

CONFLICT IN COMMON PROPERTY RESOURCE USE: EXPERIENCES FROM AN IRRIGATION PROJECT

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ABSTRACT

Many agrarian countries in Africa are experiencing high population growth with an accompanying increased demand for arable cropland. The need to provide food of crop and animal origin to meet ever growing demands necessitates opening up of lands hitherto uncultivated including marginal lands. In many cases, especially where high population densities have led to overcrowding of existing farm lands, agricultural intensification has inevitably resulted. This kind of population-driven agricultural intensification often necessitates the adoption of certain farming techniques such as irrigation procedures and the adoption of agro-chemicals or improved organic farming techniques. Farm lands that were left to fallow for natural regeneration of the soil nutrients are fast disappearing so also are grazing lands which have traditionally provided dry season grazing to pastoralists.

This changing pattern of agricultural production occasioned by population and/or market driven intensification has recently been given national and international support in many parts of Africa. Nigeria is a country that has tended towards this direction. The intention is to boost agricultural production to cope with increased demands. A recent approach has been the support of increased dry season irrigation farming. The objective of the irrigation project is to promote agricultural growth through conjunctive exploitation of surface and shallow aquifer water resources for small holder farm-owned and managed small- scale irrigation development.

Wetlands (*fadamas*) have alternative and competitive uses among which are: crop farming, grazing, fishing and wildlife hunting. Most *fadama* land in Nigeria is used largely for rainy season crop production and is left fallow for most part of the dry season for livestock grazing. Pastoralists have found relief in pasturing their animals in the uncultivated wetlands during the dry season. But with the advent of the dry season irrigation project, pastoralists have been denied the access to this dry season grazing resource. The competitive uses to which *fadama* land is put is the source of potential conflicts amongst the various rural land users. These include conflicts among settled farmers; between farmers and pastoralists; between farmers and fishermen and between fishermen and pastoralists. Furthermore, the development of the *fadama* areas is an interference on the *fadama* ecosystem which has the potential of adversely affecting plant and animal species bio-diversity. Thus, a conflict between environmentalists and the actual landless is likely.

This paper presents the different facets of conflict arising from resource utilization and the principal actors involved. The various modes of conflict resolution are presented with a discussion of the merits and demerits of each settlement mechanism. Conflicts of resource use have been grouped into two distinct categories viz:- "Within group" and "Between group." The most frequent form of tension and conflict is the "between group" where the farmer/pastoralist conflict is the most significant, involving people of divergent ethnic origins. The method used in resolving conflict depends on the nature and magnitude of the conflict. It was observed that places with a high cattle population recorded the highest cases of conflict between pastoralists and farmers due to limited dry season grazing resources.

Mitigative measures that would ameliorate conflict arising from natural resource utilization are discussed. To implement these, an awareness of principles of sustainable resource management has to be created as well as for chances arising from mutual understanding of resource needs and from the joint simultaneous or consultative use of natural resources among user groups.

INTRODUCTION

Nigeria has a population of well over 100 million inhabitants and a land area of 923,773 Km². It is the most populous sub-Saharan African state and the largest country in west and central Africa. The country enjoys a tropical climate with distinct wet and dry seasons. Mean annual rainfall varies from 4,000mm in the south to about 250mm in the Sahel savanna in the extreme north-east. The pattern of rainfall in the south is bimodal while in the north it is unimodal. The number of raining days varies from 360 in the south to only 80 in the extreme northeast. It is the pattern and duration of the rainy season that determines the vegetation cover as well as the agricultural systems practised in the different ecological zones.

The highly varied climatic and soil conditions favour a diversified crop and livestock production. The dry savanna of the north with its short rainy season in June-August is suitable for grain production while the swampy river basin areas are increasingly producing rice and the rain forest areas of south east and south west favour the cultivation of root and tree crops. About 34 million hectares (41.9%) of the country's 81.2 million hectares of arable land are estimated to be under rain-fed cultivation.

Overall, agriculture contributed between 31.2% and 39.2% of the total GDP between 1986 and 1988 of which livestock accounted for about 20%. (The Economist Intelligence Unit, 1990). Livestock production (especially ruminants) is concentrated in the Sudan and Northern Guinea savannas and in the semi-arid zones, in the hands of pastoralists who hold over 90% of the nation's livestock population. Transhumance is still a major feature of pastoral production. This production strategy has been occasioned by the seasonal alteration in the availability of fodder and water especially in the major livestock producing areas, as well as the avoidance of trypanosomiasis in the high risk areas.

