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South Coast Agricultural Development

Project Paper

Guinea-Bissau

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SOUTH COAST AGRICULTURAL DEVELOPMENT PROJECT

GUINEA-BISSAU

Public Health and Nutrition Analysis and Recommendations for Project Paper Design

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March, 1983

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South Coast Agricultural Development (SCAD) Project, Guinea-Bissau

Summary of Public Health and Nutrition Analysis and Recommendations

The planned SCAD project can be expected to have positive net public health and nutritional effects, although the formation of small fresh water lakes will be a new feature in the area, associated with certain health hazards. The Health and Nutrition Technical Annex is synopsized here, but reference must be made to the Annex and the preventive medical report for the previous Guinea-Bissau Rice Production Project, 657-0009, for the complete analysis and recommendations by disease. The appendices specify health and nutrition-related tasks for the technical assistance experts.

The positive health effects of the project will result from increased rice production, with consequential increases in local consumption and incomes. The improved incomes should facilitate purchase of a more balanced diet and various commodities and services of importance to health, such as chloroquine, mosquito nets, shoes, health service costs and transportation.

The potential hazards to the public health due to this project are expected mainly to include increases in malaria transmission in the dry season; possible introduction of urinary schistosomiasis transmission; and a variety of additional risks, such as increases in diarrheas and other fecal-oral diseases (e.g., polio, hepatitis A, and typhoid) if the new lakes were not to be protected from fecal contamination and then were to become sources of

drinking water in the future. A theoretical possibility of extension of onchocerciasis to this area exists. Mosquito-borne diseases other than malaria must also be considered, including yellow fever and bancroftian filariasis. Increased grain storage may permit growth of rodent populations, which can be associated with such problems as Lassa fever, leptospirosis, plague and relapsing fever. But the most important health problem in the project area is probably protein calorie malnutrition, and the project's potential to reduce this non-infectious disease (which also reduces the individual's defenses against contagious illnesses) implies that the various infectious threats above should not impede implementation of the SCAD project, although specific responses to control or monitor each problem are strongly advised.

Malnutrition must be reduced as rapidly as possible, by irrigation in the dry season with the new lake water of some of the bolanha land for legumes and vegetables, in addition to the wet season rice crop.

Malaria will likely continue to be a wet season problem, so access to chloroquine is essential, and increased control efforts aimed at the vector would be highly desirable. In the dry season these anti-mosquito measures should have even more effectiveness, thus helping also to reduce threats of arboviruses and wuchereriasis . (The latter also requires that latrine pits be kept dry.) No immediate action seems indicated for the potential threats of schistosomiasis and onchocerciasis, but continued health service monitoring for their appearance will be essential. Latrines are

of great importance for several diseases, and their promotion especially around the margins of the new fresh water retention ponds will be important. Finally, some attention by project technical assistance experts should be paid to methods of grain storage at the tabanca and more central levels to reduce losses as well as health hazards of rodent-related contagious diseases.

Other health and nutrition-related tasks for the T.A. experts will include statistical support by the sociologist and cooperation with health services to improve knowledge of health and nutrition conditions. The civil engineer and the soil and water expert will examine latrine structures and locations, and collaborate with appropriate health and other workers to improve designs and assure minimization of contamination of the new fresh water lakes. They will also maintain communication with health services to monitor and respond as necessary for appearance of local schistosomiasis transmission, and generally assist in providing sanitary engineering input into SCAD project plans and activities. The research agronomist will also play a role in latrine promotion, and with the social scientist will study local diets to identify priority crops for dry season irrigated cultivation.

Health and Nutrition Technical Annex

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I. Introduction

The South Coast Agricultural Development (SCAD) project is a planned series of AID-assisted activities by agencies of the Government of Guinea-Bissau in the regions of Tombali and Quinara. Although the primary intent is to strengthen the institutional capacity of the agencies involved -- DHAS (Dept. of Agricultural Hydraulics and Soils) and DEPA (Dept. of Agricultural Experimentation and Research) -- from a broad public health viewpoint essential features of the project include the following:

- Construction of very small dams or large dikes to exclude sea water from land areas to be utilized primarily for rice cultivation.
- Development of several permanent, small, fresh water lakes on the inland side of the small dams, in the beds of the formerly saline estuaries.
- Anticipated increased rice production.

The net health and nutrition effect of the project is expected to be positive, due to increased levels of real income among the participating rural population, including both increased food supplies and greater purchasing power. However, certain economic assumptions underlie this estimation of net positive health and nutrition impact. In addition, a number of specific disease threats must be considered in the design and implementation of the project. The purpose

of this technical annex is to review these diseases and outline appropriate responses to the more important health hazards.

One economic assumption is that increased food production in the South Coast area will improve nutritional status through increased consumption in the area, as well as assisting other parts of the country by transport of surpluses to those areas. If pricing policies fail to elicit an increase in production then no net increase in real incomes might result, although reduced risk of sea water damage to bolanhas at very high tides might still justify the improved, enlarged dikes and small dams. If availability of diversified food products in the marketplace and/or diversification of local food production beyond rice alone fails to occur, then the presently rice-dominated diets may fail to improve except for those currently consuming inadequate quantities even of rice.

If health-related consumer goods are not available for purchase then potential secondary health benefits of increased money incomes might not occur, such as enhanced access to key drugs, health services, mosquito nets, shoes and transportation.

This consultant recently prepared an extensive preventive medical analysis for the USAID-GOGB Guinea-Bissau Rice

Development Project, 657-0009. "Primum Non Nocere" (Wise, 1982) deals with the AID-DEPA project at Contuboel which is using a different water control strategy in an ecologically different part of the country from this South Coast Project. However, the basic background material and analysis by disease category in that report are largely applicable as well in this new project. The present Technical Annex will not duplicate core data already available in "Primum Non Nocere" such as discussion of hazards associated with pesticides, but rather will proceed through the same sequence of disease groups to specify strategically different implications in the South Coast setting. The earlier paper's availability to the readers of this Annex is assumed.

The epidemiologic data base is nearly as weak in the South Coast area as in the Contuboel zone of the earlier project. But as a result of strong Programa de Saude de Base (PSB, or Basic Health Program) presence in Tombali (Amat, et al., 1982), and some active health centers, it has been possible to glean some further information, which will be summarized under the relevant sections below. Future priorities for Guinea-Bissau, which are beyond the scope of the South Coast Agriculture Development Project, will be strengthened epidemiologic analysis and expansion of rural health services, both PSB and health centers, to cover all of the population. The present Technical Annex cannot be taken as a comprehensive health planning document, since the focus is

limited to the likely effects of the specific SCAD project, and certain options for responding to important problems and health hazards.

II. South Coast Health Conditions

A. Malnutrition

The reasons for believing that protein-energy malnutrition in Guinea-Bissau is a serious and pervasive problem are discussed in Wise, 1982, Attachment 1 to this Annex. Although much more detailed documentation on a periodic basis will eventually be required to satisfactorily monitor the nutritional status of children in the country, in the region of Tombali preliminary efforts to weigh young children at health center visits and in tabancas (villages) have begun. The weight is graphed on a "road to health" card, along with other key medical information, and after interpretation of the child's current status the record is kept by the mother. This approach is sound and only requires continued efforts to make it available to the entire population. In the future, addition of height measurements may also be desirable.

But to understand the population dynamics of malnutrition it is not sufficient to tabulate data on children brought to health services, because they are likely to be seriously non-representative subsets of their age groups. The sickest, weakest children may be taken to traditional

healers (djambacos) or left at home, for example. Or the parents motivated to utilize the modern health facilities may tend to be better educated or wealthier than average. These cautions for interpretation of future statistics from Maternal and Child Health services are also necessary for data from the PSB, even though in principle the entire population in a tabanca is monitored in the records of the agentes de saude de base (ASB, village health workers of the PSB). Careful evaluation of such statistical parameters as completeness of sampling, and definition and interpretation of effects of possible confounding variables or biases (are PSB-participating villages typical of all villages?) will be required. In addition, efforts to tease more information from the growing data base through cross-tabulations against relevant variables like ethnic group, distances (road and water) from nearest health services, presence of adequate water supply (quantity and protection) and proportion of households with latrines, will be important epidemiologic tasks for the social scientist in this SCAD project as well as future preventive medical consultants more generally. It should be emphasized that such critical evaluation and exploitation of health statistics will be required not only for direct nutritional measures but also for the key indices of age specific mortality rates and death rates by certain

disease categories, such as neonatal tetanus, diarrhea, and measles.

The SAREC report (Aaby, et al., 1980) included a sample from Tombali. As will be seen in their reproduced Fig. 4.3, page 16 of Attachment 1, before 6 months of age about 38% of their sample was malnourished, and then through 5 years of age between 90% and 95% of children are inadequately nourished, based on weight for age measures. There is a tendency for the moderately affected proportion of each age group to increase steadily from about 10% in the first year of life up to over 50% in the oldest group, but the fraction of severely malnourished children is low, only around 5% from 6 to 18 months of age. This data set is of obvious importance, but shows the situation only at one point in time. It would be of much value in the future to periodically repeat a cross-section survey of the population, sampling in a careful manner to permit generalization of results, and timing the surveys for the month prior to beginning the harvest in the wet season. Such a survey might primarily utilize arm circumference assessments, but also weight and height measurement in a subsample for estimation of the arm circumference specificity and sensitivity levels. This is a task which the existing health services might undertake, and the SCAD project's social scientist could contribute in statistical design and

analytic phases. He/She might also prepare questionnaires on socioeconomic variables for administration perhaps only to the validating sub-set's parents.

Impressions of practicing physicians are that severe malnutrition has only been occasionally encountered in the past year in Cacine, and that fewer than 10 cases of kwashiorkor and about 15 cases of marasmus are seen annually in the Catio sector hospital. One infant with frank marasmus was observed by this consultant at the latter location.

Pilot arm circumference surveys in a couple of tabancas were carried out, identifying one severely malnourished 3 year-old boy, the brother of a moderately malnourished 9 month-old girl. Five other children were moderately underfed in the total of 28 sampled, representing all children between 6 months and 3 years of age in these two tabancas. Thus, overall 25% of these children were not well-fed in this mid-dry season pilot study. A few mothers were asked to list all foods prepared for their families during the entire previous day. All reported rice, salt, water, and usually also fish, chabeu (palm nuts), piri-piri (hot pepper) and tomatoes. Onion, oil, lemons and peanuts were also listed by one or two mothers. The older women no longer prepare food, that being a duty of younger mothers only. Two mothers of malnourished children appeared to be young teenagers.

The mother mentioned above with two malnourished children reported that she has no oil, and does not give her children fish. Fish nets were in abundant evidence in this tabanca, and yet this mother had no clear explanation for the absence of fish in her children's diet.

A few older women were asked how many children they had borne, and how many were still alive. One had borne 11, and 10 of them were already dead. Most died between 1 week and 2 years of age. Those questioned reported as follows:

Age of Woman	Live Children	Dead Children
50 (cited above	1	10
37	3	5
45	4	6
36	3	5
Totals	11	26

So about 70% of these women's children were dead at this time. This figure has no comparability value with normal age specific mortality rates, but does give a rough idea of very high childhood mortality in recent memory of this population.

Fish consumption may be favored by increased catches already being reported in the fresh water lakes, but distorted market forces may tend to cause much of it to

be exported, albeit clandestinely, as reportedly occurs now in Cacine.

Iron is presently deficient in local diets, at least in relation to needs, since so many have hookworm infections. As discussed below under Fecal-Soil Diseases, anemia is therefore very prevalent. Rice has about 2 mg. iron per 100 g (Latham, 1979, although figures from Tindall (1965) indicate half this amount).

Some other cereals have much more:

millet, bulrush, whole grains. . . . . .21 mg/100 g
millet, finger, whole grains . . . . . .17 mg/100 g
sorghum, whole grains. . . . . .10 mg/100 g
teff, whole grains . . . . . .55 mg/100 g

And legumes compared to rice can have as much as 2 to 8 times the iron content by weight (although the larger quantities of cereals likely to be consumed may make them more important sources). Lentils have 7 mg iron per 100 g., chickpeas have 11, and peas have 18. Dark green leaves and fish are also important sources. In choosing legumes, vegetables and cereals for cultivation, weight should be given to iron content. (Latham, 1979, is the source of the preceding iron content data.)

Iodine deficiency is unlikely here due to proximity to the sea.

Vitamin A deficiency may not occur, because red palm oil is an excellent source, along with important amounts in piri-piri, and orange-colored fruits like mango and papaya. Storage of Vitamin A in the human body is good, so intermittent supply is satisfactory. But a question for further study will be verification that these sources are accessible in all tabancas to all persons.

Thiamine (Vitamin B-1) is lost in highly polished rice, so overly efficient mills will be serious hazards in the future. Cooking with excess water that is then discarded, or excessive initial washing of the rice, also causes loss of this water soluble chemical. Therefore it is essential, since rice eaters in West Africa are known to be at special risk for beriberi (Latham, 1979), that SCAD project T.A. experts observe milling and cooking and recommend changes as may be warranted. Eventually it would be very desirable to have all rice parboiled before any heavy milling, to avoid loss of thiamine and other water soluble vitamins.

Pellagra is said to be common in Africa, perhaps accounting for some cases of non-infectious diarrhea. Sufficient dietary niacin can be assured by refraining from more than light milling of rice, and in the long run by increasing intakes of meat and legumes. The same water solubility comments above for thiamine apply

also to niacin. Central parboiling of rice will eventually be desirable.

Vitamin C should be abundantly provided by various fruits, but again the social scientist should confirm that even the least well-off members of the community are also eating some. SCAD project encouragement of fruit trees will increase supplies.

Vitamin D deficiency is unlikely in this population with abundant exposure to sunlight. But until milk consumption increases in the future, calcium supplies can be assured if small fish are consumed whole, with bones. Calcium is especially important for pregnant and lactating women.

