## 4.7 Social infrastructures

(1) Health and hygiene

Life expectancy in Niger is 47.5 years of age; while the infant death rate is 191 per 1000, the child death rate (below 5 years) is 320 per 1000, and the maternal death rate is 7 per 1000 births. A comparison of these figures with the average life expectancy of 62 years and a child (below 5 years old) death rate of 73 per 1000 of other low income countries, for example, highlight the fact that Niger is far behind.

In addition, the health and sanitation level in the Study Area, as well as the rate of poverty in the Study Area (80%) is worse than the national level (63%).

The number of medical and health facilities in each district in the Study area are shown in Table 4.7.1.

**Table 4.7.1 Number of medical and health facilities in the Study area**

| District | Filingué | Kollo | Ouallam | Say | Téra | Tillabéri | Total |
|---|---|---|---|---|---|---|---|
| District hospitals | 1 | 0 | 1 | 1 | 1 | 1 | 5 |
| Maternity and pediatric hospitals | 1 | 2 | 3 | 1 | 1 | 2 | 10 |
| Medical centers | 0 | 1 | 1 | 1 | 1 | 1 | 5 |
| Village dispensaries | 12 | 10 | 9 | 7 | 13 | 12 | 63 |
| Pharmacies | 1 | 1 | 0 | 1 | 1 | 1 | 5 |
| Medication retailers | 12 | 5 | 4 | 7 | 11 | 13 | 52 |

Source: Hearing from the Direction de la Santé of the each district by the Study team.

The Ministry of Health established a Development Plan 1994-2000 for the health and hygiene sector, and the IBRD is the major donor supporting it. However, the amount of aid is not sufficient to supply the required level.

(2) Potable water

The coverage rate of the potable water supply facilities in the department of Tillabéri is roughly 44% (PNEDD), with variations by district. The Master Plan for the development and management of water resources of Niger established by the Ministry of Water and the Environment provides the following installation criteria for the supply of potable water:

① Installation of one modern well (Generic term which means OFEDES (the Office of Underground Water under the Ministry of Water and Environment) type well, tube well or compound well of previous two types) within 5 km from the center of villages with 250 inhabitants or less

② Installation of one modern well per 250 inhabitants for villages of 250-1,500 inhabitants

③ Installation of one small-scale potable water supply system for villages of more than 1,500 inhabitants

Table 4.7.2 presents an overview of the installation situation of water supply facilities in the department of Tillabéri, and in Niger as a whole. Figures are somewhat greater than those of PNEDD.

**Table 4.7.2 Current state of potable water supply facilities**

| Distinction | Water supply system | | Wells | | Tubewells | | Coverage (%) |
|---|---|---|---|---|---|---|---|
| | BES. | EXST. | H.S. | OP. | H.S. | OP. | |
| Department of Tillabéri | 6,470 | 3,374 | 151 | 1,749 | ND | 1,625 | 52 |
| Nation | 30,498 | 16,024 | 357 | 9,947 | 102 | 6,077 | 53 |

BES.: Need; EXST.: Existences; H.S.: Out of order; OP.: In operation
Source: Le schéma directeur de mise en valeur et de gestion des ressources en eau du Niger (31/12/1995)

The PNEDD has set a goal of achieving a potable water supply coverage of 70% based on the above-mentioned criteria by the year 2000.

(3) Education

The average school attendance rate in the Study area is 23.1%. The major reason for the low rate is because of the absolute shortage of schools due to the lack of budget on the part of the government. The government has set a target of achieving a school rate of 35% by the year 2000. To achieve the target, a total of 2,594 new classrooms need to be constructed. At present, there are no prospects of funding for 1,170 classrooms (226 classrooms in the department of Tillabéri) out of the target. The school age population was 354,385 children in 1997, and in twenty years it is expected to nearly double reaching 678,394. It is desirable that sufficient budget funds be earmarked for this sector to increase school and literacy rates. Further, there is a big difference in school rate between girls and boys; the rate for girl students is low at all school levels ( elementary school, middle school and high school).

**Table 4.7.3 Status of primary schools in each district**

| Item | Filingué | Kollo | Ouallam | Say | Téra | Tillabéri | Total |
|---|---|---|---|---|---|---|---|
| Primary schools | 132 | 141 | 79 | 62 | 114 | 94 | 622 |
| Classrooms | 404 | 461 | 227 | 215 | 352 | 351 | 2,010 |
| Male students | 8,403 | 7,164 | 3,700 | 4,613 | 7,260 | 6,629 | 37,769 |
| Female students | 5,181 | 5,869 | 3,223 | 3,716 | 5,342 | 5,776 | 29,107 |
| Total student population | 13,584 | 13,033 | 6,923 | 8,329 | 12,602 | 12,405 | 66,876 |
| School attendance rate (%) | 19.92 | 27.55 | 17.05 | 17.56 | 21.7 | 35.04 | 23.1 |

Source: Data of department of Tillabéri (1997)

(4) Major issues to be addressed

Minimal social infrastructures need to be established in order to ensure healthy daily life. All inhabitants should have access to services, even if such services are of low quality. However, the accessibility rates of services for health and hygiene, potable water and education are currently very low in the Study area. This is an obstacle to long-term development in all areas. The development of those sectors which contribute to the improvement of the capabilities of the local society is indispensable to securing wide and effective implementation of measures to combat desertification through sustainable development of agriculture, stock raising, and sylviculture.

## 4.8 Environment

National forests and soil conservation, which are closely related to the desertification combat plan and animal and plant resources which are important items in the environmental impact assessment are as follows.

(1) Animal and plant resources

1) Major animal and plant resources

The Study area has the following abundant animal and plant resources:

① The only national park, the "W" national park which is in a humid area and has been classified as a global heritage under the Ramsar Convention (considered a water bird habitat).

② Total fauna reserve of Tamou, in the vicinity of the national park.

③ Giraffes preserve in Kouré where they form a unique group, in western Africa.

④ Various mammals, including hippopotamuses and manatees, birds, amphibians, fish and insects along the Niger river and its tributaries.

2) Major issues to be addressed

① Dwelling and hunting are prohibited in the national park and in the fauna reserve. However, population growth in the vicinity results in poaching, illegal grazing and frequent forest

fires, inadvertently caused by people, which is a threat to the protection of these abundant natural resources.

② Competition between hippopotamus and men for the use of flood areas along the river, which are used as the natural habitat of hippopotamuses, as well as for agricultural purposes, or as grasslands for animals; the number of manatees is decreasing because of a reduction in its natural habitats and poaching.

(2) National forests

1) Classification of national forests

An environmental analysis summary of the department of Tillabéri reveals that the department has a total 621,192 ha of national forest, of which 60,615 ha are classified forests (five locations) and 560,577 ha as protected forests (twenty-two locations). Although cultivation is prohibited in the national forests, the collection of other forest products is authorized (see Tableau A4.8.1 – 2).

2) Major issues to be addressed

Laws and ordinances relating to natural forest management have been enforced by the GON which has been responsible for forest management since 1989. These laws and ordinances (Ordinance No. 92-037, Aug 21, 1992, Government ordinance No 92-279 Aug 21, 1992, Ordinance of the Ministry of Hydraulic and Environment No 09, Feb 23, 1993) make it possible for the administration in charge of forest management to make use of the labor of the local population. However, it has not been implemented due to a lack of personnel and budget.

(3) Soil conservation

1) State of soil degradation

The current state of desertification in plains and slopes other than that of agricultural land which are the object of soil conservation measures are described in "Section 4.4.1 Agriculture, (3) Degradation of agricultural land and other lands". Although, human factors and natural factors such as type of soil, rainfall vary in their respective impact on degradation depending on the region, the Study area as a whole is easily prone to be degraded.

2) Major issues to be addressed

(a) Negative influence on the population living downstream of the koris which are degraded due to soil erosion

Soil erosion is also rapidly progressing on non-agricultural land because of overgrazing and excessive tree cutting. This causes a reduction in the amount of land and soil resources of the area and has a negative impact on the agricultural production and life of populations living downstream. Therefore, soil erosion control measures should be urgently implemented on the grasslands and slopes located upstream of koris.

(b) Lack of management or operational system

The concerns to be addressed with regard to this issue are similar to those described in "Section 4.4.1 Agriculture, 'Inadequate control and management system' and 'Poor technical support system'".

# Chapter 5 Obstacles and Concrete Measures to Combat Desertification

Factors resulting in desertification, in addition to natural ones, include artificial (human) factors such as population increase, poverty, political causes and the influence of international economic conditions. These various factors all link together to form a vicious cycle. In order to break the cycle and promote the combat of desertification, it is necessary to take measures against each of these negative factors.

The results of a questionnaire distributed to inhabitants and local leaders as well as a field survey, covering the issues related to combating desertification taken up by the survey group, negative factors and concrete measures taken to counteract them are discussed herein.

## 5.1 Recognition and desires of local inhabitants regarding desertification

The Survey group, in cooperation with the departments and districts, selected 6 villages to represent the 6 districts in the Department of Tillabéri and conducted an agricultural questionnaire survey. The results of the survey with regard to desertification combat measures desired by the inhabitants and the level of consciousness of the inhabitants concerning the advance of desertification.

(1) Awareness of the advance of desertification by the local population

The population in each village is very much aware of the advancement of desertification, with the lowest figures being 84% in Mala in the district of Kollo. In other villages the percentages range from 98 to 100%. People are aware of the reduction of millet, fodder, and firewood production, as well as the reduction in the amount of rainfall and river flow.

Table 5.1.1 presents the reasons most commonly given for desertification by local inhabitants in descending order. They are different by village.

**Table 5.1.1 Reasons most commonly given for desertification by local inhabitants in descending order**

| District | Village | 1st | 2nd | 3rd | 4th | 5th |
|---|---|---|---|---|---|---|
| Filingué | Tidani | Decrease in rainfall | Deforestation | Farmland development | Fallow abandonment | Livestock augmentation |
| Kollo | Mala | Decrease in rainfall | Deforestation | Wind erosion | Livestock augmentation | Farmland development |
| Ouallam | Mangaizé | Decrease in rainfall | Deforestation | Fallow Abandonment | — | — |
| Say | Dyabou | Deforestation | Rainfall decrease | Farmland development | — | — |
| Téra | Kourégou | Livestock augmentation | Rainfall decrease | Deforestation | Farmland development | Fallow abandonment |
| Tillabéri | Ziban | Decrease in rainfall | Deforestation | Fallow Abandonment | — | — |

(2) Measures proposed by local inhabitants for addressing problems related to desertification

Table 5.1.2 presents a complete summary of the problems resulting from desertification and the countermeasures taken by local inhabitants.

**Table 5.1.2 Problems for desertification and the countermeasures given by local inhabitants**

| Problems relating to desertification | Proposed measures |
|---|---|
| Insufficient agricultural production | Utilization of organic fertilizer, Cultivation during dry season (with fences, wells, etc.), Introduction of agricultural credit |
| Shortage of food | Installation of cereal bank, Introduction of precocious varieties, Food for work, Food aid |
| Shortage of potable water | Repair or newly construction of wells |
| Livestock under-sized | Injection of supplemental nutrition, Education of breeders, Rent of livestock |
| Soil degradation | CES/DRS, Tree plantation |
| Overwork of women | Repair or newly construction of wells, Installation of mill |
| Health problems | Installation of clinic, Arrangement of village first aid workers |
| Shortage of fodder | Utilization of agricultural chaff |
| Silted water points | Dredging |
| Migration | Weaving, stock raising |
| Shortage of firewood | Installation of village tree nurseries |

(3) Measures desired by local inhabitants

Table 5.1.3 presents a summary of the measures desired by local inhabitants to combat desertification. Appropriate desertification combat activities were selected based on this data.

**Table 5.1.3 Measures desired by local inhabitants**

| Measures | Tidani | Mala | Ziban | Dyabou | Kourégou | Mangaizé | Total point | Order |
|---|---|---|---|---|---|---|---|---|
| Cereal bank | +2,+2 | - | +2,+2 | +1,+2 | +2,+2 | - | +15 | 8 |
| Food for work | - | - | - | - | +2,+2 | - | +4 | 22 |
| Emergency food aid | - | - | - | - | +2,+2 | +2,+2 | +8 | 18 |
| Introduction of precocious variety of millet | - | - | - | +2,+2 | - | - | +4 | 22 |
| Provision of agricultural tools | +2,+2 | +2,+2 | - | - | +2,+2 | +1,+2 | +15 | 8 |
| Provision of fertilizer | +2,+2 | +2,+2 | - | +2,+2 | +2,+2 | +1,+2 | +19 | 2 |
| Provision of agricultural chemicals | +2,+2 | - | +2,+2 | - | - | - | +8 | 18 |
| Agricultural credit | +2,+2 | +2,+2 | +2,+2 | +2,+2 | - | - | +16 | 6 |
| Improvement of water facilities | | | | | | | | |
| - Pond dredging | +1,+2 | +1,+1 | +2,+1 | - | - | +2,+2 | +12 | 14 |
| - Wells for cultivation in dry season | +2,+2 | +2,+1 | +2,+2 | +2,+2 | +2,+1 | +2,+2 | +22 | 1 |
| - Wells for potable water | +2,+2 | +1,+2 | +2,+2 | - | +2,+2 | +2,+2 | +19 | 2 |
| - Renovation of bored wells | +2,+2 | - | +2,+2 | - | +2,+2 | +2,+2 | +16 | 6 |
| Development of vegetable field | +2,+2 | +1,+1 | - | +2,+2 | +2,+1 | - | +13 | 10 |
| Support to women | | | | | | | | |
| - Mill | +2,+2 | +2,+1 | - | +1,+1 | +2,+2 | - | +13 | 10 |
| - Training | +2,+1 | - | +2,+1 | - | - | +2,+2 | +10 | 16 |
| Establishment of dispensary | +1,+2 | - | +2,+2 | +1,+2 | +1,+2 | - | +13 | 10 |
| Rehabilitation of dispensary | - | - | - | - | - | +2,+1 | +3 | 27 |
| Classroom construction | - | - | - | +1,+1 | - | - | +2 | 31 |
| Provision of school textbook | - | - | - | - | - | +2,+1 | +3 | 27 |
| Establishment of Franco-Arabic school | +2,+1 | - | - | - | - | +1,+1 | +5 | 21 |
| Establishment of middle high school | - | - | - | - | - | +1,+1 | +2 | |
| Livestock hygiene(vaccination) | +2,+2 | - | +2,+2 | - | - | +2,+1 | +11 | 15 |
| Fodder production | - | - | +2,+1 | - | - | - | +3 | 27 |
| Livestock multiplication | - | - | - | - | - | +2,+1 | +3 | 27 |
| Improvement of stock and raising techniques | +2,+2 | +1,+2 | - | +2,+1 | +2,+1 | - | +13 | 10 |
| CES/DRS | +2,+2 | +1,+1 | +2,+2 | - | +2,+1 | +2,+2 | +17 | 5 |
| Reforestation(nursery) | +2,+2 | +2,+1 | +2,+1 | +2,+2 | - | +2,+2 | +18 | 4 |
| Improved cooking stove | +2,+2 | - | - | - | - | - | +4 | 21 |
| Development of agricultural roads | +1,+2 | +1,+1 | +2,+2 | +1,+2 | - | +1,+1 | +14 | 9 |
| Construction of mosque | - | - | - | +2,+2 | - | - | +4 | 22 |
| Establishment of village market | +2,+1 | - | +2,+1 | +2,+1 | - | - | +9 | 17 |
| Rehabilitation of weekly market | +2,+1 | - | - | +2,+1 | - | - | +6 | 20 |
| Support to art craft activities | +2,+2 | - | - | - | - | | +4 | 22 |

*Points are given according to the importance in feasibility and priority respectively. (+2) : Important, (+1) : Not very important, (-) : Not desired.

## 5.2 Requests of local and regional administrators

A questionnaire was given to the chiefs of each district and canton, and an interview was conducted based on this questionnaire. The themes of the questionnaire included issues to be addressed with respect to agriculture/stock raising/sylviculture, poverty, women, ethnic groups, and combating desertification. Their requests and proposals to combat desertification with respect to socio-economy, agriculture/stock raising/sylviculture, and agricultural infrastructures are shown in Table 5.2.1, based on the results obtained. This revealed that the contents of the table are similar to the contents of Tableau A5.3.1.

