

								(Unit: ha)
Classification	Agricultural land	Grassland	Bare land	Woodland	Marshland	Aquatic zone	Settlements	Total
Area	5,575	3,208	2,767	2,269	0	51	19	13,889

Source: JAI.DA remote sensing survey commissioned in 1998

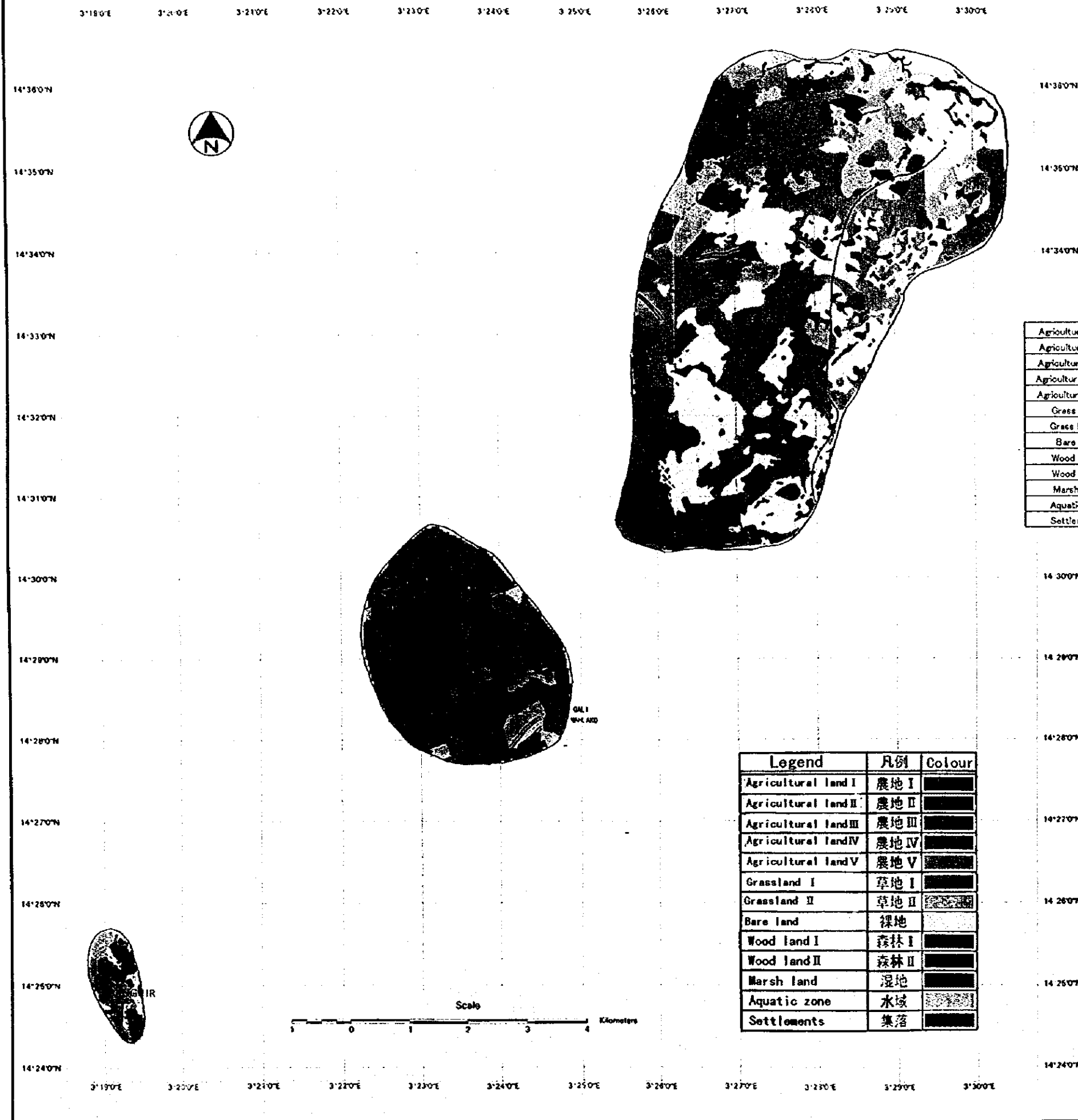
Notes: The land use map divides each land classification into sub-classifications. The area of each classification is the total of all sub-classifications (see Table A 9.3.1.1).

(Explanation of land classifications)

- ①Agricultural land: planted land, fallow land
- ②Grassland: land with at least 20% vegetation coverage, used mainly for pasture
- ③Bare land: land with less than 20% vegetation coverage, mainly exposed base layer or sandy land
- ④Woodland: land with at least 60% vegetation coverage, with numerous trees
- ⑤Marshland: marshland formed around the kori
- ⑥Aquatic zone: rivers, ponds
- ⑦Settlements: settlements with at least 10 households

Figure 9.3.3.1.1 Map of land use (TIDANI)

図 9.3.3.1.1 土地利用図 (ティダニ)



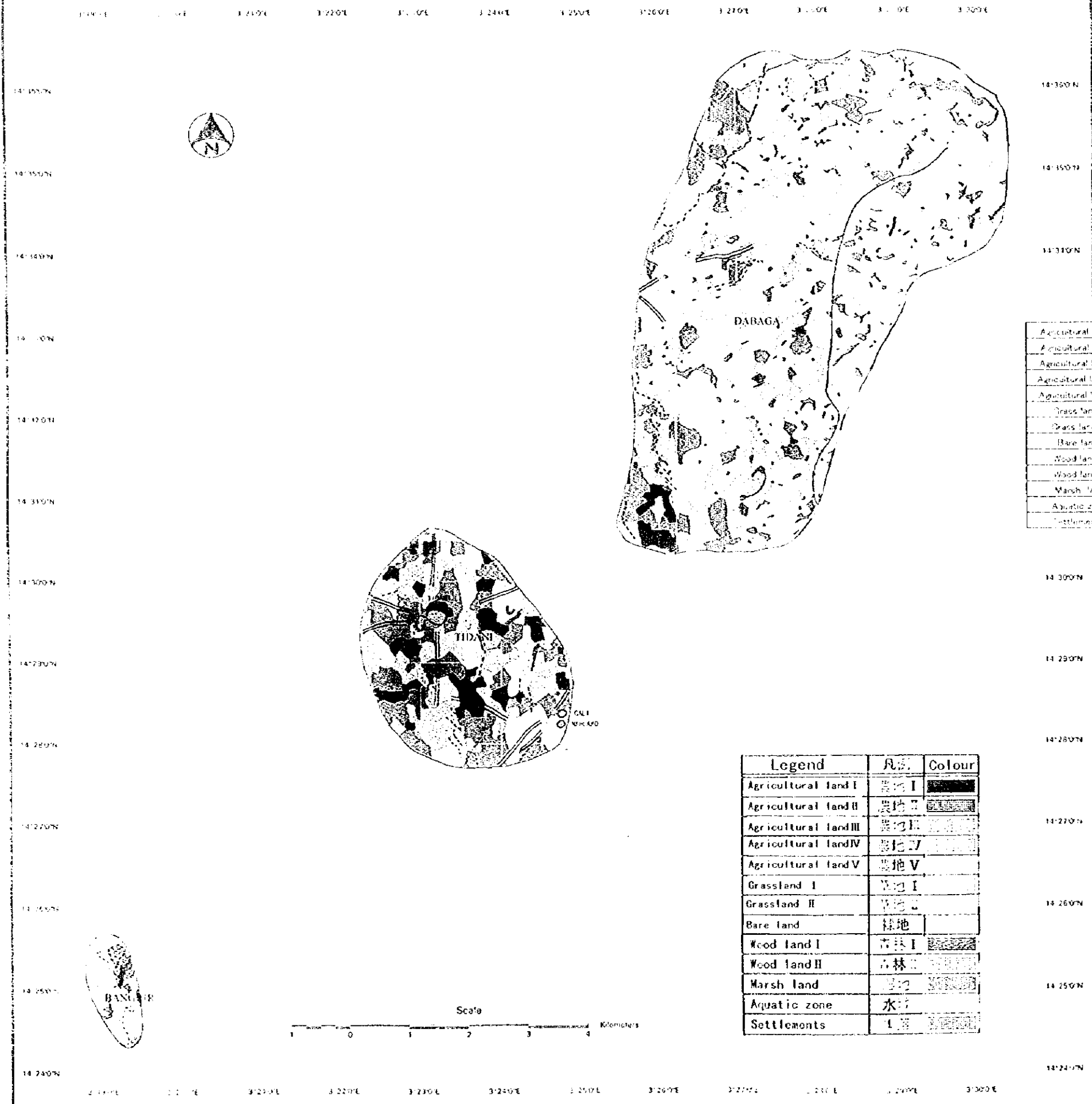
農地Ⅰ	被覆率70%以上、天水耕作地として利用。
農地Ⅱ	被覆率30~70%。
農地Ⅲ	被覆率30%未満、休耕地。
農地Ⅳ	砂丘上の農地、被覆率50%以上。
農地Ⅴ	砂丘上の農地、被覆率50%未満。
草地Ⅰ	被覆率50%以上、放牧地として利用。
草地Ⅱ	被覆率50%未満。
湿地	砂地または基岩露出地。
森林Ⅰ	樹間密生林、密林地。
森林Ⅱ	樹間疎生林、疎林地。
浮地	ワジ川が砂丘で流路を遮断され形成される浮地。
水域	ワジ川。
集落	10戸以上の集落地。

