

IMPACT EVALUATION  
OF  
PROJECT NORD SHABA

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ACRONYMS

AID	United States Agency for International Development
DAI	Development Alternatives, Incorporated
DOA	Department of Agriculture
ESTAGRIGU	Societe cotonniere et agricole de l'Est
FCD	Fonds de Convention de Developpement
GECAMINES	General de Carrières et Mines
GOZ	Government of Zaire
IRD	Integrated Rural Development
OR	Office de Routes
PMU	Project Management Unit
PNS	Projet Nord Shaba
PRE	Ponts et Routes Agricoles
SCAD	Systeme de Collection et Analyse de Donnée
Z	Zaires (Z60:\$10US, 1986)

## EXECUTIVE SUMMARY

The main purpose of this evaluation is to assess the impact of Project North Shaba (PNS) on corn production and quantity marketed, commercial activity, and social and institutional development in the region. The evaluation also includes an assessment of the overall project design, a detailed evaluation of the PNS agriculture program, and a section on lessons learned that might be applicable to similar projects in Zaire and possibly elsewhere in Africa.

### PROJECT IMPACT

The most direct impact of this project has been on the production and marketing of corn in North Shaba. Production is estimated to have increased from about 30,000 MT in 1977/78 to about 90,000 MT in 1985/86. During this same period, the quantity of corn shipped by rail from North Shaba increased from about 12,000 MT to about 50,000 MT. This amounts to almost half of all the corn marketed in Shaba.

There are definite differences in the impact of the project on the two zones of the project area, Kongolo and Nyunzu. In Nyunzu, with a population of about 50,000 people, corn was already well established as a cash crop. During the life of the project, the quantity marketed increased from 10,000 MT to 26,000 MT. In Kongolo, with a population of about 85,000 people, corn was and still is the basic staple, but was not a significant cash crop at the time that the project started. Here, the quantity marketed increased from 1,500 MT in 1977/78 to 21,000 MT in 1985/86. In addition consumption of corn in Kongolo seems to have tripled.

Cash incomes from corn vary greatly between the two regions. In Nyunzu, the income from corn per farm household in 1986 prices increased from 26,500 in 1978 to 214,000 in 1986. In Kongolo, income per household increased from almost nothing in 1978 to 22,500 in 1986. More significantly, the top fifty percent of farmers in Nyunzu earn more from corn than even the largest farmers in Kongolo.

These changes, however, are not large in terms of total income generated. In 1985/86, the total value of corn marketed by farmers in North Shaba was 188 million zaires (\$1.9 million). This amounts to 24,800 (\$80) per farm household. The resulting increases in commercial activity although significant in relative terms have been correspondingly small. Most of the farmers spend their increased incomes on basic consumer goods (foodstuffs, clothing, soap, medicines), and some of the larger farmers have also started buying minor luxury goods and consumer durables (cosmetics, higher quality clothing, kerosene lamps, bicycles, radios).

The effect has been to increase the level of economic activity in the two major centers, Kongolo and Nyunzu, by a factor of two or three, and to create a noticeable level of commercial activity in the secondary centers (Mbulula, Sola, Lengwe) where almost none existed before the project. Outside of these five towns, all of which are located on the main trunk road in North Shaba, there is almost no commercial activity except during the corn marketing season. There are also no traders going to villagers, and very few villagers travelling to the commercial centers.

In terms of social services, more children are going to school in Kongolo, and there are more pharmacies, but there has in fact been almost no social or institutional development as a result of the project. The level of economic activity, both per household and in the aggregate, is not yet large enough to support this type of change. If it were to occur it would have to be financed with external resources.

#### CAUSES OF INCREASED PRODUCTION

During the early years of the project (i.e., from 1978 to 1981), the increased corn production was due primarily to the improved market in southern Shaba and new government policies in support of domestic corn production (notably import controls and higher producer prices), and only secondarily to project interventions, specifically improved roads and the distribution of Kasai I corn seed. From 1982 onward, project interventions made possible the continued increase in production and marketing, especially in Kongolo. Area planted to corn levelled off in 1982, but yields kept increasing so that, by 1985/86 they were more than double what they were in 1977/78. Project demonstration plots indicate that Kasai I results in a 40 percent yield increase and the recommended improved practices account for an additional 30 percent, totalling a cumulative 80 percent increase over traditional practices. Also, the improved roads encouraged traders to enter areas that were too difficult to reach before the project. Traders and farmers both attribute the increase in corn marketed to the improved roads, and farmers not on improved roads cite the difficulty of evacuation as the main constraint to increased production. (See Tables 3 and 4 in the main report for more details on the relationship between project interventions and increases in the quantity of corn marketed.)

#### SUSTAINABILITY OF BENEFITS

There are three main conditions for the continuation of corn production in North Shaba at present levels. First, there must continue to be a strong market for corn in southern Shaba. The key factors here are imports of low cost corn flour from Zambia and the increased supply from upcoming corn production projects in Central and South Shaba. Next, the farmers must have continued access to high quality improved seed. If the seed used by farmers is allowed to degenerate, production could drop by one third within five or six years. Finally, the roads in the project area should not be allowed to deteriorate to the conditions that existed before the project. Even when roads remain passable, if the road conditions are very bad some areas will not be served by traders because the transport costs will be too high.

If the objective is to continue the recent progress in PNS related to crop diversification, further increases in corn production, and improvements in corn marketing and storage, there will have to be a continued extension program.

AID has arranged for the PNS roads to be maintained by OR out of its own budget in exchange for the equipment that had been used to rehabilitate the roads. Arrangements had also been made to provide technical assistance and local cost funding for the seed program through the Central Shaba project until seeds would become available from the proposed seed farm in Central Shaba. The extension program was also to have been continued for two to three more years with funding from the Central Shaba project. The arrangements for

continuing the agricultural activities were recently rejected by the GOZ because of differences over the future role of PNS in the implementation of Central Shaba funded activities.

#### LESSONS LEARNED

The main lessons learned are listed on pages 30-32 of the main report. The lessons that appear to be particularly applicable to the Central Shaba project are the following:

1. Using the farmers who are farming the demonstration plots as contact farmers for extension purposes seems to have worked very well in recent years. The next step should be to structure the process, perhaps by providing some additional training to the demonstration farmer in his role as an extension assistant, and forming farmer groups to participate in extension activities based at the demonstration plot.
2. Adaptive tests add flexibility to the technical packages and, when the extension staff is involved, the dissemination of test results to farmers is greatly facilitated. The need for adaptive testing becomes greater when the technical packages involve multiple cropping.
3. Two important lessons were learned concerning seed production. The first is that contract farmers produced seed at much lower cost than the mechanized farm at Ngaba. The second is that demand for open pollinated varieties can be easily overestimated. Farmers need to purchase only a small quantity of seed from PNS and use it to produce their own seed which will be good for two more years. This is why seed companies in the U.S. consider open pollinated varieties as very low profit items.
4. Recent experience in North Shaba has demonstrated the importance of not relying on only one crop to increase farmer incomes. The reasons, which also seem to apply to Central Shaba, are: 1) the possibility of a weakening corn market in southern Shaba; 2) the need for crop rotation to preserve soil fertility in densely populated areas, and 3) the positive impact of diversified agricultural production on commercial development.
5. An important unanswered question is the standard of road that is needed for the evacuation of agricultural crops. PNS found that just repairing impassable spots was all that was needed to assure the evacuation of corn in some of the project areas. Beyond this, there seems to be a trade-off between the quality on the road and the distance the trader is willing to go. The Central Shaba project may want to consider identifying those areas where repairing impassable spots is all that is needed to assure the evacuation of agricultural products.

## INTRODUCTION

Project North Shaba (PNS) started in 1977 and ended in late 1986. The objectives of this project were: 1) to contribute to food self-sufficiency in Zaire by increasing corn production in North Shaba; and, 2) to achieve sustained rural development in North Shaba based initially on the increased production of corn as a cash crop. The project was initially designed as an "integrated rural development" project with the following components:

- agricultural extension and research
- farmer group development
- women in development
- rural road construction
- agricultural marketing
- intermediate technology
- information systems.

Based partly on an external evaluation in 1982, the project was redesigned as a small farmer agricultural production and marketing project. Only four of the original project components were retained:

- agricultural extension and seed production
- agricultural marketing
- rural road construction
- information systems.

By 1983, when the project was originally scheduled to end, it had surpassed its original corn production and marketing targets. At that time, the Mission decided to extend the project until 1986 based primarily on the need to assure the sustainability of project benefits. The total cost of the project was \$30.7 million US. The breakdown of costs by year and by source of funding is presented in Table 1.

The main purpose of this evaluation is to assess the development impact of the project, including increased farmer incomes and consumption, the development of towns and major villages, and social and institutional development. Secondary objectives of the evaluation are to:

1. determine the sustainability of project benefits;
2. recommend a methodology for monitoring the continuity of project benefits;
3. determine the appropriateness of the project design; and,
4. record any lessons learned that would be applicable to similar projects in Zaire or elsewhere in Africa.

The main body of the report deals with project impact, evaluation methodology, and lessons learned. Detailed assessments of overall project design, the agricultural interventions, and efforts to achieve sustainability for key project activities are contained in annexes to the main report.

FUNDS USED BY PNS[a]  
(in dollars)

Funding Type	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	Totals	% of Totals
<b>1. GOZ [b]</b>												
a. Investment Budget	1,780,827	--	--	--	854,545	763,927	--	--	--	--	3,399,299	11
b. Ordinary Budget	--	--	372,000	353,103	77,794	84,424	1,636,000	140,310	73,489	22,727	2,759,847	9
c. Counterpart Funds	78,082	414,118	396,000	1,787,259	363,636	1,253,090	1,720,000	966,197	728,889	636,364	8,343,635	27
Subtotal	1,858,909	414,118	768,000	2,140,362	1,295,975	2,101,441	3,356,000	1,106,507	802,378	659,091	14,502,781	47
<b>2. GRANT [c]</b>												
a. DAI	229,785	675,488	871,640	855,062	896,484	1,201,963	938,898	1,085,113	632,198	880,393	8,267,024	27
b. MM	120,808	260,575	387,632	387,350	411,836	856,979	501,287	132,396	983,934	462,293	4,505,090	15
Subtotal	350,593	936,063	1,259,272	1,242,412	1,308,320	2,058,942	1,440,185	1,217,509	1,616,132	1,342,686	12,772,114	42
<b>3. LOAN [d]</b>											3,431,000	11
<b>TOTAL</b>	<b>2,209,502</b>	<b>1,350,181</b>	<b>2,027,272</b>	<b>3,382,774</b>	<b>2,604,295</b>	<b>4,160,383</b>	<b>4,796,185</b>	<b>2,324,016</b>	<b>2,418,510</b>	<b>2,001,777</b>	<b>30,705,895</b>	<b>100</b>

NOTES:

a For years 1977-1983 AID disbursed grant funds for participant training and related expenses, as well as for certain internal travel expenses such as plane charters.

These figures are available through the AID controller and are not included in the figures in this table.

b GOZ contributions, all made in Zaires, are converted at the then prevailing official exchange rates.

c 1986 figures are as of 11/30/86.

d In addition, \$2,050,787 of grant funds were used for commodities. Of the total U.S. dollar expenditures of \$16,203,114, 34 percent was for commodities.

TABLE 1:  
PROJECT EXPENDITURES, 1977-1986

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## I. PROJECT IMPACT

PNS interventions were mainly focussed on increasing corn production. Increased corn production was in turn to have led to increased commercial activity and competition in the corn trade and in the sale of goods and services to farmers whose incomes had increased. Finally, increased economic activity was to have led to social and institutional development, including the creation of farmer organizations, higher literacy rates, improved health conditions, and increased political awareness. Both the direct and indirect effects of PNS on the level of development in North Shaba are discussed in this section.

### A. CORN PRODUCTION AND MARKETING

#### 1. Quantities Produced and Marketed

The most reliable data on project impact relate to the quantities of corn marketed. Almost all of the corn not consumed in the project area is shipped out through two railheads, and the project was able to develop an effective system for monitoring these shipments. Production figures, on the other hand, are based on area and yield statistics that have more scope for error. PNS data on the production and marketing of corn since the beginning of the project are presented in Table 2.

TABLE 2:  
QUANTITIES OF CORN PRODUCED AND MARKETED  
IN NORTH SHABA  
(thousand metric tons)

	<u>Kongolo</u>		<u>Nyunzu</u>		<u>Total</u>	
	<u>Prod.</u>	<u>Mkted.</u>	<u>Prod.</u>	<u>Mkted.</u>	<u>Prod.</u>	<u>Mkted.</u>
1977/78	n.a.	1.5	n.a.	10.1	n.a.	11.6
1978/79	10.6	1.9	20.9	10.4	31.5	12.4
1979/80	12.7	3.7	22.6	14.5	35.3	18.2
1980/81	36.0	5.9	30.0	26.5	66.0	32.4
1981/82	n.a.	7.0	n.a.	23.8	75.6	30.8
1982/83	n.a.	9.6	n.a.	31.1	80.0	42.2
1983/84	55.9	12.0	40.1	23.6	96.1	35.6
1984/85	n.a.	19.5	n.a.	37.3	81.2	56.7
1985/86	61.6	21.1	35.0	26.3	96.6	47.4

Source: PNS, SCAD and Service de Commercialisation reports.

The changes that have occurred in the 1978-1986 period can be summarized as follows:

1. The quantity of corn marketed in Nyunzu zone, where it was already an important cash crop, has increased by 250 percent.

2. On a per household basis, corn is a much more important cash crop in Nyunzu than in Kongolo. In 1978, corn marketed from Kongolo amounted to only 100 kg per household compared to 2 tons per household in Nyunzu. By 1986, corn marketed was 1.4 tons per household in Kongolo, and 6.4 tons per household in Nyunzu.
3. In Nyunzu, the effect of increased corn production was simply to increase cash incomes. In Kongolo, the changes were more complex. First, before the project corn was not an important cash crop in Kongolo. The major cash crops were palm oil and cotton. Corn is now the most important cash crop, palm oil remains important in specific locales, while cotton production has virtually disappeared. Second, a major effect of increased corn production in Kongolo zone was to increase corn consumption. The figures in Table 1 indicate that consumption increased from 10,000 MT in 1978 to about 40,000 tons in 1986. Although these figures almost certainly exaggerate the increase in consumption, there is no doubt that there is much more corn being consumed today than there was in 1978.
4. It should be noted that the marketing of secondary crops (palm oil, rice, peanuts) which are an important source of income in Kongolo has not increased significantly over the life of the project. The main reason seems to be that the volume has not yet reached a level that would induce middlemen to mount a major marketing effort. A second reason is that project interventions related to secondary crops did not begin until 1983. Except for palm oil, almost all of the production of these crops is consumed locally.

## 2. Causes of Increased Production

Previous PNS evaluations have tried unsuccessfully to relate project interventions directly to increases in corn production and marketing. For example, multiplying the area planted with improved seeds times the yield increase from those seeds does not explain the increase in corn production in the early years. Similarly, there was little geographic correlation between the construction of rural roads and the quantities of corn marketed. The changes in production and marketing are in fact due to a fortuitous combination of project interventions and external factors, the end result of which was to greatly improve economic conditions in North Shaba (1).

In explaining these changes, it is useful to separate the period of project implementation into two time frames: 1977-1981 when production increased but project interventions had not yet had a significant impact; and 1982-1985 when project interventions were fully underway.

As can be seen from Figure 1, the quantity of corn marketed in North Shaba has increased steadily since the beginning of the project. Table 3 shows

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(1) Part of the difficulty in establishing linkages between project interventions and changes in corn production and marketing is the poor quality of production, area, and yield data. The changes in yields are inconsistent with what is known to be the impact of the technical package, and the relationship between production and quantities marketed seems to greatly exaggerate the increase in corn consumption in the area.

changes in area and yields during this period, and Table 4 presents selected factors that help explain changes in corn production and marketing during this period.