## Table 5.2.1 Requests expressed by local and regional administrators and proposals to combat desertification

| Category | | Filingué | Kollo | Ouallam | Say | Téra | Tillabéri |
|---|---|---|---|---|---|---|---|
| Socio-Economic | Poverty | • Reinforcement of the small scale rural credit system<br>• Increase of the inhabitants income through CED/DRS | • Diversification of agricultural products | • Sedentarization of the inhabitant<br>• Diversification of economic activities | • Reinforcement of forest resource management<br>• To give inhabitants responsibility and their organization<br>• Funding from the Government<br>• Assistance from donor agencies | • Increase of school attendance rate<br>• Reduction of baby death rate, through the improvement of health and hygienic conditions | • Organization of the inhabitants<br>• Assistance from the Government and donor agencies<br>• Improvement of the education conditions |
| | Women | • Installation of a mill<br>• Organization of women groups<br>• Credit scheme to women<br>• Aid for the production of vegetables and fruits<br>• Promotion of the participation of women in development activities | • Improvement of education level<br>• Enactment of the family code<br>• Riddance from the traditions and religion | • Promotion of small scale trade and small handcraft workshops<br>• Installation of a mill and introduction of carts<br>• Increased number of wells<br>• Reinforcement of women training program<br>• Improvement of social security | • To give farmers the right to own lands<br>• To give the community a decision-making power<br>• Relief from heavy workload<br>• Production of cash crops by the women group | • Promotion of populations' participation in economic activities<br>• Relief from heavy workload | • Participation of women in economic activities<br>• Elimination of sexual discrimination<br>• Promotion of school attendance opportunity<br>• Reinforcement of financial aid |
| Agricultural/Stock raising/Sylviculture | Agriculture | • Development of underground water<br>• Restricting animals from having access to agricultural lands<br>• Measures to restore soil fertility | • Improvement of millet variety<br>• Promotion of irrigated agriculture<br>• Promotion of vegetable gardening | • Measures to prevent soil degradation<br>• Introduction of new agricultural techniques<br>• irrigated agriculture using the ponds and swamps | • Measures to prevent soil degradation<br>• New land development, as a result of population pressure<br>• Provision of cheap agricultural materials<br>• Insect control measures | • Introduction of agricultural machines<br>• Introduction of new varieties<br>• Creation of the farmers' organization allowing rational use of surface water<br>• Promotion of vegetable gardening | • Promotion of irrigated agriculture for vegetables and fruits<br>• Development of rice farming<br>• Measures to prevent soil degradation |
| | Stock raising | • Construction of a veterinarian storage<br>• Restoration of degraded grassland<br>• Provision of funds to herders organization<br>• Organization of herders<br>• Rehabilitation of wells | • Creation of improved grasslands<br>• Solving problems related to the transformation of animal corridors into agricultural lands<br>• Prevention of diseases<br>• Increased number of facilities for animal water supply | • Measures against diseases<br>• Increased number of facilities for animal water supply | • Increased number of facilities for animal water supply<br>• Rehabilitation of natural grasslands<br>• Adjustment of animal density, during transhumance<br>• Development of livestock infrastructures<br>• Elimination of noxious weeds from the grassland | • Establishment of a distribution network, and organization of distributors<br>• Improvement of the livestock vaccination rate<br>• Rehabilitation of grasslands | • Securing animal corridors<br>• Rehabilitation of grasslands |
| | Sylviculture | • Adapted pasturage of livestock<br>• Planned reafforestation for fire wood | • Reinforcement of cutting control system for fire wood | • Planned reafforestation | • Measures to conserve oil erosion<br>• Planned reafforestacion and cutting | • Reafforestation | • Adapted pasturage<br>• Planned reafforestation |

| Category | Filingué | Kollo | Ouallam | Say | Téra | Tillabéri |
|---|---|---|---|---|---|---|
| Village level infrastructures | • Rehabilitation of potable water supply facilities<br>• Construction of access road from the major road | • Construction of potable water supply facilities | • Construction of potable water supply facilities<br>• Construction of a dispensary<br>• Improvement of roads | • Construction of a dispensary | • Construction of potable water supply facilities | • Construction of distributing infrastructures<br>• Construction of potable water supply facilities |
| Proposal for desertification control | • Appropriate land clearing and development of pasture<br>• Reinforcement of the agricultural sector<br>• Development of irrigated agriculture<br>• Protection of natural resources<br>• Improvement of rural credit scheme at village level | • Enlightenment of the inhabitants<br>• Conservation of agricultural lands and reafforestation<br>• Construction of reservoir | • Reafforestation<br>• Rehabilitation of degraded soils<br>• Use of alternative energies<br>• Financial aid from donor agencies<br>• Improvement of education<br>• Development of gullies and ponds | • Reinforcement of agriculture/stock raising through limitation of moving agriculture and pasturage<br>• Reform to raise the awareness of farmers and herders<br>• Stable provision of required tools and materials<br>• Control of adapted land use by the Government<br>• Development of the 5 tributaries of the Niger river | • Agricultural lands conservation<br>• Reafforestation<br>• Education of farmers<br>• Development of 3 tributaries of the Niger river | • Financial aid from donor agencies<br>• Education of farmers |

Source: Arrangement of survey results by questionnaire and interview

## 5.3 Obstacles and concrete measures to combat desertification

The main reason of the continued progress of desertification is the exhaustion of resources. Poverty by exhaustion of resources without any replacement or renewal of resources aggravates desertification. This table specifies obstacles to combat desertification and concrete measures that can be taken. This table has been developed based on data collected by members of the JICA Study team in the course of field and commissioned studies. The data is classified by politico-administrative, social, economic, agriculture-stock raising-sylviculture, and environmental areas, as well as specific obstacles in each area and the measures that should be taken.

Concrete measures adapted to combat desertification were selected, based on all these obstacles, and are presented in Table 5.3.1. These elements will be covered in the Master Plan.

**Table 5.3.1 Obstacles and concrete measures to combat desertification in the Study area**

| Issue to be addressed | Obstacle | Concrete measures |
|---|---|---|
| 1) Politico-administrative area<br>・Delayed implementation of desertification control measures | ・Non application of the various national plans and of the legislative system | ・Development and implementation of national action plan<br>・Utilization of NGOs and media<br>・Collection of autonomous exploitation fund |
| ・Government budget is insufficient to cover agriculture sector requirement | ・Insufficient national budget | ・Increase of tax revenues for the development of the secondary sector, tax reform. |
| ・Ineffective support | ・Lack of coordination among the donor agencies<br>・Lack of aid reception system in the beneficiary country | ・Harmonized aid through coordination among donor agencies, including NGOs |
| | ・Lack of participation of residents | ・Promotion of projects, based on terrior management |
| 2) Social area<br>・Weak literacy and school rates | ・Insufficient number of schools and teachers | ・Increase of the number of class rooms, enhancement of training for teachers, promotion of employment of voluntary teachers |
| ・High child death rate | ・Lack of health facilities<br>・Insufficient number of health facilities, doctors and nurses | ・Development of wells and water supply facilities<br>・Construction of health facilities |
| ・Population pressure (high growth rate)<br>・Heavy workload for women | ・Early marriage age, and big number of birth<br>・Social customs<br>・Low basic education level<br>・Absence of land and property management system | ・Education on family planning<br>・Reduction of women's work load through the introduction of mills<br>・Promotion of the participation of women in projects<br>・Expansion of small scale credit system for women |
| 3) Economic area<br>・Deficit of trade balance | ・Lack of competitive products for the international market | ・Production of exportable commercial products |
| ・Deficit of national finances | ・Fragility of industries | ・Development of the secondary industry, through agricultural product processing |
| ・No achievement of food self-sufficiency rate | ・Unstable production due to droughts<br>・Increased demands as a result of population growth<br>・Reduction of arable lands as a result of desertification<br>・Unused of water resources | ・Rational land use and improvement of agricultural production techniques<br>・Reduction of population growth rate by way of appropriate family planning<br>・Adjustment of the agriculture, stock raising and sylviculture area<br>・Legal institutionalization of land ownership and access to membership community lands, etc.<br>・Low cost development of water resources |

| Issue to be addressed | Obstacle | Concrete measures |
|---|---|---|
| 4) Agriculture, stock raising and sylviculture area | | |
| (1) Agriculture | | |
| ・Low agricultural productivity | ・Continuous cropping of the conventional varieties | ・Establishment of ameliorated seeds multiplication facility and the distribution system |
| | ・Excessive cropping | ・Keep a proper fallow period |
| | ・Surface soil run-off | ・Establishment of landuse adjustment management system |
| | | ・Promotion of agro-forestry |
| | ・Poorly adapted farming system | ・Introduction of water harvesting system |
| | ・Animal excrements are not used | ・Promotion of intercropping of legume crops such as cowpea |
| | ・Withdrawal of crop residues from the farms | ・Organized introduction of penning |
| | | ・Restoration of crop residues on farms |
| | | ・Coordination between farmers and herders |
| | ・Agricultural machines are very expensive | ・Establishment of banks, dedicated to loan granting for equipment and materials |
| ・Low income farmers | ・Agriculture for family consumption | ・Introduction of commercial products such as vegetables, fruits, etc |
| (2) Stock raising | | |
| ・Low animal productivity (multiplication, physical development, dairy production, egg production) | ・Poor fodder resources (overgrazing) | ・Development of improved grasslands and rehabilitation of degradated grass land |
| | | ・Encouraging the production of nutritional blocks for livestock |
| | | ・Animal husbandry adapted to fodder production |
| | | ・Production of stocked fodder for the dry season |
| | ・Delay in the improvement of livestock | ・Distribution of superior livestocks and introduction of artificial insemination technique |
| | ・Delay in the adoption of veterinarian hygienic measures | ・Training of the veterinarians, and construction of veterinarian hygienic facilities for livestock |
| | ・Insufficient water supply facilities | ・Construction of facilities for animal water supply |
| (3) Community forest | | |
| ・Reduction of forest resources | ・Excessive wood cutting for firewood | ・Creation of tree nursery and promotion of tree afforestation |
| | | ・Reinforcement of forest management system |
| | | ・Diffusion of improved cooking stoves |
| | ・Increase of cultivated land and overgrazing | ・Education of the inhabitants on forest protection |
| | | ・Agro-forestry promotion |
| | | ・Promotion of hedges as pasture-fence |

| Issue to be addressed | Obstacle | Concrete measures |
|---|---|---|
| (4) Agricultural land conservation<br>・Degradation of agricultural land (soil erosion, decrease in fertility and water holding capability) | ・Reduction of rainfall<br>・Reduction of fallow periods<br>・Non implementation of conservation measures in the agricultural lands, due to difficulties originating from the administration and the farmers | ・Promotion of agricultural land conservation, as part of the agriculture, stock raising, and sylviculture development<br>・Establishment of land use adjustment system<br>・Establishment of agricultural land conservation promotion system<br>・Continuous implementation of agricultural land conservation measures<br>・Diffusion of protection techniques applicable by the farmers |
| (5) Distribution<br>・Non transparency in price setting | ・Lack of market information system | ・Establishment of a market information system |
| ・Restriction of the selling period, price fluctuation , fall of commercialization rate | ・Lack of storage and processing facilities | ・Construction of processing and collecting/shipping facilities of agriculture/livestock product |
| (6) Support to agriculture, stock raising and sylviculture<br>・Poor diffusion of agricultural, stock raising and sylvicultural techniques | ・Weakness of agricultural, stock raising and sylvicultural diffusion system<br>・Insufficient diffusion budget<br>・Lack of new technique diffusion system | ・Establishment of a support organization, based on local NGOs<br>・Allocation of distribution budget<br>・Coordination between the test and research agency and the diffusion agency |
| ・Delayed establishment of organization of farmers | ・Farmers not sensitized on their organization | ・Establishment of a farmer support system<br>・Extension and development of farmers' training system<br>・Enforcement of the relationship with the international research agencies |
| ・Delayed agricultural, stock raising and sylvicultural support system | ・Delayed mechanization, heavy workload of women, lack of agricultural material and small agricultural tools | ・Establishment of equipment and materials bank, cereal bank and mills<br>・Creation of a small scale credit system |
| ・Insufficient farming fund | ・Lack of agricultural credit system | ・Development of a funding system for agricultural management |
| (7) Agricultural and rural infrastructures<br>・Unstable production , caused by the rainfall | ・Lack of irrigation facilities | ・Construction of irrigation facilities including small scale dams |
| ・Reduction of production, low quality of products | ・Unoperational existing irrigation facilities | ・Rehabilitation of the existing irrigation facilities |
| ・No provision of potable water | ・Lack of wells and water supply facilities | ・Construction and rehabilitation of wells, and potable water facilities |
| ・Difficulty in transporting agricultural/ livestock products and agricultural equipments | ・Lack of agricultural roads | ・Budget allowance for road construction<br>・Development of inexpensive agricultural road construction method |

| Issue to be addressed | Obstacle | Concrete measures |
|---|---|---|
| 5) Environment<br>・Reduction of national forest | ・Delayed implementation of environmental protection measures<br>・Excessive wood cutting for firewood | ・Promotion of reafforestation activities<br>・Enlightenment of the inhabitants on forest protection<br>・Reinforcement of the forest management system<br>・Diffusion of improved cooking stoves |
| ・Progress of soil degradation | ・Reduction of rainfall<br>・Excessive wood cut, overgrazing<br>・Poor implementation of the required measures, because of difficulties due to the administration and the farmers | ・Establishment of soil conservation promotion system<br>・Implementation of soil conservation measures (plowing) and the continual management<br>・Soil conservation through inhabitant participation. |

Legislative issues are classified as described below.

(1) Rural code

1) Obstacles

The following 3 obstacles have been identified:

① The Rural Code specifies rights related to natural resources, as are registered in the Rural Cadaster, and calls for natural resource management under the supervision of a Land Commission. However, no concrete measures have been taken to define land ownership, and in the event of an agricultural land dispute, it only anticipates that the traditional leadership (village chief, canton chief, etc.) will settle the matter, based on the means of arbitration available when the dispute is able to be settled. In almost all villages where the literacy rate is low, it is impossible to specify land ownership in the form of a document, and it is difficult to encourage the local population to specify these rights, because of the risk of causing internal conflict within the villages.

② When land ownership is defined, registration of such ownership in the Rural Cadaster leads to the supervision of land use by the Land Commission. In this case, when a land is not properly exploited, the right of use may be transferred to a third person. It is thought that since users of natural resources do not need any other provision than Article 5 of the Rural Code, as it assures their right to use those resources as originated from customary law, little progress being made to register land ownership in the Rural Cadaster.

③ The establishment of Land Commissions, established by the Rural Code, is stagnating. The establishment of a Land Commission in a specific location requires FCFA 50 million, which is not possible because of the current financial situation of the government.

2) Concrete measures

If people are forced to register land ownership in the Rural Cadaster, which is not the desire of the villagers, this will require time, money and effort even if the Land Commissions works correctly. In order to promote registration in the Rural registration book, villagers need to be given incentives to specify rights of ownership on their own and then to have them registered.

In a practical way, it is believed that it is necessary for the government to take steps to promote registration in the Rural registration book. Such steps may include providing World Food Program (WFP) food aid, or issuing bonds that may be used to cover medical fees, education, taxes, etc. It is also deemed necessary to provide priority measures at the village level, such as priority in project realization to those villages that have achieved registry exceeding a certain rate.

(2) Forest code

1) Obstacles

The following two points were mentioned as obstacles to practical enforcement:

① Forest agents do not have a good knowledge of the forest code. As a result, excessive wood cutting has brought and is bringing about a large-scale degradation of national forest resources.

② Degraded areas, such as severely eroded koris, are designated as restoration areas, where soil conservation measures should be implemented. In spite of this, if agricultural land are designated, farmers will not be encouraged to undertake restoration measures, and these lands will be abandoned since all of these restoration areas are prohibited to cropping.

2) Concrete measures

The following land recovery measures, supported by the government should be taken with regard to terriors. 1) When land is designated as land recovery land, replacement land should be designated and 2) incentives should be offered such as the granting of priority pasture use rights for land which has recovered plant life as a result of soil conservation measures.

# Basic development plan to combat desertification

# Chapter 6 Basic Concept

## 6.1 Purpose of the plan

The factors involved in the desertification of the Study area can be divided into natural (drying of climate and droughts) and human or artificial (overgrazing, overcropping, and overcollection of firewood) ones. However, the artificial factors must be viewed against a background of social factors such as poverty, increasing population and poor trading conditions.

The population movements which are caused by desertification result in further desertification, resulting in a vicious cycle. The perpetrators of desertification by human factors are often also its victims. They are in no position to promote sustainable agro-sylvo-pastral practices and fall into a destructive pattern of exploitative production. If sustainable agro-sylvo-pastral cannot be promoted, there is the danger that they will not be able to sustain their livelihoods and their villages.

For these reasons, the Plan to Combat Desertification must not merely reduce soil degradation and plant trees in already desertified areas. It must be an overall rural and agricultural development plan which must include a variety of action plans. Therefore, the purposes of this plan are to ① **achieve a change from exploitative agro-sylvo-pastral to sustainable agro-sylvo-pastral and** ② **conserve the basic living environment of the inhabitants of the area.** See Figure 6.1.1 for a diagram of the Master Plan.