Agricultural land I	Vegetation coverage \geq 70%. Generally used as rainfed field
Agricultural land II	Vegetation coverage \geq 30% and $<$ 70%
Agricultural land III	Vegetation coverage $<$ 30%. Not used so much contemporary
Agricultural land IV	This agricultural land is on dune. Vegetation coverage \geq 50%
Agricultural land V	This agricultural land is on dune. Vegetation coverage $<$ 50%
Grass land I	Vegetation coverage \geq 50%. Generally used as pasture
Grass land II	Vegetation coverage $<$ 50%
Bare land	Sandy land or exposed base layer
Wood land I	Close forest
Wood land II	Open forest
Marsh land	Marshland which is formed by interception of wadi by dune
Aquatic zone	Wadi
Settlements	Consists of more than 10 houses

Legend	凡例	Colour
Agricultural land I	農地Ⅰ	
Agricultural land II	農地Ⅱ	
Agricultural land III	農地Ⅲ	
Agricultural land IV	農地Ⅳ	
Agricultural land V	農地Ⅴ	
Grassland I	草地Ⅰ	
Grassland II	草地Ⅱ	
Bare land	裸地	
Wood land I	森林Ⅰ	
Wood land II	森林Ⅱ	
Marsh land	湿地	
Aquatic zone	水域	
Settlements	集落	

Figure 9.3.3.1.1 Map of Land use (TIDANI)

図 9.3.3.1.1 土地利用図 (ティダニ)



地Ⅰ	植覆率70%以上、天然林や人工林の 植生が50-70%。
地Ⅱ	植覆率50%未満、雑草地、 砂丘上の荒地、植生が10%以上。
地Ⅲ	砂丘上の荒地、植生が10%以上、 植生が50%未満。
地Ⅳ	砂丘上の荒地、植生が10%未満、 植生が50%未満。
地Ⅴ	砂丘上の荒地、植生が10%未満、 植生が50%未満。
森林Ⅰ	植生が50%以上、雑草地として利用、 植生が50%未満。
森林Ⅱ	植生が50%以上、雑草地として利用、 植生が50%未満。
森林Ⅲ	植生が50%以上、雑草地として利用、 植生が50%未満。
森林Ⅳ	植生が50%以上、雑草地として利用、 植生が50%未満。
森林Ⅴ	植生が50%以上、雑草地として利用、 植生が50%未満。
水	植生が50%以上、雑草地として利用、 植生が50%未満。
集落	植生が50%以上、雑草地として利用、 植生が50%未満。

Agricultural land I	Vegetation coverage > 70% (generally used as planted field)
Agricultural land II	Vegetation coverage > 50% and < 70%
Agricultural land III	Vegetation coverage < 50% (Not used so much contemporary)
Agricultural land IV	This agricultural land is on bare Vegetation coverage < 50%
Agricultural land V	This agricultural land is on bare Vegetation coverage < 50%
Grass land I	Vegetation coverage > 50% (Generally used as pasture)
Grass land II	Vegetation coverage < 50%
Bare land	Sandy land or exposed bare land
Wood land I	Close forest
Wood land II	Open forest
Marsh land	Marshland which is formed by obstruction of water by hum
Aquatic zone	Wash
Settlements	Density of more than 10 houses

Legend	凡例	Colour
Agricultural land I	農地Ⅰ	[Pattern]
Agricultural land II	農地Ⅱ	[Pattern]
Agricultural land III	農地Ⅲ	[Pattern]
Agricultural land IV	農地Ⅳ	[Pattern]
Agricultural land V	農地Ⅴ	[Pattern]
Grassland I	草地Ⅰ	[Pattern]
Grassland II	草地Ⅱ	[Pattern]
Bare land	裸地	[Pattern]
Wood land I	森林Ⅰ	[Pattern]
Wood land II	森林Ⅱ	[Pattern]
Marsh land	沼地	[Pattern]
Aquatic zone	水	[Pattern]
Settlements	集落	[Pattern]

(2) Development principle

As a northern stock raising promotion zone, the development plan for this village is as follows:

- ① Agricultural land conservation and afforestation will be promoted and ground water will be developed. Stock raising will be promoted through recovery of the fertility of agricultural land and grassland.
- ② Rational land use will be promoted to ensure land productivity to enable sustainable production without greatly changing the present state (the fallowing period is 12 years).
- ③ To support the activities of the terroir management committee, Land Commissions prescribed by Article 118 of the Agricultural Code on the departmental level will be established, and the Rural cadaster prescribed by Article 130 of the same will be prepared. The registration method is to follow the provisions of Administrative order No. 97-367 (see Annex 9.3.2.1).

(3) Plan

The land use plan for Tidani village is as shown in Table 9.3.3.1.2 and Figure 9.3.3.1.2. Farmland consists of rotational farmland (see "8.1 Land use") and irrigated farmland. The rotational farmland is to be used with one cycle of 15 years with a rain-fed planted ratio of 20%, planting period of three years (introduction of an appropriate farmland conservation measures in the first year of planting, see "9.3.3.3 Farming") and non-cropping period of 12 years (including a three-year fallow period).

As for the irrigated farmland, 0.2 ha of vegetable fields are to be set up around the pond that occurs in the rainy season.

As for non-farmland, appropriate environmental conservation measures are to be taken to prevent soil deterioration (see "9.3.3.7 Environmental protection"). To increase the production of livestock feed that is short, 100 ha of the natural meadows is to be improved through seeding of improved pasture. In addition, to secure saplings to produce firewood and charcoal, a mini nursery field of 0.25 ha is to be developed.

Table 9.3.3.1.2 Land use plan

(Unit: ha)

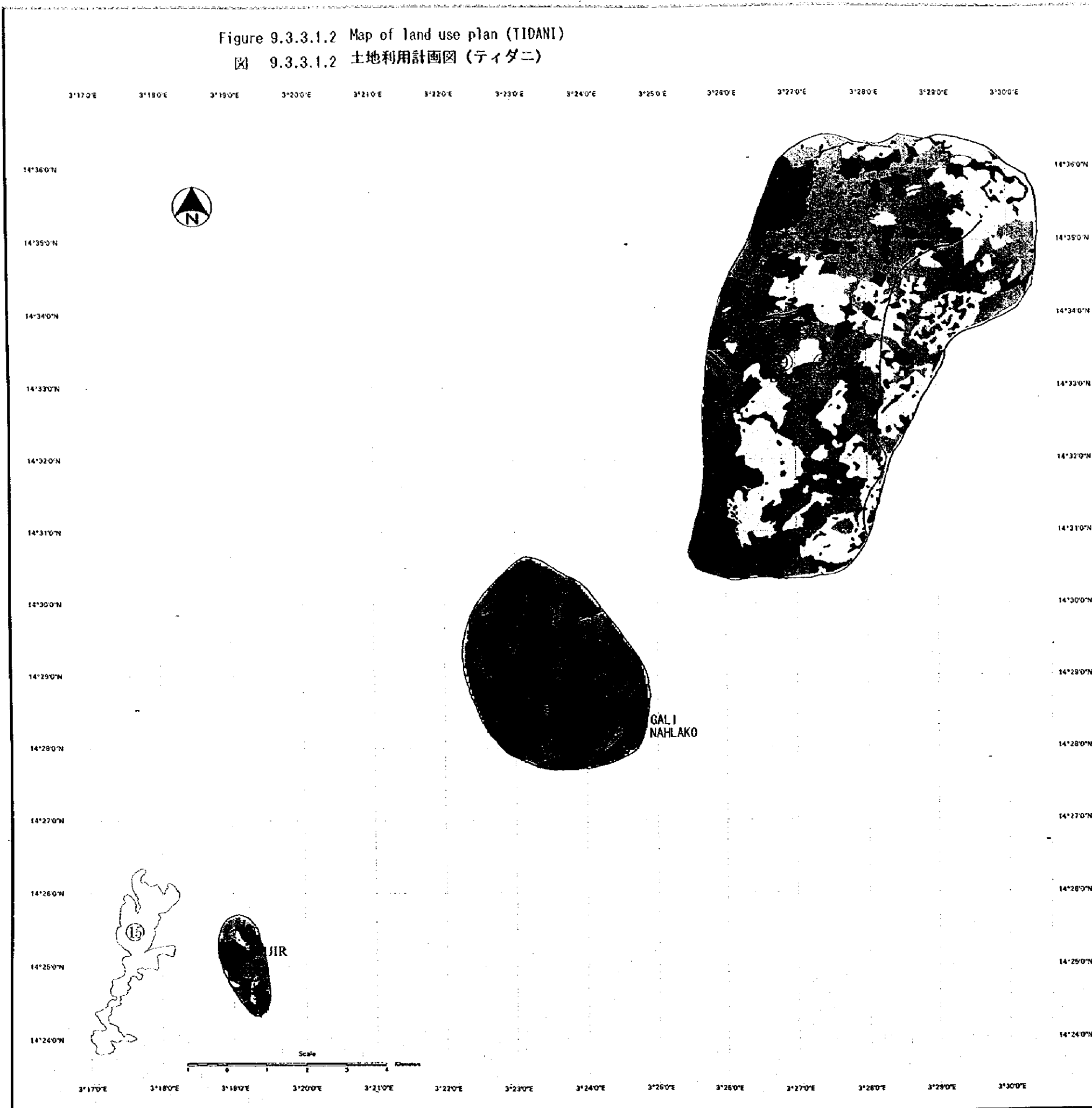
Current classification	Current area	Planned land use										
		Agricultural land					Non-agricultural land					
		Rotational agricultural land			Irrigated agricultural land		Improved grass-land	Grass-land	Wood-land	Bare land	Marsh-land Aquatic zone	Settle-ments
		Planted land	Non-agricultural land		Vegetable fields, etc.							
Fallow land	Grass-land, etc											
Agricultural land	2,705	2,704	541	541	1,622	1						
Grassland	2,332						100	2,232				
Woodland	425								425			
Bare land	2,070									2,070		
Marshland	0										0	
Aquatic zone	0										0	
Settlements	27										27	
Total	7,559	2,704	541	541	1,622	1	100	2,232	425	2,070	0	27
		100%	20%	20%	60%							