FIGURE 1:  
QUANTITIES OF CORN EVACUATED BY RAIL  
FROM NORTH SHABA - 1976 TO 1986

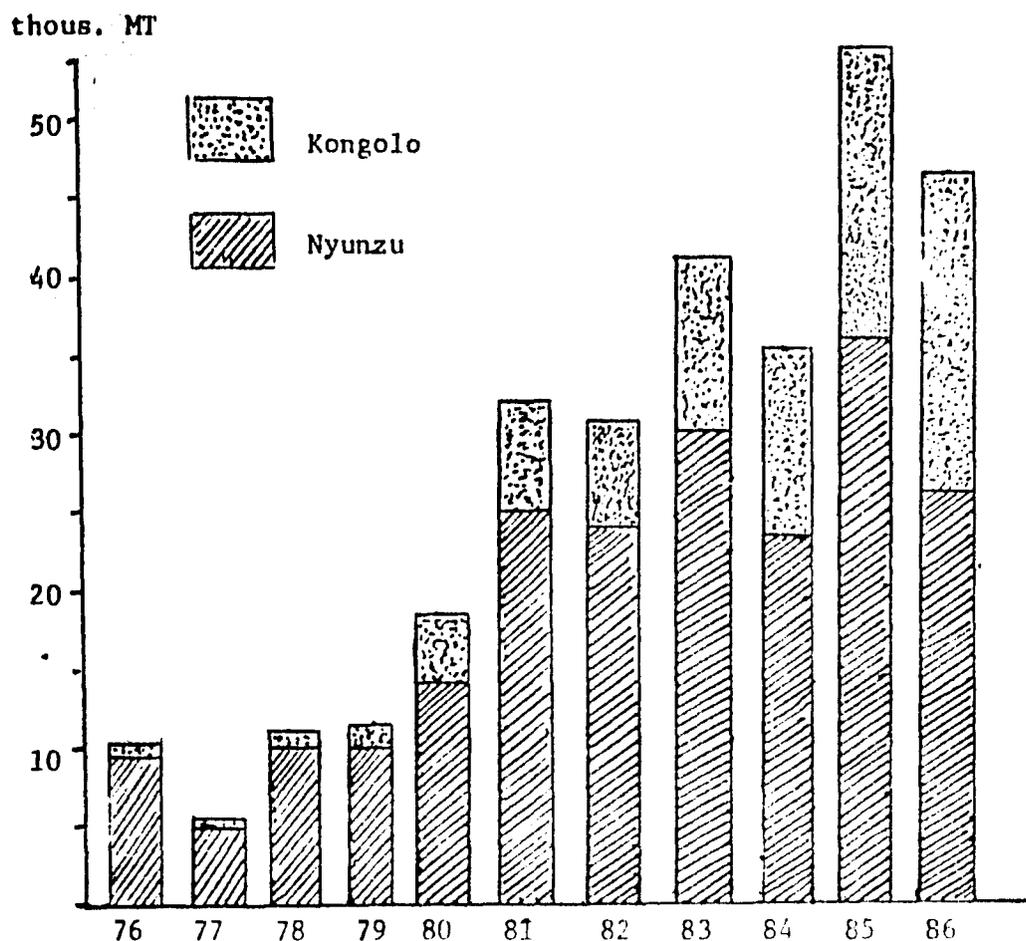


TABLE 3:  
CORN PRODUCTION, AREA, AND YIELDS

Year	Kongolo			Nyunzu			Total Prod. (000MT)
	Area (000ha)	Yield (MT/ha)	Prod. (000MT)	Area (000ha)	Yield (MT/ha)	Prod. (000MT)	
1978/79	11.3	.9	10.6	12.8	1.3	20.9	31.5
1979/80	10.4	1.2	12.7	13.5	1.7	22.6	35.3
1980/81	21.2	1.7	36.0	15.4	2.1	30.0	66.0
1981/82	19.1	n.a.	n.a.	14.3	n.a.	n.a.	75.6
1982/83	20.3	n.a.	n.a.	13.8	n.a.	n.a.	80.0
1983/84	20.3	2.8	55.9	15.6	2.6	40.1	96.1
1984/85	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	81.2
1985/86	19.6	3.1	61.6	13.5	2.6	35.0	96.6

Source: PNS, SCAD reports.

TABLE 4:  
SELECTED FACTORS AFFECTING CORN PRODUCTION  
IN NORTH SHABA, 1977-1986

Year	Seed Dist. (MT)	Extension (000hh.)	Roads Constr. (km)	Producer Prices (Z/ckg)	Corn Imports* (000MT)
1977/78	-	-	-	22	151
1978/79	23	3.8	96	35	142
1979/80	65	7.4	221	45	143
1980/81	75	11.1	475	60	102
1981/82	4	12.8	640	100	32
1982/83	45	12.8	690	200	36
1983/84	49	14.4	860	400	26
1984/85	94	15.6	1016	300	60
1985/86	112	15.7	1136	400	60

\* Imports from 1977/78 to 1983/84 refer to GECAMINES imports into Shaba. Figures for 1985 and 1986 are estimates of illegal corn flour imports from Zambia.

Sources: PNS reports, and GECAMINES records for imports.

a. The 1977 to 1981 Period

1981 was the first year of significant change in the project area. Project records indicate that production doubled and quantities marketed tripled over 1978/79. The main factors causing this increase can be summarized as follows:

1. In 1979, the Gov adopted a policy of limiting corn imports to save foreign exchange. With access to foreign exchange increasingly difficult, millers were obliged to make greater efforts to purchase local corn. Corn traders responded by bringing more sacks, trucks and fuel into the project area.
2. As part of this same policy, the regional authorities significantly increased producer prices: 120 percent in 1978, 60 percent in 1979, and 30 percent in 1980.
3. Production in Nyunzu had been disrupted by political instability in the northern part of the zone. The situation had stabilized by 1978 and farmers began returning to the area.
4. By 1981 one half of the farmers in the project area were using Kasai I seeds that yielded 40 percent more than the previous seed used in the area. On the other hand, the extension program was just getting started and very few farmers had adopted the package of improved practices.
5. Over 400 km of roads had been rehabilitated by 1981. Most of these were in Kongolo, but two PNS roads rehabilitated in 1981 opened up important production areas in Nyunzu.

In response to these factors, area planted to corn increased sharply--doubled in Kongolo and probably increased by 50 percent in Nyunzu (2). PNS figures also show that yields almost doubled in the project area. In summary, in the early years of PNS, underemployed labor and improved seeds made possible a production response to improved corn marketing conditions in southern Shaba. At the same time, the increased availability of corn resulted in a significant increase in corn consumption in Kongolo.

b. The 1982-1986 Period

After 1981, both production and quantities marketed continued to increase. During this period, production increases seem to be more directly related to project interventions, although marketing conditions in southern Shaba continued to be favorable for most of the period. Producer prices kept rising: 23 percent in 1981, 67 percent in 1982, and 100 percent in both 1983 and 1984. At the same time, imports continued to drop to a low of 26,000 MT in 1984. Project figures show that most of the increased production during this period was due to increased yields. By 1984, virtually all farmers in the project area were using Kasai I seeds, and by 1985, about two-thirds of the farmers in Kongolo zone were using key elements of the technical package (planting in rows, proper spacing, and weeding). Also, by the end of 1984, PNS had rehabilitated 870 km of roads, mostly in the corn growing areas of Kongolo zone.

Several developments in the 1981-1986 period need to be emphasized:

1. Most of the increase in the production and marketing of corn occurred in Kongolo zone. This is the area where improved practices have been most widely adopted and project roads were concentrated. By contrast, Nyunzu zone seems to have experienced a labor constraint beginning in about 1981, and little or no further increases in either land area or yields. As noted in the annex on the PNS agricultural extension program, the recommended yield-increasing but more labor intensive technical package was much better suited to Kongolo where land was a constraint than to Nyunzu where farmers found it easier to move every few years than to adopt the technical package.
2. Almost all of the farmers interviewed by the evaluation team noted that their yields are significantly higher now than they were before the project. The main factors seem to be improved seeds and increased plant density. There would seem to be little doubt that PNS agricultural interventions significantly increased farmer productivity, especially after 1980.
3. Almost all of the farmers located on PNS roads attributed their increased production to improved roads. The ability of traders to get to their villages or areas of production was cited by farmers as the determining factor in their deciding to increase production. In areas where roads were not improved, difficulty of evacuation was cited as the major constraint to increased production. Corn traders also mentioned roads as the most important factor explaining the increase in production.

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(2) The 1977 and 1978 area figures for Nyunzu are almost certainly overestimates, since very little corn is consumed in that area.

Most corn traders have invested heavily in trucks in recent years, citing the good road network as their main reason for doing so.

4. Although prices were liberalized in 1985, producer prices have not increased since 1984. This constitutes a major drop in real incomes for farmers in North Shaba. It should be noted that despite this drop in prices for corn, production has continued to increase. This indicates that 1) the price is still high enough to induce farmers to grow corn and 2) lower producer prices do not necessarily result in reduced production if there is no alternative crop or other economic activity available to farmers.
5. It is unlikely that there will be much further increase in corn production using the existing technical package of Kasai I seed and the recommended improved practices. There is scope for marginal increases in Kongolo as more farmers accept more elements of the package. In Nyunzu, the improved practices will be adopted only when farmers are no longer able to move every few years. Even then, the technical package will not increase yields significantly over what they are now obtaining by moving frequently.

**B. IMPACT OF THE PROJECT ON FARMER INCOMES AND EXPENDITURES**

1. The Spatial Patterning of Population and Production

The PNS area encompasses approximately 15,000 km<sup>2</sup> in the eastern half of the Zone of Kongolo and the western half of the Zone of Nyunzu (Map 1). An

TABLE 5:  
POPULATION, AREA, AND POPULATION DENSITY, BY ADMINISTRATIVE AREA,  
NORTH SHABA REGION, 1976

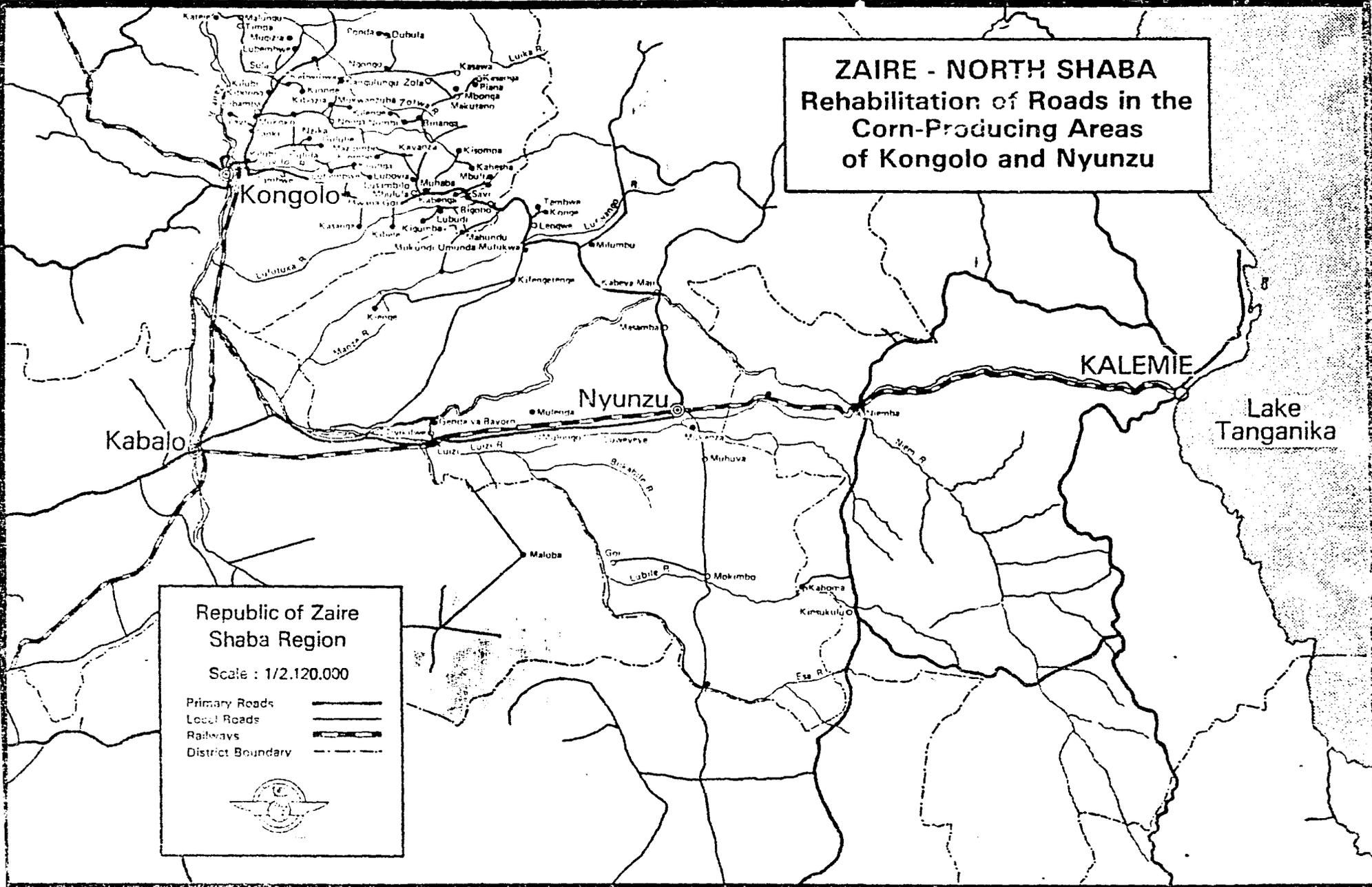
Collectivity	Populatio.	Area (km <sup>2</sup> )	Population Density
Centre de Kongolo	14,763	20	738.2
Yambula	8,650	334	25.8
M'Kuvu	10,725	498	21.5
Muhona	4,217	273	15.4
Masbwe	16,661	1,320	12.6
Nyembo	28,674	1,438	19.9
Munono	4,219	202	20.9
Baluba (1)	11,914	3,912	4.0
ZONE DE KONGOLO	85,823	7,997	10.8 (3)
Nord Lukuga (2)	25,389	9,885	2.6
Sud Lukuga (2)	27,095	5,600	4.8
ZONE DE NYUNZU	52,484	15,485	3.4
TOTAL PNS AREA	138,307	23,482	5.3 (3)

(1) The Collectivity of Baluba lies on both banks of the River Lualaba. Only that part of the collectivity that lies on the right bank (about half the area) is within the project area.

(2) Only the western halves of North and South Lukuga lie within the project zone, as defined by PNS.

(3) Excluding Kongolo center.

**ZAIRE - NORTH SHABA**  
**Rehabilitation of Roads in the**  
**Corn-Producing Areas**  
**of Kongolo and Nyunzu**



Republic of Zaire  
 Shaba Region

Scale : 1/2.120.000

Primary Roads:   
 Local Roads:   
 Railways:   
 District Boundary: 



-6-

estimated 130,000-150,000 people lived in the project area in 1976. This population was heavily concentrated in the western half of the project area (the Zone of Kongolo), where population densities in all collectivites but Baluda averaged over 10 persons/km<sup>2</sup> and most were above 20 persons/km<sup>2</sup>. By contrast, population densities in the Zone of Nyunzu were much lower--2.6 persons/km<sup>2</sup> in Nord Lukuga and 4.8 persons/km<sup>2</sup> in South Lukuga. (Table 5 presents the population, area, and population density for each administrative area.)

Farming systems in the two areas of the project zone reflect this difference in population density. In Kongolo, people farmed smaller areas (1 ha or less) somewhat more intensively. Here, farmers practiced a mixed agriculture with corn and manioc as the basic staples and with rice, peanuts, and beans, as well as palm oil, as supplementary foodstuffs. Also, cotton was then a major cash crop. In Nyunzu, by contrast, people farmed larger areas, and they grew manioc for home consumption and corn for sale; other crops, though known, were much less important in this area.

While the total area planted to corn increased, at least through 1980/81, the area cultivated per farmer has not changed appreciably since that time. There are, however, important, persistent differences in average farm size across the region (3). In 1980/81, farmers in Nyunzu cultivated over twice as large an area as those in either Kongolo or Mbulula (4): 2.47 has. versus 1.14 has. and 0.90 has., respectively. In 1983/84, when corn hectarage was at its peak, the average areas per farmer were: 1.06 has. in Kongolo, 1.11 has. in Mbulula, but 3.01 has. in Nyunzu. Two years later, the average area had generally declined to the 1980/81 level: 0.92 has. in Kongolo, 1.09 has. in Mbulula, and 2.6 has. in Nyunzu.

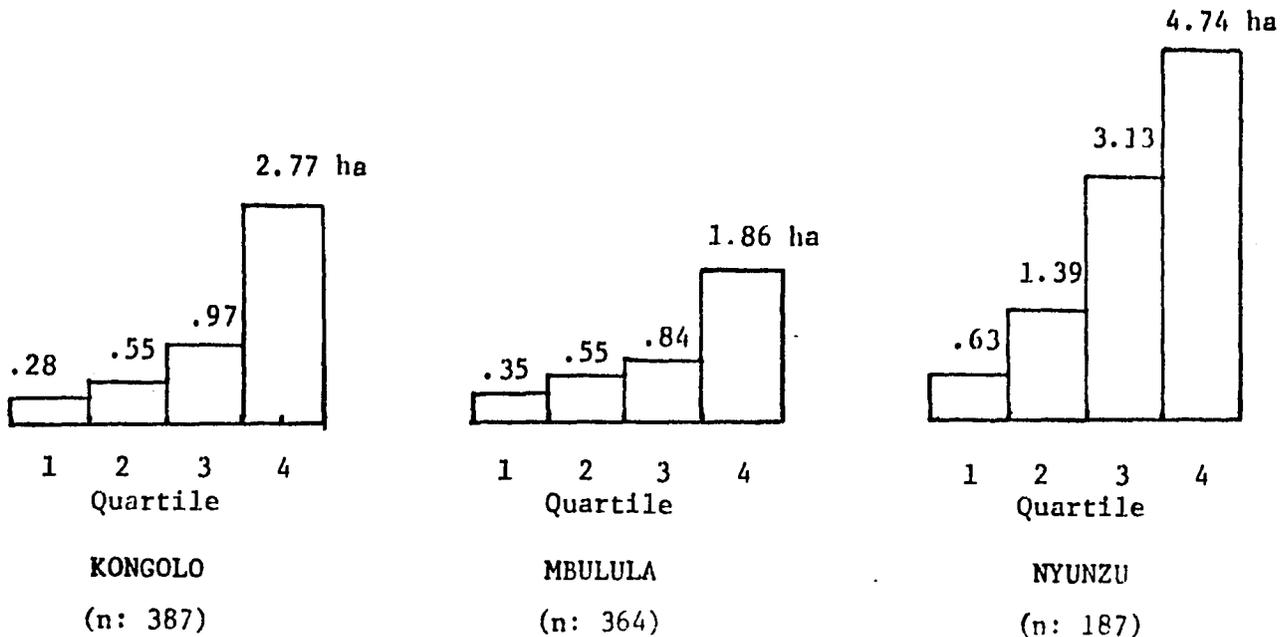
Such area-wide averages still mask significant differences in the average area cultivated by individual farmers in each part of the project region (Figure 2). In 1980/81 three-quarters of all farmers in Kongolo and Mbulula cultivated one hectare or less of corn land. Precisely the opposite situation then obtained in Nyunzu. There, three-quarters of all farmers cultivated one hectare or more of corn. Even these more disaggregated statistics disguise large differences in areas cultivated by individual farmers. In Mbulula, only three percent of all farmers cultivated more than 2.5 has.; these farmers averaged about 4 has. apiece. In Kongolo, eight percent of the farmers

(3) Because of perceived difficulties in censusing farmers wary of outside interference, the PNS socio-economic unit did its first baseline studies in 1980/81. Thus, it is not now possible to determine accurately the areas actually planted to corn before the project began or to discern what changes may have occurred in average corn areas during the early years when production was truly taking off (SCAD 1981).

