NIGERIA - SOUTHERN GONGOLA - TOUNGOU BLOCK DEVELOPMENT PRELIMINARY ECONOMIC CONSIDERATIONS IN PROJECT IDENTIFICATION

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FIRST DRAFT

prepared by

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Nigeria - Southern Gongola Toungou Block Development
Preliminary Economic Consideration in Project Identification
- First Draft -

Foreword

The Appraisal Report for the First Livestock Development Project (FLDP) called for a study of the possible development of a heavily tsetse-infested area in the south of Gongola State (the so-called Toungou Block). This study was called for in the context of a livestock project and promoted further by the implementing agency of the FLDP, the Livestock Project Unit (LPU). Nevertheless it was clear from the start that such area development in Southern Gongola would by no means be limited to livestock. Hence, an interdisciplinary resource inventory has been commissioned to RIM (Resource Inventory + Management Ltd), of which this present report forms part. Its purpose is to provide the type of economic reasoning that is is likely to become relevant if one wished to proceed in the direction of identifying a possible development project.

The information base for this report is still very incomplete. The author has only paid one visit to the study area. Neither the World Bank's Agricultural Sector Review of Nigeria nor the SOTESA (a consulting firm) study on development prospects of Gongola state has been available. Furthermore RIM's resource inventory of the Toungou block has only been half completed, the dry season survey yet to be undertaken. For these reasons this present report should be considered as a first draft to be corrected, completed and refined during and subsequent to the dry season survey work scheduled for March/April 1984.

As incomplete as it may be even this first draft would not have been possible without the cooperation from LPU, in particular Iain Colquhoun, and ILCA, in particular Ralph von Kaufmann. Of course, the responsibility for any mistakes and misconceptions remains with me.

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Hamburg, January 1984

I. Introduction

- the basic challenge of developing the sub-humid zone in West Africa -

The Toungou Block, an area of some 40 000 sqkm is situated in the South of Gongola State in Eastern Nigeria between 7° and 9° northern latitude. As such it is part of the subhumid zone of West Africa which is generally defined as a zone with a growing period of between 180 and 270 days increasing from north to south. It is an area of generally low altitude with some important elevations the most important of which is the Mambilla Plateau in the south. That plateau is different in ecology, land use, constraints and development potential and dealt with separately. For the remainder the Toungou Block is in many ways representative of the subhumid zone of West Africa.

Land use throughout the project area is characterized by small scale, rainfed upland farming of annual crops, largely cultivated by hand hoe. It is principally subsistence farming, but there is always some production for sale to provide for esential needs. Average cultivated area per farm family has been estimated at three hectares (FACU, 1981) and is generally limited to what a farmer can cultivate effectively with family labour using simple hand tools. However, recent years have seen some introduction of work oxen, in the northern parts, and of tractors.

The predominant grain crop is sorghum followed by maize and rice. The most important tuber crop is yam. Groundnuts and cowpeas are the predominant legumes. The growing of crops in association is common.

The keeping of livestock, particularly of cattle, is restricted by the presence of tsetse flies. Seasonal movement of Fulani herds and flocks into the area is common. One of the purposes of the ongoing survey is to obtain more accurate information about livestock numbers and distribution.

As is typical for the subhumid zone in West Africa population density is relatively low, potentially cultivable land is abundant and the livestock population is far below the fodder producing capacity of the area.

It is a contention for the whole subhumid zone of West Africa, well exemplified by the Toungou Block that tsetse flies and the diseases they

carry (the trypanosomiases, particularly those affecting cattle), are mainly responsible for underutilization of a zone with a vast production potential both for crops and for livestock. This is all the more important since the semi-arid zone to the north and the humid zone to the south suffer, practically throughout West Africa from heavy population pressure. With the advent of effective tsetse control techniques the development of the subhumid zone is an attractive development path in West Africa. The development of the Toungou Block therefore not only constitutes a development challenge in itself but exemplifies in practically all aspects this much grander challenge to West Africa. To overcome the tsetse problem is an essential part of this challenge. That this also holds for the Toungou Block is well demonstrated by the fact that this name has been given to the area by tsetse fly surveyors who first identified the area as infested.