## 6.2 Basic Concept

The basic concepts of the Plan to Combat Desertification are as follows:

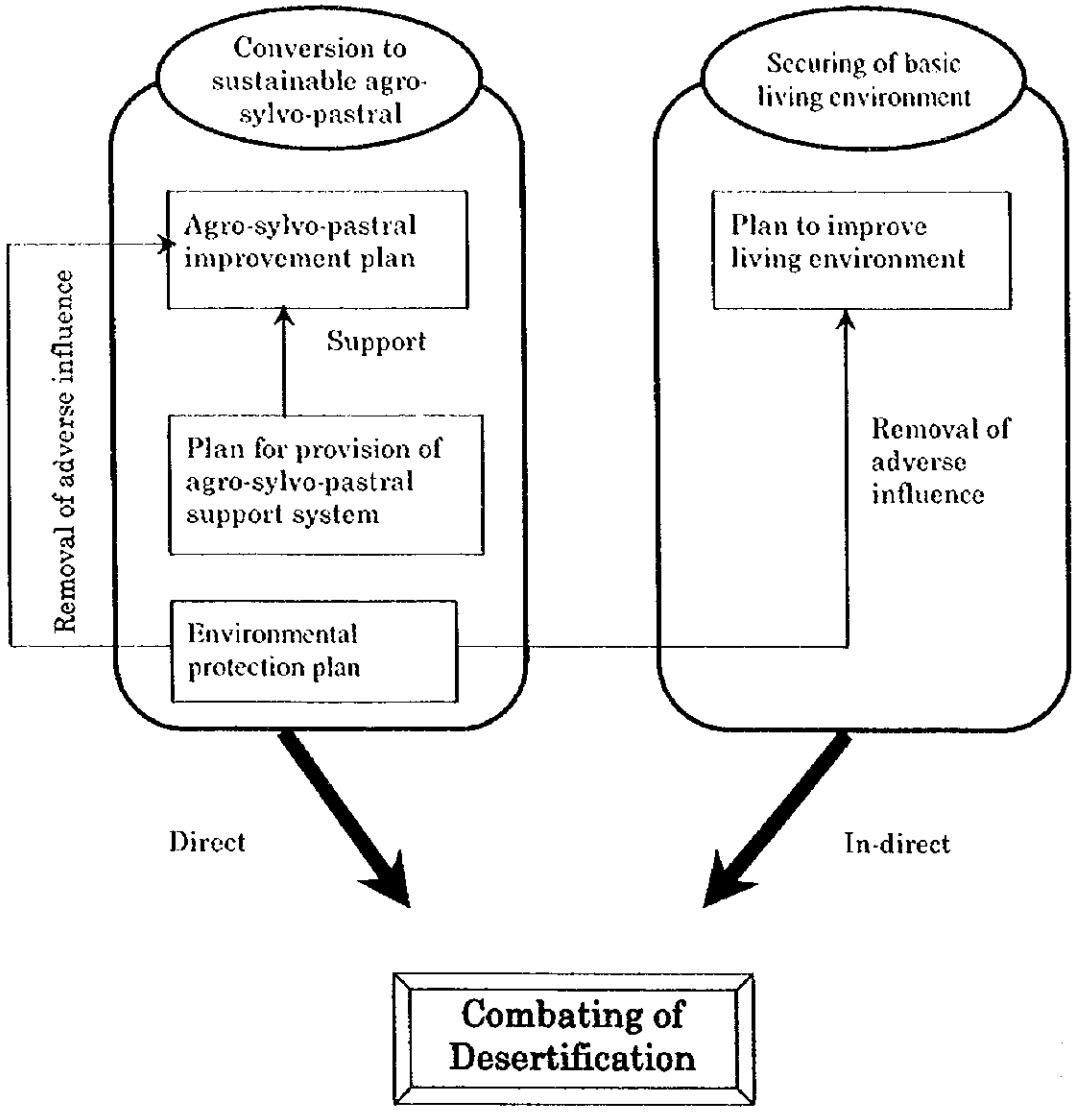
① Measures to combat desertification should aim to improve not only natural phenomena, but also to improve social factors by improving the socio-economic situation of the inhabitants. Both the planning and the execution of the actual Plan to Combat Desertification should be considered from a "bottom up" point of view and be as close to the inhabitants as possible.

② In order to decrease the drain on natural resources, recovery of plant production and fertility through effective water use and efficient land use and recovery and increase of production through the introduction of ameliorated seeds should be carried out.

③ In order to build an agricultural society which is resistant to drought, development which covers the following areas should be promoted. ① secure supplies of food and potable water, ② undertaking of planting and soil conservation measures which result in the sustainable management of land and increased production, ③ education, health and sanitation, agricultural products and energy saving measures (such as improved cooking stoves), and ④ maintenance of roads which provide access to markets.

④ From the point of view of management and ease of access by inhabitants, this project is a small-scale one aiming at villages, but it is one which reaches across natural, political and social boundaries and has a high degree of applicability in other areas as well as a ripple effect.

**Figure 6.1.1 Diagram of the Master Plan**



## 6.3 Points to be Considered Concerning the Plan

The following are points to be considered concerning the Plan

① Coordination with upper level plans at the departmental and national level

② Consideration of environmental conservation

③ Use of techniques already in use in the area and effective use of natural resources

④ Consideration of whether plan is technically and financially acceptable

⑤ Reduction of population pressure

⑥ Reduction of poverty

⑦ Reduction of working hours of women

⑧ Improvement of human resources (particularly women)

⑨ Making effective use of NGOs through gaining an understanding of the actual conditions in the area

⑩ Further empowerment of local residents

⑪ Making terrior management a main objective

## 6.4 Planning Indicators

The basic indicators for the plan to combat desertification are as follows:

① Planning baseline year: 1997

② Project implementation period: 2000-2014 (15 years)

Based on existing upper level plans, and taking into account the implementation periods of other donor agencies, etc., the project implementation period will be fifteen years, with the year 2014 set as the completion year.

③ Anticipated population growth rate to the year 2014: 3.3% per year (based on the environmental analysis summary of the department of Tillabéri)

# Chapter 7 Zoning of the Study Area

Because the Study area extends over a huge area of 104,245 km$^2$, in which natural and socio-economical conditions vary, zoning must be carried out to analyze the characteristics of each zone and formulate a development plan suitable to each zone. Zoning is to be carried out for the following purposes: ① Analysis and identification of characteristics of each zone, ② Analysis and understanding of the current status, problems and development potential relating to agriculture, stock raising and sylviculture, ③ Classification of the basic themes and concept of development for each zone, and ④ Preparation of a development plan for each zone.

## 7.1 Basic concept of zoning

According to the environmental analysis summary of the department of Tillabéri of the PNEDD, the Study area can be divided by the following natural conditions:

① Condition of agriculture and ecosystem: three zones (stock raising zone in the north (annual rainfall less than 350 mm), intermediate zone (annual rainfall 350-450 mm) in the central region, and an agricultural zone in the south (450-800 mm)

② Condition of soils: five zones (north, south, valleys, Dallos Bosso and plateaus)

③ Topographic conditions: three zones (lateritic plateaus, low marsh lands/ponds/basins/flood areas, and dunes)

For the above zoning, the Niger side found it appropriate to make a zoning based on cantons, taking into account divisions ① to ③ (the cantons are traditional social unit divisions, based on common agricultural forms or social structures). However, for this Study, it was decided by the JICA Study Team to consider the efficiency and effectiveness of each type of work and implement zoning by district because natural and socio-economic data and information required are available on a district basis.

There are six zoning criteria which cover natural and socio-economic factors: annual rainfall, potential of water resources, access to markets, productivity of millet, pasture resource, and density of population. As shown in Table 7.1.1, the differences in zones are clearly observable. Table 7.1.2 presents the major criteria along with other points related to zoning (see Figure 7.1.1).

Zone 1: Districts of Kollo and Say in the south (agricultural zone)
Zone 2: Districts of Tillabéri and Téra in the center (agriculture and stock raising zone)
Zone 3: Districts of Filingué and Ouallam in the north (stock raising zone)

**Table 7.1.1 Difference of natural, social and economic conditions in each district**

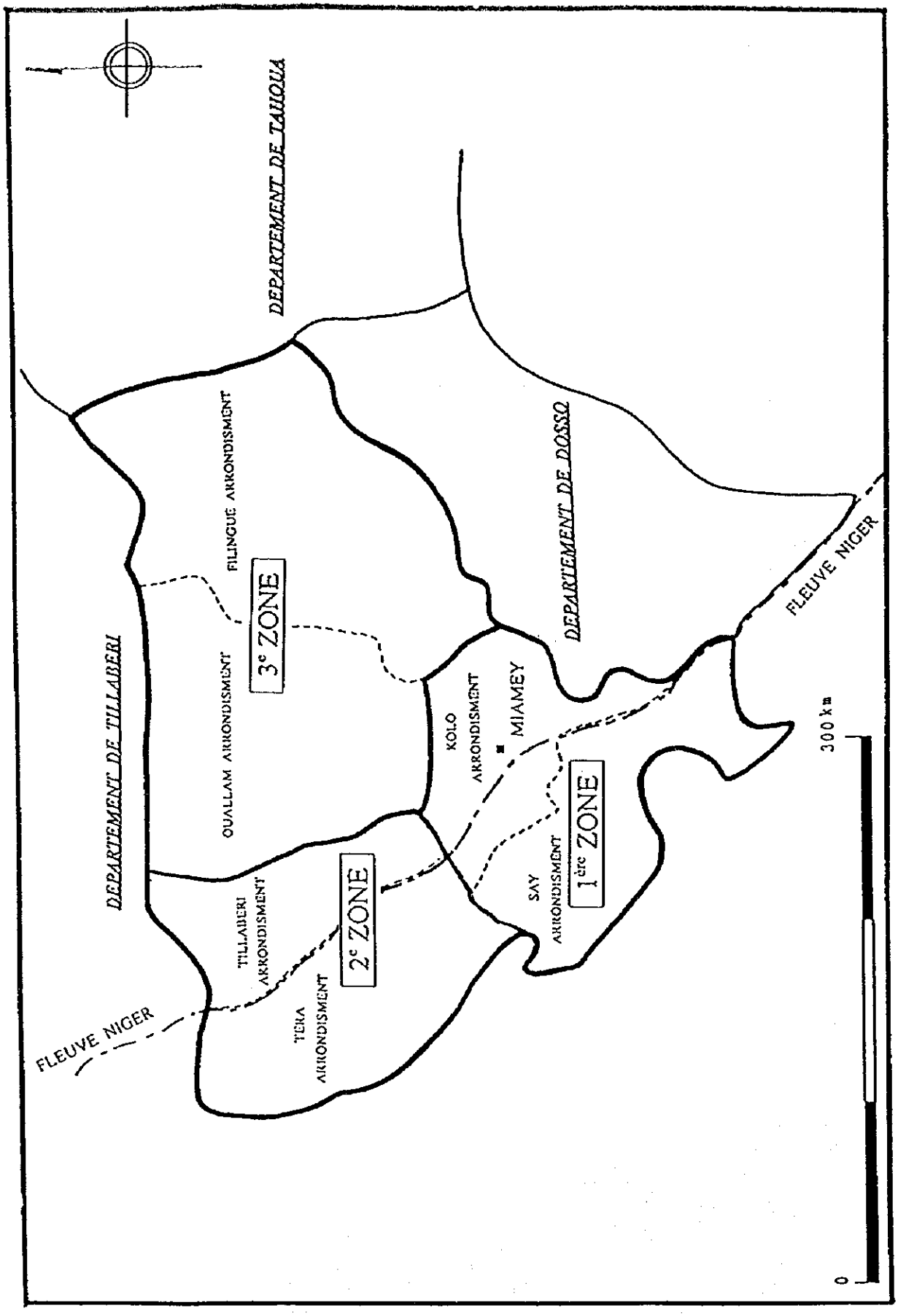
| Division | | Filingué | Kollo | Oualiam | Say | Téra | Tillabéri |
|---|---|---|---|---|---|---|---|
| Annual rainfall | More than 500 mm | | ○ | | ○ | | |
| | Less than 500 mm | ○ | | ○ | | ○ | ○ |
| Water resource | Surface water | | ○ | | ○ | ○ | ○ |
| | Groundwater | ○ | | ○ | | | |
| Access to markets | Near | | ○ | | ○ | | |
| | Far | ○ | | ○ | | ○ | ○ |
| Productivity of millet | More than 350 kg/ha | | ○ | | ○ | | |
| | Less than 350 kg/ha | ○ | | ○ | | ○ | ○ |
| Pasture resource | Much | ○ | | ○ | ○ | | |
| | Little | | ○ | | | ○ | ○ |
| Density of population | High | | ○ | | ○ | | ○ |
| | Low | ○ | | ○ | | ○ | |
| Zone | | Third | First | Third | First | Second | Second |

**Table 7.1.2 Characteristic of each zone**

| Division | Zone 1 | Zone 2 | Zone 3 |
|---|---|---|---|
| · Name of district | · Say<br>· Kollo | · Tillabéri<br>· Téra | · Filingué,<br>· Oualiam |
| · Number of Cantons – Villages | · 16 cantons – 514 villages | · 13 cantons – 398 villages | · 9 cantons – 395 villages |
| · Area (Remote sensing) | · 23,408 km² | · 30,851 km² | · 49,986 km² |
| · Population (Presumption in 1996) | · 595,000 persons | · 555,000 persons | · 593,000 persons |
| · Density of population | · 25.4 persons/ km² | · 18.0 persons/ km² | · 11.9 persons/km² |
| · Rate of increasing in population (Average in 1977~88) | · 5.2% | · 2.4% | · 2.8% |
| · Temperature (Annual average) | · Niamey: 29.6°C | · Tillabéri: 30.4°C | · Tahoua: 29.4°C |
| · Topographic condition | · Plateau, Lowland | · Flood area, Basin and lowland | · Plateau, Dunes |
| · Height above the sea level | · 150~250m | · 200~300m | · 250~400m |

Source: RAPPORT ANNUEL STATISTIQUE 1993, etc.

**Figure 7.1.1 Map of zones in the Study area**



## 7.2 Characteristics of zones

(1) Zone I

1) General conditions of the zone

The zone has a relatively important rainfall, and has the advantage of being located near Niamey, a major consumption area. There are irrigated plots, especially rice fields, which use the water of the Niger river. This zone has a high potential for fruit and vegetable production.

Population density is greatest among the three zones, and the rate of population increase is very high because of the influx of people from other regions. For recent several years, in addition to providing food to Niamey, the capital city, problems have been caused in terms of food supply to keep up with the growth in population in the zone due to the influx of people from the north. As a result, agricultural lands come short, forests get destroyed and cropping gets excessive, however, this area is relatively rich in grassland.

2) Characteristics of each sector

(a) Agriculture

Vegetables and fruits are produced along the Niger river, near the city of Niamey and the vicinity, for sale in Niamey. The main roads into the zone are in relatively good condition, and it is therefore possible to extend commercial cropping areas where irrigation water is available.

Rice cultivation using river water is also practiced. Cooperatives have been formed, the management of which is stable; but problems exist in some parts of the large-scale irrigated areas (see "Section 4.4 Agriculture, stock raising, and sylviculture"). The farmers in the surrounding areas would like to grow rice.

Excessive cropping is practiced because of shortage of agricultural lands, which in turn leads to soil degradation.

(b) Stock raising

Stock raising is mainly sedentary, with periodical transhumance practiced during the rainy season to the grasslands of the north. There are large amounts of fodder, and as it is located in the vicinity of a major consumption area, the development potential for diary production, as well as cattle and sheep fattening is important.

(c) Community forests

Although forest resources are relatively abundant, tree cutting for the development of agricultural land and for firewood have seriously reduced forest areas.

(d) Natural environment

The national forest in the department of Tillabéri is mainly located in the two districts of this zone. Since it is located near the city of Niamey, wood cutting for firewood is important, and measures to protect the forest resources should be taken immediately.

Many animal species found in this zone can be found in the "W" national park, the total fauna reserve of Tamou, and the giraffes preserve in Kouré, etc. There is an abundant variety of fauna in the zone.

(2) Zone 2

1) General conditions of the zone

Although diversified agriculture focusing on irrigation using the water resources of the Niger river and its tributaries may be expected; inland cropping can only be rainfed. Desert area is spreading from the north of the zone, and it is necessary to conserve the agricultural land and restore fertility.

The density of population is average, compared to the other two zones. The population is concentrated in the seat of the departmental capital, Tillabéri.

2) Characteristics of each sector

(a) Agriculture

Rice is cultivated on the banks of the Niger river. The road connecting the district of Tillabéri and Niamey is paved asphalt, allowing vegetable and fruit cropping by irrigation to be developed in order to supply the markets in the city of Niamey.

In a part of the district of Téra, there are dams for water in koris; they are used for vegetable cropping during the dry season.

(b) Stock raising

Both sedentary and nomadic stock raising are practiced. The vicinity of the Niger river abounds with fodder plants, and the development of dairy production, and cow and sheep raising can be expected.

The canton of Sakoira in the Sirba area in the center of the district of Téra and the area from the north of the cantons of Anzourou to Inates in the district of Tillabéri, grasslands are available during the rainy season, and used by transhumance herders coming from the agricultural zones.

(c) Community forests

Same as in Zone 3, the soil of this zone is often sandy and the vegetation is poor. However, rainfall is relatively abundant and soil erosion by surface water often occurs. Consequently, there is an urgent need to plant trees in order to conserve the soils.

(d) Natural environment

The flora is intermediate between Zones 1 and 3, and is mainly annual. In the Niger river near the border with Mali, there are herds of hippopotamuses, but the area is also used for paddy fields, vegetable gardening during the dry season, and stock raising, which causes a reduction in the amount of feed available for the hippopotamuses. Thus, there is a competition for the use of the flood area between hippopotamuses, agriculture and stock raising.

(3) Zone 3

1) General conditions of the zone

The 400 mm isohyetal rainfall line crosses this zone, almost in parallel with the latitude, but this rainfall line has been displaced horizontally from north to south about 150 km over a period of forty years. There is poor rainfall and limited water resources in this zone.

Population density is the lowest of the three zones, and many people are leaving the area in search of work elsewhere because of the advancement of desertification or migrating to other zones.

2) Characteristics of each sector

(a) Agriculture

Arable lands are mainly used for rainfed millet production, but production has fallen for several years because of the reduction of rainfall and soil degradation. Productivity in this zone is lowest of the three zones.

Vegetable production is partially practiced using Dallols-Bosso groundwater, but only on a small-scale. Important potential exists for developing vegetable and fruit production with this water resource.