(4) PNS usually subdivides the zone into three areas--Kongolo, Mbulula, and Nyunzu--for administrative reasons. There are differences between Kongolo and Mbulula in farming system and commercial development. In relation to Kongolo, Mbulula has higher population densities, smaller increases in corn hectarages, smaller income spread among farmers, and a higher adoption rate for PNS practices. Nonetheless, these two areas show many important similarities and both contrast greatly with the Nyunzu area. In this report, Kongolo and Mbulula are usually considered parts of the same area (Kongolo) and distinguished from Nyunzu.

cultivated at least 2.5 has., averaging slightly more than 5 has. apiece. Meanwhile, in Nyunzu, fully a third of all farmers cultivated at least 2.4 has. of corn. As a group these farmers averaged almost 5 has. apiece, but the range in area cultivated varied from 2.5 to more than 10 has. (5). In other words, while somewhat more farmers cultivated larger areas in Kongolo than in Mbulula, the truly significant comparison is between those two areas and Nyunzu, where the vast majority of farmers cultivate large corn tracts with the help of Pygmy labor.

FIGURE 2:  
AREA CULTIVATED IN CORN, 1980/81.  
BY PROJECT AREA, BY QUARTILE



Project recommendations for agricultural operations were also adopted differently within the region (6). Whereas improved seed early gained acceptance throughout the project area, the recommended new cultural practices were adopted earlier and more widely in Kongolo than in Nyunzu. In 1982, it was estimated that only 12 percent of the farmers in Kongolo performed some agricultural operations in accord with the project's recommendations--specifically, planting in rows and optimal plant density; today, an estimated 80 percent of the farmers in that area carry out these recommendations. By

(5) PNS statistics distinguish one-quarter hectare increments in field size up to 2.5 has. Above that limit, fields are lumped into a single category. This approach facilitates analysis in Kongolo (and Mbulula), but impedes analysis for Nyunzu, where most fields are larger than 2.5 has.

(6) At the outset of the project, PNS adopted the recommended PNM technical package in its entirety: improved seed, timely planting in rows, proper spacing, careful weeding, disease control, harvesting and storage. This set of recommendations has been simplified over the years so that today improved seed, plant density, and weeding are the major recommendations to farmers. There is, however, no standard set of recommendations at the level of the extension agent. In effect, each agent must adapt the general recommendations to his specific locale.

contrast, only 2 percent of the farmers in Nyunzu respected these recommendations in 1982. While the recommendations have gained wider acceptance, actual adoption is far below the 50 percent reported in project documents.

Further, farming in Kongolo is generally more intensive than in Nyunzu. Kongolo farmers cultivate their fields for longer periods (up to seven years in some places), weed their fields more carefully and more frequently, practice more relay and intercropping of other crops with corn, and are more interested in crop rotations once their fields cannot be planted to corn. In Nyunzu, where population densities are much lower and where productive forest land is more available, people are much more likely to move on to new, more distant areas once weed invasions begin seriously to affect yields, which typically occurs after three years of cultivation. Here fields are cultivated for shorter periods, weeding is fewer and less complete, and intercropping and crop rotation much less commonly practiced. In consequence, yields are lower in Nyunzu, though production per farmer is greater because of the larger areas farmed.

In sum, population density, production patterns--and indeed project experience--pattern systematically across the project area. Kongolo, where populations are greater and land less available, has proved more receptive to project recommendations than Nyunzu, where the sparser population has available more land on which to practice its extensive farming practices.

## 2. Farmer Income and Expenditure Patterns

PNS successfully deflected repeated suggestions in its early years to introduce costly inputs--specifically fertilizer--into its agricultural development program. The Project correctly recognized that although fertilizer would significantly increase yields, its use was called for in only certain, specific locales (mostly on savanna fields) and its availability was undependable at best. Instead, the Project emphasized the use of improved seed and, about the same time, the introduction of improved agricultural practices (7). These "simple" recommendations promised a significant increase in production over local techniques. Improved seed alone, research results indicated, could increase production by 40 percent. The suite of improved

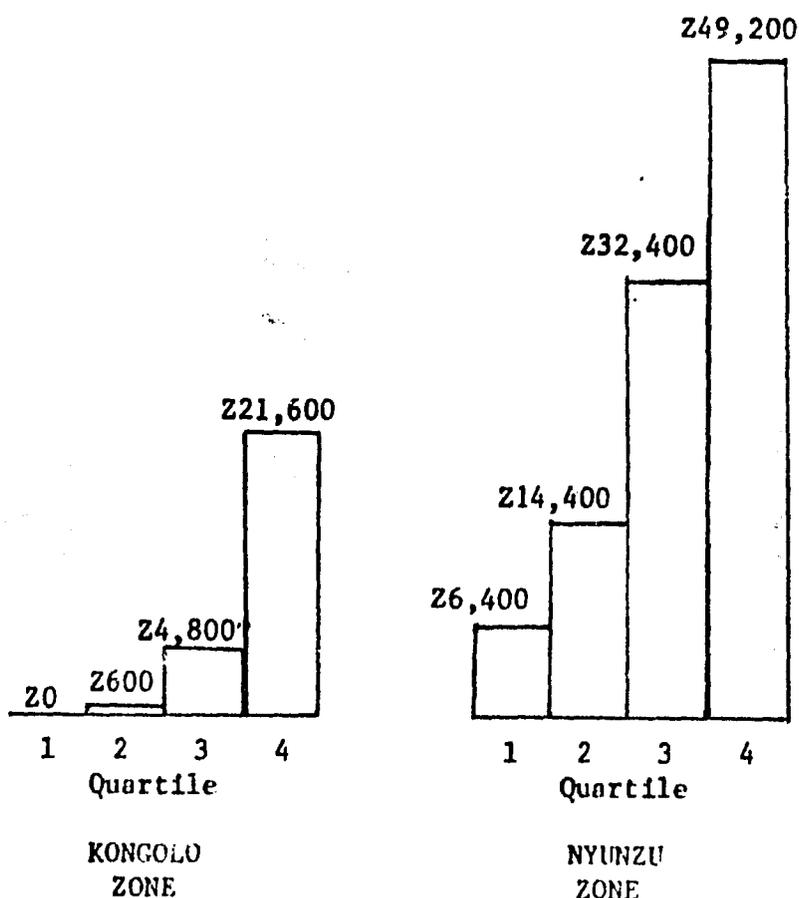
(7) Recommendations for improved harvesting and storage techniques might have significantly increased marketable production because field and storage losses in the area are very high. Although such recommendations were introduced in the last years of the project (the village silo program), it is also the case that such recommendations must await a revolution in the marketing system from the current system of purchases by volume (or sack) to a system of purchases by weight, which would allow price differences for quality. Curiously, the wholesale buying system up through 1974 operated by weight. Sometime afterwards, the system went to purchases by volume. The change may have occurred in 1975, which was a year of great competition among merchants for corn stocks. Subsequent attempts by one or another large merchant to reintroduce purchase by weight have not succeeded because weighing takes much more time to effect than purchase by volume, offers traders no significant real advantage in the amount purchased (individual sacks may weigh more or less than 100 kg. but on average sacks weight approximately 100 kg), and, too, farmers now prefer the volume system.

agricultural practices (row planting, proper density, weeding) could increase yields another 25-30 percent. Together, improved seed and the recommended practices promised at least a 75 percent increase in production over local seed and techniques without necessitating a new and significant cash outlay for agricultural production. (Actual yield increases appear to have been significantly higher.) Moreover, except for weeding, the project recommendations did not require a significant increase in labor input either. In short, the Project insisted upon low-cost (whether in terms of cash or labor) innovations that would be within the reach of most or all farmers.

In this situation of limited technological innovation, farmer income is a function, first and foremost, of the area cultivated, secondly, of the adoption of improved seed, and, only thirdly, of the adoption of improved agricultural practices. In other words, the extent to which a farmer adopts the entire set of project recommendations is not reflected in a commensurate increase in his total production. For while adoption of the project's recommendations would increase yield (kg/ha), cultivation of one additional hectare of corn land would yield a higher total production.

Within the PNS area, farm income from corn production is significantly higher for more people in Nyunzu than in Kongolo (Figure 3). For, while yields have been consistently higher in Kongolo, the area cultivated by each farmer is significantly larger in Nyunzu. In other words, in Kongolo, where yields average about 3 mt/ha, three-quarters of all farmers cultivate less than one

FIGURE 3:  
ESTIMATED ANNUAL INCOME FROM CORN, BY QUARTILE,  
FOR FARMERS IN KONGOLO AND NYUNZU, 1986



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hectare of corn land. Here, half of all farmers grow corn for consumption only and have little or no corn for sale. One-quarter of the farmers sell on average slightly more than one ton of corn apiece. In this area, even the topmost quartile of producers, with an average cultivated area of 2.3 has., could expect an income from corn of only 220,000 (approximately \$325US). By contrast, in Nyunzu, where cultivated areas are larger and corn is not a major subsistence crop, the bottom quartile of producers earn as much or more than three-quarters of the Kongolo farmers (approximately 26,400 or \$100US), and over half the Nyunzu farmers earn more than all but the biggest producers in Kongolo, averaging almost 10 tons from 4 has. for a total income of over 240,000 (about \$670US in 1986 prices). In fact, in this area, it is probable that 10 percent of the farmers actually cultivate twice this area or more, earning something over 2100,000 (\$1,600US) from corn in a year.

Farmer expenditure and investment patterns are similar throughout the area and over time. Generally speaking, a household that sells 5-10 sacks of corn will spend all its earnings (22-4,000 or \$35-65US) on basic necessities--used clothing, medicines, certain foodstuffs (fish, salt, sugar, soap), and perhaps repairs to a bicycle, if any. A family that sells 20-30 sacks (28-12,000 or \$150-200US) would purchase these same items but the quality might be better and the quantity greater. For example, the family might buy a new skirt for the wife and new shorts for one or more children. They might buy fish, meat, or beer a bit more frequently. The family would be better able to afford children's school expenses. And, in Nyunzu, it might reserve 21,000 or more for hiring Pygmy labor. These expenditure patterns are quite similar to those recorded in 1974 (Saulniers n.d.). Then a large farmer might spend 30 percent of his income on agricultural inputs, 20 percent on clothing, a like percent on health, 10 percent on food, and 5 percent apiece on shelter, education, and miscellaneous purchases. Smaller farmers spent less on agricultural inputs (15%) and relatively more on clothing and education (25% apiece). But overall, farmers bought the same limited array of goods and services, whatever their income level.

Only when a family produces at least 30-60 sacks for sale (212-24,000 or \$200-400US) can it afford to buy a radio, bicycle, sewing machine, or rifle, without prejudicing other domestic needs. These families might also buy a parcel of land in a neighboring town, in the first step towards moving there. Such major investments as building a house in town, opening a store, or buying a pick-up or truck are, however, essentially limited to only the largest of producers, those who have 200 or more sacks to sell in a year. It is thus only the largest producers who can make productive investments, as well as consumption expenditures. Importantly, the number of such large producers has increased over the years, especially in Nyunzu.

Although PNS long emphasized corn production, many farmers in the region, particularly in the Kongolo area, produce various crops for sale. Overall, the value of these crops to the regional economy may not approach that of corn. But in the local area, a marketable crop in addition to corn can represent a significant increment to family income. In parts of Mbulula, for example, palm oil may provide as much income to some families as corn does (SCAD 1986). And, too, the project in its later years began to extend improved varieties of peanut seed, manioc tubers, and rice seed, which have increased yields and rostered additional sales. Unfortunately, these additional sources of income have not been systematically quantified, so that it is as impossible to determine total family income in each of the project areas as it is to reconcile macro and microeconomic information on average family income.

Additional marketable crops in Kongolo mean that farmer incomes are higher than those calculated solely from corn sales. Nonetheless, the importance of corn production and the unequal distribution of cash income from corn production within the PNS area mean that even though expenditure and investment patterns are similar, more producers in Nyunzu have more money than do farmers in Kongolo and that the differences in income distribution are greater in Nyunzu than in Kongolo. If the amount and distribution of cash incomes directly support commercial development in an area, one would expect more development in Nyunzu than in Kongolo, a proposition which we will examine in the next section.

### C. REGIONAL COMMERCIAL EVOLUTION

#### 1. The Development of Commercial Activity

Early PNS supporters describe the north Shaba area before the project as an oppressed backwater, with little or no commercial production, very low producer incomes, and limited marketing and commercial activity characterized by monopolistic pricing and other abuses (Blakely 1982; Nyurumuringa 1982).

This description somewhat exaggerates the situation at the time. Producers in Kongolo and, especially, Nyunzu already grew corn for sale, and there was a trade in this commodity. The extent and nature of this trade was, however, strongly affected by then prevailing conditions. In the first place, road conditions very much limited the range of traders. Private buyers often cited 60-80 kilometers as the maximum distance they could go for stocks. In Nyunzu, most maize was purchased within 50 kilometers of the town; the only maize bought at any distance came from along the road south to Niemba, where merchants went as far as 150 kilometers. In Kongolo, most maize was bought within 80 kilometers of that center, though some did come from as far as 120 away, from Bigobo. With the outer range of hinterlands effectively set by transport considerations, the amount of trade in a center depended directly upon the extent of production within its immediate hinterland. Thus Nyunzu, which was then the major producing area, counted 25 licensed corn dealers in 1974. By contrast, Kongolo, where corn was much less important, had only two licensed dealers, both of whom were inactive, and two unlicensed dealers, who bought most of the stocks in that area.

Commerce at this time also reflected the seasonality of the corn-buying business. Once the crop was in, merchants began buying stocks and selling merchandise. In Nyunzu, a few large traders dominated this business. The biggest trader purchased alone purchased a third of the entire corn supply, and the five largest traders together handled over 90 percent of the area's corn stocks. Most of these largest traders came to town only for the corn-buying season. Once the last of the corn stocks had been expedited by rail, these traders left and commercial activity slumped again until the next year's campaign.

In summary, commercial activity in the PNS area before project activities were underway was concentrated in two centers along the railline, Nyunzu and Kongolo, that were also connected by road to producing areas in the interior. Commercial activity in each center was a direct function of production in its immediate hinterland, which was effectively delimited by road conditions.

Thus Nyunzu, which dominated the corn trade, was the more important commercial center, even though Kongolo then also dealt in palm oil and cotton. In both towns commerce remained highly seasonal, and trade was dominated by a few large merchants.

Within five years of project activity, as roads opened up new areas and improved seed increased yields, the nature and patterning of the regional commercial system began to change. First, Kongolo became the more important commercial center, even as the number and level of traders increased in both places. (Kongolo has always been the more important urban center, with its major secondary school, army base, rail headquarters, water and electricity, Catholic mission and other services.) Today Kongolo counts seven large establishments that sell at both wholesale and retail, another 25 stores that sell mostly retail, and 50 or more small retail shops, compared to the 1978 count of four wholesalers, five large and five small retailers. Meanwhile, Nyunzu now counts ten wholesalers, 15 retailers, and perhaps 30 small shops in town year-round (Figure 4). Although Nyunzu boasts more wholesale firms than Kongolo, those in Kongolo, such as Solbena, are significantly larger businesses, often associated with a major Zairian firm. By contrast, the Nyunzu wholesalers are all local enterprises, owned by non-resident Arabs. This difference in commercial importance is also expressed in the numbers of vehicles based in each place: there are 30 trucks based year-round in Kongolo (another 20 arrive during the corn marketing season), but only 12 in Nyunzu.