Over the long run, malnutrition will be reduced through improved real income levels, including food and revenues. This SCAD project will assist by raising rice production. An important option will be to utilize a portion of the bolanhas during the dry season to grow legumes and vegetables, as well. These latter would require only transport of relatively small amounts of water from the fresh water lakes behind the small dams, representing a lift of probably not more than one to two meters, entirely feasible using human power through buckets or simple pump arrangements. Although only a small portion of the bolanha would be used for such diversified cropping in a

given dry season, the benefits of dietary enrichment and further financial revenues from marketed surpluses could be very significant. Soil nitrogen will also be increased by the legumes. Another option for nutritional improvement will be encouragement of fruit tree planting in appropriate locations (see Sleeping Sickness discussion, below). The social scientist can assist in defining educational priorities if the population should appear unaware of nutritional and economic benefits from legume, vegetable and fruit production, consumption, and marketing. Agencies which might be recruited in these activities to promote crop diversification in the dry season would include DEPA, PSB, PIC (Programa Integrado de Caboxanque) and the CEPI (Centro de Ensino Popular Integrado). Pilot demonstration fields and irrigation devices could be a crucial early phase. A mimeographed newsletter in Crioulo and/or Portuguese might be developed as another medium to diffuse agricultural, nutritional and health information to peasants in the project area. (In addition to the value of the information conveyed, an indirect benefit of such a newsletter would be reinforcement of alphabetization programs.) Annex B of Attachment 1 outlines basic health and nutrition information that can be used for other media in addition to the initially intended agricultural extension workers.

The SCAD project does not presently include specific nutrition scientist technical assistance, but the social scientist can be encouraged to contribute through statistical design, analysis and interpretive work as discussed above. As specific food processing problems emerge, the social scientist and agronomist can devise appropriate educational interventions, such as encouragement not to excessively polish rice and overcook vegetables.

Improved grain and peanuts storage may be important for reduced losses, to reduce rodent populations (associated with 4 human diseases), and to reduce aflatoxin levels in peanuts (Patten, 1981 and Hall, 1970). Again, the likely project interventions would be limited, but might include educational and pilot demonstration model efforts, such as improvements in drying and storage. Use of plastic sheets as a barrier against ground moisture would be a possible example, with the aim of minimizing insects and fungi through more complete drying. Addition of rodent barriers to the poles of existing elevated storage sheds in the tabancas could be another feasible improvement. A useful reference (Hall, 1970) has been placed in the AID-Bissau Reference Library for SCAD project use, and a budget for test and pilot trial materials will be provided. The research agronomist and civil engineer should collaborate to familiarize themselves with this and other literature (Prevett, 1959)

and then with the range of storage methods in use by the various ethnic groups in the South Coast area.

Finally, the specific roles of women in the local economies (Eide, et al., 1977) should be studied by the agricultural social scientist, with a particular view to avoiding the hazard of displacing or discouraging breast feeding. Breast feeding should be encouraged for prolonged periods, even to three years or more. Economic activities of women should not be permitted to cause an inadvertent reduction of breast feeding, for example by separating mothers from babies for too many hours in the day. Education to begin supplemental feeding from 4 months of age with fruit, vegetables and fish will be of great value, but should be cautiously monitored lest the erroneous message that such foods might be a substitute rather than a supplement to breast milk be perceived.

B. Malaria

The general description and high prevalence of malaria in Guinea-Bissau are presented in the previous report, but there is a complete lack of reliable epidemiologic information. Medical personnel in the South Coast consistently report that "malaria" and chloroquine (or quinine) treatment are the routine diagnosis and therapy for all febrile patients. Further, these health workers, including well-educated physicians, report tnat there is

no clear seasonal cycle in numbers of patients with "malaria." This failure to notice more fever cases in the wet season requires cautious interpretation. The malaria here is probably holoendemic, but more transmission is likely occuring in the rainy season of June through October. But transportation by road is greatly impaired in the South Coast in that period, and free time away from work in the rice fields is probably more scarce. So the number of cases seen in health services ("passive detection") might be roughly constant as a result of complementary cyclic effects -- more wet season malaria but a smaller proportion noticed at the health center then. It is also possible that the relatively constant flow of fever cases year round might include more due to malaria in the wet season, and more due to other diseases in the dry season, such as dengue or other arboviruses, and relapsing fever.

A few bits of evidence tend to support the idea that an important fraction of fevers seen are not due to malaria. First, a recent survey of spleen rates in villages with and without chloroquine prophylaxis for children is said to have shown a much lower prevalence of splenomegaly than anticipated for both groups. It is an initial study only, and technical difficulties prevented correlation of findings with blood examination results. Future population-based studies will be a high priority

to confirm and extend this tentative information. The second line of evidence is from the thick smears done in the Sector Hospital laboratory at Cacine. These are not performed for all malaria diagnoses, but only in doubtful cases. The usual finding is only a few plasmodia, e.g., 1 to 3 per high power field, consistent with underlying malaria but possibly not causing the immediate symptoms. Plasmodium falciparum is the most likely species in this area, and typically gives the highest rates of red blood cell infection (Brown and Neva, 1983).

The third piece of evidence is one series of 100 consecutive children with fever on which a thick smear was performed at the larger sector hospital in Catio. About 70% were said to be positive for malaria parasites. At this hospital, fever was the most common outpatient adult diagnosis (22% of patients), and the most common inpatient diagnosis for children and adults, 175 in 1982. In 1981 the laboratory there performed 147 thick smears for malaria, again only on doubtful cases (so most outpatients and inpatients are treated presumptively), and 52% of those smears were positive.

The mosquito vectors of malaria in the South Coast area will include not only Anopheles gambiae (wet season) and A. funestus (dry season), but also A. melas in

brackish water. As the project activities convert some water from higher to lower salinity, conditions will probably improve for A. gambiae, the most efficient malaria vector. Year-round breeding on the margins of the new lakes is very possible as acidity and salinity disappear over time, unless care is taken to keep the shores free of vegetation. And as discussed also in "Primum Non Nocere" (Attachment 1), rice fields themselves are attractive to mosquitoes for breeding, in this project unlikely beyond the rainy season. Dry season irrigation of the bolanhas for legumes and vegetables is not likely to promote mosquito populations, as long as continuous ponding of water is avoided. In the wet season it will be important to keep weeds under control, as discussed in the earlier report, for the sake of malaria as well as other mosquito- and snail-borne diseases (arboviruses, wuchereriasis, and schistosomiasis). The engineering staff of the SCAD project can also undertake drainage and filling activity (and education) for the numerous pits and puddles of all sources within 1.5 or 2 km. of tabancas, including the excavation sites from which dam and dike material are obtained. Where judged cheaper or easier, such water collections can be treated with a larvicide like Abate periodically or less often with a sustained release formulation.

Although SCAD project activities can attempt to minimize the hazard of augmented malaria transmission, as discussed above, some marginal increase may be inevitable, especially associated with the new lakes. These will be small, so that periodic manipulation of water levels to reduce marginal vegetation and larvae can be contemplated, but in the long run may not be likely to be reliably institutionalized. Thus malaria has been a major problem prior to the SCAD project, and there is a certain risk of enhanced transmission, which control strategies may attempt to minimize, but good access to drug therapy for the population will continue to be essential.

Chloroquine is still the best single drug for treatment and for prophylaxis in this area. The villages participating in the PSB have access on a reportedly reliable basis. The hospital and health centers visited also reported that sufficient chloroquine is always available, but the situation for the more isolated villages not yet involved in the PSB remains seriously problematic. Continued study of ways to improve transportation to health services for this subset of the population will be warranted. And every encouragement possible must be urgently offered to the PSB in support of its planned extension into Quinara. Further alternatives for chloroquine distribution to areas currently without satisfactory supply must be sought. The social

scientist should specifically monitor this variable (availability of chloroquine) for tabancas within about two kilometers of new lakes, and necessary measures to assure drug access must be suggested to health officials.

C. Diarrheas

Background discussion of this group of usually fecal-oral diseases is available in Attachment 1. The impressions of medical workers are that in the South Coast area diarrheas are not as overwhelmingly common as might be expected. In Cacine some cases are seen, and dehydration is common in those coming from more than 5 kilometers away. (There is a rapid reduction in likelihood of using health services as distance increases, so patients from greater distance may be self-selected to tend to be more sick and have more urgent problems.) Statistics at the Catio hospital indicate a clear increase in cases of diarrhea late in the dry season, presumably reflecting the population's use of less-safe water sources as some wells dry up. The Buba project is installing good quality wells, but even these are sometimes dry or brackish later in the dry season. It is conceivable that the new lakes behind the SCAD project's small dams might have a beneficial effect on the water table nearby. It is also possible that populations might begin to use lake

water for drinking, so protection from fecal contamination will be extremely important, with a sanitary zone around the lakes given extra priority for latrine construction and use.

Oral rehydration therapy is an appropriate part of the PSB education, and is taught by health centers with varying degrees of effectiveness. But there appears to be a need for more intensive public education in this as well as other preventive medical subjects. Radio might be utilized in addition to the newsletter suggested above under malnutrition. Agricultural extension workers will not be employed in the SCAD project as agents for health education. But the basic priority information presented as Annex B of Attachment 1 can be used through other media.

Specific promotion of latrines for reduction of diarrhea and other fecal-related illnesses is said to have been more successful among Islamic groups in the South Coast area. It is reasonable initially to target informational efforts where the pay-off will be greatest, but at the same time the belief structures and attitudes of non-Islamic ethnic groups must be actively studied to find ways to deal safely with human excreta in those tabancas as well. The PP team agronomic consultant has suggested that fertilizer value of composted human

excreta would be small in comparison with that of the numerous cows, pigs, sheep and goats if these animals were to be corralled overnight and their manure then daily shoveled into compost pits. Although the human contribution might not be large, its importance would exceed direct fertilizer value if regular use of latrines could be thus encouraged. In addition, fly populations would be reduced, thus reducing that mode of fecal-oral contamination as well.

It is reported that agricultural workers in the South Coast do bring their own water for drinking to the field, but this habit might be in danger of modification if the rice field water becomes less saline over time, as a result of more effective exclusion of sea water. Thus education to keep the field water clean and to avoid drinking it should also be provided.

The suggestion in Attachment 1 that the agricultural engineer for the Contuboel project might devote efforts to latrine design and demonstration could apply to the civil engineer for this SCAD project. A new reference (AID, 1982) provides detailed technical notes on request.

Latrines observed in the project area tended not to have roofs but were surrounded by fences for privacy. They

appeared clean and free of odors. However, the holes were not covered. Mounding up of earth was observed, which would prevent surface water from entering the pit, but direct rain can enter, and fly and mosquito breeding would then be hazards for diarrheal diseases and wuchereriasis.

D. Schistosomiasis

Both *Schistosoma mansoni* and *S. hematobium* are currently absent from the South Coast area, except for sporadic cases of the latter, urinary form in persons who apparently acquired their infections in other parts of the country. The obvious significance of these periodic "imported" cases is that only the vector's absence up to now would account for absence of indigenous urinary schistosomiasis in this area. If circumstances changed to permit the snail vector, *Bulinus globosus*, to multiply, then transmission of the disease among humans would be a real possibility. It seems likely that the saltiness of the rivers in the South would be the explanation for absence of these snails up to the present. However, there is a hint, as discussed in Attachment 1, that fresh water upwellings even in salty estuaries can support populations of this snail and permit disease transmission. More recent and complete information is expected soon from researchers at the Institute of Tropical Medicine and Hygiene in Lisbon, on the current Schistosomiasis problem in Guinea-Bissau.

Unfortunately one danger of creating fresh water lakes and obstructing back flow of sea water up rivers (even where there might be annual drying, so that no permanent small lake is formed) is that ecologic conditions might then favor B. globosus snail populations. Schistosomiasis is a rarely fatal parasitic infection whose main importance is the prolonged and prevalent morbidity it causes. Although hematuria is not always seen early, it is likely that vigilance for grossly bloody urine by the health service personnel in the SCAD area, along with microscopic examination of urine sediment in these patients, would provide reasonably early warning that the disease has entered the area. In addition, lab workers should be alerted to the importance of S. hematobium ova in urines being examined for other symptoms. Not every health center has a functioning laboratory, and not all persons have access to health services, but for monitoring purposes existing facilities should detect disease in the population sample that is served. (In addition to alertness to urinary S. hematobium ova, these lab workers should suffice for detection of S. mansoni in stool smears, not currently reported in this country, but present in neighboring ones.) Special emphasis in equipping and supervising the clinical laboratories in the vicinity of SCAD project dam sites

would be an appropriate response of the Ministry of Health and Social Affairs to this health hazard.

If the disease appears, individual patients are best treated with metrifonate or praziquantel. Cautions in Attachment 1 should be reviewed. A search for the snails involved might then reveal accessible sites for molluscicide application, or other measures to reduce or eliminate them, such as periodic drainage of the small lakes.

For the sake of prevention of schistosomiasis as well as other urine-transmitted and fecal-transmitted diseases (See Annex C of Attachment 1), every effort to improve sanitation, especially in the vicinity of the new lakes, should receive high priority. Details are available in the earlier report, but essentially the point for S. hematobium is to prevent urine from reaching fresh water, whether river, lake, or rice field.

E. Onchocerciasis

Reference can be made to the earlier report for background on River Blindness. As with schistosomiasis, the disease is absent in the South Coast area, probably at least in part due to salinity of rivers. The question is whether conversion of some estuarine rivers to fresh water lakes might permit breeding of the blackfly, Simulium dammosum. Continuously turbulent water with

consequently high dissolved oxygen levels is required for Simulium larvae. At project dams, such high velocity flows might occur where overflow of fresh water leaves the lake to join the sea water. But continuous flow would not occur if the dam and sluice are so arranged to avoid a higher level in the fresh water lake than occurs at high tide on the other side. This seems to be the case at present, but the theoretical risk of onchocerciasis in the future should be kept in mind by project personnel, especially water and civil engineers.

It should be noted that travelers or immigrants to the South Coast area from the infected areas in the Northeast of Guinea-Bissau will supply microfilariae of Onchocerca volvulus to any future blackfly biting them for the duration of the adult worm's life in the human host, probably around 15 years. The blackfly vector itself is recorded on one wall map at the Ministry of Health and Social Affairs at about 13 km. Southeast of Xitole on the Corubal River, in Northeastern Tombali. This area likely is within flight range for the Simulium adults of at least some future project activities. Lecuona's (1959) map shows an area from this point due East for about 30 km (as the crow flies) along the Corubal to be infested with blackflies but free of human infections.