(b) Stock raising

Stock raising is mainly transhumance, but partially nomadic. Desertification has caused the reduction of grasslands, and fodder production is getting reduced. The Azawak cattle are a remarkable breed, both for meat and milk production. Grassland conservation measures should be implemented, because the Zone does not have many water resources, and the grasslands are being degraded.

(c) Community forests

The two districts of Filingué and Oualam have trees consisting mainly of Acacias Arubitas, which are drought-resistant, because rainfalls are weak and the soil is sandy. These trees grow slowly, and once they are cut for firewood, it is difficult for them to reproduce. This is the reason why the planting of trees should be promoted, by heightening the awareness of the population on the need of obtaining firewood and conserving soils.

(d) Natural environment

Flora is scarce and poor with sparse, thorny plants. The fauna includes gazelles, jackals, hares, etc. in the north.

# Chapter 8 Master Plan for Combating Desertification

## 8.1 Land Use

(1) Basic orientation

The basic orientation of the Master Plan with regards to land use should involve the encouragement of an effective land use system. It should be dedicated to reversing agricultural land, grassland and forest degradation, resulting from the reduction of rainfall during these last several years and from continual population growth. The Plan will promote restoration of the original condition, while will increase the productive potential of the existing agricultural land and promote its effective use.

In order to accomplish this, a system should be established for taking reasonable steps to reverse factors which cause degradation of the soil such as excessive cropping, overgrazing, excessive wood cutting, and burning. This system includes a suitable land use pattern and a land use management system on a sustainable basis. The basic design of the system is described below.

① In order to combat desertification in the area, a moderate balance both in terms of area and resources must be maintained for forest, grassland, agricultural land, and flood areas. Reasonable use of resources which does not destroy this balance will allow for stable and continual production.

② Enhancing the productivity of existing agricultural land, improving food self-sufficiency, and restraining the new development of agricultural land are considered as effective ways of combating desertification. Thoroughly carrying out fallowing agriculture with the rainfed agriculture which is the main type of agriculture in the area.

③ In preparing the land use plan, land commissions will be formed at the district level, and terroir management committees will be established at each village so as to make cadasters, eliminate the unbalanced use of land, improve the decreasing production potential of agriculture, and thus sustainable productions will be realized.

(2) Land use plan

Table 8.1.1 presents an overview of the land use plan, based on the restoration of the fertility of existing agricultural land and the promotion of irrigated agriculture.

**Table 8.1.1 Land use plan**

(Unit: ha)

| Current classification | Current area | Planned land use | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricultural land | | | | | | Non-agricultural land | | | |
| | | Rotational agricultural land | | | | Irrigated farmland | | | | | |
| | | | Planted land | Non-planted land | | Paddy field | Field, etc | Forest | Protected area | Bare land | Aquatic zone |
| | | | | Fallow land | Grassland, etc | | | | | | |
| Agricultural land I | 215,300 | 97,900 | | | | | 9,800 | | | 107,600 | |
| Agricultural land II | 1,320,000 | 1,318,400 | 898,400 | 898,400 | 2,187,900 | | 1,600 | | | | |
| Grassland | 431,300 | 431,300 | | | | | | | | | |
| Bare land I | 4,806,000 | 2,137,100 | | | | | | 2,084,400 | 584,500 | | |
| Bare land II | 3,077,400 | | | | | | | | | 3,077,400 | |
| Paddy fields | 8,000 | | | | | 8,000 | | | | | |
| Woodland | 391,100 | | | | | | | 391,100 | | | |
| Aquatic zone | 175,400 | | | | | | | | | | 175,400 |
| Total | 10,424,500 | 3,984,700<br>100% | 898,400<br>20~25% | 898,400<br>20~25% | 2,187,900<br>60~50% | 8,000 | 11,400 | 2,475,500 | 584,500 | 3,185,000 | 175,400 |

Source: JICA remote sensing commissioned in 1998.

1) Handling of current land use classifications

As a prerequisite to the measures of the plan for land use, the current land use classifications shall be as follows.

(a) Fixed classifications

The area of the following classifications of land will be fixed, such as rice paddies with high production potential and land which must be conserved.

① Bare land II 3,077,000 ha

② Paddy field 8,000 ha

③ Woodland 391,000 ha (natural parks, national forests)

④ Aquatic zone 175,000 ha

(b) Agricultural land I

This type of land consists of flood areas where aquatic and exposed lateritic lands are mixed. Field studies indicate that 50% of this land can be used for agriculture.

(c) Bare land I

Current bare land I consists of a mixture of fallow land, partial grassland and poor bush land. Rotational agricultural land, woodland, and protected area required under the Master Plan will be arranged from bare land I. According to the materials prepared by the GON, the area of forest in Niger is 2,562,000 ha. Therefore, in addition to 391,100 ha of woodland being classified, some 2,100,000 ha of poor bush land are to be allotted out of bare land I to secure forest space.

2) Division of agricultural land and non-agricultural land

The planned land use will be roughly divided into agricultural and non-agricultural land, and the design would, in principle, be as described below.

① Agricultural land

Rainfed agriculture in the Study area has been carried out based on a rotational method; three to five years of cropping followed by a fallow period of ten years, which restores productivity of the soil. In recent years, however, climate changes and population growth have led to a shortening of the fallow period which has led to further soil degradation.

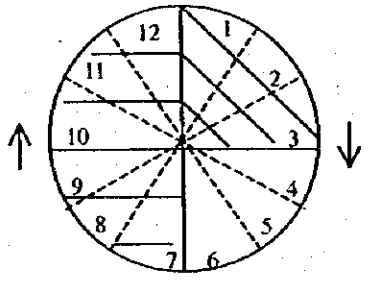
A rotational method is adopted in the Plan as an agricultural measures of restoring soil productivity most suited in this area. This method, combined with other kinds of measures such as construction of stone barriers and crescent barriers, is aimed at increasing production. Agricultural land consists of irrigated agricultural land and rotational agricultural land.

* Rotational agricultural land

Rotational agricultural land involves both planted land and non-planted land, the latter being comprised of fallow land (areas where grazing is prohibited in order to allow the restoration of fertility after cropping) and grasslands (areas where attempts are made to restore fertility but at the same time are used as pasture for grazing and for firewood collection).

Some 3,980,000 ha judged as being suitable for rainfed agriculture (see Figure 4.2.2) are targeted as the planned area. For this purpose, some 50% of current agricultural land I, nearly 100% of current agricultural land II, 100% of current grassland, and the supplemented allocation out of bare land I will constitute the planned area of 3,984,000 ha. With regard to the rotation cycle of the planted land for Zones 1 and 2, the annual planting rate is to be 25%, the lowest limit designated based on the environmental analysis summary of the department of Tillabéri of the PNEDD, with three years of planting followed by a non-planting period of nine years. The annual planting rate shall be 20% for Zone 3, taking into consideration the severe conditions affecting the recovery of soil fertility, with three years of planting followed by a non-planting period of twelve years. Each non-planting period is to include the fallow period of three years with no agricultural or stock raising use of the land so as to ensure full recovery of soil fertility (see 8.3.1 Agriculture).

The planned rotational cycle for planted land (with an annual planting rate of 25% and a rotational cycle of 12 years) will be as follows:




Period used as grassland: 6 years (grassland)

Planted period: 3 years (planted land)
Fallow period: 3 years (fallow land)

· Irrigated agricultural land

Irrigated agricultural land involves paddy and vegetable field. The current paddy field of 8,000 ha will be maintained in the Plan and effectively used. In addition, irrigated agriculture will be developed focusing on vegetables and grassland will be rehabilitated as models mainly in the flood area of 11,400 ha.

② Non-agricultural land

Non-agricultural land is subdivided into forests, protected areas, bare land and aquatic zone. They consist of current agricultural land I, bare land I and II, woodland, and aquatic zone.

· Forest

The area classified as forest will not be cultivated and will be used for pasture.

· Protected area

Although some vegetation exists in the protected area, it does not have sufficient potential for agriculture, and part of which is used as grassland. Afforestation and soil conservation measures will be taken as a means of protecting the environment.

· Bare land

The area with almost no vegetation, partially used as grassland

· Aquatic zone

It consists of rivers and ponds, etc

3) Basic measures

Table 8.1.2 shows the planned and current area of land by classification and the basic measures to be adopted in the Plan.

**Table 8.1.2 Overview of basic measures**

(Unit: ha)

| Plan | | Current classification Distribution | | Basic measures |
|---|---|---|---|---|
| Rotational agricultural land | 3,984,700 | Current Classification | (3,984,700) | |
| Planted land | 898,400 | Agricultural land I | 97,900 | Agricultural land conservation (150,000/year) |
| Fallow land | 898,400 | Agricultural land II | 1,318,400 | Creation of grasslands (1000), community |
| Grassland, etc. | 2,187,900 | Grassland | 431,300 | forest |
| | | Bare land I | 2,137,100 | |
| Irrigated agricultural land | 19,400 | | (19,400) | |
| Paddy field | 8,000 | Paddy field | 8,000 | Rehabilitation (3,000) |
| Field, etc. | 11,400 | Agricultural land I | 9,800 | Small-scale irrigation (2,000) |
| | | Agricultural land II | 1,600 | Rehabilitation of grassland (139) |
| Non-agricultural land | 6,420,400 | | (6,420,400) | |
| Forest | 2,475,500 | Bare land I | 2,084,400 | Community forest, afforestation |
| | | Forest | 391,100 | |
| Protected area | 584,500 | Bare land I | 584,500 | Soil conservation (190,475/year) |
| | | | | Reforestation (6,800/year) |
| Bare land | 3,185,000 | Agricultural land I | 107,600 | |
| | | Bare land II | 3,077,400 | |
| Aquatic zone | 175,400 | Aquatic zone | (175,400) | |
| Total | 10,424,500 | | 10,424,500 | |

Note: Details regarding "Basic measures" are explained in the text below for each respective item and planned area count fractions of 50 and over as 100 and cut away the rest.

4) Land use management system

The establishment of terroir management committees combined with the arrangement and determination of land ownership are considered necessary for effective land use. This is the reason why the Land Commissions anticipated in the Rural Code must be established in each district, as well as a Rural Cadaster must be developed and land use management must be enhanced.

(3) Development concept for each zone

1) Land use and classification of land by degree of fertility for each zone

Tables 8.1.3 and 8.1.4 indicate the current status of the vegetation and land use as well as classification of land dedicated to rainfed agricultural land by degree of fertility, with a view to the development of a plan for each zone.

**Table 8.1.3 Area of vegetation and land use per zone**

(Unit: ha)

| Classification | Zone 1 | Zone 2 | Zone 3 | Total |
|---|---|---|---|---|
| Agricultural land I | 101,300 | 114,000 | 0 | 215,300 |
| Agricultural land II | 347,600 | 318,600 | 653,800 | 1,320,000 |
| Grassland | 0 | 42,200 | 389,100 | 431,300 |
| Bare land I | 1,164,400 | 1,006,200 | 2,635,400 | 4,806,000 |
| Bare land II | 387,400 | 1,431,400 | 1,258,600 | 3,077,400 |
| Paddy fields | 4,900 | 3,100 | 0 | 8,000 |
| Woodland | 243,600 | 85,800 | 61,700 | 391,100 |
| Aquatic zone | 91,600 | 83,800 | 0 | 175,400 |
| Total | 2,340,800 | 3,085,100 | 4,998,600 | 10,424,500 |

Source: JICA remote sensing commissioned in 1998

**Table 8.1.4 Classification of land dedicated to rainfed agricultural land by degree of fertility per zone**

(Unit: ha)

| Category | Zone 1 | Zone 2 | Zone 3 | Total |
|---|---|---|---|---|
| Suitable | 5,300 | 10,200 | 0 | 15,500 |
| Not very suitable | 909,600 | 1,101,600 | 1,958,000 | 3,969,200 |
| Not suitable | 1,425,900 | 1,973,300 | 3,040,600 | 6,439,800 |
| Total | 2,340,800 | 3,085,100 | 4,998,600 | 10,424,500 |

Source: JICA remote sensing commissioned in 1998

2) Land use plan per zone

Table 8.1.5 presents a summary of the land use plan for each zone.

(a) Zone 1 (agricultural zone)

Rotational agricultural land, consisting of current rainfed agricultural land and fallow land as well as flood areas which can be effectively used for cultivation, will be 0.91 million ha. This land will have an annual planting area of 229,000 ha.

Zone 1 is a zone for agricultural development and is relatively well located in terms of distribution conditions. Thus, paddy fields will be rehabilitated to allow an increase in rice production. In addition, the plan anticipates mainly irrigated cultivation of vegetables in flood areas.

(b) Zone 2 (agricultural/stock raising zone)

Rotational agricultural land, consisting of current rainfed agricultural land and fallow land as well as flood areas which can be effectively used for cultivation, will be 1.11 million ha. This land will have an annual planting area of 278,000 ha.

As in the case for Zone 1, rice production will be increased along the Niger river and the vicinity through the rehabilitation of paddy fields and the promotion of irrigated cultivation focusing on vegetables to be consumed to increase nutritional intake. Stock production bases will be set up on suitable land for fodder production, as well as for dairy production and animal raising.

(c) Zone 3 (stock raising zone)

The rotational agricultural land will be 1.96 million ha, with an annual planting area of 392,000 ha. This zone is primarily for stock raising development. Consequently, fodder infrastructures should be developed for cattle, sheep and goats not only in current grassland areas, but also on fallow land in order to develop the zone as a base for livestock reproduction and stock raising.

**Table 8.1.5 Overview of land use plan for each Zone**

(Unit: ha)

| Zone | Current classification | Current area | Planned land use | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Agricultural land | | | | | | Non-agricultural land | | | |
| | | | Rotational agricultural land | | | | Irrigated agricultural land | | | | | |
| | | | | Planted land | Non-planted area | | Paddy field | Field, etc. | Forest | Protected area | Bare land | Aquatic zone |
| | | | | | Fallow land | Grassland, etc | | | | | | |
| 1 | Agricultural land I | 101,300 | 45,800 | | | | | 4,800 | | | 50,700 | |
| | Agricultural land II | 347,600 | 347,600 | (228,800) | (228,800) | (457,300) | | | | | | |
| | Grassland | 0 | | | | | | | | | | |
| | Bare land I | 1,164,400 | 521,500 | | | | | | 542,900 | 100,000 | | |
| | Bare land II | 387,400 | | | | | | | | | 387,400 | |
| | Paddy field | 4,900 | | | | | 4,900 | | | | | |
| | Forest | 243,600 | | | | | | | 243,600 | | | |
| | Aquatic zone | 91,600 | | | | | | | | | | 91,600 |
| | Total | 2,340,800 | 914,900 100% | 228,800 25% | 228,800 25% | 457,300 50% | 4,900 | 4,800 | 786,500 | 100,000 | 438,100 | 91,600 |
| 2 | Current classification | Current area | Rotational agricultural land | Planted land | Fallow land | Grassland, etc. | Paddy field | Field, etc. | Forest | Protected area | Bare land | Aquatic zone |
| | Agricultural land I | 114,000 | 52,100 | | | | | 5,000 | | | 56,900 | |
| | Agricultural land II | 318,600 | 318,600 | (278,000) | (278,000) | (555,800) | | | | | | |
| | Grassland | 42,200 | 42,200 | | | | | | | | | |
| | Bare land I | 1,006,200 | 698,900 | | | | | | 107,300 | 200,000 | | |
| | Bare land II | 1,431,400 | | | | | | | | | 1,431,400 | |
| | Paddy field | 3,100 | | | | | 3,100 | | | | | |
| | Forest | 85,800 | | | | | | | 85,800 | | | |
| | Aquatic zone | 83,800 | | | | | | | | | | 83,800 |
| | Total | 3,085,100 | 1,111,800 100% | 278,000 25% | 278,000 25% | 555,800 50% | 3,100 | 5,000 | 193,100 | 200,000 | 1,488,300 | 83,800 |
| 3 | Current classification | Current area | Rotational agricultural land | Planted land | Fallow land | Grassland, etc. | Paddy field | Field, etc. | Forest | Protected area | Bare land | Aquatic zone |
| | Agricultural land I | 0 | | | | | | | | | | |
| | Agricultural land II | 653,800 | 652,200 | | | | | 1,600 | | | | |
| | Grassland | 389,100 | 389,100 | (391,600) | (391,600) | (1,174,800) | | | | | | |
| | Bare land I | 2,635,400 | 916,700 | | | | | | 1,434,200 | 284,500 | | |
| | Bare land II | 1,258,600 | | | | | | | | | 1,258,600 | |
| | Paddy field | 0 | | | | | | | | | | |
| | Forest | 61,700 | | | | | | | 61,700 | | | |
| | Aquatic zone | 0 | | | | | | | | | | |
| | Total | 4,998,600 | 1,958,000 100% | 391,600 20% | 391,600 20% | 1,174,800 60% | 0 | 1,600 | 1,495,900 | 284,500 | 1,258,600 | 0 |

Source: JICA remote sensing commissioned in 1998

(4) Expected results

The establishment of a system for effective land use and the reinforcement of the organization of land use management will ensure sustainable agricultural production.

## 8.2 Development of surface water and groundwater

(1) Basic orientation

1) Development

Surface water collected during peak flooding will be stored through the construction of small dams (including bridge dams). A plan will be prepared to reinforce the capacity of pond storage by building embankments. Plans will also be made for wells, depending on groundwater level and the purposes for which it will be used.