The Nigerian livestock industry constitutes a very important national resource with a great deal of untapped potentials. Domestic livestock species contribute significantly to the nutritional, socio-economic and cultural requirements of Nigerians. The larger ruminants are particularly important in increasing and improving crop and livestock production through the use of these animals as sources of farm and off-farm power, notably their use for animal traction. However, since most of the large ruminants are fed at or even below maintenance for a considerable part of the year, productivity (growth rate, calving rate and milk yield) is low and morbidity and mortality rates high (Steinbach, 1996).

Nigeria's ruminant population is predominantly found in the arid, semi-arid and the sub-humid zones of the country. These zones contribute about 30.4%, 27.3% and 19.5% of livestock units (LU) respectively (1 LU = 250 kg). Due to the high rainfall and vast land for forage production in contrast with the low vegetation cover in the drier zones, the sub-humid zone, has a high potential for ruminant production. This potential can be put into productive use.

There is a large gap between demand and supply of meat and meat products. In 1988, for instance, beef supply stood at 260,000 tons while goat meat was 209,000 tons in the same year (EIU, 1990). This is a far cry from the effective demand for meat and meat products. The share of animal protein in total protein intake has therefore remained far short of officially estimated minimum requirements of about 75 grams of total protein and 35 grams of animal protein per person per day (Wagner, 1986). In 1985, for example, only 7.0 grams of the total 45.0 grams of protein consumed by Nigerians was of animal origin. The situation today is no better. Indications are that the situation is worsening. This suggests that the contribution of animal products to protein consumption is less than 16 per cent. The country has, therefore, a serious deficiency of daily per capita protein intake necessitating the importation of livestock and livestock products. Similarly, the daily calorie supply per capita, estimated at 2146, (World Bank, 1989:218) is well below world average figures. It is, thus, obvious that the total protein consumption is below recommended levels (Williams, 1989).

Because of the dwindling national economic resources and the high costs of importing food (including animal products) to ameliorate the nutritional crisis, it has become imperative to turn to local producers for the bulk of the domestic supply of food items. More concerned about the overall worsening food production and nutritional situation in Nigeria, the World Bank offered to assist the country (and some other countries in similar situation) in accelerating local food production. The target is to utilize flood plains and wetlands (*Fadama*) for dry season irrigated agricultural production. The objective is to promote agricultural growth through conjunctive exploitation of surface and shallow aquifer water resources for small holder farm-owned and managed small-scale irrigation development. It is a programme of full cost recovery for irrigation pumps supplied to farmers and washbores and tubewells installed. The purpose is to ensure that farmers become conscious of the

economics of operation and profitability of the venture (FACU, 1993).

The overall objectives of the environmental impact assessment study are: to identify the ecological and social impacts that the development of the Fadama areas would have, and to assess the risks associated with this development and to formulate necessary mitigation measures for inclusion in the design and execution of the National Fadama Development Project (NFDP).

The study was therefore carried out to broadly identify potential environmental impacts that could arise as a result of the implementation of the project among which are:

- i. the potential for increased conflict between farmers and pastoralists as land is converted from pasture to arable land;
- ii. conflict between farmers and fishermen over water management in the flooded Fadama areas;
- iii. potential for contamination of surface and groundwater with fertilizers and/or other agro-chemicals used for intensive irrigated crop production on the *Fadamas*;

The study covered three states within the Middle Belt region namely: Plateau, Taraba and Kogi States. Since The results obtained from field survey carried out in the three States were applied to other Middle Belt States of Niger, Benue, Kwara, and the Federal Capital Territory, Abuja because they are contiguous and have ecological and vegetational similarity.

A team of consultants comprising a social anthropologist, irrigation agronomist, fresh water fisheries biologist, wildlife biologist, tropical range management specialist and public health specialist was assembled to undertake the study. This paper is part of a larger report to which the author contributed as a consultant. The paper focuses attention on the effects and unintended consequences of converting dry season grazing resources to irrigation farming.