The skin changes of onchocerciasis are bothersome enough so that at least some patients would be expected to seek medical care. No specific monitoring or surveillance arrangements to detect disease in the project area would be required beyond sensitization of health services personnel to the importance of referring any possible cases to Sonaco for confirmatory biopsy and initial therapy. Coordination between the Ministry of Health and Social Affairs and the SCAD project is assumed, so that confirmed cases would initiate appropriate control responses.

F. Arboviruses

These mosquito-borne, viral diseases are described in the previous report. Yellow fever is the most serious. Although preventable with a vaccine, in fact immunization against this deadly epidemic disease is not yet included in the national health service programs. Others of the arboviral group may account for some of the non-malaria fever cases. A Serologic study is in progress, and results from Lisbon's Institute of Tropical Medicine and Hygiene may shed further light on this question when they are released.

The SCAD project's potential impact on these febrile diseases would depend upon the effect of project activity on the various transmitting mosquito species

populations. As in the Contuboel project, the SCAD work seems unlikely to cause more than a small marginal increase in mosquitoes in the wet season, and the same measures directed against malaria vectors will serve to minimize the additional hazard of the arboviruses as well in the dry season.

G. Wuchereriasis

Attachment 1 has a summary of bancroftian filariasis. The parasites are occasionally being noted in blood smears in the South Coast area, but prevalence appears low. However, in the relatively nearby Bijagos Islands, the problem is said to be much more widespread.

Proper siting and construction of latrines is essential to keep pit contents dry. Otherwise Culex pipiens mosquito species can breed and transmit this parasite.

Other vector mosquito species, especially Anopheles and Aedes, should generally be controlled by anti-mosquito measures outlined under malaria. In the rainy season there may be no SCAD project effect on Wuchereriasis transmission, but in the dry season the fresh water lakes may encourage mosquito breeding. If health services begin to detect more cases in areas near SCAD project lakes, then additional specific measures, such as periodic blood smears in affected tabancas and treatment of infected persons, can be considered. In

view of the irreversibility of lymphatic obstruction, early treatment with diethylcarbamazine is important. The SCAD project social scientist should offer any possible statistical assistance to the Ministry of Health and Social Affairs in its surveillance of this and other diseases potentially increased by the SCAD project.

H. Other Fecal-Oral Diseases (Beyond Diarrheas)

Polio, hepatitis A, and typhoid are not likely to be increased by SCAD project activity, but if latrines and other measures to reduce contamination of food and drink by fecal organisms are encouraged, these diseases will be reduced along with the diarrheas. Vaccine for polio and antibiotic therapy for typhoid (and transport improvement to permit access) are also needed, but beyond the scope of this agricultural project. A specific project effect of increasing these diseases (along with diarrheas) could occur if the new lakes are not protected from fecal contamination and become sources of human drinking water in the future.

I. Fecal-Soil Diseases

These four parasitic infections are reviewed in Attachment 1. All can be reduced by latrines, and two by shoes as well. The other two are also susceptible to

measures directed at keeping oral intake clean, free of soil contamination.

In 1981, the hospital laboratory of Catio examined 1,750 stools, and 54% were positive for ova or parasites.

In a three-year series of lab results from Cacine, about two-thirds of patients are said to have had hookworms demonstrated in stools. These were clinical cases, not a sample chosen to be representative of any specific underlying population group. Fewer than 1% of these stools showed Taenia or Ascaris. Anemia is extremely common in the Cacine area population, occasionally very severe and symptomatic. Certainly hookworm and malaria are contributing to this picture, but it is also likely that dietary iron is deficient. Ferrous sulphate orally gives a good response in these patients.

Medical personnel in Cacine offered the following relevant impressions of the social setting. The normal diet in the tabancas has almost no meat or fish, the latter often being exported to Guinea-Conakry where bicycle spare parts, pots and pans, cloth, shoes, and tobacco can be obtained. Almost no one has a latrine. Most defecation is in the bush near home. Small children are barefoot, but above about 8 years of age most have sandals of some sort.

Stools in the Catio hospital reportedly also show about 60% with hookworms, but in addition some 20% have strongyloidiasis.

The appendices outline ways for the social scientist, civil engineer and agronomist to contribute to latrine promotion.

J. Rodent-Related Diseases

There is little to add to the discussion of Lassa Fever, leptospirosis, plague and relapsing fever already available in "Primum Non Nocere," except that the collaboration of agronomist, civil engineer and social scientist in the SCAD project should facilitate an examination of existing grain storage methods and development and promotion of rodent-resisting improvements, such as metal barriers on piers of elevated storage buildings.

It is said that cats are familiar in the tabancas, but their encouragement for rodent control would probably not be advisable until a future date when reliable rabies vaccination for domestic animals might become available in Guinea-Bissau.

It is important again to suggest the possibility for future epidemiologic analysis that some of the fever cases currently diagnosed presumptively as malaria may in fact be such infections as leptospirosis and relapsing fever.

K. Sleeping Sickness

The review of African trypanosomiasis in Attachment 1 is applicable as well to the SCAD project. Rare cases are being recognized now, such as two confirmed by physicians in Cacine, but until health service coverage and diagnostic and reporting capacities mature further, it will be difficult to know the real incidence of this grave protozoal infection in Guinea-Bissau.

Even where minimal disease activity appears to be present continued surveillance is essential. Agricultural plantations in Ivory Coast have inadvertently provided habitats for tsetse flies with resultant human sleeping sickness (OAU, 1979). In the SCAD project, a specific hazard results from replacement of mangrove with fresh-water vegetation around the new lakes. It will be important for trypanosomiasis (as well as malaria, arboviruses, wuchereriasis and schistosomiasis) to keep the lake margins free of vegetation. It would be prudent to plant fruit trees at least 150 yards back from the water. The Ministry of Health and Social Affairs can be relied upon in future years to monitor for cases of human sleeping sickness, although support from WHO, AID, or other agencies may be required. Animal disease in the South Coast area would, of course, be an important sign that aggressive surveillance and prophylaxis among humans might be

needed, although infections of Trypanosoma gambiense can be asymptomatic in goats, cattle and pigs (Brown and Neva, 1983). Where people live near the river feeding the new lakes, some brush and tree clearing along that now-fresh water river may also be required.

L. Dracontiasis

Discussion of Guinea worm disease is provided in Attachment 1 and elsewhere (Muller, 1979). At present no disease activity is reported in the South Coast area, but the usual caution in interpretation is warranted. The Buba well-drilling project will contribute to progressive disuse of unsafe, open wells that might potentially transmit the parasite.

There is no anticipated direct effect of SCAD project activities on transmission probability. If the disease were to be noted, the civil and hydraulic engineers could assist villages in the area to enclose the open wells presumptively implicated, at least until or unless new Buba project wells could replace them.

III. Summary of Recommendations

This section will provide a review of the major recommendations for public health protection and improvement in the SCAD project. The preceding section disaggregated the preventive medical analysis by disease group, in rough sequence of priority. In contrast this summary of recommendations

will consider the successive modalities of intervention to control actual and potential hazards and problems. This material will not duplicate detail on specific diseases already available in the preceding section and in Attachment 1, but is intended to facilitate planning and later administration of these measures.

A. Economic Development

The agricultural development associated with the project is expected to lead to increased food supplies and revenues for purchase of other foods, as well as shoes, chloroquine, bed nets, transportation, and other health-related goods and services. Every disease group can be beneficially affected by better nutrition and more purchasing power, at least in the long run, but the most immediate target is malnutrition.

Sufficiency of gross energy supplies should result from increased availability of rice and oil. Good quality protein should be provided by mixing vegetable sources, especially adding legumes and more groundnut consumption, as well as through increased fish intake. Cultivation and consumption of fruits and vegetables should diversify the diet to assure vitamin and mineral adequacy, especially of iron. Implementation of these changes in nutritional practices will require contributions from the agronomist and the social scientist, as well as

the civil engineer in assisting to reduce losses (and contamination) due to rodents, fungi and insects.

An information program such as a newsletter covering health, nutrition and agricultural subjects can contribute to the development process through reinforcement of literacy as well as by diffusion of important subject matter, such as the need for supplemental feeding of fruit, vegetables and fish beginning at 4 months of age, oral hydration for diarrhea, and key sanitation concepts. The social scientist should encourage development of this and other improvements in flows of information to the camponeses. The agronomist should integrate health considerations, such as nutritional needs, in work with fruit and garden researchers in Caboxanque. Dry season irrigation of some bolanha land should be assiduously promoted, even to the extent of undertaking demonstration fields, for augmentation and diversification of food production.

B. Minimize Mosquitoes

Malaria must be controlled by making chloroquine universally available for acute attacks, and in young children and pregnant women on a prophylactic basis as well. SCAD project activities will not be involved in drug distribution. The project could contribute to minimizing malaria transmission by attention to drainage or filling

of unnecessary pits and other water collections, or applying a larvicide like Abate to them every week or ten days, or in a sustained-release form. The AID-Bissau Crop Protection Officer is an entomologist available for consultation in this regard.

Avoidance of excessive dry season irrigation, so that standing water is not produced, will be important but should not be difficult, since this water would be pumped or carried by hand.

Other mosquito-borne diseases will also be minimized by these measures intended mainly against malaria vectors, but specific attention to keeping latrine pits dry is required for prevention of Culex pipiens species which transmit wuchereriasis. Minimizing dry season mosquitoes must be recognized not to be sufficient response in itself to threats of malaria, yellow fever, and wuchereriasis. Although beyond the scope of the SCAD project, chloroquine, yellow fever vaccine, and surveillance and DEC treatement for wuchereriasis are also priorities for public health protection.

C. Epidemiologic Surveillance

Certain possible threats from SCAD project environmental changes will warrant specific vigilance for disease transmission. This monitoring activity would be carried

out by the Ministry of Health and Social Affairs, but at the very least communication with DHAS and DEPA must be maintained so that the health services centrally and peripherally know where fresh water lakes are and which tabancas are in their vicinity. The social scientist may be able to provide statistical consultation services in support of design and operation of surveillance programs.

Eventually it will be of importance to monitor the quantitative patterns of all diseases, but the concerns from the SCAD project perspective will be first to detect any local transmission of Schistosoma hematobium, second to follow the prevalence of malaria (confirmed cases, blood smear surveys, and possibly spleen rates), and third to gather more quantitative data on extent and distribution of protein-calorie malnutrition.

In addition, the possible appearance of onchocerciasis in the South Coast would require identification of black-fly breeding sites and engineering or chemical measures to terminate breeding.

The implications of improved information about most other diseases' current patterns and possible variations over time will relate to health service actions beyond the direct scope of the SCAD project.

D. Nutrition and Health Education

It is not presently planned to use agricultural extension agents as health data diffusers, but other methods of distributing the most important information to the populace on sanitation, oral hydration, nutrition and the like should be supported. A conscious effort should be made to include health considerations in discussions between technical assistants and counterparts. The newsletter proposed for health, nutrition and agricultural subjects should be of value, but will not likely require more than moral support from SCAD project personnel.

E. Latrine Promotion

This specific health education activity is discussed separately because of intrinsic importance and the contributions that the technical assistants may be able to make. The existing promotional efforts should be bolstered, especially with regard to ethnic groups not yet receptive to the concept. Diarrheas, polio, hepatitis A, typhoid, hookworm, and three other fecal-soil parasites can all be reduced or eliminated by widespread use of soundly constructed and sited latrines. The SCAD project must give particular priority to assuring a sanitary zone around the new lakes, since these may become future domestic water sources. In addition, if snail vectors of schistosomiasis become established as

the water is desalinated over the years, active disease transmission may still be avoided if little urine (or stool for S. mansoni) contaminates the lake water.

F. Minimize Rodents and Post-Harvest Losses

Attention of the civil engineer and agronomist to rodent-resistant food storage in the tabancas and at larger storage sites will contribute to reduction of risks of rodent-related diseases. Improved drying and storage methods to shrink insect and fungal growth will also help to cut down on losses, and in the case of peanuts reduce the likely amount of aflatoxin contamination.

IV. Conclusion

The health impact of the South Coast Agricultural Development Project is likely on balance to be markedly positive, due to improved nutrition and greater access to health-related consumer goods flowing from increased agricultural productivity. But specific possibilities for deterioration in public health do exist, and warrant ongoing surveillance and some control measures. These measures should often be instituted from the outset, such as drainage and filling of unnecessary pits in the dry season and vigorous latrine promotion, especially around the new lakes. In other cases, it is more reasonable to observe whether a disease in fact will appear, such as schistosomiasis, onchocerciasis and dracontiasis, before taking any specific counter-action in the project area.

In addition to preventing harm from such project effects as the new fresh water collections, it is extremely important to maximize positive contributions. The dry season irrigated crops of vegetables and legumes, aimed especially at better dietary balance, are an example.

This technical annex proposes, as summarized in the appendices, that various health and nutrition activities and responsibilities be allocated among the planned technical assistance experts.

V. Alternative Public Health and Nutrition Intervention in Guinea-Bissau, Beyond the Scope of the SCAD Project

Depending upon future resource availability and priorities for assistance, further approaches to health protection and improvement can be contemplated. These activities might flow from AID's programs, other donors, or research funds. For example, if priority were to be assigned to nutritional surveillance, education and research in the South Coast area, then a nutrition scientist fluent in Portuguese and Crioulo might be given tasks as outlined here for the social scientist and agronomist. Similarly, if uncertainty about adequacy of existing infectious disease monitoring capabilities in Guinea-Bissau were to be assigned greater importance, or additional funding were obtained, then a long-term epidemiologist might be assigned to collaborate with the project and the local and national health services in an expanded

version of the statistical consultations here proposed for the social scientist. Another alternative worth evaluation if constraints change might be to send one or more health workers for basic public health and epidemiology training in the U.S., in order to contribute to more effective long-run capacity for surveillance and disease control programs. Finally, in view of inevitable uncertainties as to what will actually happen in the project in such diseases as schistosomiasis, it might be worthwhile planning in advance for the contingency that assistance might be required later in surveillance or control programs.