FIGURE 4:  
COUNTS OF COMMERCIAL ESTABLISHMENTS IN THE PNS AREA,  
BY LEVEL OF CENTER, 1980

	Level 1		Level 2			Level 3	
	Kongolo	Nyunzu	Sola	Mbulula	Lengwe	Makutano	Butondo
<u>Stores</u>							
Wholesale Stores	7	10	0	0	0	0	0
Retail Shops	25	15	10	20	5	3	0
Kiosques	50	?	15	?	10	0	1
<u>Transport</u>							
Trucks	30	12	2	3	0	0	0
Seasonal	20						
Pick-ups	4		0	1	0	0	0

Second, several small commercial centers have now developed along the main road, between 40 to 60 kilometers from either Kongolo or Nyunzu. These newly emergent centers--Sola, Mbulula, and Lengwe--are essentially local retail centers. They have no wholesale stores. Retail shops are smaller and fewer in number--10 in Sola, some 20 in Mbulula (which has benefited directly from project activities based at the Ngaba seed farm), and 5 in Lengwe. In addition, there are numerous kiosques in each of these towns. Importantly, these centers also provide some transport services. There are two truck owners in Sola and three in Mbulula (another individual in Mbulula has a pick-up), but none as yet in Lengwe.

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Third, smaller level centers are now appearing in more peripheral areas, mostly in Kongolo zone. These "centers" are of strictly local interest at present, for they consist of, at most, only two or three small shops. There is no market in any of these places, no transporters, and usually no other service, apart from a dispensary sponsored by a local mission.

These differences among centers in type and number of retail firms and transport services are paralleled by other differences in the number and types of other businesses and services (Figure 5). While the lowest level of center might boast a small pharmacy--often no more than a seller purveying basic prepared medicines from a table--the middle-level centers all have at least one large pharmacy. In addition, these centers may boast an hotel, a restaurant or two (usually located in the marketplace), and a flour hammer-mill. The two highest-level centers each have not only several large pharmacies, two or three hotels, and a number of restaurants and bars, but also several flour mills and bakers. Similarly, the village centers seldom have any full-time artisans, though various people may ply one trade or another during the off-season. The middle-level centers, by contrast, each have a few craftsmen--typically one or more tailors, and possibly a carpenter. Meanwhile, the highest level centers provide a range of basic and more specialized services--tailors, carpenters, blacksmiths, cobblers, and masons; and photographers. These centers also support the only craftsmen in the region who can repair motorcycles, bicycles, radios, and watches.

The goods and services available in local marketplaces provide an allied index of commercial development (Figure 6). Overall, a half to two-thirds of all market sellers purvey foodstuffs, mostly from the local area. A large percentage of the remaining sellers deal in merchandise of one kind or another. Relatively few people in any market offer crafts or services. But again, within any category, more sellers offer more and different goods in higher-level than in lower-level marketplaces. Thus, foraged products (mushrooms, snails, eels), greens, tubers and grains are available in all markets. But in the higher-level markets, more sellers purvey these goods, and, in addition, other sellers purvey foodstuffs not available in lower-level markets, such as palm oil, fruits and vegetables, tobacco, and meat. Similarly, for manufactures, hardware, pharmaceuticals, used clothing, and some groceries are available in all markets. But new clothing, specialized arrays of clothing (men's pants, plastic shoes, women's skirt material), cosmetics, and some other goods are available only in the higher-level markets. The same observation holds true for locally manufactured craft goods and for various services, such as repairmen.

In other words, the increases in commercial production have fostered greater commercial activity, which is now giving rise to a hierarchy of urban centers in the region. The differences among places are often not great. But enough change has occurred that more centers and more levels of centers, defined according to the goods and services purveyed, can be discerned within the region. Specifically, where before there were only two levels of center, there are now four. And, where before there were only two centers of any importance, there are now five, with others still emerging. In short, north Shaba is experiencing a commercial transformation.

FIGURE 5:  
COUNTS OF SERVICE ESTABLISHMENTS AND ARTISANS  
IN THE PNS AREA, BY LEVEL OF CENTER, 1986

	Level 1		Level 2			Level 3	
	Kongolo	Nyunzu	Sola	Mbulula	Lengwe	Makutano	Butondo
<u>Establishment</u>							
Pharmacy	6	4	1	4 (18)	1	1	0
Restaurant	3 M §	2 M	M	1 M	0	0	0
Bar/Boite/ Buvette	1	3	M	M	0	0	0
Hotel	3	4	0	2	0	0	0
Flour Mill	6 §§	7	1	4	1	0	0
Bakery	11	5	?	1	0	0	0
<u>Artisans</u>							
Tailor	5	10					
Carpenter	?	5				2	
Cobbler	5	3				0	0
Mason	4	?					
Photographer	2	?	0	0	0	0	0
Watch/Radio Repair	5	3					
Moto/Bicylce Repair	6	2					

§ Establishments such as restaurants and bars may also often be found in the local marketplace. These typically are much smaller than such establishments that are in the town itself.

§§ One of these mills, owned by a large corn trader, is an industrial operation, which produces much more flour per hour than the usual small hammer-mills in the region.

FIGURE 6:  
VENDOR COUNTS, BY COMMODITY ARRAY, IN THE MARKETPLACES OF  
IN THE PNS AREA, BY LEVEL OF MARKET; JANUARY 1986

	Level 1		Level 2	
	Kongolo	Nyunzu	Mbulula	Leupwe
<u>LOCAL FOODSTUFFS</u>				
Foraged	13	10	5	1
Greens/Spices	43	15	6	2
Tubers/Grains	63	23	14	3
Flour	14	5	11	1
Palm Oil	13	3	2	0
Matsai	?	3	2	0
Vegetables/Fruit	23	4	1	0
Meat	?	3	1	0
Tobacco	4	4	0	0
Chicken/Eggs	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>
SUBTOTAL	174	61	42	7
<u>OTHER FOODSTUFFS</u>				
Bread	5	3	1	2
Soap	2	1	5	1
Dried Fish	17	7	8	1
Salt	7	5	4	0
Sugar	<u>7</u>	<u>1</u>	<u>—</u>	<u>—</u>
SUBTOTAL	38	17	18	4
<u>MANUFACTURES</u>				
Boutique/Table	14	14	2	4
Hardware	4	10	3	3
Pharmacy	4	2	1	1
Used Clothing	26	4	4	1
Cloth/New Clothes	12	1	4	0
Plastic Shoes	7	4	0	0
Cosmetics	?	1	0	0
Sacks	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>
SUBTOTAL	68	36	14	9
<u>CRAFT GOODS</u>				
Baskets	2	1	1	0
Iron Tools			1	0
Wooden Chairs	?	1	1	0
Pottery	<u>2</u>	<u>—</u>	<u>—</u>	<u>0</u>
SUBTOTAL	4	2	3	0
<u>SERVICES</u>				
Finger food	7	4	3	0
Restaurants	3	2	1	0
Watch Repair	1	1	0	0
Tailor	?	1	0	0
Bike Repair	<u>1</u>	<u>—</u>	<u>—</u>	<u>—</u>
SUBTOTAL	12	8	4	0

Figure 6/cont.

	Level 1		Level 2	
	Kongolo	Nyunzu	Mbulula	Lengwe
<u>MISCELLANEOUS</u>				
Firewood	5	5	3	0
Charcoal	<u>7</u>	<u>5</u>	<u>1</u>	<u>0</u>
SUBTOTAL	12	10	4	0
TOTAL	308	134	85	20

Notes to Figure 6:

1. All markets in the PNS area meet daily. Sunday tends to be the busiest day because countryside people come into town. Friday and Saturday morning markets may be less well attended because of communal labor obligations (solongo). These vendor counts were carried out: Mbulula, Wednesday, Jan. 28; Lengwe, Thursday, Jan. 29; Nyunzu, Friday, Jan. 30; Kongolo, Sunday, Jan. 31. The Sola market had disbanded by 11 am on the day of our visit (Monday, Jan. 26); it likely resembles the small Lengwe market.
2. Most commodity arrays are self-evident, even though the arrays themselves can be a seeming jumble of goods. Among foodstuffs, foraged foods include forest mushrooms, mudfish, and snails. Greens and spices are, by contrast, cultivars. Tubers/Grains include manioc, corn, rice, and peanuts (i.e., local staples). Among manufactures, Boutique/Table glosses those sellers with a few items from each of the more specialized arrays (e.g., hardware, enamelware, cloth, cosmetics). Firewood and charcoal, incidentally, are typically available in urban markets only.
3. A question mark has been put in those cells where a commodity array might reasonably be expected to be available in a particular market but was in fact not observed (i.e., could inadvertently have been missed). An asterisk denotes a good or service not observed in the market but known to be available in town.

## 2. The Spatial Patterning of Commercial Development

The spatial patterning of commercial development in north Shaba is both distinctive and uneven. In brief, the highest-level centers (Kongolo and Nyunzu) are both on the railline (for interregional evacuation) and on the main road (for intraregional bulking of rural production). The middle-level centers are located interstitially between these major centers. Sola lies 40 kms northwest of Kongolo; Mbulula, 65 km east of Kongolo, on the road to Nyunzu; and, Lengwe, 65 kilometers west of Nyunzu (about 35 km after Mbulula). This corridor of commercial towns might be termed the "core area."

Within this core area, there is a clear and consistent difference in commercial development between centers in Kongolo compared to those in Nyunzu. Kongolo town has more merchants, more truckers, more services, and a more diverse marketplace than Nyunzu (Figures 4, 5, and 6). Similarly, among the middle-level centers, Sola and Mbulula evince greater commercial development than Lengwe. The two centers in the Kongolo area have more shops and services, provide some transport services, and boast a better provisioned marketplace than Lengwe, which has a few shops, no transporters, and a small market.

The low-level centers, which are all located in the "periphery," that is, the area lying away from the commercial corridor that runs through the heart of north Shaba, show this same spatial patterning. Contrary to usual expectations, these centers are not located evenly across the region once population density, income levels, transport facilities are taken into account. Rather, these centers have arisen only in certain areas of Kongolo. Large villages in Nyunzu, such as Butondo, which have a sizeable permanent population in major corn producing areas and which once were important centers, evince no permanent commercial development, even though they are active centers during the corn-marketing season. By contrast, smaller villages in the Kongolo area, such as Makutano, in northern Mbulula, where corn production is important but not exclusively dominant, might not be expected to be developing local commercial establishments. Yet it is precisely here that local people are opening stores.

This paradox provides its own solution and an instructive lesson. Where producers market only a single crop, corn, traders come to purchase corn and also to sell merchandise during the short corn-marketing season. Because there is insufficient activity to support commerce year-round, the peripheral areas of Nyunzu, as well as parts of Kongolo, such as Muzigia, are devoid of local stores. In other words, greater commercial activity does not necessarily lead to greater commercial development. Only where producers market corn and also another commodity, most notably, palm oil, have successful farmer/entrepreneurs opened shops to bulk these commodities out of the local area. Thus, for example, in Makutano, three successful large farmers have invested in local businesses, collecting palm oil and selling merchandise, as well as dealing in the corn trade.

This spatial patterning of commercial development thus holds at every level of the regional commercial system. The difference is not explained by farmer incomes, which have always been higher in Nyunzu. Corn sales in Kongolo have reached the levels that have long characterized Nyunzu only in recent years. Yet commercial development is greater and more widespread in Kongolo than in Nyunzu. The key to urban commercial development lies, it would appear, in the

diversity of rural production for sale and the equity of income distribution in the area. Thus it is Kongolo, with its wider array of marketable crops produced by more people, that has experienced the greater commercial development, even though Nyunzu farmers, as individuals, may have benefitted more from project activities in corn production.

### 3. Changes in Trade over Time

Greater corn production has changed the extent, if not the nature, of the corn trade, as might be expected from the increased number of centers

As has been mentioned, relatively few traders in Nyunzu dominated the bulk of the corn trade in 1974 (Table 6). At that time, five traders bought 90 percent of all corn stocks, another four traders bought more than 100 mt apiece, while the majority of traders purchased only small amounts (on average 30 mt apiece). By 1983, the five largest traders accounted for only 75 percent of the entire Nyunzu corn market, while another 16 merchants each bought over 100,000 mt apiece, and numerous smaller traders handled some 3,100 mt together. These trends have continued in the past few years, so that in 1986, the five largest traders handled less than 50 percent of the corn stocks, 32 traders handled over 100 mt apiece, and a number of smaller traders together handled 4,500 mt. In other words, the corn trade is less and less dominated by a few large merchants, and more medium and small-scale traders have entered the trade.

TABLE 6:  
RANK ORDER OF CORN DEALERS IN NYUNZU; 1974, 1983, 1986  
(000 KG)

Trader	1974	1983	1986
#1	4,500	8,700	3,700
#2	3,871	4,600	3,400
#3	1,454	4,100	1,700
#4	1,228	3,400	1,600
#5	974	2,200	1,400
Subtotals	12,027	23,000	11,800
Other traders with over 100 mt	787 (4)	5,000 (16)	10,000 (32)
Remainder of Traders	363 (12)	3,100	4,500
TOTALS	13,177	31,100	26,300
Top Five Traders As Percentage of Total Trade	91.3%	74.0%	44.9%

Inquiries reveal that the small and medium-sized corn traders have all come from the ranks of the large farmers who subsequently invested their profits in businesses in town. It is these farmer/traders who are now opening shops in the periphery of Kongolo to take advantage of economic opportunity there. Successful farmers in Nyunzu, by contrast, must still base their operations in town because corn remains the only commercial crop in that area.

It is important to note that the burgeoning of the number of small and medium-sized traders does not translate into improvement of farmer prices. That is, there is no increase in farmgate price just because there are now more traders and, presumably, more competition, as was originally supposed in the PNS literature. Partly this is so because traders each have their own geographic spheres of activity. But it is also the case because prices are not entirely determined through competition at the lowest levels of the marketing chain.

In summary, the PNS area today boasts an embryonic commercial system. To be sure, the number of levels of centers in the system is not large, there are few centers in each level of the hierarchy, and essentially the same goods are purveyed from centers as ten years ago. It may be posited that further economic development would follow along these same lines. That is, centers at each level would add new and more specialized arrays of goods, and additional, low-level centers would appear in the periphery. But it is already the case that commercial development in north Shaba has outstripped that in central Shaba, which benefited from the improved corn market in the Shaba region but not from other PNS interventions.

#### D. SOCIAL CONSEQUENCES OF INCREASED ECONOMIC ACTIVITY

While increased agricultural production has fostered some commercial development in north Shaba, the extent of social change has remained very limited. Nonetheless, the patterning of change across the region is quite distinctive. Essentially, greater production has improved nutrition and health throughout the region. It has fostered changes in family and village life that are more severe in Nyunzu than in Kongolo. But it has nowhere led to much basic institutional or political change: Kongolo farmers may be more willing to support schools than their confreres in Nyunzu, but farmers in both areas are no more interested in, or amenable to, cooperative undertakings than they were at the beginning of the project.

##### 1. Nutrition and Health

Medical workers at government and missionary dispensaries throughout the region universally report improvements in nutrition and health over the past ten years.

Pregnant mothers are a high-risk group whose medical histories provide a reliable indicator of social change. According to the head nurses of the maternity units at all hospitals and dispensaries visited (Sola, Kongolo, Mbulula, Makutano, and Nyunzu), the incidence of premature births is down and the rate of well births is up. Significantly, according to those nurses who have been in the region for ten or more years, baby weights at birth have

risen from an average of 2.5 kg through the 1970s to 3 kg today. These statistics clearly suggest a significant improvement in the working conditions and diet of young mothers-to-be.

In the nurses' experience, cases of kwashiorkor and other severe childhood malnutrition are generally down. What malnutrition they now see occurs only during the immediate pre-harvest period among children under the age of five. But this "hungry" season malnutrition is a temporary condition. Once diets improve as the harvest comes in, the number of malnutrition cases dwindles significantly. This, too, is in sharp contrast to the pre-project situation, where child malnutrition was both more common and more persistent.

There has, however, been relatively little change in the nature of fatal childhood diseases. Measles, diarrhea, and respiratory illness are still the major killers of small children. But unlike times past, parents are better able and more willing to purchase prescribed medicines, as the florescence of small pharmacies in several towns of the regions would attest. Hospital workers uniformly lament the arrival of patients in late stages of these diseases, but none considers the costs of medicines to be a major problem in treatment in the region today.

The emphasis on greater corn production has increased the incidence of respiratory illness among small children in much of the Nyunzu zone, as well as in parts of Kongolo. This increase has a specific cause. As fields closer to existing villages become less productive in corn, younger families go farther out, sometimes as much as 75 kilometers to farm. These distances mean that the families must establish temporary residence in their fields. Their homes there are much less substantial than their village residences--often wattle-and-daub, sometimes just grass and palm fronds--and water supplies may be less certain and pure. In consequence, smaller children fall ill more often, and medical help is usually unavailable. Except in extreme cases, the parents wait until they return to the village, once the crops have been harvested, before taking the child to the clinic.

## 2. Migration and Residence

Demographic patterns in north Shaba have not changed appreciably in the past ten years, even though population is naturally increasing. Two patterns--one rural, and one urban--are nonetheless of interest.

As has been mentioned already, in Nyunzu, population densities are very low and land is readily available. In consequence, villagers prefer to open up new fields every three or four years rather than farm existing plots more intensively, and this search for new lands is taking younger families farther from their villages of origin. This encroachment into the sparsely populated northeastern areas of Nyunzu means that many villages are virtually abandoned during the agricultural season. And in some longer established villages there are now mostly older people, who are unable or unwilling to withstand the rigors of pioneering new areas.