THE STUDY AREA

Location, Topography and Drainage

Intensive study was carried out in Kogi, Plateau and Taraba States. The decision to visit specific states was predicated on the assumption that the climate, vegetation and bio-diversity as well as agricultural practices in the selected areas are similar to those of other States in the Middle Belt. The study area lies between latitudes 6°50' - 10°30' N and longitudes 3° - 14°40' E. The zone is endowed with many rivers, streams and abundant groundwater. The major river networks are the Niger, Benue and their tributaries. The prominent tributaries of River Niger are Rivers Kaduna, Changaga, Gurara, Teshi, Oyun and Kampe. Those of River Benue are Mada, Dep, Shemanke, Wase, Katsina Ala, Osee and Oshun and Anambra rivers. Abstraction of water for irrigation from these rivers can be done by direct pumping.

Of the extensive tributaries of the Niger river, only a few sustain permanent water flow and floodplain swamps throughout the dry season. This characteristic is of major importance to agriculture since it excludes the possibility of using direct stream flow for large scale irrigation during the dry season in many places. The development of several lakes and dams on the Niger river and its tributaries as well as the proposed Fadama development are partly expected to tap the reservoirs and groundwater sources to improve irrigation agriculture during the dry season.

Since the length of the dry season rarely exceeds 5 months within the Benue river basin area, many of its tributaries are perennial. Here, shallow aquifer washbores and tube wells will further enhance Fadama usage throughout the dry season.

Rainfall

In general, the rainfall regime decreases considerably from the south to the north. But apart from this latitudinal variation, considerable differences occur as a result of altitudinal differences. The rainy season in the north is marked by a single peak around August but the spread is between May and October. In the Jalingo area in the north the rainfall is about 1016mm with rainy days spread of 180 days. In the south, the rainy season is marked by two peaks and the spread of rains is from March to November. In Lokoja area to the south, rainfall is about 1270mm with rainy season length of 240 days. Around the Mambilla the rainfall rises to about 1524mm while around Jos the rainfall is about 1270mm as a result of orographic effects of the higher elevation around the plateaus.

Vegetation Types and Zones

The vegetation within the study area can be mostly described as typical Guinea Savanna vegetation zone (Keay, 1959). Again as a result of topographic changes, rainfall differences and edaphic factors, some pockets of other distinct vegetation types are supported within the study area. The southern most sector of the Northern Guinea Savanna vegetation zone merges into occasional patches of derived savanna forest mosaic vegetation zone (around Ebba-Kampe, in Kwara and Kogi States) containing species such as: oil palm (*Elaeis guinensis*), raphia palm (*Raphia sudanica*), *Ceiba pentandra*, *Bombax costatum* and *Khaya senegalensis*, *Lannea acida*, *Daniellia oliverii*. Of the grasses *Andropogon tectorum* is evident where the soil is deep and *Monocymbium ceresiiforme* is frequent in poorer soils; *Hyperrhenia involucrata*, *Rottboellia exultata* and *Pennisetum subanqustum*, *Sporobolus pyramedialis* are often present as weeds in more disturbed areas. At Ebba/Kampe Game Reserve in Kogi and Kwara States the dominant tree species of the southern area are: *Daniellia oliverii*, *Vitellaria paradoxum*, *Parkia clappertoniana*, *Anogeisus leiocarpus*, *Azelia africana*, *Vitex doniana*, *Burkea africana*, *Uapaca togoensis* and *Pterocarpus erinaceus*

The main shrubs are *Piliostigma thonningii*, *Annona senegalensis*, *Gardenia tenifolia* and various small leaved legumes of *Cassia* and *Acacia* species. The Northern Guinea Savanna vegetation zone in the Kainji Lake National Park in Niger State is similar in appearance to the Southern Guinea Savanna zone except that the grass growth is shorter and consists mainly of a *Hyperrhenia/Andropogon* species mixture. The main trees are *Isobertinia doka* and *I. tormentosa* which characteristically flush during the middle of the dry season. The major vegetation communities recognised within the Northern Guinea Savanna vegetation zone are: *Terminalia macroptera* woodland community; *Diospyros mespiliformis* - relic dry forest; *Isobertinia doka* woodland; and *Burkea africana* - *Detarium microcarpum* woodland.