Source: JALDA remote sensing survey commissioned in 1998.

Notes: The 1 ha of Irrigated agricultural land is rounded up from 0.45 ha, which is the total of 0.20 ha of irrigated agricultural land and 0.25 ha of mini nursery field.

Figure 9.3.3.1.2 Map of land use plan (TIDANI)

図 9.3.3.1.2 土地利用計画図 (ティダニ)

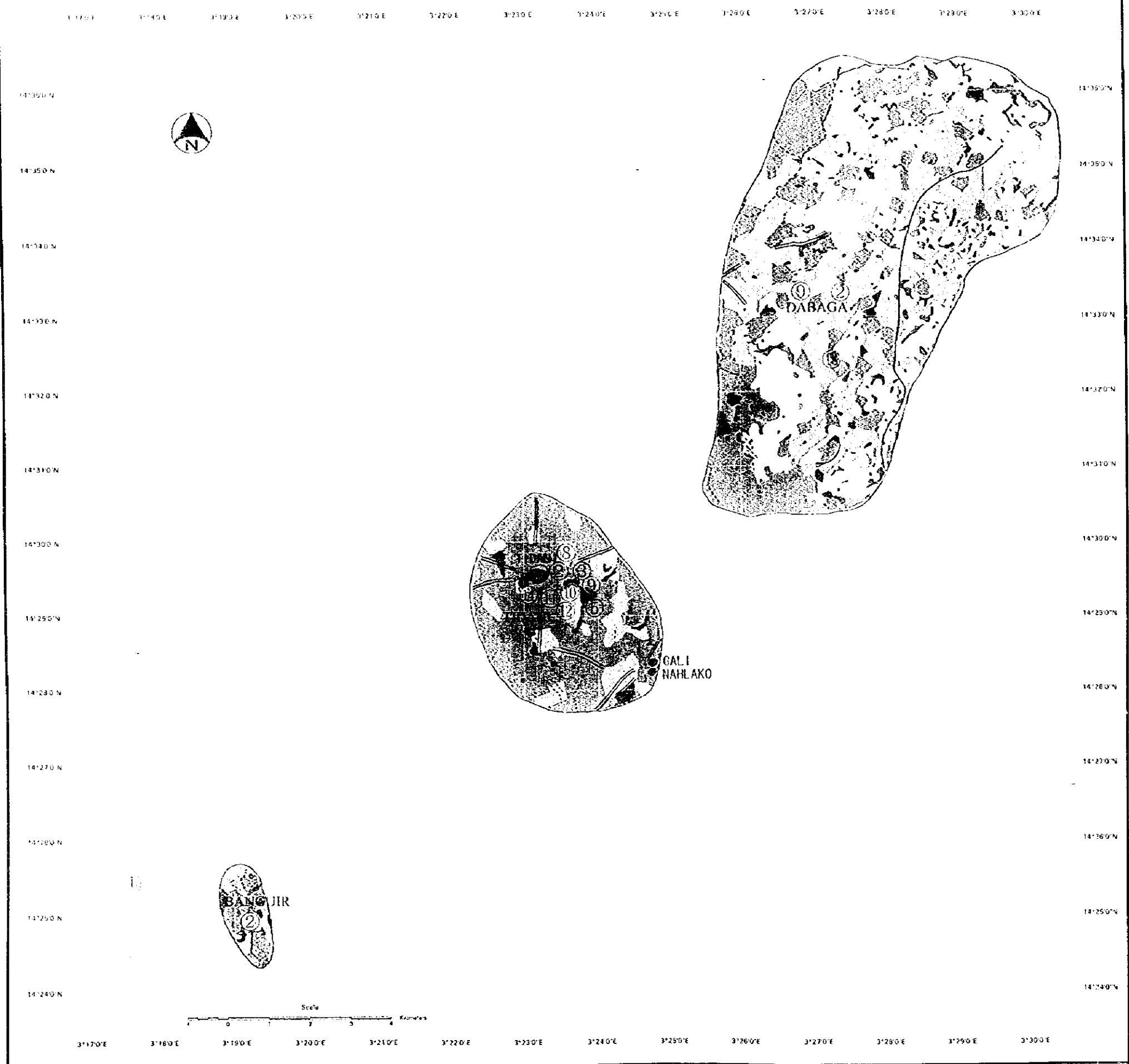


Colour	Legend	凡例
	Agricultural land	農地
	Grassland	草地
	Bare land	裸地
	Wood land	森林
	Marsh land	湿地
	Aquatic zone	水域
	Settlements	集落

①	Bridge dam
②	Well development
③	Small scale irrigation
④	Rehabilitation of ponds
⑤	Installation of dry cheese production facilities
⑥	Development of collecting and shipping facilities
⑦	Fresh milk collecting and shipping facilities
⑧	Crop bank
⑨	Equipment and materials bank
⑩	Mill
⑪	Simple health hut
⑫	Primary school
⑬	Firewood development
⑭	Mini-nursery
⑮	Soil conservation (grassland restoration)
①	潜り橋
②	井戸整備
③	小規模かんがい
④	沼改修
⑤	チーズ製造施設
⑥	農産物集出荷施設
⑦	生乳集出荷施設
⑧	穀物銀行
⑨	資材銀行
⑩	製粉所
⑪	簡易診療所
⑫	小学校
⑬	薪炭林
⑭	小規模苗圃
⑮	土壌保全 (草地復元)

Figure 9.3.3.1.2 Map of land use plan (TIDANI)

図 9.3.3.1.2 土地利用計画図 (ティダニ)



Colour	Legend	凡例
[Stippled pattern]	Agricultural land	農地
[Dotted pattern]	Grassland	草地
[White]	Bare land	裸地
[Dark shaded]	Wood land	森林
[Wavy pattern]	Marsh land	湿地
[Blue]	Aquatic zone	水域
[Cross-hatched]	Settlements	集落

[T-shaped symbol]	Bridge dam
[Well symbol]	Well development
[Circle with center dot]	Small scale irrigation
[Dashed line]	Rehabilitation of ponds
[Cheese symbol]	Installation of dry cheese production facilities
[Truck symbol]	Development of collecting and shipping facilities
[Milk can symbol]	Fresh milk collecting and shipping facilities
[Bank symbol]	Crop bank
[Bank symbol]	Equipment and materials bank
[Mill symbol]	Mill
[Hut symbol]	Simple health hut
[School symbol]	Primary school
[Firewood symbol]	Firewood development
[Nursery symbol]	Mini-nursery
[Soil symbol]	Soil conservation (grassland restoration)
[Japanese symbol]	潜り橋
[Japanese symbol]	井戸整備
[Japanese symbol]	小規模かんがい
[Japanese symbol]	沼改修
[Japanese symbol]	チーズ製造施設
[Japanese symbol]	農産物集出荷施設
[Japanese symbol]	生乳集出荷施設
[Japanese symbol]	穀物銀行
[Japanese symbol]	資材銀行
[Japanese symbol]	製粉所
[Japanese symbol]	簡易診療所
[Japanese symbol]	小学校
[Japanese symbol]	薪炭林
[Japanese symbol]	小規模苗圃
[Japanese symbol]	土壌保全 (草地復元)