Thus the bulk of the study area represents a problem common to much of West Africa. The southernmost part of the study area, the Mambilla Plateau is quite different and relatively atypical for West Africa.

The Mambilla Plateau corresponds to the Mambilla Local Government Area. It is about 4300 sqkm in extent (about one tenth of the study area) and is a highland area lying between 1400 and 1600 meters above sea level. At this altitude the area is largely free of tsetse flies. Average rainfall is relatively high at 1200 mm per annum and reliable.

Land use on the plateau is very much characterized by the conflict between cultivation and livestock keeping. Livestock graze over 95 % of all land although only kept by 25 % of the population. The cultivators, by tradition and legal right are restricted to 5 % of the land although one half of all land is considered to have a good cropping potential. Since pasture land is communal and since there are no restrictions on livestock numbers, extremely high livestock densities are found resulting in serious pasture degradation. At the same time the land pressure on cultivators has not only led to very small farm sizes (1,2 ha per holding) and the cultivation of unsuitable land with consequent degradation and soil erosion.

2. Tsetse Infestation and Control

2.1 Basic Considerations

There can be no doubt that tsetse flies exist in the study area and that tsetse flies and trypanosomiasis constitute an obstacle to agricultural development. This is, however, not to say that they are the only obstacle, or, that the elimination of obstacle "autimatically" leeds to development and improved welfare. Tsetse control can be one of the many necessary measures for the development of an area but given the many competing uses of resources the necessary efforts have to be compared with the expected gains. Many historical and economic analyses have shown that there are no "automatic" benefits from tsetse and trypanosomiasis control and that the danger of immediate failure and failure in the long run is great. In this context failure means both reinfestation (loss of an area back to the flies) and lack of development after clearance. Accordingly one can make a distinction between the justification of tsetse control in terms of economic costs and benefits and the feasibility. The latter aspect is dealt with in section 2.3. The topic of economic justification requires some more comments before being dealt with in the following sections. The economic justification has a great deal to do with the costs of control and the benefits derived from control. Costs per unit area depend on the control technique and on the environmental conditions. They are at this stage not the issue. The issue is much more the area to be treated and the area actually freed from the fly (section 2.2 and 2.3). For an assessment of the benefits a distinction has to be made between benefits arising outside the control areas (section 2.4), i.e. in areas that have always been tsetse-free, and the benefits that are realized within the cleared area (section 2.5).

In the following it is assumed that human trypanosomiases, which can also be transmitted by tsetse flies, are of no importance in the Toungou Block and that concern needs to be with animal trypanosomiases only.

2.2 Extent of Tsetse Infestation

Bourn (1983) summarizes the tsetse situation in the study area as follows :

> "Plateaux above 1200 meters are unlikely to support any significant tsetse populations.
>
> The two tsetse species considere to represent the most significant trypanosome challenge to cattle in the Toungou Block are G. longipalpis and G. morsitans, both of wich are likely to exist in isolated pockets of infestation in areas where wildlife (particularly bushbuck and warthog) persist, and where human population remains low. Of the two, G. morsitans is likely to be the most widespread and represent the greatest problem.
>
> In contrast G. palpalis and G. tachinoides, which are generally considered to represent a less severe trypanosome challenge to cattle, are likely to be found over much of the Toungou Block, but only within very limited habitats provided by thicker riverine vegetation."