2) Utilization

Securing of potable and good quality water in sufficient quantity is a priority. Water will be used to improve the productivity of agriculture, stock raising, and sylviculture.

3) Management

A maintenance system, which allows for the proper management of installed facilities and their effective use, will be set up and technical support will be provided to these organizations.

(2) Development concept for each zone

1) Zone 1

① Small-scale irrigation, done manually or using low-head pumps, will be developed on the flood areas of the Niger river and its tributaries.

② Small-scale dams will be constructed on the tributaries of the Niger river and on the koris, and small-scale irrigation will be developed manually or with low-head pumps. The stored water will also be used for animal water supply in cases when the roads surrounding are used to drive stock.

③ The causes of pond degradation will be eliminated and ponds will be reinforced for better use.

④ With the rehabilitation and construction of wells, the facilities for provision of water for small-scale irrigation and the animal water supply will be reinforced.

2) Zone 2

① Compared to Zone 1, when moving from the north to the south, the main form of groundwater use changes from stock raising to agriculture. Its structural factors are the same as Zone 1, but there are more livestock related facilities.

3) Zone 3

① Compared to the other two zones, there are no permanent streams, like the Niger river, in this zone. However, since the Dallols Bosso and the valleys of its tributaries have a high groundwater level, the focus will be on the development of ponds and shallow wells for potable water and the use of small-scale irrigation and animal water supply and terrior management staff will manage and maintain it.

### 8.2.1 Surface water

(1) Surface water development

1) Small-scale dams (including of bridge dams)

Small-dams will be constructed on the tributaries of the Niger river and on the koris for the purpose of storing water of floods. This will permit the reduction of flood and erosion, and will allow the their use as water resources for agriculture and stock raising.

Small-scale dams will have the structure that is generally used in Niger. Locally available construction materials will be used to the extent possible, and designs will be worked out in such a way as to permit simple continuous management (44 locations). Dams will be constructed at locations with desirable topographical and geological conditions and where water requirements are important. They will have a maximum bank height of 10 meters.

2) Rehabilitation and reinforcement of ponds

The Study area has 51 permanent ponds, plus 94 semi-permanent ponds, or a total of more than 145 ponds. Irrigated agriculture is practiced either manually or with the use of low-head pumps around the ponds. Although these ponds will be used for animal water supply, the recent drop in rainfall and increase in accumulated sand have caused the water volume of these ponds to become reduced, and the period during which water is available to become shorter, resulting in deteriorated water availability. To restore and reinforce the capacities of these ponds, following measures will be implemented to rehabilitate the ponds using such techniques as ① pond drainage, ② raising of the height of banks, and ③ reinforcement with gabions (4 locations for irrigation and 57 locations for livestock use).

(2) Utilization of surface water

(See "Section 8.3.1 Agriculture 2) pr 8.3.2 Livestock)

(3) Surface water management

The government has a national policy concerning the management of surface water which states that "it is possible to improve the management system of surface water based on the participation and empowerment of all users, from the local inhabitants up to government staff.". In accordance with this policy, the government entrusts users with the management and use of water facilities to the extent possible, provided its direct management is not required. The maintenance and management of this plan shall be carried out by terrior management staff..

### 8.2.2 Groundwater

(1) Groundwater development

The plan for development of groundwater will be to mainly use methods which low construction costs and simple management and maintenance.

(2) Utilization of groundwater

1) Potable water

Potable water (including water for miscellaneous use) is what the population wish to have. The provision of safe and good quality water is one of the basic requirements of life, and it is also an important health and hygienic issue, because dirty water is the source of many diseases. Therefore, potable water will be the priority theme for groundwater development, and the plan (Table 8.2.2.1) will be developed based on the following criteria (see 4.7 Basic Living Environment (2) Drinking water). Villages will be given priority. Water supply facilities (AEP) are not planned here.

(a) Modern wells (PEM) - target: 422 locations. The standards thereof shall be as follows:

① At least one modern well will be constructed in villages of 250 inhabitants or less.

② At least one modern well will be constructed when the nearest well is 5 km or more distant.

③ For communities of 250 to 1,500 inhabitants, one modern well will be constructed for every 250 inhabitants.

(b) Small-scale water supply facilities (M-AEP) - target: 34 locations

① One facility will be constructed for every 1,500 inhabitants for villages of 1,500 to 10,000 inhabitants.

(c) Water supply facilities (AEP)

① Water supply facilities will be constructed in communities of 10,000 inhabitants or more (not covered by this Plan).

(d) Miscellaneous wells – target: 120 locations (60 newly constructed and 60 improved)

① Wells will be constructed for miscellaneous water use such as for washing, seedling watering and similar activities (one such well per village, half will be based on repairs).

**Table 8.2.2.1 Plan for potable water supply facilities (by district and type)**

| Category | Filingué | Kollo | Ouallam | Say | Téra | Tillabéri | Total |
|---|---|---|---|---|---|---|---|
| M-AEP | 5 | 10 | 3 | 2 | 8 | 6 | 34 |
| PEM | 70 | 113 | 62 | 60 | 77 | 40 | 422 |
| New | 14 | 11 | 5 | 10 | 8 | 12 | 60 |
| Repaired | 14 | 12 | 5 | 10 | 8 | 11 | 60 |

Source: Le schéma directeur de mise en valeur et de gestion des ressources en eau du Niger

2) Water supply facilities for irrigation and stock raising

(See 8.3.1 Agriculture (3) Content of the Plan and 8.3.2 Stock Raising (3) Content of the Plan)

(3) Management of groundwater

(See "Section 8.2.1 Surface water".)

## 8.3 Improvement of agriculture, Stock raising, and sylviculture

### 8.3.1 Agriculture

(1) Basic orientation

The most serious problem facing agriculture in this region is low self-sufficiency in the people's staple foods: millet, sorghum, cowpeas, and rice. Along with advancing desertification, this problem is a major cause of problems disrupting the people's lives and the social and economic difficulties that afflict the region. Consequently, the planning focuses on improvements to the productivity of these rainfed products and to their production systems at the same time as it addresses the following issues. The plan also includes improvements that emphasize traditional agricultural methods so that it will be readily accepted by the people of the region.

① At the population growth rate (3.3%) projected by the plan, it will be impossible to halt the decline in self-sufficiency in staple crops. The goals of the plan include the mitigation of the decline in self-sufficiency of the major cereals.

② To manage the use of natural resources and to sustain production, it is not appropriate to attempt to expand the area of land used to cultivate major cereals beyond its present level. The present scale will be maintained. The plan will, therefore, improve unit yields through measures to restore, maintain, and increase the productivity of land, to modify the growing season for crop seeds, and to introduce and promote the wide use of ameliorated varieties.

③ The productivity and yields of wet field rice, vegetables, etc. will be improved through the rehabilitation of existing paddy fields and the introduction and improvement of small-scale irrigation. These measures will contribute to overcoming food shortages and to improving the people's nutrition.

④ Crop production is not an activity conducted in isolation; it is closely intertwined with livestock raising, sylviculture, and the people's daily lives. Consideration will be given to maximizing overall productivity by introducing suitable measures that simultaneously improve various related elements while integrating them in mutually complementary relationships.

(2) Development concept for each zone

1) Zone 1

Rainfed agricultural productivity in this zone is the highest of the three zones. As such, this zone will be designated as the cereal supply base for the Study area. The productivity of millet, sorghum and cowpeas will also be increased.

In recent years, there has been an increasing number of migrants from Zones 2 and 3, which has led to excessive cropping due to a lack of sufficient agricultural land and tree cutting. Thus

the management of land use for agricultural and other types of land is an essential point. Agricultural land conservation measures will be taken which promote sustainable and highly productive agriculture, stock raising, and sylviculture.

In addition, the Niger river basin provides plenty of water resources and fairly good access to the large consumption center of Niamey, the capital. The roads in the area are also in good condition. Consequently, the potential is high for the development of irrigated agriculture, allowing it to aim at becoming another backbone of the agricultural sector in this zone. For this reason, small-scale dams will be constructed on the tributaries of the Niger river and the koris in order to store part of the water during times of floods, which will then be used for irrigation and animal water supply. Rice production will be increased mainly through the rehabilitation of existing paddy fields. Small-scale irrigation will be promoted through the use of flood areas for vegetable, root plant and fruit production, etc. in order to create production areas.

2) Zone 2

Unit yield for rainfed crops such as millet in Zone 2 is intermediate between Zones 1 and 3. In the center of the zone, rainfed agriculture will be developed in collaboration with stock raising and agriculture.

It is anticipated that migration will result in the population concentration in the department capital of Tillabéri in the future. Consequently, land conservation measures should be strongly promoted in order to achieve sustainable agriculture, stock raising, and sylviculture in the surrounding vicinity.

The banks of the Niger river and the surrounding vicinity provide possibilities for irrigated rice, vegetable, fruit production, and the like. In addition, in part of the Téra district, small-scale dams constructed in the koris, allow vegetable gardening during the dry season. Irrigated agricultural area may be extended beyond current production areas based on the introduction of low-cost irrigation.

3) Zone 3

This zone, where rainfall is the lowest, is under the threat of advancing desertification. Soils are degraded, and their restoration capacity is weak. Therefore, development will focus on stock raising. Further, the unit yield of millet is very low in rainfed agriculture. Consequently, it is necessary to promote sustainable agriculture, stock raising and sylviculture through the adoption of broad agricultural land conservation measures with the understanding and active participation of local inhabitants based on an appreciation that the land has little of recuperative power and is extensively degradated. Water resources will be developed through the installation of wells, using the high and important volume of groundwater of fossil valleys. Ponds will also be rehabilitated and reinforced.

(3) Contents of the plan

1) Crop production plan

(a) Major cereals

Under the plan, the area of land used for rainfed cultivation of the major cereals will remain unchanged. The plan predicts an increase of 20% in yields of the major cereals thanks to the restoration, maintenance, and improvement in soil fertility and an additional increase of 30% achieved through renewing the growing period of crop seeds and introducing ameliorated seeds. The planned yield is, therefore, 50% greater than present yield (For details, see Annexe 8.3.1.1. and figure A 8.3.1.1).

While this will increase production of the major cereals by 40% in the target year, demand will more than double so that self-sufficiency in the target year will be 60%. Self-sufficiency in the major cereals is now 82% (1996 base). If the population continues to rise at an annual rate of 3.3% without the implementation of the production increase measures specified by this plan, self-sufficiency will drop to 45% by the plan target year (2014). Consequently, the plan will reduce the decline in self-sufficiency to 15%. Efforts to reduce the rate of population growth and to import food are counted on to make up for the self-sufficiency shortfall of 40%.

**Table 8.3.1.1 Current and target unit yield**

(Unit: kg/ha)

| District | Peal millet | | Sorghum | |
|---|---|---|---|---|
| | Present | Target | Present | Target |
| Filingué | 342 | 513 | 170 | 255 |
| Kollo | 547 | 821 | 318 | 477 |
| Ouallam | 254 | 381 | 131 | 197 |
| Say | 743 | 1,115 | 497 | 746 |
| Téra | 433 | 650 | 429 | 644 |
| Tillabéri | 396 | 594 | 241 | 362 |
| Study area (avg.) | 447 | 671 | 369 | 554 |

Note: Present production is the mean harvest for each district for three years between 1991-95, exclusive of largest and smallest values.

**Table 8.3.1.2 Projected supply and demand for main cereal crops**

| District | Cultivated area (ha) | | Production (t) | | | Necessary quantity (t) | | Self-sufficiency rate (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Current status | Target year (2014) | Current status | Target year (2014) | | Current status | Target year (2014) | Current status | Target year (2014) | |
| | | | | No measures taken | M/P | | | | No measures taken | M/P |
| Filingué | 289,177 | 171,500 | 84,992 | 84,992 | 80,600 | 90,992 | 147,933 | 93.4 | 57.5 | 54.5 |
| Kollo | 132,281 | 120,875 | 69,578 | 69,578 | 91,582 | 93,395 | 228,356 | 74.5 | 30.5 | 40.1 |
| Ouallam | 173,841 | 220,100 | 37,823 | 37,823 | 76,566 | 59,179 | 91,553 | 63.9 | 41.3 | 83.6 |
| Say | 109,445 | 107,850 | 64,733 | 64,733 | 99,378 | 61,537 | 136,546 | 105.2 | 47.4 | 72.8 |
| Téra | 215,881 | 198,950 | 76,523 | 76,523 | 111,861 | 95,886 | 163,798 | 79.8 | 46.7 | 72.0 |
| Tillabéri | 83,493 | 79,000 | 31,338 | 31,338 | 42,471 | 42,976 | 52,637 | 72.9 | 59.5 | 80.7 |
| Total | 1,004,118 | 898,275 | 364,987 | 364,987 | 508,458 | 443,965 | 820,824 | 82.2 | 44.5 | 61.9 |

Notes:

1. Here, millet, sorghum and cowpeas are set as the target crops of the Study. Production is estimated based on the loss rate of 15%.
2. Cultivated area
   (1) Current status
   Mean annual average of area used for the cultivation of millet and sorghum for three years between 1991 and 1995, exclusive of largest and smallest values.
   (2) Target year
   The cultivated area of the target year refers to the planted area of the rotational agricultural land under the land use plan. Cowpeas are planned to be planted together with millet or sorghum, with the planned planted area to comprise 50% of the planted area for both millet and sorghum. Because the planted area shown in Table 8.1.1 is the ha derived from $km^2$, the totals do not match.
3. Production
   (1) Current status
   Mean annual average for the three crops (millet, sorghum, and cowpeas) for three years between 1991 and 1995, exclusive of largest and smallest values.
   (2) Target year
   The same figure as the one in current status is assumed for land for which no measures are taken. In the Master Plan, a target unit yield means the mean unit yield for three years between the years 1991 and 1995, exclusive of largest and smallest values, of the aforementioned three kinds of crops multiplied by a coefficient for productivity improvement: 1.5 for millet and sorghum, 1.2 for cowpeas. The target value is produced by multiplying these figures by the cultivated area in the target year.
4. Necessary quantity
   The population is based on demographic data for the year 1996 for the current status and estimates for the year 2014 for the target year (see Table 3.2.1). The required amounts are estimated on the assumption that cereal consumption per person is 200 kg in urban areas and for nomads, and 250 kg in rural areas.
5. Self-sufficiency
   Production was divided by the necessary quantity for the current year and target year, respectively.

(b) Wet field rice

Wet field rice production will be increased in zone 1 and in zone 2. About 3,000 ha of the approximately 8,000 ha of paddy rice land in the area are deteriorated fields marked by extremely low productivity (less than 4 tons/ha). The plan calls for improvement to these 3,000 ha of land. Double cropping is practiced on about 6,500 ha of the paddy field land. It is predicted that the improvements will boost the average yield from its present 4.3 t/ha to 5.0 t/ha.

(c) Vegetables, fruits, etc.

The plan ranks food crops into three categories based on their storage properties and market characteristics and provides for stimulation of their production. The three categories are important "priority items" (lettuce, cabbage, tomatoes, red peppers, squash, onions, Irish potatoes, sweet potatoes, cassava, watermelon, melons, okra, mangoes, and citrus fruits), the next most important "quasi-priority items" (eggplant, gourds, green pepper, carrots, and cowpeas), and "miscellaneous" that are not directly consumed (sugar cane, tobacco). The land cultivated to produce priority products will be increased by 30% and land used to cultivate the quasi-priority products will be increased 10%. Overall, the present 9,300 ha area of cultivated land will be increased by 2,000 ha (surface water will be used on 1,300 ha and ground water will be used on 700 ha). The yields by product were set with reference to the results obtained on a JALDA trial field.

**Table 8.3.1.3 Production plan for irrigated crop production**

| Items | Crop | Class (Note 2) | Target year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Planted area (ha) | | | | | | | Unit yield (kg/ha) | Production (t) |
| | | | Filingué | Kollo | Ouallam | Say | Téra | Tillabéri | Total. | | |
| Paddy fields | Rice (Note 1) | | 0 | 3,900 | 0 | 4,100 | 0 | 5,000 | 13,000 | 5,000 | 65,000 |
| Irrigated fields | Lettuce | ** | 62 | - | 23 | 87 | 59 | 26 | 257 | 2,200 | 565 |
| | Cabbage | ** | 90 | - | 12 | 48 | 117 | - | 267 | 25,300 | 6,755 |
| | Tomato | ** | 34 | 354 | 22 | 64 | - | - | 474 | 5,200 | 2,465 |
| | Pepper | ** | - | 376 | - | 40 | 94 | 38 | 548 | 600 | 329 |
| | Pumpkin | ** | - | - | 17 | - | 52 | 33 | 102 | 14,200 | 1,448 |
| | Onion | ** | - | 607 | 12 | 116 | 569 | 127 | 1,431 | 24,300 | 34,773 |
| | Potato | ** | 20 | - | - | - | - | - | 20 | 9,800 | 196 |
| | Sweet potato | ** | 90 | 285 | - | 22 | - | 46 | 443 | 6,100 | 2,702 |
| | Cassava | ** | 845 | 1,430 | - | 780 | - | 39 | 3,094 | 7,500 | 23,205 |
| | Watermelon | ** | 130 | - | - | - | - | - | 130 | 2,000 | 260 |
| | Melon | ** | 12 | 60 | 10 | 40 | 7 | 8 | 137 | 16,000 | 2,192 |
| | Okura | ** | 5 | 30 | 5 | 20 | 4 | 4 | 68 | 400 | 27 |
| | Mango | ** | 3 | 16 | 3 | 10 | 1 | 2 | 35 | 2,000 | 70 |
| | Citrus | ** | 3 | 16 | 3 | 10 | 1 | 2 | 35 | 2,500 | 88 |
| | Eggplant | * | - | - | - | 33 | - | - | 33 | 16,700 | 551 |
| | Kampyo | * | - | - | - | - | - | 44 | 44 | 16,100 | 708 |
| | Pimento | * | - | - | - | 44 | - | - | 44 | 4,000 | 176 |
| | Carrot | * | - | - | - | 23 | - | - | 23 | 11,500 | 265 |
| | Cowpeas | * | 23 | - | - | - | 3,535 | 68 | 3,626 | 6,000 | 21,756 |
| | Sugar cane | | 30 | - | - | - | - | - | 30 | 37,200 | 1,116 |
| | Tobacco | | - | - | - | - | 37 | 50 | 87 | 700 | 61 |
| | Others | | 27 | 263 | 23 | 91 | 17 | 15 | 436 | 1,000 | 436 |
| | Sub total | | 1,374 | 3,437 | 130 | 1,428 | 4,493 | 502 | 11,364 | – | 100,144 |
| Total | | | 1,374 | 7,337 | 130 | 5,528 | 4,493 | 5,502 | 24,364 | – | 165,144 |

Notes:

1. The area of paddy fields is the total of the two croppings per year.
2. ** means "important crops", * means "semi-important crops", while no star mark means "others".