Second, successful large farmers have no banks and limited investment opportunities in their local area. The options are, essentially: open a store in the village, if there is a supplemental crop grown in the area; buy a pick-up or truck; or, invest in a piece of urban real estate. The first option, opening a store locally, permits continued village residence. But, as

has already been discussed, this option is possible in limited areas only. The other two options are consequently more frequently taken, and both require a move to town. In fact, the pattern throughout the region, but particularly in Nyunzu, is for a successful large farmer to establish himself in town, where he opens a business, sometimes with a branch office in his home village. Many of the small and medium-sized urban traders are in fact former farmers who invested their profits from corn production into shops in town. In short, the more entrepreneurial people are leaving the countryside as soon as opportunity knocks, as might be expected in a situation of rural development.

### 3. Family Well-being, Family Life, and Impact on Women

Farmers universally appreciate the progress that has come to them under PNS. They point to the rehabilitated roads, which opened up their communities. They mention the improved seed that increased yields, allowing them both to consume and to market more production. And, they are, as they recognize, better able to provide their families with clothing, school supplies, medicines, and other goods.

For women, the work load has not increased significantly, but it nonetheless remains burdensome. Women assist in or perform many agricultural operations, and they are responsible for pounding flour, collecting firewood, hauling water, and caring for the children. Thus while medical evidence suggests improvement in their physical condition, it remains true that women's work is never done.

Finally, it merits mention that there is a widespread perception throughout the region that the incidence of polygamy has increased over the last ten years. People generally agreed that men marry slightly earlier than before, that more men have more wives than before, and that brideprice payments have become more expensive. The reasons given for this suite of changes are greater wealth and the greater need for familial labor. Without solid baseline data, however, it is impossible to determine whether this purported change has occurred in fact or only in peoples' minds.

### 4. Institutional Change

To change the relationship between farmers and traders, merchants, and government officials requires institutional development. However, farmer organizations have fared poorly in the PNS project, despite strong early efforts to foster farmer councils. At the same time, it is important to note that Kongolo appears much more ready for such development than Nyunzu. In Kongolo, the greater population densities mean more sedentary and intensive agriculture, with greater adoption of project recommendations. Here, the limited amount of multi-cropping and of organizational work under PNS is already showing some return, small as it may be.

The only organizational change that has occurred among farmers is the village silo program. This program was introduced late in the project, and unsurprisingly, it has been limited to the Kongolo area. (The shifting cultivation practices of Nyunzu farmers make a village silo program unthinkable in that region.) Even here, however, the individual silos are

managed by family groups rather than village councils. Management group aside, the silo program would have had to have been more extensive in order to effect a change in marketing patterns. As long as the few silos are widely scattered, the stocks available late in the season are too few to attract merchants, that is, the critical density of storage silos has yet to be reached. In consequence, farmers sell their stocks locally, at the seasonally higher prices, thus reaping some gain. But the hoped for revolution in corn marketing has not occurred--indeed cannot occur--until silos are much more common in the villages.

#### 5. Minority Groups

Finally, a note on minority groups in the project area is in order. PNS literature speaks often of the acephalous Hema of Kongolo and the patrilineally organized-Luba of Nyunzu. Although other ethnicities reside in the project area, no effort was made to determine whether and in what ways their farming practices differed from the those of the dominant groups, and thus how project recommendations might need to be adapted for those farmers.

Even more egregiously, PNS paid no attention whatsoever to the Pygmies, who provide the agricultural labor for Nyunzu corn farmers. Yet there has undoubtedly been economic and social change within this group. Pygmies no longer work for substandard wages and a meal. Indeed, their daily wage rate for field work has increased over the past several years, to Z50/day at present. And, reportedly, some Pygmies are now farming their own corn fields. Nevertheless, no one has any idea of how the Pygmies have benefited from the project, or of what might reasonably be done to assist them.

#### E. SUSTAINABILITY OF BENEFITS

The benefits to be sustained are the following:

- an increase in corn production from about 20,000 MT in 1977/78 to 90,000 MT in 1985/86;
- an increase in the quantity of corn marketed from about 10,000 MT in 1977/78 to 56,000 MT in 1984/85 and 47,000 MT in 1985/86;
- an increase in income from corn per household in 1980 prices in Nyunzu from 26,500 per household in 1978 to 514,000 in 1986; in Kongolo the increase was from almost nothing in 1978 to about 22,500 in 1986;
- a consequent increase in expenditures on consumer goods, including basic necessities (foodstuffs, soap, household items, medicines) and minor luxury items (better clothing, bicycles, radios, processed foods);
- at least a doubling of corn consumption in Kongolo, and measurable improvements in nutrition in both zones;
- more children attending school in Kongolo zone;
- investments in commerce and housing by a very small number of larger farmers.

In terms of overall development impact, the changes in Nyunzu are pretty much limited to increased income which is spent mostly on consumer goods. The level of economic and social development has remained essentially unchanged. In Kongolo, because of greater population density and a greater diversity of agricultural and non-agricultural economic activity, a self-sustaining development process may have been initiated. The increase in the number of schools, the larger number of locally-owned and permanently established commercial businesses, and the establishment of a commercial bank are evidence that changes are occurring beyond increased incomes from corn production.

At the present time, sustaining the benefits listed above involves maintaining corn production and income earned from corn at existing levels. This will be possible only under the following conditions:

1. Road conditions must not deteriorate to what they were before the start of the project.

Maintaining the existing road network will require a combined mechanized and manual maintenance program, as well as voluntary contributions of labor by villagers. In the absence of a satisfactory maintenance program, roads will gradually deteriorate, trucks will reach villages and production areas with increasing difficulty, and villagers will be expected to repair impassable spots every year prior to the marketing season. The result is that certain areas will no longer be able to evacuate their corn, and increasing costs of marketing will tend to reduce the level of marketing activity and dampen producer prices. The quantity of corn marketed will decline, but as long as most of the roads remain passable (i.e., roads and bridges are maintained), the levels will not drop to where they were before the project started.

Arrangements have been made with OR for the maintenance of PNS roads. In exchange for having received the equipment that had been used to rehabilitate PNS roads, OP has agreed to maintain the roads indefinitely out of its own budget. The agreement states that the roads will be maintained by manual labor "except where mechanized maintenance will be necessary". The language is unclear, but if it means that mechanized maintenance will only be used to repair heavily eroded areas (i.e., excludes the use of graders to clear out ditches) there will almost certainly be some decline in road conditions. ESTAGRICO was certainly never able to maintain their roads to PNS standards using only manual labor. It appears that more thought needs to be given to the road maintenance program from the standpoint of the needs of the project area as well as from the standpoint of OP budgetary considerations.

2. Farmers must continue to have access to high quality Masai seed.

If farmers in North Shaba were to lose access to improved seeds, production would remain stable for three or four years and yields would then begin to drop to about two-thirds of their present levels. This could have a very serious effect on the economics of corn production in North Shaba, especially considering that other areas of Shaba are likely to become increasingly productive as a result of development projects about to get underway.

North Shaba now has a seed production system that works reasonably well. The reasons are: 1) there is an adequate number of trained seed farmers conveniently located near the seed processing center; 2) there is good quality control in the production and processing of the seed; 3) there is a reasonably efficient distribution system through the extension program;

and 4) there is tight management over the entire process.

Beginning in mid-1986, AID and the DOA began making preparation to continue seed production in North Shaba under the auspices of the Central Shaba project. The project was to provide technical assistance and cover the local costs of producing seed until a private seed company could be set up to meet the needs of both the Central Shaba and North Shaba areas. However, due to a disagreement on whether the program would be administered by PNS or by the Central Shaba project, it now appears that AID will not be supporting seed production in North Shaba after this year. This will not cause an immediate drop in production, because the seed does not begin to degenerate for at least three years. However, unless a reliable source of high quality seed can be found, production will be expected to decline by at least one third within five years.

3. There must be a continued market for corn in southern Shaba

For farmer incomes to be maintained in North Shaba the market must remain strong in the major consuming areas of Lubumbashi, Kolwezi, and Likasi. Recent developments in the corn market are cause for concern. Although prices were liberalized in 1985, the producer price for corn has not increased since 1984. This constitutes a major drop in real incomes for farmers in North Shaba. The main reason for this situation seems to be that large imports of low cost corn flour from Zambia have kept the price of flour in southern Shaba relatively stable for the last two years. On the other hand, Kasai traders are now buying corn in North Shaba, but only after the bulk of the harvest has been sold to Shaba traders at depressed prices.

Millers in south Shaba estimate that total demand for corn flour in the major urban areas of Shaba is about 120,000 MT. Two major corn production projects are about to get underway in other areas of Shaba. The Central Shaba project could produce 30,000 MT of corn, much of which is likely to go to Kasai Oriental, and the South Shaba project could produce 50,000 to 80,000 MT for the southern Shaba market. Added to the existing production of 50,000 MT in North Shaba, 30,000 MT by Gecamines Development, and 10,000 MT by the Centre d'Execution des Programmes Communautaires (CEPC), these new projects could lead to a surplus of corn within five years.

This leads to the broader issue of long-term development in North Shaba. It can be argued that perhaps the major benefit of PNS is that it may have gotten a sustainable development process started in North Shaba. Increased corn production was the first step. This was followed by commercial development in Kongolo, not all of which was directly related to corn production. In terms of impact on the target population this is about the extent of project accomplishments. If sustaining project benefits is defined as maintaining the existing level of corn production, this is as far as the process will go. If, however, sustaining project benefits is defined as continuing to move toward self-sustaining development, maintaining existing levels of corn production by keeping the roads open and providing improved seeds will not be enough.

The critical next step in the development of North Shaba is crop diversification. This is needed in order to: 1) protect against a possible decline in the corn market; 2) introduce crop rotation to maintain corn production in the absence of fertilizers; and 3) reduce the sharp seasonality

of present economic activity thereby increasing the scope for further commercial development. Even with respect to corn production, more work is needed. There is still no technical package that will induce Nyunzu farmers to become more sedentary. Also, a corn variety that is resistant to leaf streak virus would significantly increase production.

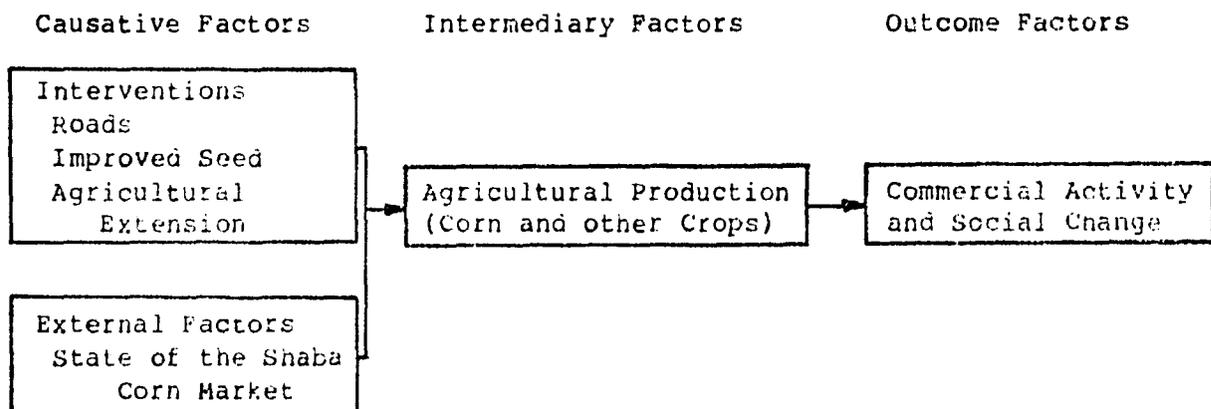
Recent progress along these lines must be considered an important project benefit. An effective and well designed program of adaptive trials is currently underway, and there is an extension staff in the project area that is experienced in monitoring adaptive trials and extending improved technologies using demonstration plots and contact farmers. As noted in Annex A, this staff cannot function effectively without technical assistance. However, with technical assistance, progress can continue beyond the production of corn as a cash crop using Kasai I seed and a technical package that is applicable primarily to the Kongolo zone.

In short, there are opportunities for continued development in North Shaba, but they will not be realized without continued technical assistance for seed production, road maintenance and extension, and access to counterpart funds (or locally generated revenues) for the road maintenance and agricultural extension programs.

## II. MONITORING AND EVALUATION METHODOLOGY

The aim of any future evaluations will be to monitor the development trajectory in the north Shaba area. It is the conclusion of this evaluation that roads, improved seed, and most recently agricultural extension have fostered increased agricultural production, which in turn has given rise to differential economic and social development across the project area (Figure 7). The working hypothesis of any future evaluations will be that such development as has occurred will slow or stop without further project inputs. A second working hypothesis is that any decline will occur more quickly in those areas where the least development has occurred (Nyunzu).

FIGURE 7:  
SCHEMA OF DEVELOPMENT HYPOTHESES FOR FUTURE PNS EVALUATIONS



Each of these variables must be examined in any future evaluations. Thus, the effectiveness of the extension service, particularly in the introduction of improved varieties of crops other than corn, must be ascertained. Secondly, the production and distribution of improved seed to farmers must be reviewed, an estimate of seed degeneration across the project area made, and an estimate of yields across space determined. Finally, the state of the road network must be assessed, identifying any areas where the roads have deteriorated seriously enough to have affected marketing. The assumption here is that without new crops or improved seed and with roads deteriorating, agricultural production, particularly of corn, will decline.

There is one major external factor that must be controlled: the state of the Shaba corn market, which includes imports and other corn projects. This information should be available from the 105 project.

Agricultural production and marketing statistics were collected by PNS precisely because reliable data were not available. Future evaluations will not have these materials available, and will have to rely on SNCZ records and merchant interviews.

The outcome variables for commercial and social development are more readily obtained. The team need only inquire into the number of stores, trucks, other businesses and craftsmen in each place. Further, the team can carry out a census of marketplace vendors, by commodity array, as was done for the present evaluation. Hospital personnel can provide accurate information on health and nutrition across the area. And, education officials can supply reasonably accurate data on schools and attendance in the project area.

Inasmuch as future change will occur slowly, there is probably no reason to schedule evaluations more frequently than every other year. All evaluations should be scheduled for January or February, so that the team can visit the fields. This is important because agricultural production statistics will be the most difficult to collect, so field visits will be particularly instructive.

### III. LESSONS LEARNED

Project Nord Shaba teaches a series of lessons about the expectable impacts from agricultural intervention and, thus, more generally, about project design.

#### A. Lessons Learned from Impacts in the Project Area

1. The essential requirements for a successful agriculture based rural development project are a technology that will increase small farmer production and a market that will absorb the increased production. These two factors explain the success of PNS.
2. Farmers will adopt only those elements of a technological package that are appropriate to their situation; witness: the differential adoption rates in Kongolo and Nyunzu.

3. While agricultural intervention may emphasize a single crop, such as corn, in the short run, sustained agricultural production soon requires the introduction of multi-cropping in order to maintain soil fertility. Some of the more densely populated areas of Kongolo zone are beginning to experience declining yields because of the lack of a satisfactory crop rotation system.

4. Increased agricultural production may increase commercial activity, but only more diverse commercial production by small-hold farmers fosters regional commercial development, as the contrast between Kongolo and Nyunzu again demonstrates.

5. It is a mistake to expect that a significant increase in agricultural production and incomes will always lead to social and institutional development. Initially, the main impact is increased commerce based on the sale of basic consumer goods. Factors affecting further development include population density and diversity of economic activity.

6. It is extremely difficult to make rural development programs financially sustainable. Government budgets are rarely able to cover all of the road maintenance and agricultural extension costs, and even when a project succeeds in generating its own tax base (which PNS has done), finding alternatives to government budgetary funding is bureaucratically and politically complicated. Therefore, even on the most successful projects, preparations for sustainability must be initiated at the very start of the project and be pursued systematically and diligently to be accomplished.

#### B. Lessons for Project Design

1. Integrated Rural Development (IRD) requires a carefully thought out work program that takes into account the natural evolution of agrarian regions. To attempt to do everything at once is to accomplish too little, as PNS learned in its first five years. To focus the program too tightly, however, runs the risk of not accomplishing enough: a single agricultural focus, such as corn, may be necessary in the short run, but it will not prove sufficient to sustain project benefits in the longer run. In other words, commercial mono-crop production must be followed by crop diversification, which then requires further agricultural intensification and marketing organization, whereupon further social and institutional innovations may be tried.

2. An IRD work plan must take into account both spatial and temporal variation within the region. People in different areas have different farming systems and will respond to different elements of a uniform technical package. Moreover, people in a particular area learn from their experiences and thus are more willing to accept further innovation after earlier successful experiences. Any practical work plan must take this variation into account.

3. Low-level or locally hired extension agents require close supervision and intensive training, but, importantly, are willing to live in the villages and to work closely with farmers. Project experience has also shown that the use of contact farmers for demonstration and extension can be a particularly effective and low-cost extension tool.