VI. References

The asterisk indicates items available in the AID-Bissau Reference Library; where the asterisk is in parentheses, it has been suggested that the item be obtained for use of the SCAD project. A more extensive list of sources is arranged by subject in "Primum Non Nocere."

Aaby, Peter, et al., "Malnutrition and Child Mortality," Swedish Agency for Research and Cooperation with Developing Countries, ?Bissau, ?1980. (Available at Swedish Embassy, Bissau)

*Agency for International Development, Safe Water and Waste Disposal for Rural Health: A Program Guide, National Demonstration Water Project, Washington, D.C., 1982.

Amat, Tonia, et al., "Compte Rendu de la Mission d'Evaluation du Projet de Sante de Base," OMS, UNICEF, MSAS, Bissau, 1982. (Available at PSB Central Office, MSAS)

Brown, Harold W., and Franklin A. Neva, Basic Clinical Parasitology, Appleton-Century-Crofts, Norwalk, Connecticut, 1983.

*Eide, Wenche Barth, et al., Women in Food Production, Food Handling and Nutrition, with Special Emphasis on Africa, FAO, Rome, 1977.

*Hall, D.C., Handling and Storage of Food Grains in Tropical and Subtropical Areas, FAO, Rome, 1970.

*Latham, M.C., Human Nutrition in Tropical Africa, FAO, Rome, 1979.

Lecuona, Mauricio de Oliveira, "Primeiros dados sobre a distribuicao da oncocercose na Guine-Portuguesa," Anais Inst. Med. Trop. 16:199-208, 1959.

Muller, R., "Guinea Worm Disease: epidemiology, control and treatment," Bull, WHO, 57(5):683-689, 1979.

*Organization of African Unity, Tsetse and Trypanosomiasis Control: A Strategy for the Future in Africa," Interafrican Bureau for Animal Resources, Rockefeller Foundation, New York, 1979.

Patten, Robert C., "Aflatoxins and Disease," Am. J. Trop. Med. Hyg., 30(2):422-425, 1981.

(*)Prevett, P.F., "An investigation into the storage of rice in Sierra Leone," Colonial Office, Colonial Research Studies No. 28, London, 1959.

(*)Tindall, H.D., Fruits and Vegetables in West Africa, FAO, Rome, 1965.

*Wise, Robert P., "Primum Non Nocere, Report of Preventive Medical Specialist, Guinea-Bissau Rice Production Project," AID, Dec., 1982. (Health Analysis for Contuboel project, provided as Attachment 1 to this Technical Annex for the SCAD project.)

Appendices

Agricultural Social Scientist

Tasks for Public Health and Nutrition

1. Monitor key economic dimensions related to anticipated health and nutrition effects of SCAD project. Examples are:
   a. Whether food production increases locally.
   b. Whether transport out of region to other parts of Guinea-Bissau increases.
   c. Whether pricing policies for foodstuffs are adjusted to elicit increased production.
   d. Whether diversification of production and consumption occurs, regarding fruits, vegetables, legumes, and possibly other cereal grains than rice.
   e. Whether health related consumer goods become more available, such as chloroquine, mosquito nets, shoes, health and transportation services.
2. Monitor dietary patterns and nutritional status of participating populations, with emphasis on priority nutrients such as detailed in Health & Nutrition Technical Annex.
3. Assist in statistical analysis and interpretation of health service data sets, including vital statistics and special studies. Collaborate in study designs, especially for nutrition surveys. Obtain social variable data for correlation with health outcome and health practices information, e.g., chloroquine access, latrine presence and usage, and oral rehydration therapy knowledge and practice.

Civil Engineer and Soil and Water Expert Tasks for Public Health and Nutrition

1. Monitor latrine structures, depth of pits in relation to water table, and locations with respect to wells and lakes. Provide feedback as necessary to PSB, Health Center and other workers responsible for diffusion and promotion of sound latrine construction information to the populace.
2. Monitor adequacy of latrine use around fresh water lakes, and assist in implementing priority education and construction programs to minimize fecal and urinary contamination of lake waters.
3. Monitor for appearance of urinary or intestinal schistosomiasis in populations in the SCAD area through:
   - periodic communication with health services personnel regarding lab detection of cases on urine and stool exams.
   - collaboration with counterparts to be alert to reports of gross hematuria (bloody appearing urine) in tabancas related in location and/or activities to SCAD project bolanhas and lakes.
   - assistance to social scientist in defining highest risk populations for periodic active surveillance by questionnaire and/or urine exams (mid-day urine, spun down, for ova.)
   - prepare contingency plans as appropriate, possibly including periodic lake drainage and back flushing of

sea water in case S. hematobium transmission develops and is traced to one or more lakes. Assure that counterparts understand logic and practice of these measures, since they may not be needed (if ever) until after SCAD project has ended.

- compilation of reference materials such as Mc Junkin (1975) and the pending report from Lisbon, and supervision of translation into Portuguese for future reference of engineering staff at DHAS of key portions of such materials if alternative sources in Portuguese are not already available.

4. Consider theoretical risk of onchocerciasis if future dams are contemplated which would raise lake levels above sea water level at high tide, e.g., for small hydroelectric generation, or for gravity fed water for domestic or agricultural (dry season) use.

5. Collaborate with agronomist in dry season irrigation pilot demonstration projects, and in analysis of grain storage systems.

Research Agronomist Tasks for Public Health and Nutrition

1. In collaboration with agricultural social scientist, learn local diet patterns and preferences. Identify most strategic vegetable and legume crops for dietary improvement and probable agronomic success. Promote dry season irrigation for vegetables and legumes, participating in pilot demonstration projects if necessary.
2. Advise and assist in fruit tree planting, but maintain safe distance from fresh water lakes and rivers (150 yards.)
3. Monitor vegetation on margins of new lakes. Advise clearing as may be needed to minimize mosquito breeding and snail habitats.
4. Promote latrine use for health and compost value. Encourage corralling of cattle to compost manure and control flies.
5. In collaboration with engineers evaluate adequacy of grain storage procedures and structures. Recommend and demonstrate feasible improvements.
6. Observe insecticide storage, labelling, use, and used container disposal. Suggest and assist with any needed improvements in training of personnel handling insecticides, procurement and procedures, with attention both to human toxicity from improper storage and handling, and preventing undue ground and surface water contamination.

Materials for Health and Nutrition Related Tasks for Technical Assistance Experts

1.	Advanced programmable calculator (such as Hewlett-Packard HP-41CV) power supplies (230 V and 115 VAC) and extra battery packs printer, statistical modules, additional memory (random access), magnetic cards, card reader, extra paper, and software manuals.	$2,500
2.	Additional calculator components and supplies as social scientist may specify to procure during project implementation phase.	$1,000
3.	Arm circumference measuring strips, preferably fiberglass.	$ 50
4.	Equipment and supplies for grain storage evaluation, such as moisture meter, temperature probes, or other items as required by agronomist or engineers, for specification and procurement after their arrival.	$1,000
5.	Supplies and tools for simple dry season irrigation pilot demonstration projects, as required by agronomist or engineers for specification and procurement after their arrival.	$2,000

6. Photocopy machine with service manuals, spare parts, specialized and general tools for repairs, and paper (should be provided periodically rather than all at outset) related chemicals, and contingency for additional materials, parts, repair service and shipping as needed. Preferably same brand as AID to facilitate supply and maintenance. To be procured in Dakar, and minimum 3 day training in Dakar to be provided for one TAE and local office manager (or other French speaker) in operation, maintenance, and key repair procedures. Spare parts to include at least 2 complete belt sets, lamps, heaters; note power will be 220 VAC, 50 Hz. $9,000

7. Thermofax type copier with 20 reams special paper sets, repair manual, tools and contingency, to serve as backup for above photocopier. Paper sets to be kept below 80°F and shipped periodically as needed, but 4 reams initially. $2,500

SOUTH COAST AGRICULTURAL DEVELOPMENT PROJECT

GUINEA-BISSAU

Agronomy/Extension Analysis

Dr. Glenn G. Davis
March, 1983

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AGRONOMY/EXTENSION ANALYSIS

SUMMARY

In Guinea-Bissau, 79% of the rice acreage is on rain-fed wetlands. More than half (56%) of the total rice acreage is on salt-affected wetland (mangrove land). About one-third of the mangrove swamp rice area is in the Tombali and Quinara regions. In addition to production on mangrove land, rice is produced on non-salt affected land under flooding and on upland sites under dryland culture. A very minor portion of the nation's rice is produced on upland irrigated land. The rice yield averages per hectare for the various culture methods are: upland dry, 350; fresh water swampland, 440, mangrove swampland, 1110. The national average rice yield is 800 kg/ha.

Climate

All of the nation is within the Guinea Climate Zone: hot, humid tropics. There are two distinct seasons, wet and dry, of approximate equal length. Most crops, including rice, are planted near the beginning of the rainy season in June/July.

Soils

About 21% of the soil area of the nation is wet (hydromorphous) during the rainy season. Half of the wet soil is saline and sulfidic (halomorphous). The mangrove associated soils are halomorphous (halic sulfaquept). The mangrove soils are high in expanding lattice clay content. They are sticky when wet and crack to about 30 cm of depth when dry. The organic matter

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content and fertility levels of these soils are high. These are the most productive rice soils in the country.

Constraints to Rice Crop Productivity

The physio-biological environment of rice plants growing in mangrove land is hostile. Salinity, pH, water stress, weeds and other pests reduce rice productivity to a level below the genetic potential of the rice varieties. In spite of these constraints, the indigenous farmers have produced rice on mangrove swampland for more than 200 years.

The lack of infrastructure for providing technical support to rice farmers is a definite constraint to rice production in Guinea-Bissau. There is no national extension service in the country. Each donor project has provided its own extension component. An extension program for the South Coast rice area has been initiated by GOGB but provides very limited services to the rice producers. There is no effective rice research program in the nation. A rice research/extension center is in the initial stages at Caboxanque in Tombali region. Its main activity is seed multiplication.

Personnel are not available in the nation for staffing extension and research positions. No agricultural training school is in operation in the nation at the present. The extension service plans to provide in-service training to its present and future staff. A classroom building has been completed at Caboxanque, but there are not enough trained agriculturalists available to conduct the training.

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Agencies with Responsibility for Rice Production Support

Two agencies within the Ministry of Rural Development have the primary responsibilities for providing technical and credit support for rice production. These are DEPA (Department of Agricultural Research and Experimentation) and DHAS (Department of Agricultural Research and Soils). Both departments have focused on the South Coast area . Each has instituted a regional center in the South Coast. Due to technical, personnel and financial constraints, neither department is able to build the infrastructure necessary to provide assistance to more than approximately 10% of the rice producers in the South Coast. Trained personnel are in critical shortage. For example, at the DEPA Center at Caboxanque, there is only one college graduate. He is responsible for Center operations, design of research, extension coordination, seed multiplication, seed distribution, and coordination of expatriate technical assistance.

Other Donors in the South Coast

Several donors are active in projects that affect rice production in the South Coast. FAO has a rice seed multiplication and distribution program. The FAO seed project has been renewed for a second five-year period. OXFAM/Belgium has a project on credit in the zone. The GOGB is negotiating a project with IFAD. The IFAD project would be the highest funded project in the nation. affecting agronomic and extension training and organization in the South Coast. Projects of various national commissions in the South Coast and projects of international donors were placed under

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the nominal coordination of the Integrated Project of Caboxanque (PIC) in 1979. Regional and sector committees were organized at that time to provide the village population a means of input in the integrated project.

Agronomist and Extension Specialist Annex

Further details on the type of agronomic and extension assistance and services that are needed are included in the Agronomist and Extension Specialist Annex of this project paper.

Agronomic Project Components

In order to strengthen the institutions that provide agronomic research and extension services to the area of this project, the following will be project components:

1) T.A. agronomist with research planning experience and rice production research to work in the research division of the Caboxanque Center and to instruct extension service training;
2) Advanced degree education for an agronomist through the AMDP who would return to work with the agronomist T.A. and eventually replace the T.A. at the end of this project;
3) Opportunity for field and laboratory technicians to have training at IRRI, WARDA, IITA and USDA;
4) Support for in-service training of technicians in research and training of extension workers in field water management (training by DHAS);

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5) Short-term technical assistance (T.A.) instructor in crop protection/integrated pest management through the regional Food Crop Protection Project to train technicians to conduct insect surveys;

6) Soil laboratory equipment and supplies to enable DHAS to establish a field soils laboratory in the South Coast and to provide soil analyses to DEPA on a contract basis. (A list of laboratory equipment and supplies is located in the Appendix of this PP.)

There is ample evidence to support the conclusions that (1) the goals stated in this project can be achieved, and (2) the proposed project plan will materially strengthen the institutions that influence agricultural development in the South Coast area of Guinea-Bissau.

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TECHNICAL ASSISTANT

SCOPE OF WORK - AGRONOMIST

This person will be experienced in agronomic research and in research planning. Preferably the agronomist will have previous experience in developing countries. This position requires a Ph.D. degree or equivalent. The agronomist must be able to speak Portuguese and understand French (approximate FSI levels of S3R3 and S2R2).

Purpose of the Agronomist Position

The primary purposes for including an agronomist among the technical assistants working on this project are:

1) To safeguard the rice production program of Guinea-Bissau against the danger of sudden failure of newly introduced rice varieties;
2) To design an adaptive research program for rice that will lead to maximum utilization of the genetic potential of improved varieties by determining the cultural practices best suited to the new varieties in the context of production on mangrove land;
3) To translate the priorities of DEPA for rice production into a long-term research plan with well-defined priorities; and
4) To initiate a program of research at the research center and on producers' farms that will have continuity into the decade following the termination of the T.A. agronomist's work in Guinea-Bissau.