9.3.3.2 Water use

(1) Present situation

- ① **Rainfall:** The past 31-year data (observation point: Filingué City) show that rain falls only from April to October and the annual precipitation is 331.9 mm (Tidani village does not have a meteorological observatory). In terms of 10-year periods, the average annual precipitation was 343.6 mm for 1967-76, 334.6 mm for 1977-86 and 320.6 mm for 1987-97. Hence, precipitation has been decreasing every decade by around 10 mm. There have been four years when the precipitation did not reach 250 mm and 13 years when it did not reach 300 mm. This coincides with the fact that 98% of the local residents in the rural Society Study considered this as a marked example of desertification.
- ② **Rivers:** None
- ③ **Ponds:** The village has four rainy season ponds namely the Tidani in the village proper, the Banguir in the Banguir enclave and the Tabchin and Balla-roi in the Dabaga enclave. The Tidani pond is being used to make mud houses and sun-dried bricks. It is also used to water livestock for two months after the rainy season ends. The Tabchin and Balla-roi ponds preserve water for four to five months and are used for irrigation and to water livestock. The Banguir pond is used to water livestock. The watering places are managed by the entire village and anyone can use them freely. However, sand accumulation is progressing gradually in these ponds and the water quantity has been decreasing.
- ④ **Wells:** The village has four deep cement wells and a tube well. The first well (50 m deep) was constructed by the Government in 1950. Over 20 years have passed since it partially collapsed and it is drying up. It however is still being used. The second well (50 m deep) was also constructed by the Government in 1971. It is used to draw drinking water and livestock water. However, due to precipitation decrease, sand accumulation and population increase, it has come to dry up in the dry season. The third well (70 m deep) was constructed by GTZ in 1987. It has collapsed partially and the water quantity is small. Hence, the village is short of water. The Banguir enclave has a well but this one dries up in the dry season. The Dabaga enclave has no wells. Both people and livestock are drinking pond water. The tube well was constructed by the Government in 1983. It however has not been functioning since a month after it was constructed. The situation is that the village's water resources are far short of satisfying the necessary quantity and this has become the village's serious handicap.

(2) Development principle

Tube wells will be constructed or rehabilitated to provide water for drinking, animal consumption and irrigation.

(3) Plan

- ① The present population is 1,240. According to the well installation standards, the village requires six wells including the existing. Since only one existing well can be used throughout the year, it is necessary to construct five new tube wells (three in the village and one each in the Banguir and Dabaga enclaves). Five drilled wells are to be constructed to secure drinking water. In addition a place to cultivate dry season vegetables (0.2 ha, for consumption in the village) and a mini nursery (0.25 ha) are to be developed using irrigation water..
- ② The partially collapsed deep wells are to be repaired to secure livestock.

9.3.3.3 Farming

(1) Agriculture

1) Present situation

(a) Agriculture

The results of surveys show that the average farmland area per household is 3.5 ha.

The main form of agriculture is rain-fed agriculture during the rainy season. In addition to the main cereals of millet (planted area rate: 80.9%, the same applies hereafter) and sorghum (17.6%), cultivated are cowpeas (40.2%) and cock sorrels (1.3%) which are mix-cultivated with the first two and peanuts (0.2%) and okras (0.2%). During the dry season, corn, tomatoes, red pepper, kidney beans, cabbages and salads are cultivated on low-lying ground whose area is limited.

The millet and sorghum are mostly conventional varieties that have been cultivated repeatedly through home seed-raising and ameliorated varieties have not been introduced.

(b) Agricultural land conservation

The region where the village is located is verging on a crisis of desertification. Soil deterioration has gone to extremes and outflow of labor force due to working away is also marked. For these reasons, at present, agricultural land conservation measures are virtually not being taken. In particular, the Dabaga enclave located to the east of the village is newly being developed. In addition, because its soil is sandy, rapid soil erosion has been occurring. The other enclave to the west is suffering from inflow of water and earth and sand from the plateau surfaces located to its west. Extensive submergence and accumulation of earth and sand in the pond during the rainy season have become problems.

(c) An overview of management of individual farm practices

Crop cultivation is centered around millet. In addition to other cereals such as sorghum, cowpeas are mix cultivated. In addition, cock sorrels, okras and peanuts are cultivated for self-supply. Their cultivation technology however is low-level and productivity is also markedly low.

As for stock-raising, small farm households are of the sedentary herding type. When the breeding scale increases, they change to the migratory type by signing contracts with the Peuhls. The outline of other management items is more or less the same as other villages. Because the conditions of farm management are severe, the dependence on off-farm income is high. There is work-away income of around FCFA 200,000 per household.

2) Development principle

(a) Agriculture

- ① As for millet and sorghum which are the main cereals, to grow out of the low productivity of the conventional varieties, ameliorated seeds bred by INRAN and ICRISAT are to be introduced to develop productivity and quality.
- ② Planting rate on rotational agricultural land: It will be around 20% (because soil deterioration is marked, long non-planting periods are to be secured).
- ③ In the lowlands, dry season vegetables are to be cultivated through hand-drawing irrigation from shallow wells.

(b) Agricultural land conservation

- ① Small basin agricultural land conservation group activities: In addition to the village proper, the Tidani village consists of two enclaves located along different small basins of Koris. On this basis, the village is to be divided into three districts, and agricultural land conservation measures are to be promoted by group (see Figure A9.3.3.3.1).
- ② Agricultural land conservation measures: Simple eyebrow ridge and/or stone ridge and simple eyebrow ridge or combination of zai with these.
- ③ Soil fertility improvement measures: Depending on the agricultural land or the producer's conditions, three soil fertility improvement measures (systematic introduction of penning (enclosure), intercropping of leguminous crops such as cowpeas, and farmyard manure production and its application to zai are to be combined as agricultural land conservation measures in ② above.
- ④ Implementation of measures to prevent the inflow of earth and sand and water from the adjacent plateau and its surfaces (see "9.3.3.7 Environmental protection").

(c) Individual management

The policies of farming and stock raising management are same as those of the Kourégou (see "9.3.2.3 Farming").

3) Plan

(a) Agriculture

① Main cereal crop production increase plan

The philosophy on increasing production is the same as that of Dyabou. See Table 9.3.3.3.1 for calculations on yield increase due to measures.

Table 9.3.3.3.1 Yield increase by introducing ameliorated seeds

Item	Planted Area (ha)*		Unit Yield (kg/ha)*		Yield (t)		Yield Ratio (%)	Yield Increase (t) (b)-(a)	Sale Price (FCFA/kg) **	Sales Amount of Increased Yield (thou. FCFA)
	Present	Planned	Present	Planned	Present (a)	Planned (b)				
Millet	634	438	342	513	217	225	104	8	155	1,240
Sorghum	138	95	170	255	23	24	104	1	148	148
Cowpeas	315	217	88	106	28	23	82	-5	221	-1,105
Total	1,087	750	-	-	268	272	101	4	-	283

Notes: * Present figures are average for three years from 1991 to 1995 excluding the highest and lowest years. Planned figures are based on remote sensing analysis.

** Average prices at Petite Marché in Niamey, 1996-97.

② Dry season vegetables cultivation plan

0.2 ha of salads which has a high turnover rate, okras which can be dry-processed and tomatoes having stable demand are to be cultivated for self-supply in the village.

(b) Agricultural land conservation

a) Rationale on small basin divisions and characteristics of each division

① Group I (Village proper)

This division includes the center of the village. It is a generally flat farming and stock-farming district. From old, it has been used as farmland.

② Group II (Eastern enclave)

This area was recently incorporated into Tidani village. Carried out are round trip cultivation or settlement farming during cultivation and stock raising. The soil is sandy and soil erosion is occurring on the dune.

③ Group III (Western enclave)

The land is relatively flat. However, water and earth and sand are flowing in from the adjacent plateau.

b) Characteristics of measures by group

① Group I

Because this division includes the residential area, farmland has become exhausted due to long-term use. The land is to be recovered through relatively intensive measures.

- Measures to improve the soil's water holding capacity and fertility to be taken are mainly stone ridge construction and penning (enclosure).
- The place for collecting stone to be used in stone ridge is located near the western enclave. Since it is 10-15 km away, the transport work is also to be supported by truck.

② Group II

- Soil deterioration is the worst among the three divisions. Measures are to be implemented promptly such as by allocating labor force on a priority basis. In this division, farmland is being developed in a disorderly way and forests are disappearing and soil is deteriorating rapidly. To prevent these, effective land use is to be promoted to enable sustainable

agriculture, stock raising, and silviculture.

- The division is distant from the residential area. Its farmland is to be conserved through methods that can be executed easily and with low labor intensity such as simple eyebrow ridge and zai.
- For areas with serious soil degradation, simple crescent structures and zai are employed to prevent soil flow and increase water retention of soil.

③ Group III

- The agricultural land conservation measures are to be the same as Group I.
- As a measure to prevent the inflow of water and earth and sand from the adjacent plateau (see "9.3.3.7 Environmental protection"), a measure to improve the water holding capacity of the soil on the plateau (restoration of grassland) is to be carried out.

c) Conservation Plan

The content of the work plan for agricultural land conservation is shown in Table 9.3.3.3.2.

Table 9.3.3.3.2 Agricultural land conservation plan (annual)

Contents	Implementation Area (ha)	Materials, etc.
① Stone ridge	36	Stone 468 t
② Zai	45	Compost 90 t
③ Simple eyebrow ridge construction	54	
④ Penning (Enclosure)	171	Livestock excrement 855 t
⑤ Intermediate planting of pulse crops	271	
Total of agricultural land conservation measures	135	①+②+③
Total of soil fertility improvement measures	487	②+④+⑤

- Notes: 1. A part of zai has been combined with stone ridge.
 2. Zai has been added to the measures area totals of both agricultural land conservation and soil fertility improvement.