4. PNS has been able successfully to extend several varieties of other crops in a very short time--three years--precisely because its adaptive research

program was in large part carried out by the local extension agents in the field. What scientific rigor may have been lost through this procedure was more than compensated by the speed with which the Project could assist farmers.

5. Qualified and dedicated technical assistance is indispensable to project success in areas similar to North Shaba. No unit of PNS could have functioned as well as they did without this assistance.

6. Relatedly, analysis of project impacts requires a careful baseline study, as well as repeated sampling to monitor changes over time and space. This work is neither easy nor inexpensive, and it requires professional direction. As the PNS experience demonstrates, unless a strong commitment is made to data collection and analysis for project management and evaluation, the effort will cause great confusion and even greater frustration.

7. Farmer organization, while a laudable aim, must be done with a purpose and only once farmers see a clear gain from such undertakings in common. Organizing for organizing's sake will prove, as it did in PNS, to be ultimately futile. Even after such work would be productive, it is often illusionary to believe that independent farmers will cooperate unless some greater social or economic force impinges on them.

8. Rural agricultural roads can be very simply designed. Bridges and culverts over perennial streams are the most important element of such a program. The roads themselves can simply be wide paths but, when justified by the economic benefits, it is best if the roadbed is higher than the surrounding area (so the road does not become a river in the rainy season) and if the roadway is paralleled by deep ditches (to carry the water off).

### C Specific Lessons for Central Shaba

The lessons that appear to be particularly applicable to the Central Shaba project are the following:

1. Using the farmers who are farming the demonstration plots as contact farmers for extension purposes seems to have worked very well in recent years. The next step should be to structure the process, perhaps by providing some additional training to the demonstration farmer in his role as an extension assistant, and forming farmer groups to participate in extension activities based at the demonstration plot.
2. Effective extension requires an adaptive testing program because no technical package is suitable to all growing conditions. Adaptive tests add flexibility to the technical packages and, when the extension staff is involved, the dissemination of test results to farmers is greatly facilitated. The need for adaptive testing becomes greater when the technical packages involve multiple cropping.
3. Two important lessons were learned concerning seed production. The first is that contract farmers produced seed at much lower cost than the mechanized farm at Ngaba. The second is that demand for open pollinated varieties can be easily overestimated. In the PNS area, if all of the farmers bought their seed every three years from PNS, demand would have been about 330 MT per year. In fact, PNS has never sold more than 112 MT. In retrospect, this is not too surprising because the seed is good

for at least three generations. Farmers need to purchase only a small quantity of seed from PNS and use it produce their own seed which will be good for two more years. This is the reason why seed companies in the U.S. consider open pollinated varieteies as very low profit items.

4. Recent experience in North Shaba has demonstrated the importance of not relying on only one crop to increase farmer incomes. The reasons, which appear to be equally applicable to Central Shaba are: 1) the possibility of a weakening corn market in southern Shaba; 2) the need for crop rotation to preserve soil fertility in densely populated areas, and 3) the impact of diversified agricultural production on commercial development.
5. An important unanswered question is the standard of road that is needed for the evacuation of agricultural crops. PNS found that just repairing impassable spots was all that was needed to assure the evacuation of corn in some of the project areas. Beyond this, there seems to be a trade-off between the quality on the road and the distance the trader is willing to go. Under very bad road conditions, producer prices tend to drop as the trader goes further in, and there is a definite point beyond which it will not pay the trader to pick up the crop. The Central Shaba project may want to consider identifying those areas where repairing impassable spots is all that is needed to assure the evacuation of agricultural products.

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ANNEX A:  
EFFECTIVENESS AND IMPACTS OF AGRICULTURAL INTERVENTIONS

I. Extension and Adaptive Research

A. Effectiveness of the P.N.S. Extension System

1. Extension Methodology.
  - a) The Functioning of Agricultural Centers.
  - b) Demonstrations and "Journées Agricoles."
2. The Training of Extension Agents.
3. The Technical Package.
4. Adoption Rates of Improved Technology for Corn

B. The Adaptive Research Program (varietal trials)

1. Corn Variety Trials
2. Kasai 1 Degeneration
3. Corn with Fertilizer
4. Cassava
5. Soybean Trials
6. Rice Variety Trials

C. Impact of Adaption and Extension Activities on Production and Farmer Productivity to Date.

D. Projections of Continued Benefits from Adaption and Extension Program

II. Seed Multiplication (Kasai 1 Corn)

- a) quantity
- b) Quality
- c) Cost of production
- d) Distribution issues

III. Conditions For a Continued, Effective Extension Program

SUMMARY OF FINDINGS

Extension and Adaptive Research

1. Result of demonstrations have found the yield increase from recommended practices was 29% and an additional 40% from the use of improved seed.
2. Due to travel distance and other activities carried by extension workers, the extension program was based on training and visits to 20-30 demonstration farmers by each of the 60 extension agents. These "contact" farmers were used to demonstrate the effects of improved seeds and technical practices to neighboring farmers.
3. Daily journals and work plans for the extension agents would have facilitated the supervision and increased the productivity of the agents.
4. Kasai 1 improved seed corn is fully accepted by farmers, however recommended practices are highly accepted in Kongolo and Mbulula and less in Nyunzu.
5. Extension agents should be provided with technical manuals of different crops introduced in the Project zone so they will be able to improve their technical capabilities.
6. Farm demonstrations on the recommended technical package should be expanded in the Nyunzu sector.
7. Elements in the technical package needed to be tested for locality adaptation. Consideration of the traditional farming system for each sector is deemed necessary to revise the technical package for Nyunzu.

Adaptive research:

1. Corn, cassava, peanuts, soybeans and rice are well tested at Ngaba station. Varietal trials were implemented at various localities in the project zone. A few varieties of different crops were found adapted to local conditions with higher yields and resistance to insect and diseases. Multiplication of these seeds has started.
2. Corn variety TZSR-W was found to be resistant to streak diseases. Seeds are distributed to farmers for B season but need approval from P.N.M. (National corn Project).
3. Kasai 1 variety was found with signs of degeneration beginning in the third year. Continuation of Kasai 1 degeneration trials at various locations to verify the exact results is being implemented.
4. Tax and IRAT 13 varieties of rice are found to give higher yields, R66 more lodging resistance, and less drought stress than R66. Trial repetition continues as relay crop with corn.

Seed Multiplication:

1. High quality seeds are being produced by contract seed farmers with close supervision from extension agents.
2. Seed processing and quality control activities at Ngaba center are being performed effectively and at very low cost.
3. Contract seed farmers are able to produce 120 metric tons of seed as a minimum requirement to replace seed once every three years. Seeds produced by farmers cost less than at Ngaba center.
4. Seed multiplication and extension activities should be continued in the PNS area. Alternatively, organizing farmers into production groups will facilitate the job of limited extension agents with lesser cost.

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## EFFECTIVENESS AND IMPACT OF AGRICULTURAL INTERVENTION

### 1. EXTENSION AND ADAPTIVE RESEARCH

The adaptive research and agricultural extension (SS/AV) subsystem has the following objectives:

- To design, test and introduce corn (and to a lesser extent, other crops) cultivation techniques tailored to existing farming systems.

- To develop an institutional base in North Shaba capable of carrying out an adaptive research program and of disseminating the improved agricultural techniques to farmers.

- To create communication channels among farmers, extension workers, and researchers.

#### A. Effectiveness of the PNS Extension System

The P.N.S. extension system area seems to have worked well during the project period 1979-1986. Although only 60 extension agents were assigned to the 60 agricultural centers, the project covered an agricultural area of 33,154 ha with 15,732 households in 1986. Extension appears more effective in Kongolo, and, especially, in Mbulula, where the Ngaba seed and extension center existed. The extension system only began to develop in Nyunzu in the 1984-1985 planting campaign.

##### 1. Extension Methodology

###### a) The Functioning of Agricultural Centers

Each extension agent is assigned to work at an agricultural center ("centre agricole"). He is responsible for carrying out the extension activities in three to nine villages, covering approximately 200 to 300 households. Since more than 82% of the farmers in the P.N.S. area have their land in the forest, the extension agent has to travel a distance of from 5 to 40 km to work with the farmers in various activities: seed distribution, implementation of demonstration plots, organization of farmer's training and visits, and carrying out varietal tests on corn, peanuts, rice, soybeans, cassava and cotton.

In theory, the extension agent tries to frame his activities around 200 households but actually works with only 20 to 30 farmers each year. These "contact" farmers help with the demonstration trials. If these farmers could be used also as assistants to the extension agents, they could help the agent repeat messages and summarize the importance of each recommendation to other farmers. The extension agent may also visit other villages and other farmer blocks in the forest in order to supervise demonstration plots of other farmers. This approach will extend the agents range of activities.

During the field visits, the team met a number of extension agents, who were asked about their work plans and daily journals. It seems that they possess only "protocoles d'essai" (test trial guidance) and instructions for demonstration trials. The lack of daily journals and work plans makes it difficult for agricultural assistants (supervisors) to discuss the daily activities of the extension workers in the field.

At present, only 34 extension workers remain in the project zone. Because each extension agent must cover additional villages, it was deemed necessary to reduce the number of demonstration plots in 1986-1987 due to the lack of logistic support and field supervision from the extension sector and P.N.S. headquarters. In one instance, the agricultural assistant kept asking when he would receive gasoline for his motorcycle. He has not visited extension agents in the field during the last two months.

In addition to material support, extension agents do not now receive their salaries on time, and the uncertainty of P.N.S. project in the future is also affecting the morale of extension workers. The question is whether some locally hired agents could be financed by local groups of farmers. In fact, P.N.S. did not consider whether project funds could remunerate these locally hired agents or whether farmers could provide compensation for the agents' efforts.

b. Demonstrations and "Journées Agricoles"

Farm demonstration is the most effective element in the P.N.S. extension system. The major success of the demonstration effort has been farmers' adoption of the Kasal 1 variety, planting in rows, and proper plant density. Another success of extension activity, in the 1986 - 1987 agricultural campaign, is the distribution of new varieties of cassava with higher yield for the season B. The multiplication of selected cassava varieties (such as 30085/28/10, 30085/28/8, A56/1 and ATINS/4(2) and 246/11) is being done at Ngaba Station and at the farm centers. According to the extension agents, cassava stems of these varieties were stolen from the farm centers by farmers because these varieties are more productive than the local varieties and less infected by pests and diseases (mosaic). This shows that farmers are eager for new crop varieties when demonstration results show significantly better yields.

The P.N.S. extension system used both direct contact with farmers (personal discussion and persuasion) and demonstration trials in the farmers' fields. In addition, extension agents live in the villages to work with farmers and help them solve daily problems. In the case of Nyunzu sector, however, farmers abandon their fields frequently and go farther into the forest, which makes the agents' job more difficult. Extension agents must redouble their efforts in these new development zone. They must spend more time with farmers in the forest. And they must set out more demonstration plots in the forest than in the savanna, which is more easily accessible but accounts for very little production.

The table below presents the P.N.S. demonstration program as planned and executed in 1985-1986:

<u>Type</u>	<u>Planned</u>	<u>Realized</u>	<u>Harvested</u>
Corn Production practices	5	9	9
Corn Fertilization	45	42	42
Corn Streak Virus Resistance	12	27	27
Cassava Production Practices	32	14	4*
Cassava-Peanut Inter-cropping	30	37	20
Rice Production Practices	26	24	10
Soybean Production Practices	15	5	N/A
Cotton Production Practices	36	8	N/A
TOTAL	203	166 (82%)	

\*Cassava is harvested 15-16 months after planting.

Two new types of demonstrations were introduced in 1985/1986 and will be implemented in 1986-1987:

- The demonstration of yield improvement from corn varieties highly resistant to streak virus, such as TZSR-White in season B and,
- The demonstration of soybean production practices.

The technical advisor of Ngaba Center agrees that if manpower and financial limitations occur in 1986-1987, the number of soybean demonstrations will be reduced in order to promote the planting of new varieties of cassava. Since soybeans are not well known by the population, it is difficult to market the product either within or beyond the project zone.

More effort will be given to rice production practices in 1986 and 1987. Three varieties -- IRAT 13, K66, TOX -- were found well adapted to the local conditions. These varieties could be planted as a relay crop with corn.

Along with the demonstration of cultural practices of various crops, the "journées agricoles" (training and visit) was a most effective tool for training farmers. About 20 to 30 farmers in a village are invited to come to observe the cultural practices at the demonstration plot. At least three "journées agricoles" were organized for each demonstration plot during the planting season. The "journées agricoles" treated the following topics:

- Planting Time: seed selection plus cultural practices.
- Vegetation time: thinning and weeding
- Harvesting Time: comparison of yield for improved practices and farmers' practices. (Result demonstration)

The table below shows the number of field days organized by the Adaption and Extension Subsystem of P.N.S.

Campaigns	No. of Journées agricoles organized	No. of participants
1982-1983	15	261
1983-1984	59	1,054
1984-1985	337	5,161
1986-1987	709	8,603

Interviews made with extension agents and farmers in the project zone indicate clearly that better cultivation practices and the use of improved seed significantly increases yields over traditional farmer practices.

In addition to "journées agricoles", daily contacts and visits by extension agents to farmers' fields reinforce the training lessons for farmers.

## 2. The Training of Extension Agents

The training program for extension agents has contributed to the effectiveness and the performance of these agents in the field.

In July 1986, a three-day training session was organized at Ngaba Center. The objective of this training was to provide extension agents not only with an extension methodology but also with the technical know-how for the conduct of demonstration plots with different crops. "Fiches techniques" (crop technical sheets) for major crops in the project area were prepared. These fiches cover: cultural practices for corn, cassava, peanuts, soybeans, fertilizer use, soil identification, intercropping, relay cropping, crop rotation etc. The three-day training session was done in July, after the harvesting season and before the vacation period.

In addition to the above training, the extension agents located within each sector were called to the sector headquarters for one day's training each month. The objective was to keep the work done by the extension agents up to date and to provide solutions to the problems experienced by the extension agents.

Before the 1984-1985 campaign, training consisted of presenting subject matter to the extension agents and an analyzing or synthesizing results from the previous year's activities. In 1985-1986, the program presentation included a debate on different technical topics. A few of the important items for debate were:

- TZSR-W and Kasai 1 varietal differences.
- Calculation of yields from demonstration and trial plots.
- Fertilizer response curves.

- Cost-benefit ratios of farmer adoption of fertilizer and practice recommendations.
- Seasonal distributions of solar radiation and its effect in yield potential.
- Stand establishment problems with rice.
- Stand establishment problems with soybeans.

The debate system seemed to motivate the extension workers in the discussion and responded more immediately to the technical concerns of field agents. Also, the supervisory staff acquired more information regarding field problems, and they ask more questions of senior staff before presenting a standard topic.

The technical training program for extension agents is acceptable. But during visits to extension agents in the field, it became clear that they do not possess any technical documents regarding the different topics presented by the trainers. It would be more beneficial to the field agents if they had a field manual for major crops introduced into the project zones, as well as the technical explanations for each crop. Extension workers could then refer to the manual as a guide when training of farmers.

Debate, discussion, and presentation of a subject matter in the classroom create great enthusiasm in learning. Technical manuals used as references will help extension workers when they are in the villages where a library is non-existent because they seldom meet subject-matter specialists in the field.

Interviews given to extension agents in the field have proven that they understand the agricultural situation of the area where they work. Many of them understand how to conduct a demonstration plot, trial test plots and the extension approaches to farmers. Few of them need to be given on-the-job training due to the lack of training in extension methodology when they were in school. The nine months of refresher courses has contributed to upgrade the technical knowledge of the extension agents before assigning them in the field.

Continued training of extension agents in the field contributes greatly to the success of farm demonstration and farmer training and visits.

### 3. The technical package

Seed multiplication was implemented in the 1962-1963 planting campaign. The technical package of the first phase P.N.S. consisted only of using Kasai 1 improved seeds, sowing in rows with spacing .75m x .50m, weeding and harvest time.

The full corn production package was introduced in 1983-1984 planting campaign with the following recommendations.

1. Use of Kasai 1 improved seeds.
2. Early sowing (about September 15).
3. Line planting (0.75<sup>m</sup> x 0.50<sup>m</sup> with three seeds per hill).
4. Thinning two plants per hill.
5. Disease control.
6. Two or three weedings before flowering.
7. Optimum plant population (50,000 plants per hectare).
8. Optimum time of harvest.

Results from the demonstration plots show that if farmers adopt the full package of recommended practices, they may receive higher yields up to 3 to 4 tons per hectare. However, improved practices that require more labor are not as readily accepted, especially in Nyunzu, where the area planted to corn can exceed 10 hectares per household. In Kongolo, there is a high acceptance of improved practices because many farm households possess less than one hectare of land. The full package of recommended practices is therefore more easily adapted by these farmers who are intensifying production. In Mbulula, where the Ngaba center operates, and contract seed farmers have participated in the seed multiplication program, the full package of recommended practices is widely disseminated and accepted, not only by contract seed farmers, but with other farmers as well.