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Responsibilities

1) To cooperate with the pest management specialist to determine the extent to which the newly distributed variety, ROK 5, is tolerant to the insect population in the South Coast;
2) To design field experiments that will adequately test the optimum plant population and field bed dimensions for ROK 5 and other promising varieties identified in the DEPA/WARDA variety trials;
3) To cooperate with the Holland rice research planner before this individual completes the anticipated three-year tenure in Guinea-Bissau;
4) To assist in training research technicians, selecting technicians for third-country short-term training, and orienting advance degree students to the research program design for mangrove rice;
5) Cooperate with all coordinating agencies and technical assistants in the project;
6) Cooperate with the water specialist in providing design water management and cropping schedules for the complete year. It will be necessary to work closely with farmers using the project social scientist to inventory and evaluate management techniques adapted by the farmers.

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7) Rice is traditionally planted on beds, requiring additional labor and reducing plant density. The reasons for and validity of this practice should be established with literature review and applied research in both newly reclaimed land and old land which has been desalinized and deacidified. If results show that land bedding is not necessary in new or old land, the agronomist should work with extension agents to teach producers more appropriate techniques of land preparation.

8) The traditional method of bolanha land reclamation and management often uses seawater for flushing new as well as old fields. Reported benefits are reduction of acidity, destruction of soil structure for land preparation, and weed control. The validity of these benefits and necessity of saline flushing should be shown or refuted. It there are benefits, the agronomist should work with the DHAS to investigate the feasibility of modifying system design to incorporate saltwater flushing capability.

Time Frame

Three years (36 months) of service in the nation, beginning in year two of the project.

TECHNICAL ASSISTANT - SHORT-TERM

SCOPE OF WORK - CROP PROTECTION

Crop Protection (Pest Management in Entomology) Training Course

Instructor

If a B.S. degree entomologist is available in the country to organize a class of trainees, the instructor should be contracted for six weeks. If no entomologist is available to organize a class, the instructor should be contracted for four months. Four or more Guineans are studying entomology/crop protection at Texas Tech University and at Oklahoma State University.

- Objectives:
  1) To train 12 persons to conduct pest surveys (especially insects) in bolanha rice fields. The population counts of insects on various varieties of rice will be used to determine the comparative tolerance of introduced varieties to the insect species, ecotypes, and populations in the project area.
  2) To teach the students how to develop instructional materials for the purpose of training extension agents and producers to identify the insects of rice and to conduct field population counts.

PROJECT PAPER SOUTH COAST RICE

RESPONSES TO STATEMENT OF WORK

AGRONOMIST/EXTENSION SPECIALIST

I. Introduction

The list of eleven specific tasks assigned to the agronomist/extension specialist has been modified rather extensively since the PID was written. Modifications have been indicated to the agronomist/extension specialist by the AID/Washington South Coast Rice Project committee, the Guinea-Bissau desk officer, the AID Guinea-Bissau Program Officer and Agricultural Project Officer, and the Director of the Department of Research and Extension (DEPA). The elaboration of the Guinea-Bissau situation following the PID by REDSO/WA indicated the activities of donors from other nations would require changes in this project. Otherwise dupli ations of activities by various donors would occur.

Note: The following responses should be modified to accommodate changes in the situation at the time the PP is completed.

- Task 1 - Analyze Caboxanque research extension center's current extension capabilities.

  The primary extension activities of the DEPA center at Caboxanque are multiplication and distribution of rice seed of improved varieties (almost exclusively ROK 5). Pesticides and hand sprayers are controlled by the extension system. Seed multiplication and distribution are conducted under the direction of FAO representatives and in cooperation with West Africa Rice Development

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Association (WARDA). The technical staff at the Caboxanque station includes a director, eleven technicians with four years of agricultural training beyond the basic four years of schooling, eight workers who studied in the CEPI school at Cufar (South Zone), and about 40 additional workers. Graduates at the former agricultural school at Boe, Gabu region, are leaders at the Caboxanque center in the following sections: seed production, horticulture, rural credit and research.

Extension activities both on the station and off are mostly associated with rice seed multiplication and distribution. Leading rice farmers from various villages receive a sack of seed from the extension center to plant on their farms. The seed multiplication extension personnel instruct the farmers on the importance of maintaining varietal purity when the crop is harvested. The farmers agree to return the amount of seed received plus 10% to the seed program after harvest. Sector extension leaders live in larger villages or towns of the South Zone. These leaders visit the cooperating seed producers farms to provide assistance and to collect seed after harvest. The sector leaders are employed by DEPA.

Each village or group of two or three villages designates a producer among them as the contact person with the

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extension system. This village-level extension contact person does not receive pay from DEPA but may have more access to new seed than other producers.

Pesticides and sprayers are distributed by the extension system. Insecticide (usually malathion) is usually the only pesticide used in rice production in the South Coast.

Instructions are provided by extension workers on the care and use of the hand-pumped low-pressure sprayer and on insecticide handling. A farmer will spray his own field or seed bed after he receives the instructions on use and handling.

Twenty hectares of rice land are available for seed multiplication, research, and extension demonstration at the Caboxanque Center. Nineteen hectares are designated for seed multiplication fields. The other one hectare is for research plots. Part of the field area is used for production demonstrations. Producers and extension leaders who live in the sectors visit the fields, seed processing plant and seed laboratory at the Center to observe the work being done. Variety trials and plant spacing demonstrations were reported to be of special interest to the station visitors.

A classroom for 30 people has been constructed at the Center. Plans have been made to give instructions on the

various aspects of rice production, seed multiplication, and extension technique in the classroom facility. Leaders at the Center and DEPA leaders from other units in the nation would serve as instructors in the short courses. Some orientation of extension cooperators on the function of DEPA has been given to this time.

The Caboxanque Center has some of the elements required to conduct an effective extension program. The seed production unit is well equipped with seed separators, germinators, scales and covered work space. The seed multiplication and distribution program occupies most of the human and land resources of the Center. Other aspects of the extension program are only slightly developed. Housing and canteens for training of extension workers are needed. More sector leaders will be required in order for the extension program to reach more villages. Instructors who are well informed in technical subject matter are needed to conduct in-service training of agents and to instruct prospective extension workers.

An apprenticeship program is needed for development of agricultural extension agents. Specific plans have been made to provide extension assistance on field water management in the IFAD project proposal but no provision has been made to develop research on water management techniques to extend to producers.

In summary, the present extension program reaches a very small percentage of the producers in the project area. There are only two or three experienced extension sector leaders in the South Zone. The extension agents lack technical expertise to provide advice to experienced producers. There is no research program to provide training to agents or producers in field water management. The IFAD project does not propose to address the subject of water management training; therefore, this project should provide assistance on water management reasearch and training.

- Tasks 2 & 3 - Identify those areas that can best be developed by (1) technical assistance and (2) commodity assistance.

  Note: If the GOGB negotiates the IFAD loan project as anticipated, the extension specialist will be provided by the IFAD project. A specialist in rice agronomy and research planning may be provided by the government of Holland for three years of work at Caboxanque.

<u>Technical Assistance</u>

Technical assistance is needed at Caboxanque in several aspects of work, including:

- extension specialist to serve as associate director of extension for agronomic crops and preparation of extension materials (provided by IFAD loan project).

- agronomist to serve as technical specialist in rice research planning and rice production on mangrove soils.

- a specialist in crop protection/integrated pest management (IPM), preferably an entomologist, to lead a zone-wide survey of crop insects (primary duty with the Regional Food Crop Protection Project, _____, but partial duty with DEPA/ Caboxanque).

- a hydrologist for rice water management (primary responsibility with DHAS, but partial duty with DEPA/Caboxanque).

Each of these specialists should be provided with a counterpart from the Ministry of Rural Development. Each should conduct training courses in his specialty. Their objectives would be to develop programs that would continue after the departure of the project specialist.

Short-term technical assistance or a service contract with an established laboratory will be needed to assist in the standardization of soil laboratory analyses techniques. A short-term specialist will be needed for the crop protection/IPM program.

Commodity Assistance

Extension needs a dormitory and cafeteria for housing and feeding trainees at the Caboxanque Center and at the proposed DHAS Center at Catio. Four-wheel drive vehicles and motor boats are needed at each location. The agronomy specialist, the hydrologist and the IPM specialist would require land and water transportation. Common supplies for making slides, visuals, marking field plots, preserving samples and writing reports will be required. The IPM program would require light traps, lenses, nets and a work area. The hydrologist will require a work laboratory, measuring weirs, portable meteorological stations and supplies.

The soil analysis laboratory at Bissau will require an atomic absorption spectrophotometer, mettler balance, kjeldahl apparatus, titration equipment, pH meter, flame photometer, sieves, wheatstone bridge and supplies. A list of soils laboratory equipment and supplies is attached to the PID. The estimated cost is $112,000.

Task 4 - Evaluate ongoing projects in the South Coast that have actual or proposed extension components. Identify those extension activities that should and should not be addressed by the USAID project.

The FAO-assisted seed multiplication and distribution project is progressing well. The USAID project should not be involved in the seed project.

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If the proposed IFAD project is not funded, then all aspects of extension would require assistance. The following are vital components to the development of a viable extension program in the South Zone.

- an agricultural extension specialist on site at the Caboxanque Center;
- an agronomist on site at Caboxanque;
- a hydrologist and IPM specialist in the area of Caboxanque;
- a training program for prospective extension workers;
- a training program for present extension workers;
- on-farm visits by extension workers;
- preparation of tapes, slides, posters, manuals, pictures, graphs, etc; and
- field and office demonstration of efficient methods.

USAID should be involved in the above eight activities if other donors do not include these activities in their projects.

- Task 5 - Credit Plan (task deleted).

- Task 6 - Proposed organizational chart which will facilitate coordination of technical assistance in both DHAS and DEPA.

Ministry

Services Contract Agreement

DHAS	DEPA
Soil Laboratory Director	Caboxanque Center Director
Field Hydrologist/ Irrigation Specialist	Agronomist
Soil Pedologist	Extension Specialist
Water Quality Specialist	Research Director

A contract for services would be presented to DHAS by DEPA, biannually. The request would be submitted to DHAS for acceptance and included in the annual work plan and budget request presented to the Ministry of Rural Development by DHAS. The DEPA extension specialist, agronomist, Center director, or research director would be authorized to activate requests for services in keeping with the contract agreement. Funds requested in the annual budget would not be released to DHAS by the Ministry if the work agreed upon were not performed. The agreement should specify types and amount of services requested, such as number of soil samples to be analyzed and number of days of hydrology extension training required.

- Task 7 - Suggest types and structure of in-service training to be provided by DEPA and DHAS.

- o <u>DEPA</u>
  - Instruction and practice in insect survey techniques
  - Instruction and practice in insecticide and herbicide application and safety
  - Instruction in field demonstration management
  - Instruction in method of developing an extension service learning center in the villages and preparation of visual materials
  - Instruction in collecting samples of soil, plant material, weeds, insects, diseases and nematodes for transmission to laboratory
  - Instruction in basic crop production to explain the reasons behind each field production activity.
- o <u>DHAS</u>
  - Instruction in field water management
  - Instruction in field testing soil pH
  - Instruction in field testing water conductivity.

o <u>Task 8</u> - Suggest alternative for strengthening linkages among Center's research, extension and community development efforts as well as between DEPA and DHAS.

Research and extension field work should continue to be conducted at the same Center. Village leaders and outstanding farmers should continue to be involved in

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seed multiplication. The suggestions of village leaders on the direction to be taken by the seed multiplication and extension program are solicited and respected by DEPA. This approach is vital to the success of the programs. These leaders can be of great assistance in defining problems to be investigated through research.

The demonstrations to be conducted at the Center for training extension sector leaders should be chosen by joint action of extension and research leaders. Demonstrations to be installed on producers' farms should be selected by extension personnel in conference with researchers and producers. Village leaders, including the village extension contact person, should be invited to a program day at the extension Center. The program should include viewing of field demonstrations, variety trials, and education materials developed at the Center. Village, sector and regional planning committees should be encouraged to suggest program activities and to make periodic evaluations of program progress.

DEPA and DHAS have developed a plan for extensive interaction and cooperation. Clear definitions of the two agencies' responsibilities by the Ministry of Rural Development should encourage productive cooperation between the agencies.

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In situations in which one agency uses the specialized services of the other agency, a long-term renewable contract agreement is recommended.

- Task 9 - Evaluate DEPA/WARDA relations and suggest if and how linkage might be strengthened.

  South Coast rice programs and DEPA in general have benefitted greatly from their relations with WARDS. A mangrove land rice variety that is tolerant to salt-induced physiologic drought and is a short-maturity variety was introduced in the South Coast by WARDA. Other WARDA varieties are included in the variety trials at the Caboxanque Center. WARDA administrators have written evaluations of the program plan for rice in the South. DEPA technicians have been involved in short-term training at WARDA in crop protection and marshland culture technique. The positive response of DEPA to WARDA assistance enables WARDA to fulfill its mandate as a regional development agency. Continued cooperation between DEPA and WARDA should be encouraged. Short-term training of DEPA technicians at WARD should be increased under this project.

- Task 10 - Analyze and evaluate DEPA's research efforts and recommend ways in which, if deemed necessary, they might be modified and improved.

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Mangrove area rice producers' requests for seed of the ROK 5 variety have exceeded the available supply of seed in the nation. This variety has a distinct advantage in salinity tolerance over traditional varieties of the south mangrove areas, such as the variety 'Atahna'. However, when producers begin to use newly introduced varieties, an accelerated research program is usually required for the crop. Without research on the susceptibility of new varieties to pests under the new environmental conditions, a pest can have a sudden and dire effect on the productivity of the new variety. A new variety of a crop seldom responds to the production practices used with a traditional variety. Field production research and pest surveys are needed for developing production practices that will allow the production potential of the new variety to be realized.

At the Caboxanque Center only one hectare of twenty was allocated to research. Variety testing is carried out at the Center under a plan developed by and with seed from FAO, WARDA and IRRI and other sources. Seed multiplication occupies most of the field and building space as well as human input at the station. A few demonstrations on plant population and spacing have been included in the seed multiplication plots. The coefficients of variability for replicated variety trials at the Center were in the range of 9 to 15, indicating

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reasonable care in design of the trials. Regional and village committees review the Center's plans for seed multiplication, research and extension.

The field sampling techniques used in the rice variety trials at the Caboxanque Center have resulted in apparently inflated yields. Yields from these trial plots are nearly four tons per hectare greater than reported yields of the same varieties under field conditions (5.8 t/ha as compared with 2.0). A research program may lose its credibility with producers if results reported are constantly inflated.