METHODOLOGY

Reconnaissance survey

The study was carried out in two phases. The first phase involved a reconnaissance visit to the sample States. This was in an attempt to collect secondary information that would be used in drawing up the detailed study plans in the second phase. Visit to agricultural establishments (government and non-governmental farms, community agricultural groups including Fadama Users' Associations, pastoral groups, fishing communities and community leaders). During this period, discussions were also held with the various Agricultural Development Project (ADP) management staff including but not limited to the Programme Manager, Directors in charge of Engineering, Technical, Forestry, Fisheries, Livestock and Extension Services. Specific officers such as those in charge of the ADP zones, Women in Agriculture, livestock, fisheries as well as the Fadama Co-ordinators (at ADP headquarters and the zonal offices) were interviewed. Other government establishments visited apart from the ADPs included the State offices of the National Livestock Projects Division (NLPD), State Ministry of Agriculture, State Ministry of Health, National Agricultural Land Development Authority (NALDA), Women Commission and the Livestock Development Project (in Plateau State). Reports and available data were collected from these sources.

Detailed Study

Observations made during the reconnaissance visit were discussed at a seminar. The extent of available information in the sample States was discussed. Logistics for detailed study were fine-tuned based on observations made during the reconnaissance visit. The detailed study was launched in November, 1993.

The study adopted the Participatory Rural Appraisal (PRA) method. This method was used because the immediate concern was to assess the impact of the fadama project on the environment from point of view of different disciplines. PRA uses an inter-disciplinary approach and depends on teamwork in order to arrive at common conclusions. As very limited time was available for the study, it was only appropriate to utilize methods which were far quicker and more cost effective than traditional survey methods. Therefore, low input data collection has been emphasized since our focus was on identifying key parameters that could facilitate and/or impede the planning and execution of the Fadama project. Sample selection was purposive (in many cases the advice of ADP staff was followed in making a decision). Substantial use was made of indigenous knowledge of the farmers.

With the assistance of the ADP staff, especially the Fadama Co-ordinators and Women in Agriculture (WIA) co-ordinators, the research team was able to assemble the various fadama interest groups. The sampled communities were contacted and appointments were made to discuss EIA with them. Such communities are

made up of independent fadama farmers, fadama users' association, fishermen, hunters, herdsman, women farmers. Issues relating to conflict between farmers and herders were discussed exclusively with either farmers or herdsman in areas in which social tension already exists.

The ADP staff provided useful information about incidents of conflicts. Communities that were identified as experiencing conflict between interest groups were visited. Attempts were made to interview farmers and herdsman that have been aggrieved in the recent past. In this instance, the parties were interviewed separately after allowing a group discussion on the best ways to mitigate the problem areas. All aggrieved parties were urged to open up in order to unearth the root cause of conflict.

All consultants went to the field as a team. Group interviews were conducted among different interest groups - herders, farmers, fishermen, women groups, fadama users association, Miyetti Allah Cattle Breeders' Association of Nigeria (MACBAN), and traditional rulers. An individual team member interviewed which ever group he wished to. At the end of every visit made to farmers, the consultants convened to discuss observations and compare notes. The next day's activities and movements were then planned. An interview schedule was used to guide the collection of information.

RESULTS

Livestock Management Practices

The total potential fadama areas for irrigation development in the three states is 521,670 hectares. The total number of cattle in the three states is 3,092,411. The largest concentration of cattle comes from Taraba with 1,841,411, followed by Plateau State with 1,251,000 while Kogi had about 1,125,900. These could be regarded as potential graziers of the available 521,670 hectares of fadama land in the three states. Additional stress is also put on the fadama by the transient pastoralists who migrate to fadama areas during the dry season from as far as hundreds of kilometers away.

Availability of fodder and water is a basic principle in livestock management practices. In general, two major systems of livestock production were identified within the study areas, each with its own management practices. These are settled agropastoralism and migratory pastoralism.

Settled agropastoralists live continuously in permanent settlements all year round, and practice arable farming in addition to livestock husbandry. On the other hand, most migratory pastoralists live in tents for a defined season and move to another site for another season. Some them build their huts or tents around major towns and others in the periphery of the villages. The settlement pattern of these pastoralists is frequently determined by proximity to village market, availability of fodder resources, water and a healthy social environment as well as an area devoid of livestock diseases.

In the day time, herds are grazed by younger members of the household while the animals are kraaled at night. The grazing orbit during the rainy season is often within 5km of the homestead. At this period of the year the herds are kept away from the cropped farmlands. Immediately after harvest, the cattle are put to graze on crop residues. At the height of dry season, herds are split into portions, and deployed to other areas with greener pasture. Available crop residues are supplemented by cutting tree branches, shrubs, and leaves. Relay cropping system practised impedes the utilization of crop residues by grazing.