Another factor affecting the adoption of the technical package by farmers is the availability of land in the forest or savanna areas. In Nyunzu, farmers readily shift their agricultural exploitations into new forest land. A majority of Nyunzu farmers cultivate larger areas than those in Kongolo or Mbulula. The breakdown of farming area in different sectors in the forest and savanna land is as follows:

	<u>Forest</u>	<u>Savanna</u>
Kongolo	73%	27%
Mbulula	84%	16%
Nyunzu	98%	2%

According to the extension workers in the field, the different interpretations of what constitutes full adoption of project recommendations is obvious. Extension agents in Nyunzu consider only 4 elements of the whole technical package practiced by farmers as a full technical package. These are: 1) Use of Kasai 1 improved seed, 2) Sowing in line, 3) One weeding, and 4) Optimum plant population (25 to 30 kg/ha). However, in Kongolo and Mbulula, the full package is interpreted as the adoption of the 5 elements. Considering the farming systems of each sector, the consultant feels that the technical package should not be a standard set. The current package is viable, but certain elements of the package should be tested for location specificity before implementation. The important task of the extension agent is then to

educate the farmers about the advantages of the elements of the technical package relevant to them in order to increase their production. Therefore the technical package should be taken into consideration with the traditional farming system of each locality. This is also true for other crops that P.N.S. introduced since the 1983-1984 planting campaign.

#### 4. Adoption Rate of Improved Technology for Corn

According to P.N.S. report, 64% of farmers in the project area have adopted fully improved technology for corn and 36% adopted partially recommended practices.

As mentioned above, measuring the rate of adoption depends on the judgement of the extension workers in the field and on the traditional farming system of the farmers each sector. In Nyunzu, farmers clear land in the forest. During the first two or three years, the application of two weedings is not economical. After 3 years of cultivation on the same land, grasses may overgrow the field and so two or three weedings become necessary. By this time, farmers may consider moving to another area rather than stay on the same plot. Experiences in the field have showed that the adoption rate of improved technology depends on successful results and the training of farmers. To demonstrate, the success of the adoption rate achieved in Mbulula, which may be as high as 80%, as due to the large number of demonstration plots carried out in farmers' field. Moreover, they had received a careful guidance from the agricultural assistant and the "Chargé" of the adoption and extension system of the P.N.S.

In addition, contract seed farmers in Mbulula follow more recommended cultural practices than other farmers who live away from Ngaba center. The close supervision of Ngaba extension staff has ensured the quality-control of seeds produced by the contract seed farmers. A sanction was established to eliminate contract seed farmers who do not follow recommended practices after the first few inspections. The seed multiplication plots conducted by the seed growers has two-fold advantages: the control of adoption of the improved technology and the training of farmers nearby.

In conclusion, from the standpoint of adoption rates, the project had achieved very successful results in Mbulula and high acceptance of the technical package in Kongoio. In Nyunzu, the low level acceptance demonstrates that few elements of the package were relevant to the farmers. Plus, the extension effort of P.N.S. began only in 1984-1985.

#### B. The Adaptive Research Program

The adaptive research program was designed to search for new varieties which adapt well to local conditions with high yields and resistance to diseases and insects:

- Identify the appropriate dates of planting rice and soybeans.
- Verify yield response to fertilizers for different crops.
- Search for crop rotation systems or relay cropping systems which help increase soil fertility.

The following type of trials were carried out at farm centers and at Ngaba Center in 1985-1986:

- PNM corn varieties
- Kasai 1 degeneration
- corn with fertilizer
- Cassava clones
- Cassava clones resistant to spider mites
- Rice varieties tests
- corn varieties for resistance to streak virus
- Cassava and peanut intercropping
- Soybean variety trials

#### Results of findings:

Corn: (season B Leaf streak virus disease resistant) P.N.S. continues to cooperate with P.N.M. (National corn project) on a varietal testing program in corn. After the 1984-1985 trials, the variety TZSR-W and TZSR-Y from I.I.T.A. were found much more streak-disease resistant than Kasai 1. Since white corn is more acceptable to the local population, the TZSR-W variety was selected to replace Kasai 1 for season B planting. The seeds are multiplied at Ngaba Center and farm centers. The yield is up to 2,425 kg/ha with recommended practices. P.N.S. will get approval from P.N.M to distribute these seeds to farmers.

Kasai 1 degeneration: Five generations of Kasai 1 seeds were put on trial at Ngaba Center. It was found that G4 seeds had only 4% less yield. Yields from G-5 seed has declined sharply. To verify these results on Kasai seed degeneration, trials will be continued at various locations in the project zone.

Corn with fertilizer: Corn fertilization trials have shown a positive impact in yields. Various rates of fertilizer applications were conducted at Ngaba Station in 1984 and 1985. Demonstrations of corn fertilizer were also carried out in the villages. The reasons for conducting fertilizer demonstration were:

- to show that economic yields can be obtained in savanna fields
- to indicate that fertilizer can maintain high yields on forest fields (after 3 or 4 seasons) lengthening the time farmers can farm them and to decrease pressure to clear new forest land.

Cassava: P.N.S. has cooperated with PRONAM (Cassava National Project) in Gandajika on best cassava clones. Adaptability and yield trials were tested in 19 site trials across the project area. Ngaba station, screened many varieties. The 30065/28/10, 30085/28/18, M501, Kilondo varieties were selected to reproduce stems for distribution to farmers.

Soybean trials: Herdon and Sola varieties were found to be the most productive varieties in the project zone. Trial efforts were oriented in the improvement of cultural techniques and the date of planting.

Rice variety trials: 50 varieties of rice were tested 1984-1985, and a number cultivars were found. The TOX and KAT13 rice varieties give good yields (961 kg/ha and 800 kg/ha). Taller varieties (R66 and R46) produced only 240 kg/ha, however.

Repeat trials were done in 1986 in order to insure accurate results and to identify a variety that will give higher yields, and be more lodging-resistant and less drought stressed than R66.

In general, the adaptive research program has responded to the need of extension agents in the field. Varietal tests and demonstration plots implemented by extension agents in the field would help them to acquire on the job training experiences.

C. Impact of Adaption and Extension Activities on Production and Farmer Productivity to Date

Extension activities of P.N.S. contributed a great deal to the agricultural development of the North Shaba region. The increased 29% yield of corn production per hectare resulted from the high adoption of technical package in Kongolo and Mbulula at the demonstration plots. Use of improved seeds can increase yield up to 40%. The total adoption of improved seeds and recommended improved techniques increase the production of 69%.

The following table represents the yield in kg/ha on corn production practice demonstrations in 1985-1986.

SECTOR	AGRIC. CENTER	FARMER PRACTICES Kg/ha	RECOMMENDED Practices kg/ha	YIELD Increase kg/ha
Kongolo	Malakuya	935	1,200	265
	Timjra	1,642	2,424	782
	Kabeta	4,329	4,640	311
Nyumzu	Lwela	1,250	1,650	400
	Masamba	2,873	4,157	1,284
	Benze	1,128	1,562	434
Means		2,026	2,605	579

The mean yield increase from recommended practices (spacing, inline planting, thinning and weeding) was 579 kgs/ha or 29% higher than farmer practices. (Humpal report June 1986).

However, the project figures have shown that from 1978-1986, Kongolo has increased up to 200% and Nyunzu up to 100% of corn.

The table below shows the corn production area and yield from 1978-1979 to 1985-1986:

CORN PRODUCTION, AREA AND YIELDS

YEAR	Kongolo			Nyunzu			Total Prod. (000MT)
	Area (000ha)	Yield (MT/ha)	Prod (000MT)	Area (000ha)	Yield (MT/ha)	Prod. (000MT)	
1978/79	11.3	.9	10.6	12.8	2.3	20.9	31.5
1979/80	10.4	1.2	12.7	13.5	1.7	22.6	35.3
1980/81	21.2	1.7	36.0	15.4	2.1	30.0	66.0
1981/82	19.1	n.a.	n.a.	14.3	n.a.	n.a.	75.6
1982/83	20.3	n.a.	n.a.	13.8	n.a.	n.a.	80.0
1983/84	20.8	2.8	55.9	15.6	2.0	40.1	96.1
1984/85	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	61.2
1985/86	19.6	3.1	61.6	13.5	2.6	35.0	96.6

Source: P+S, SCAD reports.

Improved varieties of cassava resistant to mosaic have given yields of up to 9 tons/ha. If multiplication of these varieties will continue for another two years, the production of cassava could tripled in the future, over the present level of 72,000 MT. Cassava is the staple food in Nyunzu and is consumed in substantial quantities in Kongolo.

Peanuts are being produced in the savanna fields. Peanuts help improve soil fertility. Farmers will produce more peanuts if the marketing problems can be improved. Quantity of peanuts marketed in Kongolo increased from 200MT in 1978 to 900MT in 1986. Production was estimated at about 7,000 MT in 1985/86.

Rice production reached a production of 5 tons. People are changing their diet by eating more rice, in addition to cassava or corn. Rice is a relay crop with corn in Mbulua.

The following table shows the secondary crops production in both season A and season B.

	<u>Peanuts</u>	<u>Cassava</u>	<u>Rice</u>	<u>Cotton</u>
1983-1984				
Season A	3,606	57,114	2,564	-
Season B	<u>2,913</u>	<u>19,233</u>	<u>2,585</u>	<u>1,416</u>
TOTAL	6,519	76,347	5,149	1,416
1984-1985				
Season A	2,508	30,630	373	14
Season B	<u>4,368</u>	<u>41,535</u>	<u>3,769</u>	<u>1,899</u>
TOTAL	6,876	72,171	4,142	1,913

D) Projections of Continued Benefits from Adaption and Extension Program

At present Kasai I improved corn is fully accepted by the farmers in the project zone. The introduction of new varieties of other crops, such as cassava, peanuts and rice, is also being accepted by the population in Kongolo. The cultivation of corn and cassava is not new but the project has helped the farmers improve cultural practices and adopt new varieties, which has led to increased production.

Can the agricultural extension program remain at the same level without technical assistance from U.S.A.I.D. and funds available from GOZ? The answer to this question requires more knowledge on the GOZ administration. Since the consultant has only a few weeks experience in the field, it is impossible for him to give an accurate answer. However, the presence of an agronomist in charge of seed multiplication and another in charge of extension and training is clearly necessary. Without these two specialists in the field and the necessary funds to support the activities, it appears that there will be a total halt in the adaptive research and trial tests within a year. It also appears that the extension activities could well return to the pre-P.N.S. situation (D.O.A. and ESTRAGICO) within a two to three year period.

II. SEED MULTIPLICATION

A. Effectiveness of the present program

a) Quantity

At the present time, Ngaba station produces a small amount of seeds and is involved primarily with seed processing and storage. The production of improved seeds at the center will be reduced to 18 tons for the 1986-1987 season. However, 380 contract farmers will produce another 100 tons of seeds.

The following table shows the seed production of Ngaba center and at contract seed farms from 1981 to 1987:

Year	Ngaba Center/Tons	Contract Seed farmers/ton	Total/Ton
1981-1982	14	-	14
1982-1983	15	53	68
1983-1984	46	56	102
1984-1985	41	74	115
1985-1986	40	52	92
1986-1987(est)	18	100	118

The PNS recommendations to replace seeds once every three years at the rate of 30 kg/ha implies an aggregate demand of 330 MT of seeds per year (33,000 ha x 30 kg : 1 = 333,000 kg). If farmers replace seed at this rate but only once every five years, the P.N.S. area would require 198 MT of seeds (33,000 ha x 30 kg : 3 = 198,000 kg).

However, the most seed distributed thus far was 112 metric tons in 1984-1985. Serious degeneration was not observed during our field visits. Therefore, we assume that farmers have bought improved seeds directly from seed growers or have multiplied their own seeds from a small quantity of G<sub>2</sub> seed purchased from PNS. Based on the above assumptions, we agree with the extension advisor that P.N.S. could produce annually about 120 MT of seeds and still meet the needs of project farmers.

Most seed is produced at the farm centers because of the poor soils for maize at Ngaba Center. Since farmers around the center are interested in seed multiplication, the participation of more seed growers will not pose any problem and will cost less than the seeds produced at Ngaba.

#### b) Quality

G<sub>1</sub> generation of Kasai 1 is produced at Ngaba center then distributed to contract seed farmers. According to the extension advisor, good seeds can be produced by the contract seed farms, even better quality than that at Ngaba Center. Strict supervision by the extension agents and Ngaba staff ensures the genetic purity, germination rate, humidity control, insect and pest control of the seeds.

#### c) Cost of Production

The cost of seed production at Ngaba center remains higher than that at the contract seed farms. The use of labor, equipment costs at the center, both increase production costs. Seeds produced by contract seed farms are paid in cash, at a price with 8% high or than the grain price.

The following table shows the cost of producing corn seeds at Ngaba center and on the contract seed farms.

Year	Ngaba Center Z/kg	Contract Seed farms Z/kg	Sale Price	Producer price for corn
1984	7.14	4.52	Z4	Z4
1985	10.15	6.6	Z6	Z3
1986	11.75	9.48	Z10	Z4

PNS staff have explained that many indirect costs are not included in the Ngala Center figures. They estimate that seeds produced at Ngala cost twice as much as seed produced by contract farmers. The cost figures for contract farmers, on the other hand, are considered fairly accurate. It should be noted that neither figure includes technical assistance. If it were possible to obtain a qualified expatriate technician for \$50,000 per year and one half of his time was spent on the seed program, this alone would add Z21 per kg to the cost of the seed. This compared with prices of Z30-60/kg for commercially produced seed sold in southern Shaba.

d) Distribution issues

The seed distribution to the farmers is under the control of the adoption and extension sub-system of P.N.S. Seeds are delivered to the villages in June or July after the processing is done. Extension workers at each center are in charge of delivery. The main problem with respect to distribution are the sale price and the lack of cash.

According to extension workers, farmers must pay for the seed in cash upon delivery based on the "bon de commande" (purchase order) from the farmers. However, an undetermined amount of seeds was sold on credit to farmers who claimed that they did not have cash on hand. Most of the credit was repaid when the crop was harvested.

As far as the sale price is concerned, most farmers in the project area realize that replacing new seeds would help them to increase the yields at least 10%. (The improved variety of Kasai 1 corn has shown yield increases of 40%). If he invests in buying 30kg of seeds at the price of 10Z per kilo for one hectare of corn production, he would receive 200 kg more of corn. If the market price of grain is 4Z per kilo, he would receive an extra 800Z. The benefit he receives will be  $(800Z - 300Z) = 500Z$ ; if the seed increases his yield by 20 percent not an unreasonable assumption, his profit increases to 1,300 for a 200 investment. The task of the extension staff is to communicate to the farmer that a relatively small cash outlay will result in substantial increases in income for the subsequent three years.

The following table shows the seed distribution in kg from 1980 to 1987:

Sector	81-82	82-83	83-84	84-85	85-86	86-87
Kongolo	1,165	4,500	14,673	31,277	43,210	13,000
MBulula	1,950	15,117	19,205	30,043	58,886	14,000
Nyunzu	910	27,115	14,833	32,802	9,703	13,000
TOTAL	4,025	46,912	48,711	94,128	111,799	40,000

### III. CONDITIONS FOR CONTINUED EFFECTIVE EXTENSION PROGRAM

Since 1982, P.N.S. has made considerable progress in adaptative research, seed multiplication, and training of farmers through the demonstrations. The improved technical package is being adopted by farmers at Mbulula and Kongolo, but less so in Nyunzu. In addition, diversified crops were introduced into some villages during the last two years. Many farmers expressed their appreciation regarding the existence of P.N.S. extension activities in helping their increase of production.

For the system to remain effective, two main components of the P.N.S. system be maintained: seed multiplication, and extension activities through farmers' production groups.

#### Seed Multiplication:

The seed multiplication program is a key factor in the continuation of P.N.S. benefits for acceptance of Kasai 1 seed by farmers contributed importantly to production increases.

After 3 or 4 years, the seed must be replaced. The seed multiplication program should therefore be continued with contract seed farmers. Cost is a concern to farmers. The lower cost of seed production with contract seed farmers should assure a reasonable and acceptable price to farmers. Seed quality is another concern. It depends upon proper processing, which means seed quality, the equipment (such as now operated at Ngaba center) and the professional capabilities of the P.N.S. technicians. Maintenance of this equipment and the control of seed quality must be taken seriously.

#### Extension activities:

The reduced number of extension agents will not affect extension activities, only if farm demonstrators, and contract seed growers undertake the training of other producers. Otherwise, it will be important to consider organizing farmers into production groups that could facilitate seed supply and marketing.

At present, the extension agents handle a number of activities: seed distribution, farm demonstrations, variety trials and farmer training and visits. With fewer agents covering wide area, extension personnel will be stretched too thin and some activities might need to be dropped. Alternatively, organizing farmers into production groups could facilitate the job of extension agents.

Small groups of farmers will continue to be an important contact point for training. The training and visit system with field demonstrations should therefore be continued under P.N.S. because this system has achieved results rapidly and at little cost.

## ANNEX B

### PROJECT DESIGN ISSUES

#### 1. ASSESSMENT OF THE INTEGRATED RURAL DEVELOPMENT APPROACH

The theory underlying integrated rural development projects is that all constraints to rural development should be addressed simultaneously with the objective of achieving a self-sustaining development process. A key element in this strategy is for project beneficiaries to participate in the selection and funding of project activities. The assumption is that if the beneficiaries contribute their own resources they are more likely to be committed to the continuation of project activities. The participation of the beneficiaries is usually encouraged through the development of local organizations.