2)Revival, maintenance and increase of agricultural land productivity

In these past several years, rainfed agricultural land productivity has notably declined due to the advance of land degradation, as a result of a reduction in both the non-planted period and injected quantity of organic matter. Land productivity will be restored through the systematic combination of the following agricultural land conservation measures, centering on the effective use of local resources. The objective will be to increase unit yield by about 20%.

(a) Establishment of management/guidance system

In order to conserve agricultural land, it is necessary to adjust land use through a rational arrangement of non-planted areas, and planted areas. Therefore, in keeping with the Rural Code, land commissions will be actively established in five districts (one has already been established in Say) to act as management and guidance bodies (see Section 8.1, "Land Use"). A viable system for adjusting interests resulting from agricultural land protection activities such as land and water, will be established. Further, agricultural land conservation measures will be implemented smoothly.

(b) Diffusion and guidance

A continuous training system for soil conservation technicians will be established in order to realize sustainable implementation of agricultural land conservation measures so as to allow sustainable agricultural management.

In addition, diffusion of agricultural land conservation measures will be executed in such a way as to permit farmers to recognize the direct merits and accept the implementation, as part of the activities of the assistance team.

(c) Conservation activities in each small basin

Surface run-off water that causes soil erosion starts from the upstream of land, and some small water courses join to form a small basin. Consequently, even if farmers in the different small basins may well talk about agricultural land conservation activities and implement some measures, they do not have any effect on each other.

Therefore, agricultural land conservation activities and measures will be implemented in such a way that the land within a village be divided by a number of small basins, and the measures will be carried out by each respective group consisting of farmers in the same small basin.

(d) Agricultural land conservation techniques

Techniques which are readily understandable and applicable by the farmers will be introduced in an organized and well planned manner into the rotational agricultural land used for the production of major food crops, which accounts for the majority of agricultural land.

a) Promotion of farming measures

The following farming measures will be promoted to reduce soil degradation on agricultural land and in order to reinforce soil fertility and the water holding capability.

① Improved soil fertility through adoption of non-planted period

Since the major reason for the decrease in fertility in rotational agricultural land where rainfed agriculture is practiced is a reduction in non-planted period, land use should be planned so that annual planting rate is decreased to less than 25% in Zones 1 and 2, and 20% in Zone 3, where the natural conditions are severe, in order to improve soil fertility. In addition, the period of continuous planting in agricultural land will be limited to three years with periods of nine to twelve years of non-planting.

② Securing organic matter input through penning (enclosures)

Penning (the use of enclosures) is a traditional farming method used to improve water holding capability and fertility of the land by allowing domestic animals such as cattle, goats and sheep onto the farmland or fallow land where they spread their excrement directly onto the land. Especially in the dry season, penning has been practiced through the mutual cooperation of farmers and herders: in return for providing crop residues and cereals to herders seeking animal feed, while farmers obtain excrement of animals in the fields. In theory, the maximum possible area for penning (enclosures) in the Study area reaches 1,066,000 ha (Table 8.3.1.4). However, the actual executing rate is declining due to antagonism between farmers and herders, deficiency of cereals, and farmers removing crop residues from the fields. In order increase the penning rate, the terroir management committee shall prepare plans and make arrangements between farmers and herders in an organized manner.

③ Promotion of intermediate cropping of legumes, such as cowpeas

The planting of legumes, such as cowpeas, on bare part of agricultural land together with millet or sorghum will produce a number of favorable combined effects, such as a reduction in soil erosion and evapo-transpiration, enhanced soil fertility, increased food production, and the like. This is the reason why the objective is to promote intermediate cropping of such as cowpeas, in over 50% of the cultivated areas of millet and sorghum.

④ Enhancement of soil fertility, through agro-forestry

Given that agricultural production, such as millet and sorghum, on lands planted with trees like the Acacia Albida, will increase because of the resulting input of organic matter and nitrogen fixation by such trees, agro-forestry will be developed on rotational agricultural land (see Section 8.3.3, "Community Forests", for details).

b) Introduction of water harvesting

Suitable water harvesting measures will be introduced, depending on the condition of the soil and topography, in order to prevent soil erosion and improve water holding capability of soil, which will secure more efficient millet and sorghum production, etc. In this case, local equipment, materials and manpower are to be effectively used so that local inhabitants themselves can manage the measures in a sustainable fashion.

The major measures to be used in this plan consist of the stone ridges, aligned contour plantation of Andropogon, as well as the utilization of eyebrow ridges and zais (see Annexe

8.3.1.2 – 5). Measures will be implemented for 50% of the newly planted lands which are changed from non-planted to planted each year under the rotational farming system.

**Table 8.3.1.4 Planned area of restoration of land productivity to rainfed agriculture**

| | Filingué | Kollo | Ouallam | Say | Téra | Tillabéri | Total |
|---|---|---|---|---|---|---|---|
| Annual planting rate of rotational agricultural land (%) | 20 | 25 | 20 | 25 | 25 | 25 | -- |
| Above land area (1000 ha/year) | 172 | 121 | 220 | 108 | 199 | 79 | 898 |
| Maximal area used for penning (100 ha/year) | 248 | 196 | 70 | 260 | 198 | 92 | 1,066 |
| Intermediate cropping area for cowpeas, etc. (1000 ha/year) | 86 | 60 | 110 | 54 | 99 | 40 | 449 |
| Area changing from non-planted to planted status (1000 ha/year) | 57 | 40 | 73 | 36 | 66 | 26 | 299 |
| Area subject to water harvesting (1000 ha/year) | 29 | 20 | 37 | 18 | 33 | 13 | 150 |

Notes

1. The maximum area used for penning is calculated by dividing annual production of animal excrement by the required volume of excrement for the penning of one ha (5 tons).
2. Area of intermediate crops, such as cowpeas, is set at 50% of the annual planting area of millet and sorghum.
3. The combined total for each district does not always correspond to the total given because of the rounding of figures.

3) Major cereal ameliorated seeds distribution project

Ameliorated seeds of millet and sorghum will be disseminated in order to increase production capacity and product quality. For that purpose, the existing seed center is to be remodeled so as to multiply the foundation stock of seeds that have been ameliorated and adapted to local conditions by INRAN and ICRISAT for distribution to contracted seed producing farmers (see Tableau A8.3.1.1 - 2). The seeds thus produced will then be sold to cereal growing farmers with the aim of eventually replacing currently cultivated millet and sorghum within the five-year period of the project (first phase) throughout the Study area, so that better seeds can be disseminated in an organized and well-planned manner.

The plan does not need any changes in the current system of farming. Thus, it does not require any input of new fertilizers or chemicals.

The plan seeks to realize an increase in unit yield of about 30%. The areas covered and the area of seed garden plots by district are shown in Table 8.3.1.5.

**Table 8.3.1.5 Target planted area and total area of seed producing plots (for five years)**

(Unit: ha)

| District | Planned area | | Area of seed producing plots | |
|---|---|---|---|---|
| | Peal millet | Sorghum | Peal millet | Sorghum |
| Filingué | 163,440 | 8,060 | 548 | 100 |
| Kollo | 116,524 | 4,351 | 391 | 54 |
| Ouallam | 193,028 | 27,072 | 648 | 338 |
| Say | 81,319 | 26,531 | 273 | 331 |
| Téra | 180,647 | 18,303 | 606 | 228 |
| Tillabéri | 72,127 | 6,873 | 242 | 86 |
| Total | 807,085 | 91,190 | 2,708 | 1,137 |

Notes:

1. The total planned area of 898,275 ha is shown in Table 8.3.1.1 and was divided into Peal millet and Sorghum (See Table 8.3.1.3).
2. The area of seed producing plots were calculated based on values for the number of cultivated plants and weight of harvested 1,000 seeds on the Major Cereal Varieties Catalog of Niger released by INRAN (1994).

4) Agricultural production infrastructure improvement plan

The plan calls for the improvement of about 3,000 ha of the approximately 8,000 ha of paddy rice land in the area that are deteriorated fields marked by extremely low productivity (less than 4 tons/ha). The water canals and pumps will be improved.

To strengthen vegetable and fruit productivity, small-scale irrigation facilities will be provided by improving the small dams used to obtain surface water at the koris (44 locations) and marshes (4 locations) and by digging shallow wells and preparing new dry fields for dry period cultivation (2,000 ha).

And to improve farm working conditions and distribution conditions, roads usable by motor vehicles will be constructed linking the farming villages with the arterial roads. Because there are now parts that can not be traveled safely even during the dry period, facilities that are both road structures and storage facilities will be constructed according to topographical conditions that permit safe travel throughout the year. A total of 65 km of road will be provided, or about 0.5 km/village for the 120 villages that are beneficiaries of the agriculture, stock raising, and sylviculture support project. And kori crossing facilities will be constructed at a total of 240 locations, or two for each village.

(4) Expected results

1) Rainfed agriculture

Production improvement measures for major cereal crops of rainfed agriculture (the distribution of ameliorated seeds, recovery of land productivity (conservation of agricultural lands)) are expected to lead to increases in food production. Improved self-sufficiency will contribute to a more stable living.

2) Irrigated agriculture

The introduction of irrigated cultivation will result in the achievement of more productive and stable agricultural production, leading in turn to higher income and better nutrition. By

allocating the surplus income to food purchases, the level of self-sufficiency is expected to be raised.

3) Agricultural roads

The development of agricultural roads will result in reduction in damaged agricultural products during the collection and shipment, rapid shipment to consumption places, as well as easier transport of farming materials.

### 8.3.2 Stock raising

(1) Basic orientation

Cattle are considered to be a form of savings and not a commercial product. Consequently, the productivity and reproduction efficiency of cattle are poor. This plan proposes the adoption of an effective cattle milk and meat production method. It anticipates dairy production for national markets and the production of meat for export. This will allow milk and meat to be turned into commercial products, and therefore serve as an important source of income for farmers, which will help to stimulate rural society. By maintaining the production base, the production of sheep and goats will be promoted and an effective production system will be planned for milk and meat.

The basic orientation of this sector is outlined below.

① Major animals for production development will consist of beef cattle, dairy cattle, sheep, goats, and bees considering use of natural resources (pasturage and raw honey) and exportability. Sheep, goats and bees are animals which are relatively simple to maintain and require little capital investment.

② Improvements in productivity per animal, reproductive efficiency, and the quality of animal products should be focused on rather than an increase in the number of animals.

③ Improvement of production infrastructures will mainly be focused on the rehabilitation of degraded grasslands, the creation of grasslands, the establishment of animal water supplies, and livestock management infrastructures.

④ Improvement of cattle will focus on the Azawak breed. In the far future, development concept of artificial insemination will also be included in the Plan taking into consideration the effectiveness of improved stock raising.

⑤ Infrastructures and human resources related to animal hygiene will be enhanced.

⑥ Long-term and profitable funding systems with low interest rates will be established in order to facilitate the introduction of improved breeds and infrastructure construction.

(2) Development concept for each zone

1) Zone 1

The two districts of Say and Kollo benefit from relatively heavy rainfall and enjoy prosperous agriculture, among the three zones. Animal husbandry, using abundant fodder resources, is also prosperous. In this zone, stock raising takes either the sedentary or transhumance form. The banks of the Niger river and its vicinity are abundant in fodder and can support the development of dairy production, as well as cattle and sheep raising for supply to major consumption centers, such as Niamey. The combination of agriculture and stock will be promoted.

The Plan also anticipates the development of beekeeping with the use of honey rich plants.

The integration of agriculture and stock raising will allow animal tillage of agricultural land, the restoration of soil fertility, and the production of fodder thereby allowing these two activities to complement each other. The measures to promote and encourage stock raising in this zone involve: ① construction of fodder production infrastructures, ② establishment of a model dairy farm, ③ reinforcement of animal health facilities, ④ distribution of improved breeds of livestock, and ⑤ the development of beekeeping.

2) Zone 2

The districts of Téra and Tillabéri have the characteristics of both Zones 1 and 2. Stock raising is practiced in both sedentary and transhumance forms, and to some extent, under nomadic form in the north of the district of Tillabéri. In the Niger river basin near the city of Tillabéri, it will be possible to develop dairy production along with cattle and sheep raising. However, in areas distant from the Niger river, the degradation of grasslands and fodder production infrastructures are very serious. It is possible to classify Zone 2 as a zone with mixed development of animal reproduction, dairy production and livestock raising. In this zone, the measures to promote and encourage stock raising cover ① construction of fodder production infrastructures, ② construction of animal water supply facilities, ③ reinforcement of animal health facilities, ④ distribution of improved breeds, and ⑤ establishment of a model dairy farm.

3) Zone 3

In the two districts of Ouallam and Filingue, transhumance of livestock is practiced for cattle, sheep and goats. Nomadic stock raising is also practiced to some extent by the Tuaregs and Peulhs. This zone may allow the development of animal reproduction. However, the capacity of available natural grasslands to supply fodder is limited, and the rehabilitation is necessary. Water supply facilities are insufficient in number. The district of Filingue is the land of origin of the Azawak breed of cattle which are capable of producing both good meat and milk. They will be the essential elements of the development of dairy production for the breed improvement plan. In this zone, the measures to promote and encourage stock raising include ① rehabilitation of degraded grassland, ② increased establishment of animal water supply

facilities, ③ reinforcement of livestock improvement center and distribution of improved breeds of livestock, and ④ reinforcement of animal health facilities.

(3) Content of the plan

1) Stock raising and management plan

(a) Cattle

The plan will seek to turn cattle into commercial products for supply to markets from being a form of living savings. However, the fragility of fodder production infrastructures acts as an impediment to production development based on an important increase in the number of animals. Consequently, the plan will seek to increase milk and meat production by improving breeds and fodder production infrastructure. Beef cattle are fed all year round on natural grasslands. The herds are led by transhumance from Zone 1 to Zones 2 and 3 to the north during the rainy season. Livestock are raised with fodder from improved grasslands and crop residues in Zones 1 and 2.

The baseline elements to be considered with respect to beef cattle in planning are: weight of reproductive cows: 400 kg, interval between births: 16 months; birth rate: 75%; active period as a reproductive cow: 10.6 months; total number of births: 6; number of years to be grown: 38 months; weight at the time of sale: male: 450 kg, female: 400 kg. There is a plan to reduce the length of the interval between births which would be achieved by improving fodder production infrastructure and providing nutritional bricks, as described below, in order to reduce the accident rate and improve the shipping rate by reducing the selling age.

In the Study area, people do not raise cows exclusively for milk. That is the reason why the development of the production of cows for both meat and milk will be conducted. Cattle are fed all year round on grasslands, and the milking of cows is done manually twice per day, in the morning and evening. The milking period is roughly eight months per year, and the average annual production of milk per cow is 800 kg (500 kg of which are used as fresh milk) (see Tableau A8.3.2.1 for details).

In this plan, the anticipated annual supply of milk is 52 liters per person, including milk from cows, sheep, goats and camels, and an annual consumption of meat, other than fowl, of 17 kg per person. (see Tableau A8.3.2.2 for calculation methods).

(b) Goats and sheep

Sheep and goats, which have a strong tolerance of dry climates, are bred for milk, meat, leather and manure production. The meat of sheep and goat is very much appreciated in Niger. This animal husbandry requires little capital, and is possible in limited areas. Since the selling age is low, production effectiveness is high, and the two animals are distributed as commercial products. This is the reason why this type of animal husbandry is considered to be an income generating activity for women. A small-scale credit scheme is to be arranged under the agricultural assistance system to support the activity. Animal management techniques are

mainly targeted at improving productivity through the improvement of fodder production infrastructures. The baseline elements of the Plan for sheep are: weight of adult sheep: 55 kg (male) and 40 kg (female); interval between births: 12 months; active period as a reproductive sheep: 8 years; total number of births: 6 births; average number of births per year: 1.2; selling age: 12 months; weight at time of sale: 47.5 kg for both male/female, on average and milk production is 60 kg per year per head (see Tableau A8.3.2.3 for details).