(c) Farm management by type

These plans were prepared as follows based on a policy similar to that for the Dyabou village. The village's farming patterns are three: ① only rain-fed agriculture (centered around cultivation of cereals, of vegetables for self-supply and breeding of a small number of livestock), ② rain-fed agriculture and stock raising (sedentary type) and ③ rain-fed agriculture and stock raising (transhumance type) which is mainly herding and the family moves with the livestock in search of grassland UBT of 10 or higher.

Table 9.3.3.3 ① Exclusively rain-fed agriculture

Category	Average Farmland Area	Planted Area	Corresponding Households		
Present	3.5 ha	4.8 ha	40%		
Planned	2.4 ha	3.6 ha			
	Item	Millet	Sorghum	Cowpeas	Total
Present	Planted Area (ha)	2.8	0.6	1.4	4.8
	Unit Yield (kg/ha)	342	170	88	—
	Total Production (kg)	958	102	123	—
	Unit Price (FCFA)	174	167	274	—
	Gross Production Value (FCFA)	166,692	17,034	33,702	217,428
	Management Expenses (FCFA)	2,654	405	557	3,617
	Farming Income (FCFA)	164,038	16,629	33,145	213,811
Planned	Planted Area (ha)	2.0	0.4	1.2	3.6
	Unit Yield (kg/ha)	513	255	106	—
	Total Production (kg)	1,026	102	127	—
	Unit Price (FCFA)	174	167	274	—
	Gross Production Value (FCFA)	178,524	17,034	34,798	230,356
	Management Expenses (FCFA)	3,982	608	836	5,426
	Farming Income (FCFA)	174,542	16,426	33,962	224,930

* The unit yields of principal crops are based on Table 9.3.3.3.1. Operating expenses are expected to rise 50% from present.

Table 9.3.3.4 ② Rain-fed agriculture and stock raising (Sedentary type)

Category	Average Farmland Area	Planted Area	Average Number of Livestock			Corresponding Households		
Present	3.5 ha	4.8 ha	2 cattle, 4 sheep, 5 goats			50 %		
Planned	2.4 ha	3.6 ha	3 cattle, 4 sheep, 5 goats					
	Item	Crops			Stock Raising			Total
		Millet	Sorghum	Cowpeas	Cattle	Sheep	Goats	
Present	Planted Area ha	2.8	0.6	1.4	2 (heads)	4 (heads)	5 (heads)	—
	Unit Yield kg/ha	342	170	88	-	-	-	—
	Total Production kg	958	102	123	-	-	-	—
	Unit Price FCFA	174	167	274	39,210	10,380	7,110	—
	Gross Production Value FCFA	166,692	17,034	33,702	78,420	41,520	35,550	372,918
	Management Expenses FCFA	2,654	405	557	11,120	6,230	5,330	26,297
	Farming Income FCFA	164,038	16,629	33,145	67,300	35,290	30,220	346,621
Planned	Planted Area ha	2.0	0.4	1.2	3 (heads)	4 (heads)	5 (heads)	—
	Unit Yield kg/ha	513	255	106	—	—	—	—
	Total Production kg	1,026	102	127	—	—	—	—
	Unit Price FCFA	174	167	274	63,760	12,000	7,710	—
	Gross Production Value FCFA	178,524	17,034	34,798	191,280	48,000	38,550	508,186
	Management Expenses FCFA	3,982	608	836	40,980	7,220	5,790	59,416
	Farming Income FCFA	174,542	16,426	33,962	150,300	40,780	32,760	448,770

Table 9.3.3.3.5 ③ Rain-fed agriculture + stock raising (Transhumance type)

Category	Average Farmland Area	Planted Area			Average Number of Livestock			Corresponding Households	
Present	3.5 ha	4.8 ha			9 cattle, 11 sheep, 14 goats			10 %	
Planned	2.4 ha	3.6 ha			10 cattle, 11 sheep, 14 goats				
Item	Crops		Sorghum	Cowpeas	Stock Raising			Total	
	Millet				Cattle	Sheep	Goats		
Present	Planted Area	ha	2.8	0.6	1.4	9 (heads)	11 (heads)	14 (heads)	
	Unit Yield	kg/ha	342	170	88	—	—	—	—
	Total Production	kg	958	102	123	—	—	—	—
	Unit Price	FCFA	174	167	274	39,210	10,380	7,110	—
	Gross Production Value	FCFA	166,692	17,034	33,702	352,980	114,180	99,540	784,038
	Management Expenses	FCFA	2,654	405	557	50,040	17,130	14,920	85,707
	Farming Income	FCFA	164,038	16,629	33,145	302,850	97,050	84,620	698,331
Planned	Planted Area	ha	2.0	0.4	1.2	10 (heads)	11 (heads)	14 (heads)	—
	Unit Yield	kg/ha	513	255	106	—	—	—	—
	Total Production	kg	1,026	102	127	—	—	—	—
	Unit Price	FCFA	174	167	274	63,760	12,000	7,710	—
	Gross Production Value	FCFA	178,524	17,034	34,798	637,600	132,000	107,940	1,107,896
	Management Expenses	FCFA	3,982	608	836	136,590	19,870	16,200	178,086
	Farming Income	FCFA	174,542	16,426	33,962	501,010	112,130	91,740	929,810

(2) Stock raising

1) Present situation

In this village, the Haousa agricultural people and the Peuhls stock-raising people have been promoting the development of stock-raising based on a relationship of trust built over a long period. Most of the villagers belong to farm households that have livestock. Some households have UBT-equivalents of over 20. The results of surveying 100 farm households showed that as many as 24 had UBTs of over 5. Excluding livestock being milked for home consumption, many of the village's livestock are entrusted to the Peuhls. From June to December, these are moved to and pastured on natural grasslands in the Abara area. The entrustment fee is a sheaf of millet (20-30 kg of harvests, 10-20 kg after threshing) per head in the case of cattle and per two heads in the case of sheep and goats. During the entrusted period, the Peuhls can use the milk. Livestock are also pastured on the enclaves. The Dabaga enclave has grasses having high nutritive values such as *karangia* (*Cenchrus biflorus*), *gadagi* (*Alyscarpus ovalifolia*), *marack* (*Zorunia Glochidiata*), *faratchawa* (*Aristida mutabilis*) and *komeya* (*Eragrostis tremula*). In the dry season, the livestock return to Tidani and are pastured on millet fields. The main feeds are crop residue such as stalks and leaves of millet, sorghum, cowpeas and peanuts. Other feeds include withered grass on the natural grasslands in the village. Therefore, the number of livestock raised is determined by the quantity of the feed available during the dry season.

The issues of stock-raising include the following. ① There is a national breeding stock ranch near the village. However, due to fund shortage, the villagers cannot even borrow improved breeding stock so that the livestock productivity is low. ② Shortage of facilities to supply water to livestock. ③ Feed shortage during the dry season.

2) Development principle

There is a limit in expanding the production by the agricultural sector due to the severe meteorological conditions and shortage of water resources. Therefore, this village is to be developed mainly through stock-raising. There are limits on the feed and water resources during the dry season so that it is difficult to drastically increase the number of heads. The plan is to develop the livestock productivity by valuing the traditional form of stock-raising based on cooperation by the Peuhls and Haousa peoples. The livestock productivity is to be developed by introducing improved breeding stock through support by the National Toukounous ranch located nearby. The productivity is also to be developed by manufacturing nutritional bricks for livestock by utilizing millet's by-products. The livestock watering facilities are to be repaired.

3) Plan

(a) Livestock raising plan

The feed resources are limited so that it is difficult to drastically increase the number of heads. The feed shortage during the dry season is to be compensated for by developing improved grasslands. The pasture obtained from such grasslands is to be stored as hay and fed to livestock. Through this, cattle are to be increased by 100 heads. No change will be made to other livestock. Table 9.3.3.3.6 shows the livestock raising plan.

The standards for the introduction of breeding bulls are the same as in Dyabou and 6 bulls will be introduced. 100 high-quality brood cows will be introduced. 15 sets of stock nutrition block production tools will be introduced.

Table 9.3.3.3.6 Livestock raising numbers plan

Kind of Livestock	Present		Planned		Notes
	Numbers	UBT	Numbers	UBT	
Cows	430	344	530	424	
Sheep	720	101	720	101	
Goats	1,000	140	1,000	140	
Camels	100	100	100	100	
Donkeys	180	90	180	90	
Horses	20	20	10	10	
Total		795		865	

(b) Fodder supply and demand plan

The village's issue is to secure feed during the dry season. Accordingly, the plan is to develop 100 ha of improved grassland, store hay and feed this to livestock. The pasturage to be introduced in the improved grasslands is to include *karangia* (*Cenchrus biflorus*), *Stylosanthes*

(*Stylosanthes humilis*) and *kiara* (*Cymbopogon schænanthus*). The feed supply and demand plan is shown in Table 9.3.3.3.7 (for the basis of calculation, see Table A9.3.1.3.1-6).