The most important point that transpires from Bourn's review, however, is the fact that neither extent of tsetse infestation nor trypanosomiasis challenge are accurately known. Bourn emphasizes the necessity to undertake a tsetse survey before embarking on any development measures concerning cattle. This comment may be enlarged : For all agricultural development planning in the area it is essential to know the extent of tsetse infestation because this would clarify to what degree tsetse flies can be blamed for the underutilization of the area. At present there is conflicttkä nstünkzn. From the "conjectural limits of G. morsitans belts" used by RIM (1983) the infested area can be estimated to be in the order of 11360 sqkm or one fourth of the study area. On the other hand the tsetse control division assumes that the two belts are now linked. In any case if one included the species other than G. morsitans the total area under risk of tsetse and trypanosomiasis is likely to be greater. Nevertheless all this is speculation. The presence of considerable numbers of cattle in supposedly infested areas adds to the confusion (RIM 1983). But without substantiated figures on tsetse infestation neither costs nor benefits of control efforts can be assessed.

2.3 Feasibility of Tsetse Control

Technically it appears to be possible to eradicate tsetse flies or at least, to bring the fly population down to a level where trypanosomiasis loses its economic importance. The most common method today is the application of insecticides, either from the ground or, particularly in the form of ultra-low volume droplets, from aircraft. Nigeria has successfully cleared well over 200 000 sqkm of land from 1956 to 1978. Nevertheless some particular problems associated with tsetse control in the Toungou Block should be mentioned.

1) All of Nigeria's experience with tsetse control stems from areas further north which are drier and have a less dense vegetation. In the last analysis it is not known whether and to what degree these techniques also work in the sub-humid zone. In any case it is likely that the costs per unit area treated will be higher.

2) In the drier areas of the north tsetse populations can be attacked during the dry season when they concentrate on limited well-watered surfaces. Typically the ratio of area treated to area freed has been very favourable. That ratio is likely to be reversed in the subhumid zone where practically all the area to be freed has to be treated although not all this area can eventually be put to agricultural use. This again affects the cost-benefit ratio.

3) Problems of reinfestation are much more pronounced in the sub-humid zone. The natural habitat is more ideally suited to the different fly species and it tends to be more difficult to separate infested areas like the Toungou Block form the large contiguous belts of infestation.

4) One contiguous belt extends from the study area into Cameroon. While intentions of a joint appoa ch by both governments have been voiced the practicalities of implementation appear far from a solution. All experience shows that international cooperation in tsetse control efforts is difficult, virtually impossible, to achieve. The creation of fly barriers (vegetation removal and or chemical barriers combined with fly controls) is possible though risky and in any case more costly.

5) A basic decision would need to be taken about flies in conservation

areas. The large wildlife reservation in the south east might be adversely affected by massive control operations, particularly if because of ruggedness of terrain ground spraying has to be resorted to. Furthermore the tsetse fly as an important guard of conservation areas would be lost.

These points do not mean that tsetse control is impossible in the area concerned. They do suggest that a number of additional problems will be incurred and that costs are likely to be very high.

2.4 Potential Benefits Outside Control Areas

Tsetse infestation in one area may have adverse effects on welfare and development of other, tsetse-free, areas. If that is the case removal of tsetse flies brings aboutbenefits outside the actual control area.

A number of authors see the main problem of tsetse infestation in the fact that it prevents the keeping of cattle and thus the production of urgently needed protein for a country. It is erroneous, however, to conclude that tsetse and trypanosomiasis control are suitable measures to relieve a protein deficiency. If a protein dificiency exists it exists among the poorer sections of the population. It is therefore necessary to find cheap sources of protein. Beef and milk produced in outlying areas after expensive tsetse control are likely to be the most expensive sources of protein in any country. It is unrealistic to assume that the poor population groups benefit from this expensive protein. It is therefore strongly recommended to discard the protein argument in the development of a tsetse and trypanosomiasis strategy.

There are then only three major ways in which tsetse-infested areas constitue an obstacle for the development of tsetse-free areas and call for action (Jahnke, 1975) :

- Tsetse-infested areas may constitute a focus of expansion and tsetse-free areas may therefore be threatened by a tsetse-invasion.
- Tsetse-infested areas provide the possibility of sporadic contacts between

tsetse and cattle so that cattle trypanosomiasis may be a problem in tsetse-free areas.