The baseline elements of the plan for goats are: weight of adult: 33 kg (male) and 28 kg (female); interval between births: 6.5 months; reproductive years: 6 years; total number of births: 11 births; average number of births per year: 1.85; selling age: 18 months; weight at the time of sale: 30 kg male/female, on average and milk production is 80 kg per year per head (see Tableau A8.3.2.4 for details).

(c) Bees

Beekeeping will be developed in the two districts of Say and Kollo in Zone 1, which have rich vegetation suitable to honey production. Currently, honey is mainly collected from wild bees. In the plan, improved breeds will be introduced, and honey will be collected twice per year, with a harvest of 30 kg per hive. Farming density will be 500 ha per hive. A management body will cover five hives. Honey can be produced with little capital, so development of production will be done by women's groups (see Tableau A8.3.2.5 for details).

2) Livestock improvement plan

Since livestock are mainly raised on extended natural grasslands, livestock improvement, through the introduction of artificial insemination, seems difficult. Therefore, the improvement of cattle is to consist of conventional natural cross-breeding. To achieve this objective, the national Toukounous ranch (livestock improvement center) will work as a base to improve the Azawak breed for the production of beef and milk. The ranch will also have the role of preserving genetic resources and providing improved breeds.

The supply of breeds, judged from the supply capacities of the Toukounous ranch, is estimated to be 525 of sire bulls and 900 of superior cows (see Tableau A8.3.2.6 - 7 for supply by department). Although the introduction of artificial insemination techniques will be necessary in order to facilitate faster improvement of livestock, it will take time to disseminate such techniques to farmers in the field. Therefore, in this Plan, the Toukounous ranch is designated as a center for the technical development of artificial insemination and the learning of techniques. It will also train artificial insemination technicians.

3) Fodder production plan

With the progress of desertification, the fodder productivity of natural grasslands is declining. Grasslands are comprised of fallow grasslands, non-agricultural forest lands, protected lands and barren lands as shown in Table 8.1.1 Land Use Plan. Thus, in relation to the soil conservation sector, the productivity of degraded grasslands will be restored, and fodder yields will be increased. In addition, fodder production will be extended across the conserved

areas in the Niger river basin and koris through the rehabilitation of existing grasslands and the creation of new grasslands. Grasses to be introduced include the *Andropogon gayanus*, *Bourgou* (*Echinochloa stagnina*), *Stylosanthes humilus*, and the like. Dry grass of 4 t/ha will be produced for the areas of improved grassland, and the utilization rate will be 70%. A total of 50% of the crop residues that can be supplied by agriculture will be provided for use as animal feed. Currently 70% are used, but this will be reduced in order to protect agricultural land. Table 8.3.2.1 presents an overview of fodder supply under the Plan (see Tableaux A8.3.2.8 – 10 regarding the basis for calculation). The supply/demand balance is negative for the districts of Kollo and Say because the produce more livestock than is necessary for self-sufficiency. For this reason, because in the north during the rainy season grass resources can be found, there is seasonal transhumance.

The Plan calls for the creation of 1,000 ha of improved grassland. Some 130 ha of degraded grassland is to be rehabilitated taking into account demonstration effects, because the common grasslands that are used by the dairy farmers in the outskirts of the capital are degraded.

It is proposed that tilling method using hoof of cow and rotational herding be taught to herders as part of the agricultural assistance system to improve the productivity of natural grassland.

In addition, if urea is provided to ruminants, it can easily be assimilated by the stomach (rumen) and be transformed into microscopic proteins. An adapted quantity of urea becomes proteins. Since fodder resources in the Study area lack in proteins, minerals and vitamins of good quality, urea will be effectively used as an auxiliary form of fodder to improve production. For that, in order to make effective use of fodder resources such as millet and sorghum brans, women's organizations will undertake to fabricate multi-nutritional bricks for livestock, using millet and sorghum brans, urea, cement and salt. Facilities for producing nutritional bricks for livestock will be established in line with the number of livestock to be raised, with 510 units of such facilities (see Tableau A8.3.2.11 for details on the number of units installed by department).

**Table 8.3.2.1 Test calculations of fodder supply/demand plan**

(Unit: t)

| District | UBT | Demand (dry weight) | Estimated supply (dry weight) | | | Supply/demand balance |
|---|---|---|---|---|---|---|
| | | | Grassland | Crop residues | Total | |
| Filingué | 248,916 | 590,553 | 603,962 | 104,186 | 708,148 | 117,595 |
| Kollo | 196,674 | 466,609 | 162,883 | 128,401 | 291,284 | -175,325 |
| Ouallam | 69,757 | 165,499 | 513.361 | 97,991 | 611,352 | 445,853 |
| Say | 260,039 | 616,943 | 234,566 | 138,026 | 372,592 | -244,351 |
| Téra | 198,876 | 471,833 | 296,645 | 161,423 | 458,068 | -13,765 |
| Tillabéri | 92,406 | 219,233 | 216,266 | 62,537 | 278,803 | 59,570 |
| Total | 1,066,668 | 2,530,670 | 2,027,683 | 692,564 | 2,720,247 | 189,577 |

4) Livestock production plan

The number of livestock animals will be increased under the Plan by 10% for cattle and 5% for both sheep and goats compared to 1996, considering available fodder resources. Increased turnover rate of animals will allow an important increase of all livestock production. Table 8.3.2.2 shows the production plan.

**Table 8.3.2.2 Livestock production plan and planned number of animals**

| Category | District | Number of head or hive | Number of head | Production (t) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Meat ♂ | Meat ♀ | Meat of waste animals | Fresh milk | Honey |
| Cattle | Filingué | 139,205 | 44,546 | 3,859 | 1,960 | 1,247 | 22,273 | |
| | Kollo | 201,935 | 64,619 | 5,598 | 2,843 | 1,809 | 32,310 | |
| | Ouallam | 25,795 | 8,254 | 715 | 363 | 231 | 4,127 | |
| | Say | 256,025 | 81,928 | 7,097 | 3,605 | 2,294 | 40,964 | |
| | Téra | 163,980 | 52,474 | 4,546 | 2,309 | 1,469 | 26,237 | |
| | Tillabéri | 77,408 | 24,771 | 2,146 | 1,090 | 694 | 12,386 | |
| | Total | 864,348 | 276,592 | 23,960 | 12,170 | 7,745 | 138,296 | |
| Sheep | Filingué | 64,950 | 29,227 | 426 | 228 | 82 | 1,754 | |
| | Kollo | 73,035 | 32,866 | 479 | 256 | 92 | 1,972 | |
| | Ouallam | 85,327 | 38,397 | 560 | 299 | 108 | 2,304 | |
| | Say | 152,238 | 68,507 | 998 | 534 | 192 | 4,110 | |
| | Téra | 151,647 | 68,241 | 995 | 532 | 191 | 4,094 | |
| | Tillabéri | 58,764 | 26,444 | 385 | 206 | 74 | 1,587 | |
| | Total | 585,961 | 263,682 | 3,843 | 2,057 | 739 | 15,821 | |
| Goats | Filingué | 174,528 | 33,160 | 724 | 547 | 63 | 2,653 | |
| | Kollo | 97,955 | 18,611 | 406 | 307 | 35 | 1,489 | |
| | Ouallam | 112,101 | 21,299 | 465 | 352 | 40 | 1,704 | |
| | Say | 180,609 | 34,316 | 749 | 566 | 65 | 2,745 | |
| | Téra | 197,891 | 37,599 | 821 | 621 | 71 | 3,008 | |
| | Tillabéri | 51,318 | 9,750 | 213 | 161 | 18 | 780 | |
| | Total | 814,402 | 154,735 | 3,378 | 2,554 | 292 | 12,379 | |
| Camels | Filingué | 85,626 | 11,131 | | | 64 | 5,009 | |
| | Kollo | 5,375 | 699 | | | 4 | 315 | |
| | Ouallam | 10,237 | 1,331 | | | 8 | 599 | |
| | Say | 548 | 71 | | | 0 | 32 | |
| | Téra | 6,032 | 784 | | | 5 | 353 | |
| | Tillabéri | 8,657 | 1,125 | | | 6 | 506 | |
| | Total | 116,475 | 15,141 | | | 87 | 6,813 | |
| Honey bees | Filingué | | | | | | | |
| | Kollo | 1,882 | | | | | | 56 |
| | Ouallam | | | | | | | |
| | Say | 2,800 | | | | | | 84 |
| | Téra | | | | | | | |
| | Tillabéri | | | | | | | |
| | Total | 4,682 | | | | | | 140 |
| Total | Filingué | | | 5,009 | 2,735 | 1,456 | 31,688 | 0 |
| | Kollo | | | 6,483 | 3,407 | 1,941 | 36,085 | 56 |
| | Ouallam | | | 1,740 | 1,014 | 387 | 8,734 | 0 |
| | Say | | | 8,845 | 4,706 | 2,551 | 47,852 | 84 |
| | Téra | | | 6,361 | 3,462 | 1,736 | 33,692 | 0 |
| | Tillabéri | | | 2,744 | 1,457 | 793 | 15,258 | 0 |
| | Total | | | 31,182 | 16,781 | 8,864 | 173,309 | 140 |

Moreover, the production of livestock excrement is expected to reach 5,333,000 tons (see Tableau A8.3.2.12 for the breakdown of type of stock). It will be used as valuable organic matter for agriculture.

5) Livestock hygiene and livestock management plan

Six veterinarian centers (one per district) and twenty livestock capture facilities will be established under the Plan as animal health measures.

The number of required animal water supply facilities will be established along the animal corridors used for transhumance herding and should be placed at practical locations for movement based on the following conditions: ① a small increase in the number of animals, ② an increase in the number of animal water supply facilities, ③ given that the extent of insufficient water volume and locations are unknown, necessary facilities are to be planned as shown in Table 8.3.2.3 emphasizing rehabilitation work.

**Table 8.3.2.3 Planned animal water supply facilities**

| Content | Quantity |
|---|---|
| ① Rehabilitation of deep wells | 9 |
| ② Rehabilitation of wells | 45 |
| ③ Rehabilitation of ponds | 57 |
| ④ Construction of wells | 8 |

A total of 500 model dairy farms will be established primarily in Zones 1 and 2. The Plan also provides assistance for creating 560 bee breeders in the district of Say and 380 in the district of Kollo, in which honey-rich plants are plentiful.

(4) Expected results

On the condition that no large-scale expansion in the number of animals is planned, the following results can be expected.

① Defining the number of animals in keeping with fodder resources will restrict overgrazing, will allow sustainable animal husbandry, and will contribute for combating desertification.

② The development of milk, meat, leather and honey production will result in an increase in income and a stabilization of the living conditions of farmers and to an improvement in their nutritional condition.

③ Increased production of improved breeds will allow exports and foreign currency gains.

④ Transforming cattle into commercial products will serve as an income generating source for farmers and will stimulate the economy of rural areas.

⑤ The practice of small- and medium-size livestock raising managed by women will help them achieve financial independence and will improve their status.

### 8.3.3 Community forests

(1) Basic orientation

1) Forest management by the local population (Community forestry)

In the 1980s, the importance of social forestry was recognized but because forests were managed under the control of the government participation of local inhabitants was not sufficient., As a result they were simply paid as workers. Many conflicts occurred among various groups regarding the use and maintenance of the forests. However, because the government had financial difficulties and the forest area is large, it has proved more effective to entrust the management of the forests to a group which acts as a liaison between the government and local inhabitants for an adapted forest management. This is the reason why the introduction of community forestry in which forests are managed by local communities and benefits are divided directly and indirectly in a fair way among the inhabitants is indispensable.

2) Forest management, taking into account Women in Development (WID)

Generally, women are the ones responsible for collecting firewood. If the size of the forest is reduced, this has a direct negative impact on their workload. They would then need to walk greater distances in order to collect firewood, which would require much time and effort. This is why WID should also be taken into account with respect to the effective use and management of forests.

According to the guidelines of the FAO's "Women in Community Forestry: A field Guide for Project Design and Implementation 1989", fair participation of men and women is indispensable for community forestry projects. At all levels of project proposal, design, implementation and evaluation, the social role of men and women should be taken into account and be reflected in the output of the project. These FAO guidelines will be considered in this Project.

(2) Development design for each zone

The following community forestry plan covers all zones and will be promoted. However, specific activities will be implemented in each zone.

1) Zone 1

The following activities will be undertaken taking into account the promotion of agro-forestry and management of national forests

① The planting of windbreaks and trees for the conservation of agricultural land.

② Tree cutting management for firewood in national forests.

2) Zone 2

The following agro-forestry activities will be promoted taking into account national forestry management and CED/DRS.

① The planting of windbreaks and trees for the conservation of agricultural land.

② Tree cutting management for firewood in national forests.

③ Tree plantation for soil immobilization to impede sand movement to the Niger river.

3) Zone 3

Priority commitment will be given to diverse sylvo-pastoral and CED/DRS activities.

① Fodder tree management and improvement.

② Implementation of different soil conservation measures.

(3) Community forest plan

Concrete measures in this plan include the promotion of mini-nurseries, rehabilitation of central nurseries, and increasing the awareness of local inhabitants regarding the importance of forest protection.

1) Promotion of mini-nurseries

The supply of suitable plants is an essential element of tree plantation activities. If plants are transported from an area that is far from villages, transport costs will be high. Timely planting would be difficult, thus it is not realistic. The rural society studies conducted during the field Study revealed that local populations needs their own nurseries to obtain firewood, shade trees, fruits, and edible products.

Trees that were especially popular among local inhabitants were the Baobab (its leaves and fruit are edible) and the Acacia Albida (best suited for agro-forestry). The species to be planted would be grown in very small-scale or mini-nurseries and determined based on the preferences of the local population.

Although establishment of mini-nurseries was promoted in 1982-90 under the National Forest Project (PFN), raising the awareness of local inhabitants on tree planting and monitoring was insufficient. Drawing on the lessons of this failure, the promotion of mini-nurseries will be undertaken taking into account the points below. The villages covered will be as indicated in Section 8.5, "Provision of Agriculture, Stock Raising, and Sylviculture Support System" (in principle, 15% of the 804 villages of the PRSAA or a total of 120 villages).

- Seedling producers will be trained in villages to deal with tree planting, nursery management and planting monitoring
- For three years from the introduction of the mini-nurseries, this Project will give aid to public tree plantation (an initial set of equipment and annual expendables), and seedling production will be carried out. The seedling producers will also be able to produce fruit trees from which they themselves can gain profit.
- A self-supporting system will be established starting the fourth year after the introduction of the mini-nurseries which will allow continued operation of the mini-nurseries even after the project is completed.
- The tree plantation will be mainly managed by terroir management committees of the villages, and a monitoring system will be established (see "Section 8.5 Agriculture, stock raising, and sylviculture support system provision"). The number of plants produced annually

in a mini-nursery will be set at about 5,000 to allow the villagers to deal with planting during their spare time when they are not working in their agricultural fields. Thus, the total number of plants to be produced under this plan will be 600,000 per year.

2) Rehabilitation of central nursery

As was indicated earlier, the central nursery will be used for the training of seedling production specialists who would manage the village-based mini-nurseries. The central nursery will be rehabilitated to allow this training activities.

3) Promotion of education on forest protection activities among the general population

Increasing awareness with regard to the following five points will be conducted through the sensitization and dissemination of information as described in "Section 8.5 Provision of agriculture, stock raising, and sylviculture support system". These sensitization activities will increase the interest of the inhabitants in planting and they will set aside time for such activities even during cropping seasons.

(a) Improvement of agricultural land fertility

Fallen dead leaves provide nitrogen and other nutrients and matter necessary for crops to the fields. This is the reason why Acacia Albida trees have been protected from soil degradation on cultivated land as a traditional method of agro-forestry in the Sahel. Twenty trees per hectare would secure an almost totally balanced system. A Study conducted in Senegal shows that even a land totally deprived of any nutrients has a harvest of about 500+ or -200 kg to 900+ or -200 kg/ha of millet when cultivated with Acacia Albida trees. In addition to increases in harvest, organic matters contained in the soil is increased by 50 to 100%. The water holding capacity of the soil is also improved.

Fruits that fall on the fields during the dry season are utilized as fodder of good quality. Acacia Albida trees produce more than 1,500 kg of fruit per hectare, which is sufficient to feed one cow. Wood is used for firewood and construction materials, while the thorny branches are used as fences for gardens.

(b) Restoration of non-planted lands

Adoption of a rotational planting system, with a planting period of three years and a non-planting period of nine years or more will help to maintain fertility and restore the soil, including its organic matter content. The following requirements should be met for effective operation of rotational planting:

a) The variety of trees planted in the non-planted land should consist of those which not only help to improve the soil fertility, but also produce edible products, fodder, construction materials, combustibles, and the like.
b) Because cereal production periods and tree planting periods overlap, labor distribution must be taken into consideration.
c) Good results should be obtained and soil fertility be improved within a short period of time (2 - 4 years).

d) Animal-resistant trees will be planted. Trees with no fodder value include the acacia which fixes nitrogen.

(c) Erosion control measures

a) Wind breaks

Trees which are effective in stopping wind which used in the creation of wind breaks which are easily accepted by the population include a mixture of fast-growing trees that rapidly become effective as windbreaks, slow growing trees that reach a certain height and become dense with fine protective capacity (*Banalities aegyptiaca*, etc.), and short trees that provide forest products and fill low spaces (*Acacia nilotica, seyal, laeta, senegal*, etc.).

b) Afforestation bands for soil conservation

Plantation of tress with various functions on plateaus and koris where erosion is serious can serve to protect the soil and realize benefits of forest products.

c) Creation of afforestation bands along hypsometric contours

Afforestation bands which consist of a mixture of tall and low trees planted along hypsometric contours are effective against soil erosion. The establishment of afforestation bands will allow soil fertility restoration within about ten years and will be effective for non-planted agricultural land.