Migratory pastoralists have between 50 and 200 cattle. Pastoral households often move with their herds to fadama lands during the dry season in search of pastures. They move back to upland areas during the rainy season avoiding areas with tsetse flies and their diseases. Their mobility is largely determined by the location of farming communities which provide crop residue for grazing, markets for sale of their animals and produce as well as for the purchase of essential needs. Their main occupation, however is livestock production and management.

Livestock management practice for both settled agropastoralists and migratory pastoralists is entirely fodder-based, and the direction of cattle movement is guided by the availability of fodder and water. These factors are responsible for the migration of herds coupled with an attempt to avoid areas considered to be of any disease risk. This migratory nature of the pastoralists is a source of potential conflicts as there is intense competition between livestock rearers and farming communities.

The competitive uses to which fadama land resource is put serve as a basis for potential conflict. Thus, there exists intense competition between the various rural land users, notably between farmers and pastoralists; between pastoralists and fishermen; between upland and fadama farmers; and between these groups and the hunters.

Estimates of herdsman, stock population and times of resource use

In all cases, the project areas are used by pastoralists as dry season grazing resource. Different pastoral groups utilise the resource during the dry season (the settled pastoralists as well as nomadic herdsman). The nomadic herdsman are first to arrive as soon as the dry season sets in. In Plateau and Taraba States large camps of these nomads are seen in different places on the fadama flood plains in early October. They stay for between 4 and 6 weeks before moving to areas that are not being cropped in the dry season. In the Lokoja/Koton Karfe area, for instance, herdsman come for dry season grazing as soon as the flood plains recede in late October and remain there for up to 6 months. While there, they engage in dry season cropping, raising crops such as vegetables, sweet potatoes, sugar cane and onions.

Fishermen likewise migrate to the river Niger basin at this time. They come from Sokoto and Kano areas. While there, they, like the migrant pastoralists crop vegetables on patches of land allocated to them by the village heads. There was no incident of conflict reported between fishermen and pastoralists.

Estimates of nomadic herdsman and their cattle population are extremely difficult to get. However, the herds of nomadic pastoralists are considerably more (between 200-380 cattle) than those of the settled herdsman. Nomadic households are, however, considerably smaller. The estimated cattle population of settled pastoralists in the zones visited is given in Table 1.

It was observed that areas with high cattle population recorded the highest incidents of conflict between pastoralists and farmers. This is an indication of the competitive use of the fadama resource.

Fadama Pasture Use and Crop Residues

The importance of fadamas as a source of dry season grazing cannot be over-emphasized. They serve as one of the main sources of fodder, together with crop residues and browsing of trees and shrubs. (Turner, 1977). The main grass species used for fodder in the fadamas are *Echinochloa pyramidalis*, *Oryza barthii* and *Vetiveria nigritana*, *Hyparrhena spp.* and *Andropogon gayanus*. The leaves of Elephant grass (*Penisetum purpureum*) are good fodder but not the stalks, and *Bracharia spp.* which are found in the clay areas are useful fodder. The perennial fadama grasses are very valuable, providing nutrition to livestock throughout the year. In the wet season, the fadamas are flooded and cannot be grazed but the fadama grasses may be cut and fed to the animals, especially goats, which are kept, fenced in the compound to prevent them from damaging crops. In the dry season, the leaves of fadama shrubs and trees are cut to feed the animals. The pasture requirement is a function of the total livestock population and its density. Whether or not the requirement is met will depend on the available biomass. The livestock density for the sub-humid zone study area is estimated at 13.89 cattle per km². In Plateau State, for example, the density is 18.166 while that of old Gongola State (Adamawa and Taraba) is 16.45 Km² per (RIM, 1992). Although a figure for Kogi State is not readily available, the density is expected to be below the average. This shows that some parts of Taraba and Plateau could be faced with adequate pasture, considering the stocking rate especially during the dry season. Olayiwole *et al* (1981) have noted that during the dry season, 18.0% of the animal feeds come from fadama and 13.0% from crop residues. This underscores the importance of fadama as a dry season grazing resource.

One of the most immediate environmental impacts of the NFDP is a drastic reduction in the fadama pasture, and the intensification of the strained relationship between the farmers and herders. These problems can however, be mitigated if the NFDP is carefully planned and executed to enhance proper utilization of crop residues that will result from the expanded fadama cultivation.