- The presence of tsetse may result in over-crowding in and over-utilization of the tsetse-free areas with negative effects on their productivity.

If any one of these adverse effects existed and was eliminated by tsetse control this would be a benefit attributable to tsetse control.

Threat of a Tsetse Spread: There is some contention that the fly has spread in the more recent past to now form a contiguous belt of infestation. Just like the issue of extent of infestation there is, however, no real substantiation by data. The fact that the study area is by and large thinly populated would indicate that most of it is suitable for the tsetse fly. Langlands (1971) in his study of Uganda implied that under subhumid conditions all areas with a population density of 15 persons per sqkm or less can potentially become infested.

What is required here is an experienced opinion on the likelihood of a tsetse spread and of the accompanying effects. If it can be made plausible that without tsetse control the fly might spread to new areas leading to loss of animals, retreat of the human population and further overcrowding in already densely populated areas the case for tsetse control is strong.

Cattle Trypanosomiasis : Trypanosomiasis does occur and leads to losses of production and productivity, increased animal mortality and also to costs for drug treatment against the disease. It has not been possible to obtain a quantitative idea of these effects. This would, however, be necessary if their elimination was to be counted as a potential benefit from tsetse control.

Overcrowding : If the presence of tsetse flies reduces possibilities of settlement and land use, it is obvious that tsetse-free areas have to carry higher human and livestock populations. In the study area a particularly striking example is provided by the tsetse-free Mambilla Plateau. The consensus of opinion is that both human and livestock populations are far too high and that overgrazing and land degradation result from overuse of the area. Tsetse control in the lowlands might allow humans and animals to

immigrate thereby reducing the ill-effects of excessive pressure on the highlands. If such an argument can be put forward it would point to a most important benefit of tsetse control, a benefit that might well overrride all other considerations.

It is fortunate that the Mambilla Plateau has been included in the study area to allow this aspect to be examined further.

2.5 Benefits within Tsetse Control Areas

The basic question is whether and to what extent tsetse-infested areas constitute a potential for economic development which can be exploited once the tsetse fly is eliminated. The question can be approached from three angles: (1) What is the degree of underutilization of infested areas? (2) To what extent would increased settlement and land use by themselves take care of the tsetse problem? (3) What is the potential utilization of the areas to be cleared from tsetse flies?

Degree of Underutilization : The degree of underutilization of infested areas is one factor which determines the benefits from tsetse control. Even heavily infested areas are rarely completely empty and unused. But only the additional production net of the opportunity costs of the additional resources used can be counted as a benefit attributable to tsetse control.

It is necessary to develop quantitative ideas of present and potential level of land use and of the ratio between area to be cleared versus area made available for (increased) production. Such information is presently not available. A good deal could be compiled with relative ease by relating information on cultivation intensity to LRD's land resource assessment and by ground-sampling for cropping patterns and yields. A basic problem that remains is the lack of accurate information about the tsetse distribution.

Land Use Intensity and Tsetse Infestation:A low present intensity of land use points to sizeable potential benefits from tsetse control. The higher the existing intensity of land use is, the lower are such potential benefits. This appears to be a clear-cut result. There is, however, a closely related relationship that is also of interest: The higher the land use intensity the less likely it is to find tsetse flies. General human activity and land use in particular can lead to a reduction of the tsetse habitat. This interaction has been demonstrated for many cases just as the opposite: A

reduction of population and human activity can lead to an expansion of tsetse flies (Ford, 1972).