(d) Hedge promotion

Currently, in order to preserve agricultural land, include vegetable gardens, against vagrant animals, thorny tree branches are cut for use as hedges. The plantation of hedges is proposed as a means of preventing the reduction of forest resources..

(e) Diffusion of improved cooking stoves

The promotion of the diffusion of the improved "Mai Sauki" cooking stove is being conducted in towns under the GTZ project. This stove fabricated with old metal is supposed to be used by 25 to 50% of urban families by 1997. However, its use is not yet common in rural areas because of its cost.

The "Albarka" cooking stove is made of mud (banco) and can be readily fabricated in rural areas. This is the main reason why its dissemination will be promoted in rural areas and villages.

Local inhabitants are made to fully appreciate of the benefits of improved cooking stoves in terms of reduced firewood consumption and fewer hours of labor needed to collect firewood so that they are willing to introduce the cooking stoves themselves.

To promote dissemination of above-mentioned activities, the role of the Directorate of Forestry and the communities will be as described below.

(a) Role of the Directorate of Forestry

Protecting forests from destruction by fire or excessive tree cutting is the major function of the Directorate of Forestry. It should also promote timely free plantation, as well.

In addition, rather than focusing on its function of collecting taxes on the use of forest products which were formerly utilized free of charge, the Directorate of Forestry should give directives to local communities and individual farmers regarding tree plantation.

The Directorate of Forestry should also work to promote agricultural, stock raising and sylvicultural activities on agricultural land from the perspective of establishing a rotational fallow system and to encourage local population to implement it.

(b) Community-based measures

The major problem for forest rehabilitation is the protection of young trees during the first year after planting. In those cases when herders bring their animals into fields to feed crop residues after cultivation, farmers should monitor the animals not to eat the young trees in the field.

(4) Expected results

The diffusion of mini-nurseries and promotion of the assistance system for agriculture regarding afforestation will allow the implementation of sustainable forestation activities by focusing on local inhabitants. Tree planting also contributes to the production of agriculture and livestock, along with the stable provision of firewood. This, in turn, will lead to an improvement in the living conditions of the local population in rural areas and an increase in the sustainable production of forests.

### 8.3.4 Farming

(1) Basic policy

Farming in the Study area primarily consists of the cultivation of millet and sorghum, supplemented by stock raising, and is managed in a self-sufficient manner. Crop production is mainly done manually using traditional farming tools and is dependent on in-house labor. However, because of frequent draughts and soil degradation, and without any effective control measures being taken against them, farmers are obliged to carry out low-productive agriculture. This makes it difficult to achieve food-sufficiency.

The following basic policies have been formulated in order to address the situation:

① To implement various comprehensive measures in the field of agriculture, stock raising, sylviculture, and conservation for sustainable agricultural production;

② To improve the skills and techniques in agriculture, stock raising and sylviculture of farmers with the supports provided by the Support Team under the agriculture, stock raising and sylviculture support system (see figure 8.5.1);

③ To increase agricultural income by introducing more intensive commercial agricultural products.

(2) Farming plan

The plan calls for farming to continue to be based on self-sufficiency mainly through rainfed agriculture and stock raising and includes a trial calculation of future agriculture income for typical individually managed farm households practicing representative types of farming in each zone (see Tables 8.3.4.1 to 8.3.4.3). The trial calculation treated factors that increase farm income from rainfed agriculture as the effective use of water, rationalized land use, and increased yields achieved by introducing ameliorated seeds. It treated factors increasing stock raising income as the provision of feed production bases and the improvement of stock raising productivity through the introduction of improved stock.

(3) Farming types analyzed by zone

① Zone 1

Zone 1 is blessed with comparatively better agricultural conditions, and stock raising is popular. Therefore, promotion of either rainfed agriculture alone or a combination of rainfed agriculture plus stock raising (sedentary) is planned as the main forms of agricultural activity.

Paddy rice and vegetables are also cultivated along the Niger river. However, the percentage of the area of land used in this fashion within the zone as a whole is so small that paddy rice and vegetables are excluded from the target crops in the planned farming type.

② Zone 2

Zone 2 is nearly the same as Zone 1 in terms of farming type. (Since stock raising (transhumance) is found only in small numbers, it is not included in the farming type in this zone.)

③ Zone 3

In this zone, rainfed agriculture as well as transhumance (pastoralism) stock raising on natural grassland are predominant. In addition to the two farming types described above, a combination of rainfed agriculture and stock raising (transhumance) is set up as another farming type. Thus, three farming types will be developed.

The profitability of major crops in the zone are outlined below (see Tableau A8.3.4.1 - 14 regarding the basis of calculation).

**Table 8.3.4.1 Profitability of major crops (Planned)**

(Unit: FCFA)

| | Unit | Gross Income | Operating expenses | Net income |
|---|---|---|---|---|
| Millet | Per ha | 104,000 | 1,400 | 102,600 |
| Sorghum | 〃 | 82,000 | 400 | 81,600 |
| Cowpeas | 〃 | 21,200 | 600 | 20,600 |
| Cattle | Per head | 63,760 | 13,660 | 50,100 |
| Goats | 〃 | 7,710 | 1,160 | 6,550 |
| Sheep | 〃 | 12,000 | 1,800 | 10,200 |

**Table 8.3.4.2 Plan of farming type**

| Zone | Farming type | Characteristics |
|---|---|---|
| Zone 1 | Rainfed agriculture only | Consists primarily of millet and sorghum cultivation, and some stock raising |
| | Rainfed agriculture+stock raising (sedentary) | Combination of rainfed agriculture and stock raising (sedentary) |
| Zone 2 | Rainfed agriculture only | Same as Zone 1 |
| | Rainfed agriculture+stock raising (sedentary) | Same as Zone 1 |
| Zone 3 | Rainfed agriculture only | Same as Zone 1 |
| | Rainfed agriculture+stock raising (sedentary) | Same as Zone 1 |
| | Rainfed agriculture+stock raising (transhumance) | Combination of rainfed agriculture and stock raising (transhumance) |

**Table 8.3.4.3 Amount of farm income by farming type (standard individual model)**

(Unit: FCFA)

| District | Zone 1 | | Zone 2 | | Zone 3 | | |
|---|---|---|---|---|---|---|---|
| | Rainfed agriculture only | Rainfed agriculture+ stock raising (sedentary) | Rainfed agriculture only | Rainfed agriculture+ stock raising (sedentary) | Rainfed agriculture only | Rainfed agriculture+ stock raising (sedentary) | Rainfed agriculture+ stock raising (transhumance) |
| Farm area | 8.4 ha | 8.4 ha | 6.4 ha | 6.4 ha | 2.1 ha | 2.1 ha | 2.1 ha |
| Cultivated area Number of head raised | Millet: 6.9 ha Sorghum: 1.5 ha Cowpeas: 2.9 ha | Millet: 6.9 ha Sorghum: 1.5 ha Cattle: 2 head Goats: 3 head Sheep: 3 head | Millet: 4.7 ha Sorghum: 1.7 ha Cowpeas: 2.6 ha | Millet: 4.7 ha Sorghum: 2.7 ha Cattle: 5 head Goats: 15 head Sheep: 10 head | Millet: 1.8 ha Sorghum: 0.3 ha Cowpeas: 0.6 ha | Millet: 1.8 ha Sorghum: 0.3 ha Cattle: 2 head Goats: 4 head Sheep: 5 head | Millet: 4.7 ha Sorghum: 2.7 ha Cattle: 10 head Goats: 11 head Sheep: 14 head |
| farming income | 922,720 | 1,013,430 | 674,500 | 1,071,690 | 221,520 | 386,560 | 925,010 |
| Portion from agriculture | 922,720 | 862,980 | 674,500 | 620,940 | 221,520 | 209,160 | 209,160 |
| Portion from stock raising | - | 150,450 | - | 450,750 | - | 177,400 | 715,850 |

The area of cowpeas is the intermediate cropping area with millet and sorghum. thus inside of the farm area.

Source: Prepared based on the results of local commissioned study (survey of 100 households per district) and current area under cultivation

## 8.4 Market distribution

(1) Basic orientation

Market and distribution is classified into three stages: ① place of production, ② transportation and storage, and ③ place of consumption. As has already been indicated earlier, production is currently meant for self-consumption. There are not many products which have

been commercialized, and no distribution system exists to support the sale of agricultural and livestock products on markets. There are many issues needing to be addressed with respect to each of these three stages. The Master Plan will cover these issues as well, but as it will be difficult to solve them all within a short period of time, they will be addressed progressively in this plan considering the present market and distribution situation.

1) Progressive handling of issues

The following is the progressive handling of issues in accordance with format of main production area, market and shipping improvement and provision of legal system.

(a) First term plan (5 years from start)

The following items are to be undertaken at the place of production: ① organization of farmers and ② establishment of family-based processing facilities. With regard to the transportation and storage stage: ① improvement of agricultural roads to the major roads, and ② introduction of carts drawn by donkeys, cattle, etc. At the place of consumption, a market information system is to be set up at consumption places where information is abundant with the aim of installing a market office and information gathering system in Niamey and Tillabéri together with a nation-wide information gathering network. In addition, efforts will be made to pass a commercial law, and a market management distribution system will be set up. The overall sanitary status of food products will also be addressed.

(b) Intermediate and final term plan (from the 6th through the 15th year)

One of the main issues to be addressed during the intermediate and final terms of the Master Plan is the participation of farmers in the market economy through their education. The following issues are to be addressed according to the development of the places of production ① establishment of collection and shipping facilities (at three locations as a model case) and means of transportation, ② establishment of processing facilities, ③ standardization of products for export purposes, ④ creation of a low interest rate funding system for the construction of distribution related facilities, and ⑤ the gathering of information on export market trends for onions and beef which can be used for export.

2) Reduction of production loss rate

Measures will be taken to minimize the loss in storage, transport and processing of products and to increase the rate of commercial products.

(2) Content of the plan

1) Improvement of agricultural products distribution

The plan will focus on the improvement of strategic products for irrigated agriculture exclusive of good storage capacity cereals. Current traditional storage methods will be used for cereals that are easily stored. No other measures will be adopted for cereals.

The following components should be addressed in the first term plan. Farmers will be organized at the places of production. Dry vegetables processed at the farm level will be routed

for common shipment, and the required funding will be provided through the funding scheme included in the agricultural support system. An information system will be set up for the markets of Niamey, the national capital, and the city of Tillabéri to record volume and price information on the trading of fresh fruits and livestock products. Information on Niamey and Tillabéri is gathered by each city and this information is collected by the Ministry of Agriculture and combined with other information from all over Niger. It is then managed as a whole by the Financial Management Department of the Ministry of Agriculture. This information will be provided on the radio.

Improvement of transport means will be made based on an agricultural management credit scheme, for example, the purchase of a donkey. The improvement of agricultural roads is planned so as to prevent damage to products during transport and the effectiveness of transportation will be improved.

In the intermediate and final term plan, if major places of production, for example, for the production of vegetables, are established, model collecting and shipping facilities will be introduced at 3 locations.

2) Improvement of livestock products distribution

As shown in 8.3.2 Stock raising, because the consumption level of milk is still low, there is much room to increase consumption. However, with the exception of those living in urban areas, farmers are not accustomed to eating dry cheese, it will be necessary to educate them to affect an improvement in their lifestyles. With regard to fresh milk, which cannot be stored, the establishment of 600 family processing workshops are planned so as to be managed by farmers' organizations, for example, for cheese making. This is planned for the following reasons: ① dry cheese is a storable, processed dairy product for which production changes by the season ② because the investment level for equipment required is low and the manufacturing techniques are simple, it is certainly possible to distribute production among farmers and ③ compared to areas, fresh milk, transportation costs are low. As to dairy products development, in urban areas eight collecting and shipping facilities are planned to be constructed for producer groups in order to reduce production costs by purchasing cooperatively. It is also planned to establish six small-scale milk processing facilities for yogurt making near major consumption places.

3) Improvement of forest products distribution

Firewood markets have been established by the government in the districts of Kollo and Say (see 4.5 Market distribution (3) Forest products). Such markets should also be established in other districts in order to stimulate forest products distribution.

(3) Expected results

The following results can be expected:

① The improvement of farmers' income through an increase in the rate of commercialization and added value;

② Foreign currency gains from increased exports; and

③ Increased possibilities for work opportunities in the villages.

## 8.5 Provision of agriculture, stock raising, and sylviculture support system

(1) Basic orientation

① Measures will be planned which will allow farmers to manage the terrior management committees that they have formed in a sustainable and regular manner.

② The technical training will be given to farmers in order to improve agricultural, stock raising and sylvicultural techniques, as well as to strengthen the commitment of farmers towards increasing production.

③ A support system and program will be established for farmers in collaboration with research and extension organizations.

④ A support system will be established to improve the management skills of farmers and to increase their income.

(2) Content of plan

Because the results of field surveys etc. have shown that the needs of each zone are very similar, a plan for the entire study area is to be established.

The plan will be conducted in harmony with the PRSAA now being implemented by the Government of Niger in the department of Tillabéri with the support of the IBRD (see 4.6 Agriculture, stock raising, and sylviculture support and farmers organizations (1)).

1) Need for the plan

In order to achieve sustainability of development, in addition to improving the capabilities of terroir management committees and supporting agriculture, stock raising, and sylviculture, it is also necessary to train key farmers and seedling producers. To do so, a support system staffed by experts in agriculture, stock raising, and sylviculture and by promotion staff from the department will be formed. In conjunction with this, a support system that can contribute effectively to the improvement of farm management and increase of farm incomes will established (see Figure 8.5.1).

The following are the types of support necessary in each field for the achievement of sustainability.

① For agriculture, technical advise on the introduction of suitable varieties, measures to improve soil fertility, and cropping of major cereals and vegetables;

② For stock raising, technical support for the improvement of livestock, immunization, livestock management, product processing, and fabrication of multi-nutritional bricks for livestock

③ For community forests, sensitization of local inhabitants on forest protection, diffusion of improved cooking stoves, effective use of firewood, as well as on the training of seedling producers.

④ Guidance on agricultural land and soil conservation measures among key farmers, and technical guidance for seedling producers.

These various types of support will be provided through the following components with voluntary participation of local farmers based on terroir management method. Considering the impact of the plan, about 15% of the 804 villages covered by PRSAA, or 120 villages, will be covered by the Plan.

2) Contents of plan

(a) Provision of agriculture, stock raising, and sylviculture support systems

At the project office, Support Teams for agriculture, stock raising, and sylviculture will be formed by agriculture, stock raising, and sylviculture experts with rich experience in their respective fields and detailed understanding of conditions in the area's farm communities (from NGO). An Agriculture, Stock Raising, and Sylviculture Support Center will be established in each district as a base for activities in that district. Three promotion personnel from the Department will be assigned to each Support Center. Their duties will include providing operating, management, and production technology guidance to the village level terroir management committees and providing a research system. The experts on the Support Teams will be in charge of the training of the key farmers and the seedling producers and the education of the promotion personnel. For this reason, the offices will include a meeting room and lodging facilities (see Figure 8.5.1).

(b) Provision of agriculture, stock raising, and sylviculture support procedures

The following support procedures will be provided in order to improve farm management and increase farm income and at the same time, to reduce the work load on women and children and enhance their social standing.

① Establishment of cereal banks

The stable provision of food products to the general population is an important issue for the study area, where agriculture is almost entirely rainfed, and where many people starved in the past due to repeated droughts. Cereal banks should be established in 120 villages where millet is saved and after harvest in the event of a crop deficiency due to a natural disaster, farmers would be granted loans to cope with food shortages.

②Establishment of mills

Since mechanizing the grinding of millet grain will help to relieve the workload of women, mills will be established in 120 villages

③ Small-scale credit scheme

In accordance with the installation of a mill, credit system will be established in 120 villages, especially for women, to cover costs for stock raising, vegetable gardening during the

dry season, fabrication of handicraft items, and fabrication of nutritional bricks for livestock, which will permit cash income.

④ Agricultural management credit scheme

With the establishment of a training system, agricultural management credit will be granted to trainees for the improvement of agricultural, stock raising, and sylvicultural activities in 120 villages.

⑤ Establishment of equipment and materials banks

Agricultural equipment and materials such as animal drawn carts, transport carts, improved agricultural tools, agricultural equipment, and the like will be loaned to farmers in 120 villages in order to promote the use of advanced agricultural equipment and materials and to increase productivity.

(3) Expected results

As stated above, development efforts in the past conducted with the support of donor countries, etc, have had implementation problems with respect to sustainability due to many reasons, such as the lack of farm management practices, the lack of will, the low level of education, the different forms of living, amongst others (see 3.6 Trends in assistance). Since the government as well as regional directive and extension agencies had insufficient budgets, monitoring of these development efforts has also been inadequate. Therefore, the Study area will be generally supported with the measures outlined above (Figure 8.5.1) which should be effective. In this way, progress in desertification control will be made through the improvement of productivity and increased income from a human and institutional point of view(see Figure 8.5.1).

Figure 8.5.1 Pattern of the agriculture, stock raising, and sylviculture support system (proposal)