In brief, research efforts are minimal at the Caboxanque Center. The present program is inadequate to support the goals of this project in institution building. A long-term research plan should be designed for the Center and for the South Zone. Producer committees should have distinct input into the setting of research priorities. Advanced training (M.S. or Ph.D. level) will be required to provide the technical expertise to guide the research program in the zone. Training of research technicians should be conducted at IRRI and WARDA. The agronomist technical assistant should train the technicians who do not receive third country training.

o <u>Task 11</u> - Scopes of Work

(A) SOW for agronomist as technical specialist (Completed. D. Jenkins' points included. See Attached.)

(B) SOW for extension activities for a hydrologist which ties into DEPA infrastructure. (See SOW for hydrologist/irrigation engineer by D. Jenkins. Extension element of hydrologist SOW follows below.)

(C) SOW for sociologist. (Written by D. Hess. G. Davis concurs.)

<u>Task 11, Part (B)</u>

SOW for extension activities for a hydrologist which ties into DEPA infrastructure.

The project hydrologist is responsible for all aspects of on-farm water management in <u>bolanha</u> rice production in the target area.

Hydrology functions are described in the Ministry of Rural Development as part of the responsibility of DHAS. Extension functions, however, are the responsibility of DEPA in the same Ministry. The services of the technical assistant hydrologist for this project (and the permanent hydrologist to follow) will be contracted from DHAS by DEPA as outlined in the scheme in Task 6, above.

The hydrologist's services would be contracted to instruct extension personnel in the techniques of water management in bolanha after these techniques are developed and field tested by DHAS. The training would be directed to all levels of DEPA personnel, including the zone leader, sector leader, village (tabanca) extension agents and persons in training to become extension workers. In addition, demonstrations of the water management methods developed by DHAS would be established on the Center at Caboxanque and in producers' fields in Tombali and Quinara regions. Two of the demonstration fields should be in bolanhas reclaimed by the DHAS dam-building brigade.

Instruction methods used by the hydrologist would include visual-aided classroom instruction, a field practicum and development of a guide manual for extension agents.

The extension training program in hydrology would be coordinated by the extension zone director in collaboration with the project agronomist, the zone development committee and committees representing the producers of bolanha rice.

OTHER DONORS TO AGRONOMIC AND EXTENSION SERVICE PROJECTS IN THE SOUTH COAST

The FAO/UNDP seed multiplication project has operated in the South Coast for five years and was renewed last year for an additional five years. FAO is a major donor in the South Coast area. Improved varieties of rice that have been introduced by WARDA and other rice institutes are planted in seed multiplication blocks on land in the Caboxanque Center. The seed increase is distributed among leading farmers in the area. After harvest the farmers return the amount of seed received plus 10% to the seed project. The FAO program has distributed the salinity-resistant, short-season variety ROK 5 in the South Coast.

WARDA and IRRI have provided rice seed of improved varieties for adaptation testing at the Caboxanque Center. WARDA also provides training in conduction of variety trials and in crop protection at its various centers in West Africa.

The GOGB is negotiating with IFAD for a loan/donor project for the South Coast. The funding level is $15-$16 million (U.S.). The IFAD project has a large rice extension program element, including training and providing expatriate technical assistants.

The IFAD project would be the highest funded project in the South Coast. It would operate in the area of this USAID project. The activities of the two projects would be highly complementary to each other.

OXFAM/Belgium Volunteers has an agricultural credit project that is centered at Caboxanque. Funding is at a level of approximately $500,000. Three expatriates work in this project in the South Coast.

The Dutch government is reportedly placing an agronomist at the DEPA Center at Caboxanque for a period of three years, beginning in 1983. The USAID South Coast Rice Project agronomist should receive valuable orientation from the Dutch agronomist. The Dutch seem to be concentrating their efforts in the South Coast area.

The PIC program is assisted to some extent by the government of Holland. An expatriate who works primarily in the Ministry of Plan and lives in Catio, Tombali provides some guidance to the PIC program.

BADEA and the Islamic Conference loan have provided some funds to DHAS for land reclamation.

SIDA is a major donor in Guinea-Bissau, but concentrates it efforts in "Zone 1." Zone 1 does not include the South Coast area.

The World Council of Churches provides funds for program coordination in the South Coast.

Agronomy/Extension Technical Analysis

Rice Consumption and Production in Guinea-Bissau

In Guinea-Bissau, per capita annual rice consumption is about 113 kg of milled rice, second only to Sierra Leone (125 kg) among West African nations. Sixty to 70% of all cereal consumption in the nation is rice.

The nation produces nearly 120,000 metric tons of paddy rice on about 135,000 ha. Wetland rice makes up 79% of the nation's rice hectarage with 23% of the total rice hectares on fresh water wetland and 56% on salt-affected wetland (mangrove land). The remaining 21% of the rice land is upland rice. (Data from DEPA 4ª ENTA, Feb. 1982) One-third of the mangrove swamp rice area in production is in the regions of Tombali and Quinara, the South Coast zone of Guinea-Bissau. About 86% of crop land in the South Coast zone is planted to mangrove rice. The national rice yield average is 800 kg/ha. The comparative rice yields among the three production types are as follows: wetland fresh water, mangrove swampland, and upland dry area; 440, 1,110 and 350 kg/ha, respectively.

Physical Features and Population

Guinea-Bissau is located in West Africa between 10° 55' and 12° 40' north latitude and 13° 38' to 16° 43' west longitude. The total surface area of the nation is stated as 36,125 square kilometers, of which 31,600 are not covered with water on a

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permanent basis. Elevation varies from sea level at the coast to 300 m in the Northeast. The population density is approximately 25/km^2 with 80% of the population in rural areas.

Climate

All of the nation is located in the "Guinea Climate Zone," which involves precipitation greater than 1000 mm per year. There are two distinct seasons in Guinea-Bissau: wet and dry. The rainy season endures about six months, from May/June to October/November. Heaviest rains are in August. About 97% of the rain falls from June to October, with 77% of the annual total rain falling July to September, inclusive. Highest annual average rainfall is in the southwestern coastal region (2500 mm). Lowest rainfall is in the northeastern part of the country (1200 mm annual average). The distance between the regions of highest and lowest precipitation is 200 km. The long-term annual rainfall fluctuation (range) at Bissau is 1,100 to 2,300 mm. Relative humitity follows roughly the two-phased annual rainfall pattern with approximate averages of 50% R.H. in December to February and 85% in July to September.

The average annual temperature in Guinea-Bissau is 26°C. April and May are the hottest months (28°C average). January and February are the coolest months (24°C). The maximum temperature is slightly less than 40°C and the coolest is slightly greater than 14°C.

Potential evaporation from the open surface of a class "A" pan is 2100 mm per year with a potential of 9 mm per day in April and 3 mm per day in August.

There are 2700 hours of sunshine per year with 310 hours total in March and April and 115 hours in August.

The agricultural calendar of the nation is synchronized with the rainy season. Planting of most crops and almost all rice begins with the rainy season.

Soils of Guinea-Bissau

Most of the soils of the nation fall within one of four broad groups. These groups, the square kilometers covered by each, the percentage of total land, and a brief description of each group follow.

- Group A - Laterite Soil; 19,600 km^2; 62% of total land area.
  Description: Sandy at surface; clay increases with depth. Rich in iron oxide.
  Sub-group aa - Ferrallitic soil
  1:1 clay; CEC less than 100 meq/100 g; B.S. less than 40; 4 different colors.
  Sub-group ab - Fersiallitic soil
  Has A, B, and C horizons; free oxides present; kaolinitic and 2:1 clays; CEC greater than 100; B.S. greater than 40 in B horizon. Generally very eroded; penetrable.

- **Group B** - Lithosalt Soil; 5,500 km^2; 17% of total area.
  Description: Layerless. Located over laterite.

- **Group C** - Hydromorphous Soil; 3,500 km^2; 11% of total area.
  Description: Mineral soils. Wet soils: (a) temporary wetness; (b) permanent wetness. Developed along water courses and sea coast. Gleying occurs where fresh water predominates.

- **Group D** - Halomorphous Soil. 3,000 km^2; 10% of total area.
  Description: Alluvial sediments. Subject to seawater inundation. Are mangrove marshlands. High content of mono and polysulfides. After drainage pH drops from former level of slightly acid (wet condition) to 2.0 to 3.0. All have low available phosphorus.

The mangrove soils (seawater affected) of the South Coast region where this USAID project will be located, belong to Group D, above.

A more specific classification of the mangrove soils as used by DHAS is discussed below. Approximate equivalent categories in the U.S. Soil Classification System, USDA-SCS, are listed. The classifications of the mangrove soils of the South Coast zone that follow are based on three factors.

- the nature of the organic matter
- salinity level

- actual (present) acidity and "potential" acidity (potential acidity as projected from peroxide oxidation).

The three main divisions of mangrove soils (seawater affected) and their characteristics are as follows:

- Group 1 - Fluviosolos halic sulfuric. (Approximate U.S. System equivalent is Halic Sulfaquept.) Soils generally drained. EC greater than 4 mmhos in 1:1 paste; jarosite present above 100 cm depth; pH often less than 3.5. Formed over fluvio marine material.

- Group 2 - Fluviosolos halo sulfidic. (U.S. System, Halic Sulfaquent) Soils generally not drained. Conductivity greater than 15; pH near neutral; Saline but jarosite not present.

- Group 3 - Fluviosolos not halic sulfuric. (U.S. System, Sulfic Tropaquept) Leached soil; sandy. Not saline; jarosite present.

Vegetation

In the tidal swamplands, Rhizophora racemosa is associated with the more saline areas and Avicennia nitida with the less saline areas. In higher zones, the oil palm Elaeis guineensis, var. 'dura', is a major species of economic importance. The prevalence and distribution of other trees in the higher zones are mostly determined by burning practices for land clearing. The

baobab tree is an important source of wax, wood and fruit throughout the nation, including the South Coast. The grasses that are found most frequently in the country are members of the Andropogon, Hyparrhenia, Paspalum and Setaria genera. Species of the Cyperaceae (sedge) family are prevalent in the marshlands.

Constraints to the Agronomic and Extension Aspects of the Project

An extensive listing of constraints to the project can be readily identified. Constraints in agency infrastructure, training programs, qualified personnel, transportation, communications, extension and research are present. Environmental constraints, such as saline land, rainfall, mangrove growth, weeds, insects, and rats, are encountered in the project area. Some of the primary constraints related to the probable success of the agronomic and extension aspects of the project are discussed in this section.

- **Infrastructure and Personnel**

  The lack of infrastructure within the Ministry of Rural Development to assure implementation and continuation of a comprehensive program in extension and training has been addressed in other sections of this Project Paper. Adequate infrastructure is indeed lacking in the areas of extension, training, research, hydrology and pest management.

There is not a sufficient number of personnel available in Guinea-Bissau at any of the training levels required to execute the above elements of this project. Technical assistance will be required during the tenure of the project. Personnel must be trained to replace the technical assistants after the project is concluded. Means of providing overlap of trainees and the technical assistance specialists must be maximized.

Specifically, personnel qualified to fill the following five positions that are vital to agronomic extension, research, training, hydrology and pest management are not available in the nation:

- Extension Specialist to design the extension program and develop training program and materials;
- Research Agronomist to project long- and short-term research priorities and to design experiments that will provide answers required by producers;
- a Training Program Director for extension personnel;
- a paddy rice field water Hydrologist to evaluate water management practices and to conduct field demonstrations and train extension personnel in hydrology;
- a specialist to design an integrated pest management program for mangrove land rice culture, design a pest survey program and train extension personnel to conduct the surveys.

These positions of responsibility require advanced technical degree preparation or a basic technical degree in the specialty plus four years of field experience.

- Technician Training

A training school for agricultural technicians to support the five elements mentioned above will be required. The school could be a pre-employment training school or an in-service training program with a section for extension agents and a section for field and laboratory technicians. The extension section of DEPA would be the logical agency responsible for organizing the curriculum and managing the calendar. The extension classroom building on the Caboxanque Center would serve as the school headquarters. The instructors would include the technical assistants on this project in agronomy, hydrology and sociology, the extension sector leaders, the Center director, the extension specialist in the IFAD project, and the short-term technical assistant for training crop protection technicians.

- Agricultural Support Services

Services available to rice producers in the area of the project are extremely limited. An agricultural center for agricultural extension, research and credit has recently been established at Caboxanque. Construction on seed laboratories, some technical staff housing and a classroom building are complete. Other buildings are planned for Caboxanque. A

field area (bolanha) of 20 ha is in use almost exclusively for multiplication of the salt tolerant rice variety, ROK 5. Some plant population demonstrations have been conducted in the seed multiplication fields. Rice variety trials are conducted at the Center.

- Extension: The extension service staff in the project area consists of 14 agents selected from among the better farmers in the region. A few extension sector leaders are located in towns (larger villages) such as Cacine. The agents in the villages have received limited in-service training in use of insecticide sprayers, in the process of seed distribution, and in insect identification. The agents have little access to transportation.

  Eleven technicians who had studied four years in the Agricultural Training School at Boe (Gabu region) are employed at the Caboxanque Center. These personnel had completed four years of primary school before entering the training school. The division leaders, such as seed laboratory director, were selected from among these technicians.

  Because of the lack of additional qualified technicians at the Caboxanque station, eight students who had completed the sixth year CEPI school program at Cufar were employed at the station. These employees were

rated low in technical preparation by the station director in his report to the National Rice Workers Conference in February, 1982. (These students might serve better as extension agents.)

- Research: The research efforts conducted by DEPA for rice have very short-term goals. The long-term objectives of increased yields will probably not be attained until research priorities are selected. New varieties are being tested and released in the South Coast zone with little or no research on the tolerance of the varieties to pests found in the various subsections of the zone. Field plot techniques presently in use need to be refined. An experienced research planner will be required for guiding the rice research program. Rice variety trials constitute the highest form of research conducted in the project area. Some comparisons of plant populations have been conducted in the seed multiplication fields at Caboxanque. A survey of insects attracted to a light source in the fields at the Center was discontinued because of damage to the lanterns.