Is the policy implication to sit back, do nothing and wait until tsetse habitat becomes eliminated by sheer population pressure (autonomous reclamation)? The most important counter-argument probably is that by such a policy an important opportunity for establishing desirable land use patterns is lost. Especially for the sub-humid zone the danger of soil degradation is acute. Haphazard settlement, utilization of marginal areas and the application of unsuitable agricultural practices are likely to accompany the process of autonomous reclamation. The danger of trypanosomiases would for an extended period of time keep the role of cattle to a minimum. By this, however, mixed farming - generally thought to be the ideal form of land use in the subhumid zone - would be excluded. Furthermore, the use of ranges that are best put to grazing would become impossible. In other words, the opportunity of planning (and controlling) land use and of applying the instrument of land allocation in accordance with a suitable general development strategy gets lost. This is not an argument in favour of tsetse control as such. Rather it is an argument in favour of overall land use planning for areas that are presently underutilized.

Potential Untilization of Tsetse Areas: To determine when and for what purpose a tsetse-infested area is needed for development is the task of general land use planning as part of an overall strategy for economic development. This obviously exceeds the scope of this paper. Only some steps or elements can be highlighted.

- The conservation requirements have to be defined (forests, wildlife, scenic sites etc)
- The development of tsetse-free areas should be given priority because (1) costs and risks of tsetse and trypanosomiases control are avoided, (2) intensification of land use is often preferable to expansion as a development path, and (3) potential ecological ill-effects from tsetse control are avoided
- The use of infested areas should be planned in accordance with their agroecological potential.

Overall, a comprehensive agroecological inventory is called for. One might add that this holds irrespective of whether an area is tsetse-infested or not. It is also only after such an inventory and a land use plan has been made that the basic justification of tsetse control can be determined. The result may be that the potential is too low to justify control efforts. It might also be that alternative approaches to the tsetse and trypanosomiasis problem show more promise like drug control (if cattle are to play a minor role) or the introduction of trypano-tolerant animals.

3. Resource Assessment

3.1 Basic Considerations

Tsetse control has to be thought about in the context of an overall resource assessment. Such an assessment must not be limited to the infested areas only and it should be part of an overall land use plan for an area whether infested or not and whether agricultural or other uses stand in the foreground.

This paper can only provide some comments on major elements normally part of a resource assessment exercise.

3.2 The Land Resource

The land resources of today's Gongola State have been assessed by LRD (1966). The following table summarizes the results for the study area. The boundaries of the area studied by LRD and of the present study area do not fully coincide. Thus the LRD total works out at 48 500 sqkm while the present survey has been carried out over an area of 44 000 sqkm.

Summary of Land Resources and their Recommended Use in RIM Study Area

	Extent	Proportion
	sqkm	%
Arable and mixed farming	26 493	54.6
Arable and mixed farming with strict conservation	5 869	12.1
Grazing only with strict conservation	2 566	5.3
Reservation	10 806	22.3
Special highlands	2 785	5.7
Total	48 519	100.0

Source : LRD (1966)

Over 50% of the study area are considered suitable for cropping and grazing without any particular problems of fertility of topography. This is a huge land resource of 2.6 million hectares which at present is unterutilized. On the other hand, one can also say that almost 50% of the land should only be used in connection with special conservation measures or is unsuitable for any agricultural use. The category of special highlands relates to the major part of the Mambilla Plateau, for which the problems of overuse and misuse are noted.

Already at this crude level of analysis it becomes obvious that control over land use is of paramount importance if the productivity of the resources is to be maintained in the long term. In addition it will be necessary to identify areas for cropping, for mixed farming and for grazing to bring about a balance between the agroeclogical potential of the land and the demand by people for the different forms of land use. The 30 land systems identified by LRD provide an excellent basis for this work. The tsetse status as an important characteristic of the land, however, is only given in qualitative terms and needs updating in any case.

3.3 The Human Population

Bourn (1983) has reviewed available figures on the human population. He has noted (1) the virtual absence of recent reliable figures and (2) the indications that the study area is less densely populated than the surrounding areas. These indications include evidence from satellite imagery. They hold despite the fact that also in this zone the population has grown rapidly and that there has probably been a net inflow of people.