Table 9.3.3.3.7 Calculation of fodder supply and demand

Category	UBT	Required Dry Matter	Estimated Quantity Available			Supply/Demand Balance
			Grassland	Crop Residue	Total	
Present	795	1,886	1,789	421	2,210	324
Planned	865	2,052	1,728	328	2,056	4

(c) Livestock product production plan

Through support by the nearby Toukounous ranch, sire bulls and superior cows are to be introduced to improve the cattle productivity. The livestock products production plan is shown in Table 9.3.3.3.8.

As for the quantities of excreta that can be used for penning (enclosure), 2,120 t from cattle, 504 t from sheep and 700 t from goats can be expected.

Table 9.3.3.3.8 Livestock product production plan

Category	Kind of Livestock	Numbers Raised	Of Which, Number of Adult Females	Products (t)			
				Meat (male)	Meat (female)	Waste Meat	Milk
Present	Cows	430	150	6.30	2.10	3.33	49.50
	Sheep	720	542	4.10	2.03	0.83	17.10
	Goats	1,000	342	3.65	2.70	0.34	14.14
	Total			14.05	6.83	4.50	80.74
Planned	Cows	530	170	14.73	7.48	4.65	85.00
	Sheep	720	322	4.69	2.51	0.95	19.32
	Goats	1,000	186	4.06	3.07	0.37	14.88
	Total			23.48	13.06	5.97	119.20

(3) Community forest

1) Present situation

This region's vegetation can be categorized as follows.

① Sandy soil (*les sols sableux*)

The major tree varieties are *Combretum glutinosum*, *Guiera senegalensis*, *Boscia senegalensis*, *Bauhinia rufescens* and *Ziziphus mauritiana*. There are also grasses *Andropogon gayanus*, *Panicum letum* and *Sida cordifolia*.

② Glacis soil

The major tree varieties are *Acacia albida*, *Balanites egyptiaca*, *Acacia scorpioides* and *Acacia senegal*.

③ Plains and low basins

The major tree varieties are *Acacia albida*, *Balanites egyptiaca*, *Acacia leata* and *Acacia nilotica*.

The issues of the community forest are the same as in Dyabou.

2) Development principle

The issues of the community forest are the same as in Dyabou. However, the following activities are especially necessary.

- ① Rehabilitation of the glacié soil through CES/DRS activities for the purpose of increasing agricultural production.
- ② Dune stabilization.
- ③ Taking of anti-field fire measures.
- ④ Taking of measures to prevent water resources and cultivated land from becoming sand-covered.
- ⑤ In the farmland, planting of tree varieties that fertilize the soil.
- ⑥ The following tree varieties are to be planted.
 - Varieties having economic value: *Adansonia digitata*, *Moringa oleifera*, *Tamarindus indica*, *Borassus eathiopum* (Rônier)
 - Varieties having high nutritive value and value as feed: *Adansonia digitata*, *Acacia raddiana*, *Acacia seyal*, *Parkinsonia aculeata*
 - Varieties to improve the fields' fertility soil: *Acacia albida*, *Acacia nilotica*
 - Shade trees and firewood: *Azadirachta indica* (Neem), *combretacées*
 - Vegetable garden hedges: *Prozopis juriflora*

3) Plan

The plans related to the community forest are as follows.

- ① Education for residents on the necessity to plant trees in fields and vegetable gardens, on roads and in village-owned forests (to produce firewood)
- ② Education for the residents on the danger of field fire and measures to prevent such fire
- ③ Training for residents on the technology to stop dunes
- ④ Training for village representatives on the technology for producing seedlings.
- ⑤ In the terroir management committee, establishment of an organization for managing and maintaining mini-nurseries
- ⑥ Installation of small nurseries to produce seedlings of varieties having economic value
- ⑦ Tree planting for soil rehabilitation, dune stopping and afforestation of wasteland
- ⑧ Maintenance of planted saplings

9.3.3.4 Agriculture, stock raising, and sylviculture support system

(1) Present situation

At the village, and as far as agricultural extension is concerned, the situation is that extension agents in charge of agriculture, stock-raising and environment at the Directorate of Agriculture of the Filingué District Office are providing itinerant guidance only once or twice a year. Since the farmers are facing many problems such as related to farming improvement, soil deterioration and prevention of blights and infestations, such an extension activity cannot be said as sufficient.

In addition to the traditional organization called *samarita* since the colonial times but now stripped of contents, the village has a cooperative association. It was organized by covering all farmers and herders for the purposes of supplying agricultural materials and selling products. Its activities however have been suspended for such reasons as dissolution of the UNC to guide it and the constitution of self-supply agriculture.

(2) Development principle

Development principles are the same as in Kouregou.

(3) Plan

The plan is the same as in Kouregou

9.3.3.5 Market distribution

(1) Present situation

The Village of Tidani is about 25 km from the City of Filingué. The departmental highway and the village are linked by a 4-km road of sandy soil.

In the village grain produced for self-consumption is the main farm product, and commercial crops are not cultivated. As for manual industry, women weave mats and elderly men twist ropes. Some villagers engage in business; a few make clothes, and women sells fried sweets and mats. Virtually no products are supplied from the village except livestock.

Livestock markets near the village include Taisho, Abala and Filingué. Of these markets, Taisho is a market mainly for goats. Cattle are traded in Abala and Filingué markets. As for livestock products, livestock are sent to markets for meat and all milk is self-consumed by the Peuhls with whom it is deposited and the inhabitants. Toukounous ranch located near the village processes milk into dried cheese. Thus, they are in a position to produce milk products on a commercial basis for sale if they learn processing techniques. Although they have no experience producing dry cheese, but they are accustomed to eating it. There are markets for it in Filingue and Niamey.

As for distribution of forestry products, in the village there are no national forests where trees can be cut down by permission, and firewood in the village is for consumption within the village and not for distribution.

There are some problems related to distribution through markets: ① the access road to the national highway is a bad road; ② infrastructure for processing livestock products is not developed; ③ livestock are raised as live savings and not categorized for commercialization, resulting in an extremely low sales rate; and ④ some of the poor farmers do not own a cart or a donkey that provides a means of transportation.

(2) Development principle

A shortage of water resources makes it difficult to increase agricultural production in this village. Therefore, the policy should aim at developing the village by increasing livestock production.

- ① Introduction of the Azawak breed through technical assistance from Toukounous ranch and increase of added value by processing surplus milk into dried cheese.
- ② Installation of crossing works on the Koris crossing roads from the national highway to the village for improvement of distribution access.
- ③ Securing a means of transportation by providing loans for a means of transportation (donkeys, carts, etc.) in the plan for support to agriculture system.

(3) Plan

1) Agricultural roads

Since activities related to agriculture, stock raising and silviculture account for a large portion of all activities on the access road from the national highway to the village, a section of the agricultural road will be improved and crossing works will be provided at one place.

2) Processing

This village produces about 120 tons of milk. Of this, about 60 tons of milk is consumed within the village, and the remaining 60 tons of milk is processed into dry cheese. The plan calls for provision of four home industry facilities for processing. The details of the facilities are shown in Table 9.3.1.5.3. Loans for a means of transportation will be detailed in "Agricultural Support System."

9.3.3.6 Living environment improvement

(1) Present situation

1) Health and hygiene

The village does not have a dispensary. The village's emergency medical service team consists of one emergency medical technician and two midwives. The emergency medical

technician gives medical treatment for headaches, malaria, eye diseases and wounds. The midwives assist women in childbirth at home and help babies grow and suck their mothers' breasts. The activities of the emergency medical service team are limited to within the village, and they are limited by the fact that the village has isolated plots of land. The Medical Service Center makes a tour of medical treatment to compensate for the activities of the village's emergency medical service team. Inhabitants go to the dispensary in the village of Toukounous, which is 10 km away from the village, when they become ill, and when they get seriously ill, they go to the Medical Service Center in the City of Filingué, which is 20 km away from the village. The only hospital near the village is located in the City of Niamey, which is 200 km away from the village. All inhabitants receive traditional treatment from faith healers.

2) Education

A three-class elementary school was constructed in 1982. The present number of pupils is 106, 61 boys and 35 girls. The school attendance rate for boys is higher than that for girls. According to inhabitants, providing education for women is essentially good, but it is also a source of worry (they think that if their children attend to school, the time set aside for them to help with housework is reduced, and thus education turn them into lazy and idle women.). A group of parents carry out maintenance and minor repair work of the school. Three teachers work for the school. The schoolmaster has been working for the school for 15 years and keeps good relationship with inhabitants. Of the remaining two teachers, one has been teaching at the school for three years and the other for two years. Owing partly to the efforts of the schoolmaster, more than 80% of the prospective graduates graduate from the school every year. Just a few graduates are sent to college, and the school in the village of Tidani has not produced even one teacher since 1982 when the school was established.

There is a Koran school that accommodates 20 boys. Like a modern school, the Koran school admits boys from neighboring villages.

(2) Development Principle

1) Health and hygiene

A simple health hut should be set up and first-aid medicine boxes should be provided to establish a system that allows inhabitants to receive necessary minimum initial treatment. Medical supplies should be initially provided by the project, and should be replaced by sale of medical supplies.