The older and fuller-staffed research and extension center operated by DEPA at Contubocl (NE zone) has had several unsuccessful research projects. In rice variety trials under irrigation, the coefficient of

variation (CV) was 30.0 in one test and 34.5 in another. LSD at the 5% level of probability was 1179 kg/ha in a field test in which the highest yielding variety produced 4220 kg and the lowest 2340. Least Significant Difference (LSD) at 5% was 1020 kg in a test with yield range of 3390 to 1280. There were 15 varieties entered in each of the above tests. The number of varieties was too great or the soil type and fertility varied from plot to plot. No variety was designated as the standard variety; therefore, LSD is not a valid method for separating means.

In weed control research plots in irrigated rice in 1980, the baseline treatment in which weeds were allowed to grow yielded more than the weed-free treatment. There were no statistically significant differences reported among herbicides or between herbicides and the experimental control treatments. Farmers have gained more information by production experience than this test provided.

The experiments referred to above show evidences of incorrect design and excessive "human error" in the experimentation process. The "human error" factor in field experimentation can be reduced by increasing the accuracy of measurements. Design changes could include increasing the number of replications.

- Hydrology

Adequate water control is a primary constraint to rice production in the mangrove swamp lands. Saltwater from the daily tides reaches 150 km inland in the river and creek beds that bisect the mangrove swamplands in the project area. The tide rises up to four meters, inundating mangrove thickets and unprotected fields. The equinox tides often destroy dikes that endure the diurnal tides. Fresh water for irrigation and for flushing rice paddies is available only from rainwater. Dikes must be used to protect the growing crop from the saltwater (tides).

- Soils

The soils of the mangrove land in the project area are high in their content of expanding lattice clays, high in organic material, and generally very fertile. These soils are predominantly acid sulfate, silty clays. Salinity decreases along a line perpendicular to the estuaries. Under reducing conditions (that is, waterlogged), the soil pH is near neutral. When the soils are aerated (that is, drained), the pH drops quickly to about 3.0.

- Pests

Rice crop pests cause an unknown amount of damage to the crop in the project area. Grasshoppers attack the seed bed plants. Caterpillars and stem borers are present in the paddies. Weaver birds damage the rice in the standing seed

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head. Rats destroy harvested rice in both unthreshed and threshed form. Grain storage insects of Lepidoptera and Homoptera orders do considerable damage to rice in the region. Various rice diseases have been reported in the region, but the extent to which they depress yields has not been determined. The most important rice disease in Guinea-Bissau in terms of yield loss is reported to be caused by Pyricularia, a fungus. Helminthosporium and several stalk diseases are also present.

Weeds in mangrove rice are severe constraints on production. Weed infestation is extremely heavy before the soil is turned each year in preparation for transplanting rice seedlings. Saltwater will often be let into paddies near the estuary before the crop season in order to reduce the weed population. Many paddies remain unplanted each year because of the perennial grasses that dominate these paddies.

- Management in Mangrove Rice Production

Rice production in tidal basin estuaries (mangrove riceland) requires that a delicate balance of soil salinity, pH and moisture content be maintained. This delicate balance in a basically hostile plant environment has been maintained by farmers in the southern coastal region of Guinea-Bissau for many years. The production techniques are traditional in origin and distinctly unique to salt marshlands of West

Africa. There are many more years of successful rice production than there are years of rice failure on the mangrove lands. This fact is the greatest recommendation for the existing system of rice production on mangrove land. Interventions must be introduced with caution to incrementally improve a system which should basically be maintained.

o <u>Agencies and Scope of Responsibilities</u>

DEPA is the agency within the Ministry of Rural Development that is primarily responsible for agricultural production. Its main activities in support of production are centered in two research and extension stations. The station for upland crops and irrigated rice is located at Contuboel in the NE. The station for saltwater paddy rice (mangrove tidal zones) is located at Caboxanque in the southern part of Tombali. The main agronomic activities at the Caboxanque Center are variety trials, seed multiplication, and seed distribution. The salt-tolerant variety 'ROK 5" is almost exclusively the improved variety distributed from Caboxanque. Each donor typically operates its own extension program in the country.

DHAS is the department within the Ministry of Rural Development that is responsible for dam building, water management in the paddies, and soil classification and fertility analysis.

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The nation has adopted a regional development approach by establishing four development zones. The project will be involved with the South Zone, "Zone 3," which includes the regions of Tombali and Quinara.

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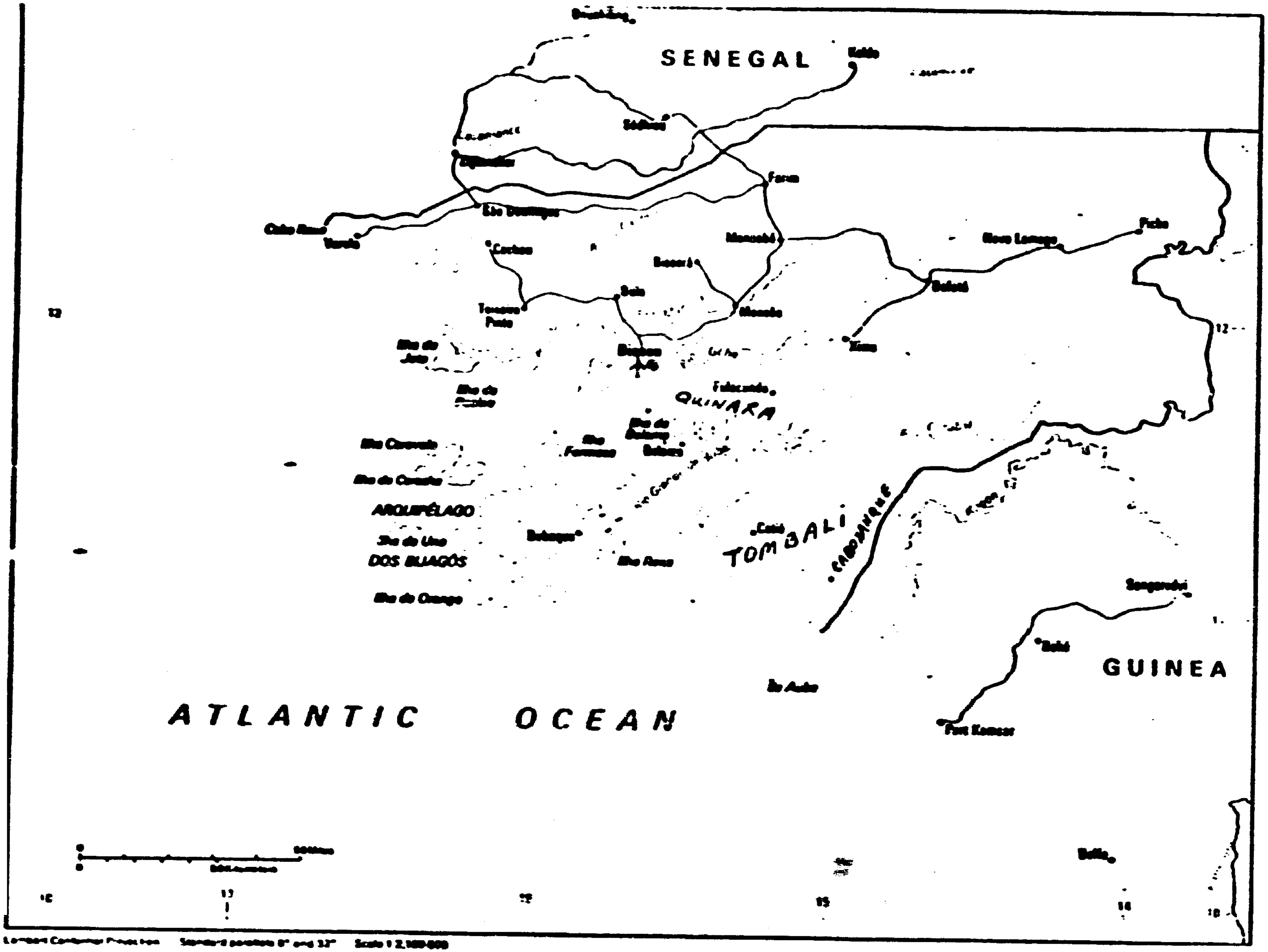

Guinea-Bissau

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SOUTH COAST AGRICULTURAL DEVELOPMENT PROJECT

GUINEA-BISSAU

Economic Analysis

Project Paper

Charles Stathacos
March, 1983

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ECONOMIC ANALYSIS

A. Objective

The objective of the economic analysis is to consider and analyze the economic factors and issues related to the implementation and success of the South Coast Agricultural Development Project (SCAD) and assess whether the proposed expenditure is justifiable. Because the project is an "Institution Building" project, the methodology used for this analysis must be appropriate for such a project. In this case, the nature of the project does not lend itself to quantitative analysis. However, qualitative criteria are used to test the project for its feasibility considering the alternatives under prevailing economic conditions in Guinea-Bissau. To pass the test, the SCAD project must be the best alternative means for allocating U.S. development assistance in a manner consistent with the development goals of Guinea-Bissau.

B. Data Collection and Synthesis of Information

The material used to formulate this analysis fall into the following categories: (1) general economic literature relating to methodological problems in making economic analyses of projects; (2) reports and articles concerned with agricultural development policies specific to the African context; (3) reports and data on macroeconomic aspects of Guinea-Bissau; and (4) reports, data and field observations related to the agricultural sector as well as the specific project area.

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C. Methodology Appropriate for an Institution Building Project

The economy of Guinea-Bissau is in a transition phase between the colonial past and the full development of a self-sustaining economy. Many of its present economic problems find their roots in the legacy of the colonial economy. Guinea-Bissau shares the same misfortune of many African countries where colonial governments "failed to develop institutions for training African agricultural scientists and managers." 1/ Research undertaken was often biased toward cash or export crops to the neglect of staple food crops. For a variety of reasons, countries once self-sufficient in foodstuffs no longer produce enough to feed their own populations. In Guinea-Bissau lagging domestic production has resulted in a reliance on food imports and food aid. The SCAD project proposes to respond to the food problem of Guinea-Bissau by strengthening the institutional capacity for planning, organizing and implementing agricultural products that contribute to increased food supplies.

A major underlying assumption of this analysis is that policy makers recognize the critical need to direct agricultural projects to smallholder agriculture in terms of research, extension, technical assistance and training. 2/ Of course, the specific project must stand up to tests of economic viability and cost-effectiveness. As pointed out by the design engineers (see Jenkins Memo-Annex VI), an institution building project of this kind precludes the need for a quantitative cost-benefit analysis. 3/

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The methodology appropriate for the SCAD project has two components: (1) a description of the economic context of the project; and (2) the actual economic analysis. The first component -- the economic context -- assesses prevailing macroeconomic conditions in Guinea-Bissau and microeconomic issues relating to mangrove rice production in the South Coast region; appraises the objectives and activities of the two agricultural institutions -- DEPA and DHAS -- which the SCAD project is designed to support; and evaluates the net additional benefit arising from the implementation of the project, if successfully realized.

The second component -- the economic analysis -- evaluates the cost-effectiveness of the project in view of alternatives in other sectors of the economy; proposes alternative project designs to identify the "least-cost" alternative to achieving the stated objectives of the SCAD project; and finally calculates the estimated recurrent costs of the project to GOGB after USAID has terminated its assistance.

The analysis will defer to the other analyses in the PP where appropriate.

Macroeconomic Issues

The economy of Guinea-Bissau is based mostly on agriculture. The agricultural sector contributes the largest proportion to national wealth and output of any of the sectors, representing 50 percent of the Gross National Project of $177.5 million in

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1982. In fact, because of data deficiencies in measuring agricultural output, the contribution of agriculture to GNP is understated. However, economic problems and drought in recent years have combined to engender a decline in food availability (see Project Rationale for background). Consequently GOGB must now import rice and other goods, primarily in the form of food aid, in order to meet food needs. GOGB has targeted the agricultural sector for development assistance with the ultimate aim of achieving self-sufficiency. The constraints to achieving self-sufficiency are institutional as well as economic. To a certain extent, the increased capacity of agricultural institutions to provide services is dependent on the performance of agricultural pricing and marketing arrangements.

Agricultural commodity prices are fixed by the GOGB Ministry of Commerce. The government has legal control over the purchasing, transport and sale of agricultural produce. Two state-owned and operated stores -- Armazens do Povo and Socomin -- are the government marketing agents of most agricultural commodities produced in the country. In general, the state-owned stores have not been successful in the distribution of agricultural products and other consumer goods. As a result, the commercial system in Guinea-Bissau is disorganized and relies on the existence of informal or illegal parallel market channels. The main cause of this commercial malaise is the fact that the peso is overvalued -- the exchange rate for the

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peso on the parallel market is 1/4 of the official exchange rate. In addition, the system of administered prices does not represent real market values. Since Guinea-Bissau cannot afford to regulate and enforce state marketing and distribution, producers and consumers turn to the parallel market for exchange. Producers can exchange rice for essential non-food household goods on the parallel market; within the official system producers receive fewer pesos per kilo which cannot be used to purchase non-food goods at state-owned stores because none are available. The general effect of present commercial policies on food supply throughout the country is that surplus production of smallholders (over and above subsistence needs) is not marketed to deficit areas on a regular basis.

The GOGB Economic Stabilization Plan aims to reorganize the economy and the commercial system. Under the new system the state will continue to control external trade, central warehouses, and regional warehouses. The private sector will enter into the distribution of goods, transporting out agricultural products from areas of production to regional warehouses and bringing in necessities for rural populations. In addition, import programs will give attention to the basic consumer needs as well as the production input needs of peasant farmers. The Stabilization Plan sets agricultural development as the cornerstone of GOGB's development strategy. Basic food self-sufficiency is given the highest priority along with improvements in the marketing system.

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The above plan should enable Guinea-Bissau to develop better its capacity to absorb and utilize foreign assistance and consequent development programs in a constructive manner. The World Bank Economic Report emphasizes the potential of Guinea-Bissau in terms of resource endowment (soil quality, arable land) and human skills (especially traditional methods of rice production). The Report recommends a development strategy appropriate for the country that:

(a) makes a full commitment to agricultural development;

(b) increases the emphasis on institution building;

(c) selects carefully ongoing and planned projects according to requirements in organizational capacity and skilled manpower needs;

(d) raises foreign exchange earnings.