Population estimates for Gongola state (except Mambilla) were made by FACU (1981) by administrative sub-units of the "Local Government Areas" (LGA). For the total area examined (95 700 sqkm) the average population density turned out to be five families/sqkm (say, 25 persons). For the sub-units fully contained in the study area - they represent 3/4 of the study area - the average population density is only 10 persons/sqkm. The border districts of the study area again show much higher population densities (above 60 persons/sqkm). According to these figures the total population of the study area may be in the order of one million. The average population density is around 24 persons per sqkm. However, the core of the

study area, the Toungou block proper with an extent of almost 33 000 sqkm, carries only 330 000 people (10/sqkm) and is therefore typical of the sparsely populated subhumid zone of West Africa, of the middle belt as it is called in Nigeria.

Population figures are an important indicator of land use intensity for the different ecological zones. However, for purposes of land use planning they are required at a lower level of administrative sub-units. It might be possible to arrive at estimates by also using the aerial counts of human habitations together with ground-truthing. The relationship between population distribution and tsetse distribution could provide a further important indication of potential benefits attributable to tsetse control.

3.4 Livestock Population

An important part of the present survey is the determination of livestock numbers and of the distribution of livestock over the study area through the year. Since this survey is not completed yet the data from the recent livestock census of the State are taken and interpolated for the study area. Thus the total cattle population is in the order of 1.3 million, that of sheep and goats may be 2 million. Using the normal factors for conversion to a tropical livestock unit (TLU, an animal of 250 kg liveweight) the ruminant livestock is equivalent to 1.1 million TLU. The average stocking rate would be 25 TLU per sqkm or 4 ha per TLU. However, the average is here misleading. Already the first aerial survey has brought out the uneven distribution of livestock and this is confirmed by the census figures. The central part of the study has less than 10 TLU per sqkm (more than 10 ha per TLU). On the other extreme, there is Mambilla with an extremely high livestock density. The rate of one TLU per hectare of total land area is probably without comparison anywhere in Tropical Africa.

Excluding the Mambilla livestock population (460 000 cattle and 70 000 sheep and goats or a total of 330 000 TLU) the following ratios of farm families to livestock hold:

	cattle	sheep/ goats	TLU
Per family of five	4.2	9.7	4.0

secondly, consisting of various activities and elements which themselves can be looked upon as systems or sub-systems. Micro-organisms in the soil are a sub-system of the soil system; the soil system is a sub-system of the crop-producing system and that in turn is a sub-system of the farm system. The livestock system is also a sub-system of the farm system. In some cases the livestock (or cropping) system encompasses the whole of the farm system because livestock production (or cropping) constitutes the sole activity of the farm.

To look at individual management units becomes cumbersome and often impossible when the interest is in the outcome for larger aggregates or even a continent. It is then useful to group management units which are similar in their structure and in their production functions. Such groups are commonly referred to as farming systems (Ruthenberg 1980). In this definition the management units are the building blocks of a farming system. A distinction is therefore made between any given farm unit which, as it stands, is a system, and classes of similarly structured farms which are classified as belonging to a certain farming system. In both cases the term system is appropriate because the variance of the whole is less than the sum of the variance of the parts.

The grouping and delimination of farming systems can be effected in different ways, but the way in which the land is used is a central consideration. The large groups normally distinguished are grazing systems, tillage (or annual crop) systems and perennial crop systems.

A useful additional grouping of farming systems is by ecological sub-zones or land system. Placing farming systems in the context of ecological zones has the particular advantage of providing information of the basic resource endowment (livestock-land, land-man ratios, extent of tsetse infestation, productivity of the land) since the aggregate resources have already been broken down to the level of ecological zones.

It is strongly recommended that the resource assessment being carried out in the Toungou Block result in the identification and specification of farming systems in the way outlined. This is the best way of bringing resource assessment to bear for the purpose of development strategies and projects.