2) Education

New classrooms should be added because the number of classrooms is not enough for the number of prospective school children. A small-scale school farm should be provided to give instruction in basic cultivation techniques that will be helpful in the future in addition to providing a normal school education. Trees should be planted along the boundary of the school yard to teach the importance of forest preservation.

3) Information

The village is not electrified, creating a situation where it is difficult to receive information and instructions from the central and local governments. One TV set should be provided to spread information from the national government and familiarize villagers with French, their official language. This will be managed by the terror management committee.

(3) Plan

- ① Construction of a simple health hut, and provision of one set of first-aid medicine boxes.
- ② Construction of a new classroom building, and provision of a 0.01ha school farm (including construction of a new well). Planting trees along the boundary of the school yard (about 400m x 2 lines). Giving instruction in simple vegetable cultivation techniques to students, and teaching them the importance of forest preservation.
- ③ Provision of one solar electricity tower for recharging TV batteries and one TV set to spread information. Giving training in maintenance of facilities.

9.3.3.7 Environmental protection

(1) Present situation

In the Dabaga area, the dunes move often and damage agricultural and water resources. In addition, the plant life is suffering damage in the western portion of the Banguir area and during the rainy season, a large amount of water and soil flows. For this reason, ponds are damaged in the Banguir area and surrounding areas by the flow.

(2) Development principle

- ① Dune stabilization will be carried out in the Dabaga area.
- ② Water and soil flow will be reduced in the Banguir area through plant rejuvenation in the western part.

(3) Plan

- ① Dune stabilization (Dabaga area)
In addition to education the inhabitants regarding the influence of windborne sand on agricultural production and life, the dunes will be stabilized by tree planting.
- ② Grassland replenishment measures on the plains (Banguir area)
On 320 ha of plain area, water retention of the soil and grassland recovery will be achieved by surface ploughing.
The management and maintenance of ① and ② above will be the same as in Dyabou.

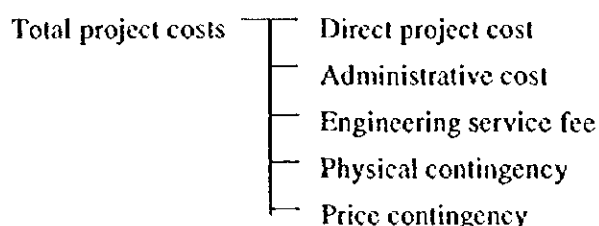
Implementation

Chapter 10 Project Evaluation

10.1 Project cost estimates

(1) Structure of total project costs

The structure of total project costs is as follows: In the case of project implementation, maintenance costs are collected under the form of charges from the beneficiaries by the maintenance group and are not included in the total costs. In the case of activities needed to be conducted by the government under the form of public service, the maintenance costs are included in direct project costs.



1) Direct project cost

Construction cost of the direct project cost includes contractors' fees.

2) Administrative costs

10% of the direct project cost is counted for the major implementation agency as overhead expenses.

3) Engineering service fee

15% of the direct project cost is counted for measurement, tests, design and implementation supervision.

4) Physical contingency

10% of the direct project cost is reserved as an increasing portion of the implementation cost, following incidentals such as design change, climatic variations, etc.

5) Price contingency

10% of the direct project cost is reserved to cope with price escalation during the implementation period.

6) Basic calculation year

The basic calculation year is 1997.

7) Exchange rate

The exchange rate will be FCFA 583.67/US\$, the average of 1997.

(2) Total project cost

The total project cost calculated on the basis of estimation given in the above section (1) is as shown in Table 10.1.1.

Table 10.1.1 Breakdown of total project costs

Area	Name of Plan	Project cost (FCFA million)
1. Agriculture, stock raising, and silviculture improvement plan		
1) Sector of Agriculture		
	(1) Distribution of major cereal ameliorated seeds project	183
	(2) Agricultural land conservation project	18,406
	(3) Improvement of agricultural roads project	2,135
	(4) Rehabilitation of large-scale irrigation facilities project	9,000
	(5) Improvement of small-scale irrigation facilities project	42,788
	(6) Improvement of distribution of agricultural products project	484
	(7) Establishment of land commission project	250
2) Sector of Stock raising		
	(1) Livestock improvement project	521
	(2) Stock raising infrastructure improvement project	323
	(3) Improvement of water supply facilities for livestock project	189
	(4) Improvement of animal hygiene project	300
	(5) Livestock management facilities project	2,520
	(6) Improvement of livestock products distribution project	1,065
3) Sector of Community Forest		
	(1) Establishment of mini nursery project	1,612
2. Improvement plan for agriculture, stock raising, and silviculture support system		
	(1) Agriculture, stock raising, and silviculture support system (organizational, technological support, etc.)	2,506
	(2) Agriculture, stock raising, and silviculture support system (financial support, etc.)	3,271
3. Improvement plan for living environment		
	(1) Improvement of potable water facilities project	7,695
	(2) Information diffusion/education facilities project	79
	(3) Improvement of health/hygiene project	666
	(4) Improvement of education project	4,995
4. Environmental protection plan		
	(1) Soil conservation project	2,466
	(2) Afforestation project	2,177
Total of direct business cost		103,629
Administrative cost		10,363
Engineering service fee		15,544
Physical contingency		10,363
Sub-total		139,899
Price contingency		10,363
Grand total		150,262
(US \$1.00 = 583.67 FCFA)		(US \$257 million)

(See Tableau A10.1.1 - 2 for details)

10.2 Project evaluation

10.2.1 Economic/financial evaluation

(1) Basic assumption

The basic assumption for economic/financial evaluation is as follows.

- 1) **Period for evaluation:** The period for project evaluation has been determined as thirty years.
- 2) **Calculation standard:** The cost and benefit used for project evaluation were calculated on the basis of 1997 prices and an average exchange rate of 1997 of 1.00 US\$ = 583.67 FCFA was used.
- 3) **Economic prices:** Economic prices of goods other than those the international prices of which were known as internationally traded goods were calculated as the domestic market prices denominated in the domestic currency multiplied by a standard conversion factor (SCF) of 0.92.
- 4) **Sensitivity analysis:** Sensitivity analyses were conducted in the case of a 10% increase in the direct project cost (case-1) and in the case of a 20% decrease of the benefit or the amount handled (case-2) in addition to the planned case.

(2) Economic evaluation

Economic Internal Rates of Return (EIRR) was calculated only for projects which should be undertaken by the government and the benefit could be grasped clearly in figure out of the projects included in the Master Plan. The results are shown in the Table 10.2.1.1.

Table 10.2.1.1 Calculated economic internal rates of return (EIRR)

Project name	Case	EIRR	Remarks
1) Distribution of improved major cereal ameliorated seeds	Plan	17.4%	The costs for agriculture, stock raising, and sylviculture support system (organizational support, technical support, etc.) out of the improvement plan for agriculture, stock raising, and sylviculture support system are included in the project cost. As a 20 % increase in yield is anticipated as the effect of the agricultural land conservation, the expenses required for the agricultural land conservation are included in the ordinary expenses for farming.
	Case 1	17.3%	
	Case 2	12.4%	
2) Rehabilitation of large-scale irrigation facilities	Plan	7.7%	The maintenance costs of facilities are included in the expenses for farming.
	Case 1	6.4%	
	Case 2	4.9%	
3) Improvement of small-scale irrigation facilities	Plan	24.1%	
	Case 1	21.8%	
	Case 2	19.0%	
4) Livestock improvement	Plan	146.2%	The costs of the livestock infrastructure improvement, the improvement of water supply facilities for livestock, the improvement of animal hygiene and the livestock management facilities are included in the calculation.
	Case 1	134.4%	
	Case 2	120.2%	
5) Seedling production	Plan	22.6%	The costs for improvement of the central nursery are included in calculation.
	Case 1	21.7%	
	Case 2	20.4%	

(See Tableaux A 10.2.1.1 - 6)

Except the rehabilitation of large-scale irrigation facilities, all the other projects are considered appropriate for implementation as their effects exceed the opportunity cost of capital, 10 to 12% employed generally in West Africa.

Though the EIRR of the large-scale irrigation project is as low as 7.7% for the planned case, the government considers it appropriate to promote the project because ① the project can be expected to lead to the stable production of cereals unlike rain-fed agriculture, ② the project could become a model case in consideration of future diffusion of irrigated rice fields that can be developed along the Niger river, and ③ implementation of the project will have a foreign currency saving effect, as Niger imports several ten thousand plus tons of rice every year.

The EIRR of the livestock improvement project shows 100% or more in either of the cases. This is because livestock have not been supplied to the market sufficiently as commercial products in spite of high potential for a livestock products industry due to the traditional custom in Niger whereby social status is demonstrated by the number of livestock owned. A key issue in pursuing the project will be how smoothly people can be made more aware of the fact that the livestock could be distributed in the market place as commercial products.

(3) Financial evaluation

The financial evaluation is carried out for judgement of the appropriateness of a project from the view point of private business, and the calculated Financial Internal Rate of Return (FIRR) of the improvement of livestock products distribution and the improvement of small-scale irrigation facilities planned under the priority projects is shown in Table 10.2.1.2.