As originally designed, PMS was a classic integrated rural development project with the following characteristics:

1. The project design was based on the hypothesis that sustained rural development is dependent on an increase in small farmer production and incomes. The increased incomes would provide the resources for off-farm economic activities, and the development of economic infrastructure and social services.
2. The technology for increasing farmer productivity was to be compatible with existing farming systems, based on an on-depth understanding of those systems.
3. The project design included the following components:
  - agricultural applied research and extension
  - agricultural marketing
  - rural roads
  - farmer group development
  - women in development
  - intermediate technology
  - farming systems data gathering and analysis

One of the problems early on in the project was that the farmer group development staff, including the technical advisor, favored using local organizations to foster social development at the same time or prior to increases in agricultural production. This was inconsistent with the project design and led to considerable wasted effort during the first three years. By 1982, it was clear that, not only was there very little for farmer organizations to do, but the effort to organize farmers was diverting resources and management attention away from more pressing concerns related to agricultural production. This was also true of the women in development component.

The Intermediate Technology component also proved to be marginal to the primary objectives of the project. The component was to have been a research and development effort to design and produce tools and equipment that would increase the efficiency of agricultural production and processing in the project area. As it turned out, the project had neither the resources nor the

expertise to mount a credible program and, in any event, the needs for improved equipment in the area were not large enough to justify the requisite level of effort.

When the project was redesigned in 1983, it was changed from an integrated rural development project to a small farmer production project. The revised project consisted of: agricultural extension, rural roads, and a small agricultural marketing component. The farming systems data gathering and analysis activity was transferred to the DOA Bureau d'Etudes in Kinshasa, but when it became clear that they would not be able to do the job, the activity was returned to PNS. The feeling lingered in AID, and to a lesser extent in PNS, however, that farm-level data gathering and analysis was not a key element in a program to increase small farmer production. It was seen primarily as a means of measuring project impact.

In general, the redesign can be said to have improved the project. The costs certainly were reduced, and priority placed where it should have been all along, on increasing agricultural production and improving the road system. The main negative impact was that, with the weakening of the farming systems analysis capacity, the project never developed a good understanding of farming systems in the area, including production constraints in the Nyunzu zone, and opportunities for crops other than corn throughout the project area. As a result, in many respects the extension program has been forced to depend on trial and error rather than on a sound understanding of production constraints at the farm level.

Although changing PNS to a small farmer production project was generally well advised, it should be emphasized that the integrated rural development approach represents a valid strategy for achieving self-sustaining development, especially in countries that do not have huge resources to transfer to rural areas. Increased agricultural incomes lead to increased commercial activity and some increase in social services. After production and incomes reach a high enough level, local organizations are formed for agricultural marketing, agricultural processing, commerce, the provision of social services, and the development of village-level social and economic infrastructure. The key to this process, which is lacking in too many projects, is beneficiary participation from the outset. The end result, if everything goes well, is a self-sustaining and self-financing development process.

## II. PROJECT ADMINISTRATION

The key issues with respect to project administration relate to the Project Management Unit (PMU). These issues vary according to what aspect of the PMU is being considered. The most obvious of the PMU functions is overall project administration. This includes logistics, personnel management, and financial management. Given the size of the project, which is another issue discussed later in this annex, these administrative tasks needed to be performed either at a central level or at the level of each project component. There does not seem to be much doubt that it was more efficient to centralize most of these tasks. This is especially true of logistics. The ordering and transport of equipment and supplies from Kinshasa, Lubumbashi, and abroad would have been extremely difficult on a decentralized basis, and would certainly not have reduced costs. Thus, a central office of administration and finance would

seem to have been justified. However, the administrative functions could probably have been carried out with fewer people. The evaluation team had neither the time nor the expertise to properly address this issue.

A second function of the PMU was to centralize substantive planning, programming and decision making. This not only helped assure proper coordination among the different project components, but established a central office for dealing with the GOZ, AID, and the regional authorities. In the absence of a PMU, the GOZ and AID would have had to spend a lot of time and effort coordinating activities, setting priorities, and preparing budgets for a complex project being implemented in a very remote area of Zaire. The process by which each project sub-system had to justify their annual budgets to the PMU, and report on their workplans monthly, quarterly, and annually seems to have resulted in a better allocation of resources and organization of effort than would have occurred otherwise.

Finally, a major reason for the PMU was the desire of the project designers to assure almost complete autonomy from the DOA and Ok in the day-to-day management of the project. It was judged that implementation would be difficult enough in North Shaba without adding the many bureaucratic hassles and delays that result from being part of the ongoing programs of GOZ line ministries. Here again it is difficult to argue against the underlying premise, although setting up an autonomous project does increase the difficulty of achieving institutional sustainability later on. Once the decision was made to have an autonomous project, separate administrative arrangements were necessary and, as noted above, it was almost certainly more efficient to centralize all of the administrative tasks in one office.

The key question is: was there in fact an alternative to a large PMU? The answer is that it would have required a very different project design. I.e., a small extension program, the use of an Ok brigade (responsible for its own logistics) to do road construction, and a very small and self-sufficient technical assistance team. The issue of whether the project objectives could have been achieved with a much smaller project is discussed in the section on project costs.

### III. THE ROLES PLAYED BY AID, THE GOZ AND DAI/MM

This section addresses the following item in the Scope of Work for the evaluation:

Evaluate the roles played by the GOZ (DOA), the contractor (DAI), and USAID in the development of the project over time. How did they benefit the project's progress, and how did they hinder it?

This is a difficult question to answer because, by and large, the initiatives of these organizations with respect to the project were never deliberately intended to hinder the project. Throughout the project the main concern of the GOZ, AID, and DAI was to improve the final product. An assessment of the roles of the different parties during key phases of project implementation will help explain how they affected the overall direction and accomplishments of the project.

## 1..Early Implementation

This phase of the project was very much a learning process. Neither AID nor DAI fully understood what was involved in implementing a large and complex project in a remote area of Zaire. The DOA provided a reasonably qualified staff but was unable to meet its funding commitments due to the serious budgetary problems of the GOZ. In general, DAI/MM seem to have taken the lead in identifying and addressing implementation and design problems during this period. When it became clear that serious implementation delays were occurring, DAI/MM sent an evaluation team from the home office to determine what corrective actions were needed. The evaluation team correctly identified the major problems, namely the very slow progress of the agricultural research and extension component, the lack of qualification of certain members of the technical assistance team, and serious shortfalls and delays in GOZ funding. During this period, DAI also had a positive impact on PNS staff by introducing farmer participation and communication with farmers as key elements in the agricultural extension program. The contrast between the PNS extension system and those of the DOA and ESTAGRICO in the area was striking.

During these early years, AID played a critical role in supporting PNS activities and helping to break bottlenecks. Of particular importance were interventions with the GOZ to release funds from the national budgets and later the decision to fill funding gaps with counterpart funds. Despite a generally positive attitude on everyone's part, many of the problems that had been identified in 1980 remained in 1982. DAI/MM and PNS management did not directly and systematically address many of the problems identified in the 1980 evaluation, and neither AID nor the DOA exerted much pressure on the project to take the necessary actions.

## 2. Project Redesign

An external evaluation of PNS in 1982 confirmed that many serious problems remained, and recommended the immediate termination of the project. This recommendation was not accepted by AID, mainly because the project had in fact succeeded in surpassing many of its original end-of-project objectives and many of the problems identified in the evaluation seemed to call for project redesign rather than termination.

Thus, AID took the role of initiating the redesign of PNS from an IRD project to what was essentially a small farmer production project. DAI, on the other hand, remained committed to the original design and was not ready to abandon the underlying integrated rural development strategy. PNS management and staff were supportive of the DAI position. The GOZ also opposed the redesign, but more for bureaucratic than substantive reasons. It is always difficult for underfunded ministries to accept cuts in their projects, especially when they entail staff reductions. However, once the final decision was made, it was accepted by DAI/MM, PNS and the GOZ, and all parties were committed to implementing the project as redesigned. PNS and DAI/MM, in fact, carried out an exemplary small farmer production project between 1982 and 1986. The activities were well conceived and efficiently implemented, and the project was able to achieve impressive results in the areas of agricultural extension, adaptive trials, seed production, and road construction. In retrospect, it appears clear that the increased focus on agricultural production

significantly increased the effectiveness of the project and AID must be given the credit for taking the lead on this.

### 3. The Search for Sustainability

By 1983 it was clear that the project had achieved some benefits that were worth continuing. However, that was where the agreement ended. The first point of disagreement concerned what activities were needed to assure sustainability of benefits. At one extreme the feeling was that only minimal road maintenance and improved seeds were needed. At the other extreme, it was felt that everything that PNS was then doing needed to be continued. These differences were based on very different, almost irreconcilable, interpretations of what was occurring in North Shaba.

The second issue had to do with institutional sustainability. AID was convinced that it would be impossible for the GOZ to continue project activities. An intensive search for alternative institutions ensued, and the decision was finally made to integrate PNS road maintenance, agricultural extension, and seed production into ESTAGRICO, a cotton parastatal based in Kongolo. DAI, PNS, and the GOZ strongly opposed this approach on development as well as practical grounds. Many observers felt that ESTAGRICO as a failing profit oriented enterprise had neither the commitment nor the capacity to carry out project activities in support of PNS development objectives. Aside from the institutional issue, there was the question of funding. It soon became clear that ESTAGRICO did not have the financial resources to continue PNS activities, and an outside source of funds would be needed.

The first crisis related to integration with ESTAGRICO. The DAI Chief of Party, PNS management, and the DOA all refused to accept the AID decision and resisted its implementation at every opportunity. This was probably the low point in terms of the ability of the different parties to work together. Eventually, DAI brought in a new Chief of Party with instructions to do everything possible to assure an effective integration of PNS activities into ESTAGRICO. Due to perceived weaknesses in ESTAGRICO management, PNS was reluctant to transfer full responsibility to that organization. Consequently some have maintained that the integration was never given a chance to work. In defence of PNS and DAI, it must be said that the ESTAGRICO extension and road maintenance programs were extremely inefficient by any measure. For a maximum production of 3,000 MT of cotton, ESTAGRICO had an extension staff of 140 agents (compared to PNS which had 60 agents for 90,000 MT of corn) and maintained its roads with a manual system that cost twice as much per km as either the OR or PNS systems.

There was also very little progress on funding. There was in fact no agreement on how to assure funding for continued development activities in North Shaba. It was recognized that there would be no funding from the DOA. This left the regional authorities and autonomous funding sources such as the Fonds de Convention de Developpement (FCD). The GOZ made almost no effort to find funding. Efforts by AID, PNS, and DAI all led nowhere, largely because 1) neither the GOZ nor the regional authorities were interested enough in sustainability to come up with the resources, and 2) the policy issues and economic implications of generating local revenues to finance project activities were not well understood by those who had to make the decisions.

In the end, the lack of progress can be attributed to: 1) a lack of interest on the part of the GOZ, 2) the strong and relatively inflexible positions held by AID on the one hand and DAI and PNS on the other in their attempts to find appropriate institutions and sources of funds, and 3) the extreme difficulty of sustaining any development activity in a country that is chronically short of funds and qualified personnel.

#### 4. The Final Phase Down of Project Activities

Given the tensions over the sustainability issue, when the time came to start thinking about the post-September 1985 period, there was not much agreement among the different parties on what the next steps should be. AID felt strongly that the level of activity should have started to phase down at least as early as 1983 but felt that this process should have been managed from North Shaba rather than from the AID Mission in Kinshasa. DAI and PNS, on the other hand, felt equally strongly that the level of activity was at an appropriate level and maintained that any reduction would result in a lessening of project outputs, all of which were considered essential. By early 1986, DAI had accepted the need to start the phase-down and PNS and ESTAGRICO began reducing the agricultural extension and road rehabilitation programs. The objective was to get the level of activities to a level that would be appropriate for continuation within the Central Shaba project -- in other words, to a level that had a chance of being sustainable in the Zairian context.

#### 5. Preparations for the continuation of activities in North Shaba

Prior to the end of PNS, AID had decided to continue certain essential activities under the Central Shaba project. Roads were to be maintained indefinitely by OR with their own budget in exchange for the equipment that was then being used to rehabilitate roads in the PNS area. This was a major accomplishment since the OR budget which is financed by a fuel tax is supposed to be limited to national and regional roads. In addition, the Central Shaba project was to have provided technical assistance and funds to continue the extension and seed programs for two to three years, but at a reduced level. The seed program was eventually to have been taken over by a private seed company which would be supplying the needs of both North Shaba and Central Shaba.

AID took the lead on this. The DOA supported the approach but made no firm commitment to provide budgetary support. The main sticking point was the future of PNS as an organization. The AID position was that AID-supported activities in North Shaba would have to be administered as an integral part of the Central Shaba project. PNS insisted on continued authority for all agricultural activities in the North Shaba area, and eventually succeeded in obtaining DOA support for this position. At this point, relations between AID and PNS became strained and the possibilities of compromise became increasingly remote. Recently, the decision was made by the DOA that the GOZ would fund all agricultural development activities in North Shaba through PNS. This meant that the area will not be receiving any funding from the Central Shaba project. As noted in the section on benefit sustainability, it is unlikely that the seed production and extension activities can continue at their present level of effectiveness without technical assistance and access to counterpart funds.

#### IV. PROJECT COSTS

Table 1 on page 2 of the main report gives total project costs by year and source of funds. The major expenditure items were: \$10.5 million for technical assistance, \$5.4 million for equipment and commodities, and about \$14.5 million in zaire funding of local costs, including salaries, fuel, and other supplies. A complete assessment of whether the project could have achieved the same objectives at less cost would require a breakdown of costs by project component. Since PNS financial records were not kept by component, it is not possible to reconstruct these budgets. However, several comments can be made on ways in which costs could have been reduced. Of course, such comments are always easier after the fact, but they may be helpful for future projects.

1. There were definite delays in implementation in the early years. Some were unavoidable given the difficult working conditions. Others, such as the five year delay in providing a qualified advisor for the agricultural extension component, could have been avoided. Thus the same objectives could have been achieved in less time. This would have reduced costs.
2. If the project had been designed as a small farmer production project from the outset, this would have significantly reduced the technical assistance requirements. The breakdown of the \$10 million in technical assistance is as follows:

DAI Chief of Party	9 years
Logistics Advisor	9 "
Financial Advisor	6 "
Pilot	5 "
Agronomist	8 "
Seed Production	2 "
Intermediate Technology	2 "
Farmer Groups	5 "
Women in Development	2 "
Information Systems	4 "
MM Chief of Party	9 "
Roads Advisor	5 "
Bridge Advisor	9 "
Mechanic	9 "

These positions add up to 84 person years. If the Farmer Group, Women in Development, and Intermediate Technology positions had not been included in the original design, this would have cut 9 person years. Other possible cuts would be: departure of the financial advisor after three years, elimination of the pilot position, and combination of the MM Chief of Party and the Road Advisor positions. These reductions in management and administrative support positions would have cut the technical assistance by another 13 person-years. Some would argue that there should have been an Information Systems Advisor for the duration of the project, which would have added four years. The end result of these changes would have been to reduce the technical assistance component by about 25 percent for a savings of \$2.5 million.

3. After technical assistance, the largest cost item was the road component. This component is considered the most successful and has been the least criticized. There is some question, however, regarding the need for the entire road network. The evaluation team verified that there is almost no traffic on most of these roads outside of the corn marketing season. Project experience has also demonstrated that, if there are no impassable spots, trucks will follow trails to villages and production areas. Therefore, a program to build bridges, install culverts, and repair heavily eroded areas would have significantly increased the quantity of corn marketed in North Shaba. This change in project design would have cut both the size and duration of the road component.

The issue is partly technical and partly economic. The technical question is how much more it cost to build the roads to the PNS level rather than to simply have made the paths passable for trucks. The team was not able to answer this question. On the economic side, the issue is whether any benefits were obtained from the improved roads that would not have been obtained if only bridges had been built. There is no doubt that the traders consider the roads to be the major benefit of the project. Their trucks sustain much less wear and tear and can cover much greater distances in one day. (The PNS roads permit speeds of 40 to 60 km per hour, compared to 15 km or less on unimproved paths.) It would appear that in Nyunzu, with long distances between population centers and production areas and limited commercial potential because of low population density, there would be little economic justification for much more than bridges and minor improvements in existing paths. This is more or less what PNS did.

In Kongolo, the issue is less clear. Corn marketed has grown steadily even after the quantity marketed levelled off in Nyunzu. The number of corn traders in Kongolo has risen dramatically and they seem to be there to stay. Also, there are other crops, especially palm oil, that are transported throughout the year. Finally, villages are close together and close to market centers. The short distances mean that the costs of improving roads are lower per beneficiary, and the higher population density means that the potential for increased commercial activity is greater. It should be noted, however, that except for the road from Kongolo to Sola, this increased activity has not yet occurred.

The conclusion is that roads could definitely have been constructed at lower cost, but the longer term benefits of improved roads in the Kongolo zone may have been worth the extra investment.

4. Another important source of savings would have been the elimination of the Ngaba Center. Here again we were not able to obtain figures on the costs of that facility.
5. The evaluation team was not able to determine by how much the local staff could have been cut, but any savings would probably not have amounted to very much in dollar terms.