4. Development Models

4.1 Basic Considerations

In the framework of development projects investments and organizational efforts are undertaken to achieve improvements in the attainment of socially desirable objectives. Such objectives commonly relate to production, income, income distribution, resource conservation and the like. In order to make the cause-effect relationship within the project more transparent and to lay out the expected improvements in space and time so-called development models are often used. They show in an idealized way how a project or project component would typically work and have its effects. For agricultural projects such models are closely related to the concept of farming systems. They show for a farm, a ranch or any other decision making unit that is representative (of a farming system) how development is expected to take place. Such models have been established by LPU for livestock production systems and they are here examined for their potential applicability for Toungou Block development. Livestock models, particularly models for ruminant livestock are of particular relevance for the estimation of development effects and of benefits in connection with tsetse control. The keeping of ruminant livestock that is made possible by tsetse control is the most direct and unambiguous effect. Eventually, however, considerations should not be limited to livestock systems because a general increase in land use intensity may result. Crop models and the interaction between livestock and cropping should also be taken into account.

The models are here only discussed for their general applicability. A more detailed presentation of the parameters and an elaboration of the practical implications of the models will have to come at a later stage.

4.2 Grazing Reserves and Pastoral Ranches

The concept of grazing reserves is not entirely clear. It seems to encompass anything from a public holding ground to a private ranch and from a mere demarcation on a map to a sizeable investment in infrastructure and livestock facilities on the ground. The fluidity of the concept is not surprising because it relates to an evolutionary process rather than to a

defined situation.

The gazetting of grazing reserves in accordance with the agroecological potential and traditional grazing rights is a first step. Then infrastructural developments are undertaken, e.g. for six such reserves under the FLDP. On average a reserve covers 27 500 ha. The infrastructural investments include roads, firebreaks, water, stock handling facilities, pasture development, houses, buildings and equipment and amounted to some N 500 000 per reserve. State Government Livestock and Veterinary Services are responsible for management of the reserves.

The possible next step has been demonstrated in Bauchi where the State Government has legislated to provide for the grant of leasehold titles to graziers for blocks of land on or adjacent to the reserves.

This pattern of the issue of formal title or of the confirmation of traditional rights within the reserves is being actively promoted by both State Governments and LPU. The development model foresees that participating groups would be allocated formal title to specific wet season grazing areas, and credit would be granted for the establishment of improved pasture, construction of firebreaks, permanent watering and stock handling facilities and for the purchase of selected breeding stock. A feature of the investment programme is the incentive of a development grant of approximately N 12 000, which would be made in kind to each group of beneficiaries to offset the total investment costs of approximately N 24 000 per unit. Illustrative herd and flock projections based upon a typical pre-development herd of about 130 head of cattle and a mixed flock of 120 small stock have been depicted. Accompanying budget and financial projections have demonstrated the viability of the investments which would also benefit from the proposed strengthened animal health and extensions services. Improved pasture based upon the introduction of Stylosanthes spp would increase milk production from an estimated annual 150 l. per head milked to 300 l. and by full development in year 9 the herd would produce about 12 600 l. per annum. Cattle off-take would rise from estimated 1.56 tonnes of dressed weight to about 4.12 tonnes and the herd would produce an annual surplus of about 8 breedable heifers for sale. Small stock production would also rise from a pre-development off-take of 175 kg to 660 kg per annum as a result of improved health and nutrition. The average development loan would be N 12 000, disbursed over a two year period. The

since this model is also the basis for the ruminant fattenting and dairy models described in the following sections.

4.4 Smallholder Fattening

Smallholder cattle fattening has provided the major part of the FLDP supervised credit programme and is to be continued. Qualifying beneficiaries receive credit for the purchase of four to five head of stock and for the supply of supplementary feed and animal health treatment for a three to four month fattening period. LPU experience has been that liveweight gains of about 60 kg per head are achieved. Such gains are in meat except for about 6 % in intestinal fats i.e. the gain per head in c.d.w. is about 56 kg. As at the date of report preparation, the lack of parallel marketing organisation, with a provision for all-year-round marketing of fattened stock at guaranteed prices, limited the programme to one fattening cycle per year, the development model was established on that basis. It is anticipated that by 1986, marketing will have been developed to permit two cycles per annum. In a number of instances, smallholders have retained fattened animals for training as work-oxen; this trend would be encouraged and necessary adjustments made to the length of the term of the loan. The average loan is expected to amount to N 2 000.