Table 10.2.1.2 Calculated economic internal rates of return (EIRR)

Project name	Case	FIRR	Remarks
1) Production of dry cheese	Plan	72.7%	
	Case 1	67.9%	
	Case 2	61.9%	
2) Production of yogurt	Plan	19.4%	
	Case 1	17.5%	
	Case 2	15.3%	
3) Fresh milk collecting and shipping facilities	Plan	11.9%	
	Case 1	9.8%	
	Case 2	7.1%	
4) Improvement of small scale irrigation facilities (the Dyabou village)	Plan	18.1%	When the construction cost of a bridge dam is included in the calculation, each FIRR is 2.3%, 1.6%, 0.7%, respectively.
	Case 1	16.5%	
	Case 2	14.6%	
5) Improvement of small scale irrigation facilities (the Kourégou village)	Plan	12.4%	
	Case 1	11.1%	
	Case 2	9.5%	
6) Improvement of collecting and shipping facilities (the Dyabou village)	Plan	17.2%	
	Case 1	14.9%	
	Case 2	11.0%	

(See Tableaux A 10.2.1.7 - 12)

The FIRR of both the production of dry cheese and yogurt exceeds the estimated real interest rate of 15.0% in Niger, hence satisfactory from the view point of financial evaluation.

In the case of the production of dry cheese, FIRR was calculated on the assumption that the planned production would reach a peak after five years following the development and securing of demand during the initial five years time after the start of operation in consideration of limited demand for dry cheese at the time of establishment of the plan. Although the FIRR is sufficiently large, the key issue for successful implementation of the production of dry cheese is development of demand for dried cheese.

In the case of fresh milk collecting and shipping facilities, the FIRR is less than 15% even in the planned case. This is because the cost of the means of transport (two-ton truck) is large compared to the benefit realized. In implementing the project, introduction of inexpensive means of transportation such as motor cycles should be considered.

In the case of bridge dam in the Dyabou village, the project is financially not viable when the construction cost is shouldered by the beneficiaries. While the project is viable when the beneficiaries bear only the cost of field development.

Although IRR was not calculated for the production of livestock nutritional bricks, the project is expected to be viable from the beginning of the project implementation. As it is an inexpensive project, the rural population could fully manage the project.

In common for all projects, it is recommended to study well the population's demand for the project before the implementation.

10.2.2 Social evaluation

(1) Agreement with higher-level plans and programs

The following four basic programs are described in the national rehabilitation plan.

- 1) National program for combating poverty
- 2) National program for promoting the private sector
- 3) National program for enhancing the management of the economy and promoting good governance
- 4) National program for promoting sustainable development of the environment

Of the four major programs mentioned above, the Master Plan is in direct agreement with program number 1 above, in addition to number 4 concerning the PNEDD.

(2) Priority projects

The following priority items will be described by area in the annual summary regarding the execution of the projects for Tillabéri and the urban community of Naimey.

1) Priority items in the area of rural development

Management of natural resources, improvement of the living environment of local inhabitants, enhancement of the participation and responsibility of local inhabitants, improvement of the rate of self-sufficiency in food.

2) Priority items in the area of health and hygiene

Training and instruction to local inhabitants, improve the rate of preventive vaccinations, provide low-priced basic medical and pharmaceutical supplies, allocation of budget for the field of health and hygiene.

3) Water usage

The Master Plan is in accord with the priority items of all of the national programs 1 – 4 mentioned above with respect to improving of supplies of potable drinking water for people and livestock through the development of surface and ground water sources.

(3) Participation of the local inhabitants

The concept of terroir management, in which the local inhabitants themselves actively participate in the entire process of a project, is to be incorporated in implementing the projects

planned for the village level. Consequently, the awareness and management ability of the people themselves will be enhanced through the implementation of each project activity.

(4) Equitable distribution of benefits

Numerous projects are proposed, such as the introduction of flour grinders, mini-nurseries, and small-scale loans, amongst others, in order to increase benefits to women, who are socially disadvantaged.

10.2.3 Forecast of food supply and demand

(1) Low degree of self-sufficiency of major cereals

According to the environmental analysis summary of the department of Tillabéri, demand for major cereals per person per annum is 250 kg for rural regions and 200 kg for urban and nomadic regions. Trial calculations of the degree of self-sufficiency of major cereals (total of millet, sorghum and cowpeas for the target year of 2014) indicate 44.5%, 61.9% and 70.9% respectively for the following three different scenarios in terms of population growth and implementation of the Master Plan.

- ① Scenario 1: Population growth of 3.3%, with food production staying level,
- ② Scenario 2: Population growth of 3.3%, with food production increasing through implementation of the Master Plan,
- ③ Scenario 3: Population growth gradually decreasing from 3.3% to 2.5% (target year: 2014), with food production increasing through implementation of the Master Plan.

The degree of self-sufficiency under Scenario 3 which anticipates a gradually declining population growth rate under Scenario 2 shows an improvement of approximately 10% compared to scenario 2, if not reaching the current (1996) level of self-sufficiency (82.2%). This means that the increase in demand for food due to the population growth which exceeds the growth of food production is a cause of the shortage of food. This leads to excessive practice of agriculture, livestock and sylviculture, in turn presenting a serious threat to the natural environment.

In short, the high rate of population growth is a major cause of the acceleration of desertification. Hence, measures to limit population growth are an issue of crucial concern.

Table 10.2.3.1 Degree of self-sufficiency of major cereals by scenario

	Production volume (tons)	Necessary volume (tons)	Degree of self-sufficiency (%)
Current status	364,987	443,965	82.2
Scenario 1	364,987	820,824	44.5
Scenario 2	508,458	820,824	61.9
Scenario 3	508,458	717,207	70.9

(2) Nutrition

According to the Food Supply/Demand Table of the FAO, the average supply in calories per person/per day to the entire population of Niger during 1987 to 1996 was 2,059 Kcal, comprising 56.2 g. of protein and 31.3 g. of fat (Table 10.2.3.2).

This level is as low as 85.8%, 78.6% and 75.0% respectively in terms of calories compared to those of the Africa, developing countries and the whole world, exhibiting severe food conditions in this country. In terms of ingredients of food, the ratio of protein is relatively high, and that of fat relatively low. In particular, fat is as low as about 50% compared to the developing countries and the whole world.

Table 10.2.3.2 Status of supply of nutrition

Nutrient type and unit per person		Supply per day				Comparison of Niger to other world (%)		
		Africa	Developing countries	Whole world	Niger (national average)	To Africa	To developing countries	To the whole world
Calories	kcal	2,400	2,619	2,745	2,059	85.8	78.6	75.0
Protein	g	59.5	66.4	73.4	56.2	94.5	84.6	76.6
Fat	g	50.5	57.4	70.1	31.3	62.0	54.5	44.7

(3) Self-supply of food in terms of calories

The self-supplied calories in the department of Tillabéri are estimated to be currently (1996) 1,972 kcal based on FAO's Food Supply/Demand Table (see Table 10.2.3.3). Also, the self-sufficient calories in 2014 under Scenario 2 of 10.2.3.1 is estimated to be 1,390 kcal. The degrees of self-supplied of calories expressed as the said 1,972 kcal and 1,390 kcal divided by the average supply of calories of 2,116 kcal are 95.8% and 67.5%, respectively. By product, supply of rice, meat and milk in these areas is currently as high as 310%, 157% and 122% respectively compared to the national average thanks to the Niger river flowing through the Study Area and reflecting relatively greater rainfall in the area for this country.

As a result, although the level of supply of calories is low at present, it will become necessary for about 30 to 40% of the supply of calories to be imported or supplied by aid in 2014 when taking into consideration future population growth.

Table 10.2.3.3 Trial calculation of self-sufficiency of food in terms of calories

Item	FAO's Food Supply/ Demand Table		Food supply/demand estimate in the department of Tillabéri					
	All of Niger		1996			2014		
	Supply of food per person		Supply of food per person		Degree of self- sufficiency of calories (%)	Supply of food per person		Degree of self- sufficiency of calories (%)
	kg/year	kcal/day	kg/year	kcal/day		kg/year	kcal/day	
	A		B	B/A		C	C/A	
Total		2,059		1,972	95.8		1,390	67.5
Kind of cereal	217	1,492	201	1,444	97	143	1,015	68
Wheat	8	58	0	0	0	0	0	0
Rise	10	96	31	298	310	19	177	184
Corn	1	10	1	10	100	1	5	50
Millet	155	1,048	156	1,055	101	114	769	73
Sorghum	42	280	12	81	29	10	64	23
Potatoes	28	83	29	84	101	15	43	52
Beans	18	167	11	97	58	7	67	40
Vegetables	25	22	25	22	100	18	16	73
Fruits	6	13	6	13	100	3	7	54
Meat	13	51	20	80	157	20	80	157
Eggs	1	2	0	1	50	0	1	50
Fish	1	1	1	1	100	0	1	100
Milk	32	45	39	55	122	49	69	153
Others		7		171			92	

Note: The Food Supply/Demand Table of the FAO shows the average from 1987 to 1996.