Microeconomic Issues

The SCAD project is designed to support the most productive and extensive farming system in Guinea-Bissau -- mangrove rice production. Yield estimates of rice production in Guinea-Bissau show 1,100 kgs. per hectare for mangrove swamp, 440 kgs. for wetland fresh water, and 350 kgs. for upland dry production. Yields for mangrove swamp are above average in the project area (1,500 kgs. per hectare in Tombali and 1,200 kgs. per hectare in Quinara). The traditional techniques and practices involved in reclaiming and cultivating mangrove swamps are described in the Social Soundness Analysis and Water Engineering and Management Analysis. There are no

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in-depth empirical studies measuring the relative productivity of this method of mangrove swamp rice production as compared to alternative activities. However, existing socioeconomic studies (e.g., Hochet) show that it is extremely labor-intensive.

An important obstacle to providing support to farmers has been the lack of good information and analysis of the traditional methods, especially concerning the utilization of labor. The SCAD project aims to upgrade data collection and analysis in order to better identify factors which inhibit increased production and productivity. At present, even baseline data on area in cultivation and total production is not of good quality.

Before the war of liberation, the South Coast region was self-sufficient in rice production. During the war, many of the dikes (ouriques) protecting the rice fields (bolanhas) were destroyed by bombing or deteriorated as fields were abandoned. Consequently, a considerable amount of land reverted to mangrove swamp. Reclamation efforts began in 1977 with the creation of DHAS, which has reclaimed 5,000 hectares throughout the country. Individual farmers using traditional methods have also reclaimed old fields and brought some land back into cultivation. However, the South Coast has not regained its productive capacity. Drought conditions in 1980 and 1981 resulted in crop shortfalls and food deficits in villages

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throughout the region. While conditions improved in 1982, and there are surplus areas within the region, food availability remains a problem.

In order to reestablish former levels of production and further advance living conditions in villages, the farmer must receive a minimum level of assistance from national agricultural institutions. Deficiencies in the provision of services to farmers tend to build walls of distrust and cynicism between farmers and extension agents or other representatives of government agricultural services.

Building Agricultural Institutions: DHAS and DEPA

The Institutional Analysis provides detailed background of both DEPA and DHAS. The primary concern of the economic analysis is whether the impact of the project on the institutions can justify the proposed expenditure. One way to measure the net additional benefit of a project is to describe qualitatively the benefits accruing from the project compared to not undertaking the project. That is, how will the institution develop "with" the project versus "without" the project. A common sense approach is to identify the immediate needs of the insitution which the project addresses and just the impact on the institution of not undertaking the project.

DHAS

The immediate needs of DHAS are as follows:

(1) Technical assistance for the sluice construction, water control management, and equipment maintenance;

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(2) Training of TA counterparts, technicians and skilled laborers;

(3) Construction supplies for sluices and spare parts for equipment and vehicles;

(4) Relocation of DHAS facilities to the South Coast.

The SCAD project responds to the above needs by providing technical assistance, training and commodities (see Financial Plan for breakdown).

The SCAD project will increase the operational capacity of DHAS to build better dams more efficiently and to open up bolanha land for later cultivation. DHAS will become self-reliant in its operations and improve water control management of bolanhas. The modern dam system minimizes risk to the farmer by increasing the security of dikes against unexpected flooding. Second, the project will ensure that present technical problems with drainage and sluice construction can be overcome. In the process, increased DHAS cumulative technical experience represents a transfer of appropriate technology. The application of improved technology in soil and water management and water control structures will increase land in production and improve farmer productivity (see Technical Analysis for further discussion and Project Rationale).

Without the SCAD project, DHAS will languish and not be able to perform its functional role of providing services to farmers. Dams will not be built according to the needs of the region, difficulties with sluice design and construction will continue to hamper the implementation of the modern dam system, and necessary research on the bolanha farming system will not be completed.

DEPA

The immediate needs of DEPA are as follows:

(1) Research and laboratory facilities;

(2) Technical assistance for research planning and methodology, training of TA counterpart and extension workers, and pest management;

(3) Close collaboration with DHAS;

(4) Development and promotion of new seed varieties.

The SCAD project will enhance the research program in Caboxanque by responding to the priority needs of the rice research program in Caboxanque. A research agronomist will upgrade research, train a counterpart as well as extension workers, coordinate pest management activities, and assist in the development and promotion of new seed varieties (see Agronomic Analysis). The training of DEPA technicians in regional centers in West Africa will further improve DEPA's research and extension role. The SCAD project contribution to DEPA's infrastructure will provide the environment

necessary for the successful operation of the Caboxanque research station. The eventual long-term benefit will be the increased farmer productivity resulting from the introduction of new seed varieties and improved cultural practice.

Without the SCAD project, DEPA will flounder and not provide services to farmers or fulfill its commitment to rice research. The effect on the region will be that agriculture will stagnate as farmers will not benefit from the application of agricultural innovations.

Feasibility and Cost-Effectiveness

An important factor in determining the feasibility and cost-effectiveness of the SCAD project is to assess the opportunity cost of the project. Are there alternative projects in other sectors which could result in greater proportionate benefits with the same level of investment, given the administrative orientation of USAID? Areas of concern in Guinea-Bissau include agriculture health, population, education, transportation and industry.

Social and economic statistical data for post-independence Guinea-Bissau, especially for the rural sector, are inadequate and indicative of the need for adequate reporting systems.

Agriculture as the mainstay of the economy is of the subsistence, traditional variety, characterized by a high labor/

capital ratio. Colonial rule did nothing to upgrade the predominantly peasant economy of Guinea-Bissau. To the contrary, colonial administration considered education and any technological change adapted by the population as a potential threat to colonial authority. Since independence, Guinea-Bissau's debilitating level of poverty has continued. The standard of living -- life expectancy, infant mortality and illiteracy -- remains among the lowest in the world.

Agriculture

The country's large rural sector is comprised almost exclusively of subsistence farmers and, to a lesser extent, small-scale fishermen. As such, the agriculture sector is expected to provide the major source of employment and foreign exchange. The principal crops of Guinea-Bissau are rice, other cereal grains, peanuts, palm oil and cashews.

The agricultural potential of the country must be rated as excellent in terms of soil fertility/arable land ratio and rainfall. However, overall agricultural productivity is low. The level of agricultural technology remains a primary con straint to improved small farmer production/productivity. The bulk of production is derived from subsistence agriculture which never reaches the market.

A large proportion of Guinea-Bissau's rural population lives close to waters rich in fish -- the preferred source of animal protein in the Guinea-Bissau diet. The income, employment

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and nutritional potential of such small-scale fisheries is high. However, fishing practices are at present archaic. An almost total lack of basic supplies and transport services inhibit the development of viable fisheries production by small fishermen. Large fisheries are already a high priority of the government.

B. Health Sector

Standard health indicators show the health status of Guineans to be one of the lowest in the world. (See Health Annex)

Foreign assistance in Guinea-Bissau's health sector is both substantial and diverse. Foreign donor contributions, in fact, exceed the GOGB health commissariat's own annual budget. Numerous donor countries provide scholarships, drugs and supplies, and full complements of physicians and equipment to staff regional hospitals. In addition to providing personnel, a number of multilateral and bilateral donors have participated in capital investment programs in Guinea-Bissau's health sector. During the period 1976-1978 approximately $3.7 million in foreign financing was directed into the health sector. Presently, the African Development Bank is completing a pre-investment study for major investment in Guinea-Bissau's health sector infrastructure.

The GOGB's health commissariat is successful in getting foreign agencies and professionals to help finance, plan and run its health programs. Because of the substantial growing

contribution of other donors, USAID/Bissau does not plan to assist the health sector.

C. Population

The national census taken during the first half of 1979 indicated a total population of 777,000. The only other census taken during the last 30 years was in 1950. However, because of the time gap, there is disagreement over the actual population growth figure. Population growth figures range from 1.4 percent, 2 percent, or 2.1 percent. The 1.4 percent figure is consistent with birth and death rates estimated at 42/1,000 and 29/1,000, respectively.

The amount of actual and potentially available arable land per capita is adequate and land/population pressures are minimal. However, latent population problems do exist. The population is skewed toward younger age-groups (42 percent of the population under the age of 15). As this group grows older, population growth is likely to increase, especially if mortality rates decrease as a result of successful preventive health measures.

Given its immense reconstruction problems, the GOGB does not assign any priority to population and family planning. While family planning and information are available at some Government clinics, the GOGB does not promote their dissemination. USAID/Bissau has not received any official GOGB request for assistance in studying the implications of population growth

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and does not consider any prospects for AID involvement in population and family planning in the near future.

D. Education Sector

The educationsl status of the country's inhabitants highlights the neglect of basic human needs by the colonialists. During five centuries of rule, the Portuguese produced a total of 14 university graduates in all of Guinea-Bissau. Under colonialism, education, even at the primary level, received inadequate support. For example, in 1965, at the outset of the war, there were only 13 colonial government schools with an approximate enrollment of 2,000 students.

During the war for independence, the PAIGCG as part of its liberation program, established a national education system which by independence had grown to 156 schools. The teachers in these schools were PAIGC loyalists who had no formal teacher training. Many of these "professores combatents" still bear a large part of the teaching load.

The structure of formal education has been reorganized and new curriculum and methods of instruction are being introduced. Non-formal education focusing primarily on literacy programs is being expanded throughout the country. The number of primary schools has increased considerably as a result of the explicit GOGB policy of making free primary education available on a universal basis. At independence there were approximately 15,000 primary school students. By

1979, 80,000 students were in primary school, half in the first grade. The lack of properly trained teachers remains a severe problem at all levels of education. Other donors provide substantial assistance.

Transportation

The transportation network of Guinea-Bissau consists of 2,200 kilometers of roads, 1/5 of which are paved. Due to inadequate maintenance, the road system is in poor condition, limiting its effective role in the economy. The inadequacy of the transport system inhibits the development of marketing arrangements which further discourages the production of surplus food products, as farmers do not have access to markets. As a result, the World Bank has initiated a rural roads project consisting of three construction brigades, two of which repair laterite roads (one in South Coast and one in Bafata), and one of which concentrates on repairing paved roads. The World Bank will finance $9 million of the total cost of the next phase of the project (estimated at $16 million). The level of donor assistance in transportation is already substantial. From 1978 to 1981, almost 25 percent of all development projects executed were in transportation and communication category (see following table). Of that 25 percent, one-quarter were in communication and three-quarters in transportation.

Sectoral Distribution of Development Assistance

Table I shows the value of development projects executed during the four year period from 1978 through 1981, broken down by major sectors. Considering the importance of agriculture to the economy, its share of projects is disproportionately low. Industry and Commerce has received a large portion of total project assistance but has encountered severe problems with implementation.

For example, OPEC and several other donors gave $18 million to construct an agro-industrial complex in Cumere. While construction is completed and equipment is now installed, intractable economic and technical problems prevent it from beginning operations. The project was premature given the stage of development of Guinea-Bissau. The GOGB has recognized the need to focus efforts on the primary sector of agriculture. As a result, and in view of the foregoing analysis, USAID has made a commitment to concentrate its activities in the agricultural sector. The SCAD project is targeted to the South Coast region as it is considered the region with the highest productive potential.

Least-Cost Analysis Considering Alternative Project Designs

For the SCAD project to be viable, it must be the "least-cost" alternative to achieve the stated objective of strengthening the capacity DEPA and DHAS to assist and provide services to farmers that result in increased production and productivity.

TABLE I

Value of Development Projects Implemented, by Sector, 1978-81

1978-1981

- million dollars

	Value	% of Total
Agriculture and Livestock	20.0	8.7
Fishing	15.8	6.8
Natural Resources	15.7	6.8
Energy	19.4	8.4
Industry and Commerce	40.0	17.3
Transport and Communications	56.0	24.2
Education	21.2	9.2
Health	11.0	4.8
Miscellaneous	32.1	13.9
TOTAL	231.2	100.1

Source: UN, General Assembly,

Assistance to Guinea-Bissau, October 15, 1982

The major financial component of the SCAD project is technical assistance by experts with years of academic training and field experience. Given the time horizon involved in attaining a level of expertise, and given the immediate need for such expertise, there is no alternative to the TA component of the project.

Other alterantives to the project design are more costly, primarily due to the fact that the SCAD project builds on past experience and is therefore a logical continuation of the previous programs. There are few options to strengthening institutions through technical assistance and manpower training. The ground has been broken and the SCAD project will complete the foundation. Research and training are basic pro-conditions for agricultural development for which few substitutes exist.

E Recurrent Cost Analysis

A detailed breakdown of the financial plan is provided in the Financial Analysis. The government contribution to the project is approximately $2.5 million for the first five years. This amount represents annual budgetary expenditures (mostly DHAS) for equipment, personnel, and other operating costs. The recurrent costs to the government of continuing the objectives by the SCAD project are $165,000 per year in 1983 dollars.

	Cost	Depreciation	Annual Cost
Sluice Construction			
Commodities	$ 50,000 (per year)		$ 50,000
Tools for Regional Center (DHAS)	$122,000	12 yrs	$ 10,000
Vehicles, Equipment and Spare Parts	$400,000	5 yrs	$ 80,000
Laboratory Equipment	$140,000	7 yrs	$ 20,000
Generators	$ 30,000	6 yrs	$ 5,000
			$165,000/yr

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Project Paper References

1/ Carl K. Eicher, "Africa's Food Crisis," in Foreign Affairs, Fall 1982, p. 157, and The World Bank, Accelerated Development in Sub-Saharan Africa, Washington, D.C. 1981, Chapter 5.

2/ Peter Delp, "Cost-Effectiveness Analysis," in AID/Washington, Cost-Benefit Analysis and Project Design, 1980.

3/ Carl K. Eicher and Doyle C. Baker, Research on Agricultural Development in Sub-Saharan Africa, Paper No. 1, Dept. of Agri. Econ., MSU, 1982, p. 21.