Again this development model should in principle be retained as an important potential development path for farming systems in the Toungou Block. For farmers only starting to take up livestock it may, however, come at a later stage.

4.5 Smallholder Dairy Production

The traditional Fulani herd is maintained in two sections; the breeding animals which are kept at the permanent, or wet season homestead and the dry herd which is managed on a transhumant basis. This is also a known phenomenon in the Toungou Block, The Fulani family's economy and life style is based upon the cash flow generated by milk sales from the wet herd and it is of critical importance to him to maintain his herd in reasonable condition throughout the dry season. For this purpose he needs a supply of both stored fodder and supplementary feed. LPU has already made a number of successful loans on this basis and would expand the

programme. A typical target beneficiary would be a settled Fulani with a permanent homestead, to which he had traditional rights of occupancy and at which his family maintained the wet herd. Credit would be provided for pasture and browse establishment, fencing and stock handling facilities and for improved breeding stock. A capital development grant of N 200 would be made in kind to each beneficiary to assist with the cost of fencing and pasture establishment and the average loan N 1 400, repayable over 5 years, would cover approximately 70 % of the total investment cost of N 2 000. Incremental milk production would rise to 760 litres per annum from a milking herd of four cows; production, expressed in c.d.w., would rise from an annual average 92 kg of beef to 432 kg from the cattle herd and to from 28 kg to 108 kg of either mutton or goat meat from the family flock, due to improved nutrition and animal health. The incentive of a regular dry season supply of supplementary feed (principally molasses), confirmation of his tenure and assistance with development costs would encourage producer participation and ready take-up rate of the proposed development model.

Again this model is relevant for the potential development of the Toungou Block. The extent of its applicability is not known at this stage but might be the topic of further investigation.

4.6 Sheep and Goat Breeding and Fattening

Goats and sheep are kept by the vast majority of the rural population also in the Toungou Block and are a key element in their diet. LPU has made a number of smallholder loans for sheep breeding/fattening but disease control, particularly that of PPR ('Peste de Petits Ruminants') in goats has, in the past, proved a limiting factor in the Western and Eastern States. However, the successful development of a joint animal health and nutritional package by the Ibadan-based ILCA team has created the opportunity for a large scale improved production programme at smallholder level. This essential research work is now being continued in the Eastern States both for goats and sheep and NAPRI/ILCA teams are carrying out further work in the Guinea and Savannah zones. Although continuing investment opportunities are open to smallholders for small ruminant fattening, project support would be aimed at the small breeder, and credit would be provided for the establishment of browse, simple stock shelters, joint dipping facilities and improved breeding stock. The investment package would vary with the ecological conditions and marketing

opportunities facing the smallholder but, for purposes of project preparation, a typical goat breeding model based upon the proven ILCA package has been selected as representative of the scale of production suited to the average producer. Control of PPR, internal parasites and sarcoptic mange together with improved nutrition would reduce mortalities and improve off-take from the average herd of 5 breeding goats from about 28 kg to 84 kg per annum. The average loan of N 440 per annum would cover about 80 % of total investment costs.

Again this model is relevant for the development of the Toungou Block. In an overall economic assessment of proposed investments it would receive less weight simply because the attribution of resulting benefits to investments in tsetse control is less obvious. This also holds for the following models.

4.7 Other Relevant Development Models

Under the FLDP poultry and pig development models have also been established. There is no doubt that they would also be valid for the potential development of the Toungou Block. However, it is not clear to what extent they could be considered benefits from tsetse control. Therefore it is suggested that they be not taken up in more detail at this stage.

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