In Plateau State, for example, fadama crop residues are intensively used. The fadama crop residues commonly mentioned is *Acha*, a staple cereal harvested in October, and its residues are known to be highly valued as fodder. Farmers usually sell this as hay or sometimes exchange it with table salt. Pastoralists also grow this crop. Elsewhere in the state, agro-pastoralists use residues from their fadama farms and from those of other farmers. Pastoralists pay fadama farmers for grazing their crop residues. The cost of such residues, however, depends on the crop type, and the relationships between the graziers and the farmers. For example, in Shendam, rice crop residues on fadama is free while graziers pay for maize and guinea corn.

Table 1. Estimated cattle population in sample States/zones (settled pastoralists)

State	Zone	H/holds	Cattle Pop. per H/hold.	Estimated cattle pop.
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Kogi	A-Isanlu	150	150	22 500
	B-Ogba-Bete	38	50	1 900
	C-Koton Karfe	21	125	2 625
	D-Aloko-Ina	18	40	720
	Total	227	365	27 745
Plateau	North-Mangu	400	120	48 000
	West-Keffi	100	50	5 000
	South-Lafia	415	160	66 400
	East-Gwiwan Kogi	150	100	15 000
	Total	1650	430	134 400
Taraba	1-Garin Dogo	48	110	5 280
	2-Gassol	55	95	5 225
	3-Gazabu	105	155	16 275
	4-Gembu*	na	na	na
	Total	208	360	26 780

* The team could not visit Gembu (due to time constraint). However, from information collected from various official sources, the incident of conflict is highest in the Gembu area of the Mambila Plateau. This area is said to have one of the highest cattle populations in the State. The incident of conflict on the plateau has necessitated the fencing of farm plots in the area. It should be noted, however, that the fadama potentials in Mambila plateau is poor. Only pockets of fadama land exist in the valleys.

The same pattern obtains in Taraba state. The fadama crop residues commonly mentioned here are those of rice. Agropastoralists use residues from their farms and those of other farmers. They also buy. The cost depends on the crop residue type, nutritive and cultural value and the relationship between grazer and the farmers concerned. This pattern is a bit different with respect to Kogi State. The use of *fadama* crop residues is constrained by the relay-cropping system, a situation whereby cassava takes over from maize or vice versa.

Improvement in Livestock Management on the Fadamas

All the *ArDOS* (Fulani leaders) interviewed expressed the belief that improvement in livestock management cannot be made on fadamas without pastoralists right of access to and control of land in general and that of fadama in particular. Even the agropastoralists who are non-indigenes of their respective areas suffer this deprivation. This is probably why our respondents, mostly *ArDOS* suggested that fadama land should be surveyed and portioned between the various rural land users, notably farmers, fishermen and herders. With access to land,

- ② the pastoralist could be allowed to take full responsibility for managing such land for pasture development;
- ② livestock/crop integration could be encouraged by promoting the production of such crops whose residues could be used as feeds.

According to one *ArDO*, "Fulani's choice of crop depends on its utility as residues". Since fadamas are limited and are often complimentary to the upland resources, there is need to revisit the issue of Grazing Reserves. More reserves should be created while the existing ones are provided with facilities. This will ease the pressure on the limited fadama resources.

An effective extension service can be regarded as the link between agricultural research institutes and the practising farmer. The Fulani see extension agents as their 'eyes'. Extension staff determine the right drug to buy and whether or not the drugs are fake/genuine. Fake or expired drugs are very dangerous for the animals as it can wipe out a complete flock. With the non-availability of drugs, the Fulani have had to resort to the use of herbal medicines. Problems commonly mentioned are liverflukes, worms (endo-parasites), trypanosomiasis, black water, foot and mouth disease, and skin diseases, especially dermatophilosis.

The Fulani are saddened that extension services, which could have improved the livestock management practices, are presently lacking. They observe that salt lick, veterinary services and feed supplements like cotton seed cake are no longer readily available. Most pastoralists are very willing to pay for such services.

SOURCES OF CONFLICT AND TENSION BETWEEN DIFFERENT FADAMA GROUPS OF USERS

It is generally acceptable that where there are competing uses for a resource, some amount of conflict may be imminent. This is even more so when the resource in question is land which can be put into different productive uses. Fadama land has traditionally been used for crop production (wet and dry season cropping) as well as dry

season grazing for herders. The importance and utility of *fadama* land to crop and animal farmers necessitates some amount of competition. Competition for such resource is aggravated by growing human and animal populations.

Conflict in *fadama* resource use can be caused by agricultural intensification where the existing resource is put into more intensive use by any group of farmer (crop or livestock). Such intensification may be population-driven (more persons to a unit of *fadama* resource). In this case, competition/conflict becomes very stiff between different resource users (crop farmers and animal farmers, for example). Such situations usually favour crop farmers who tend to control the resource. For livestock to benefit from the use of the resource, therefore, there must be some form of integration of cropping and livestock by the same resource owner.

On the other hand, intensification may be market-driven. This form of intensification may not be as stiff as the former. A major feature of market-driven intensification is the commercial-orientation of the resource user. The drive for profit could encourage a crop/livestock interaction to the extent that crop residues could be converted to cash when sold to herd owners. Another dimension of conflict relates to instances where agricultural expansion includes *fadama* land hitherto left uncultivated. Such land may have been used as dry season grazing resource by herdsman where alternative dry season grazing resources are difficult to find, tension builds up and serious conflict could arise. The hypothesis that there exists a direct relationship between population (human and/or cattle) and level of conflict between a farmer and a herdsman can, therefore, be advanced.

In the use of *fadama* resources, tension and conflict can be within groups or between groups:

Within groups = farmer/farmer, pastoralist/pastoralist, fisherman/fisherman

Between groups = farmer/pastoralist, farmer/fisherman, pastoralist/fisherman. The most important form of tension and conflict is the "between group" category. This often involves people of divergent ethnic background. In the event of a conflict, people tend to go along ethnic divides. This is very evident in the types of conflicts reported between farmers and herders in the different sample states and locations.

The most frequent cases of conflicts are those that arose as a result of crop damage caused by animals belonging to herdsman. Such conflicts have arisen from farm encroachment on cattle routes and sometimes watering points. Other conflict sources include grazing of harvested crops, and destruction of fishing traps by cattle herders. There were certain instances where deliberate encroachment of cattle routes were done by farmers to bait herdsman into trouble. This is a very common phenomenon. Pastoralists are usually on the receiving end in such instances as they are often incriminated for crop destruction.

Conflict resulting from disputed land is hardly found in the "between group". Such conflicts are almost exclusive to the "within group" category such as the farmer/farmer category. The pastoralist/pastoralist conflict category is very rare. Where it exists, in a few places visited, it was between sedentarized pastoralists and the long-distance transhumant pastoralists. In this case, the settled pastoralists claimed they confronted the nomads whenever the latter encroached into farmlands of their agriculturist neighbours. This was so because the settled herdsman did not want to be held responsible for any crop damage that was caused by the nomadic herdsman. The fishermen/farmer category of conflict is not common because in most cases the fishermen also farm land contiguously where they carry out their fishing activities.

Conflicts occur in the three States in the rainy season but it is higher during the dry season (November - March). This is the critical period for livestock as there is scarcity of fodder. This is the period nomadic pastoralists start to migrate in search of pasture and water. The *fadama* areas therefore, are ready destinations. Most of the conflicts around this period arose from blockage of cattle routes/corridors and water points by farmers; destruction of standing crops on the upland farms en route *fadama* land, and grazing of harvested crops. Where available, crop residues are utilized by herdsman. In Plateau and Taraba States, for example, there is an understanding over the use of crop residues between the farmers and herders. In Kogi State, however, relay-cropping system would seem to be an impediment to the use of crop residue, and a potential source of conflicts.

Another notable period of conflict is at the on-set of the rainy season where the nomadic pastoralists begin their return migration to the north. Fulani leaders (*ArDOS*) and officials of the *Fadama* Users Association (FUA) believe that conflicts during the rainy season are minimal. This is because fodder and water are readily available at this period and the user groups are disadvantaged. Minor incidences merely occur when cattle stray into farmlands.

As the degree of Fadama utilisation for dry season agriculture is now relatively low throughout the Middle Belt, it is not the use of fadama *per se* that causes the conflicts. However, with the commencement of NFDP, conflicts over access to and control of fadama could be heightened. Pastoralists will be disadvantaged if fadama resources are exclusively developed for crop irrigation farming.

Mechanisms used to resolve conflicts

The method used in resolving conflict depends on the nature and magnitude of the conflict. In all cases, where conflict has been occasioned by crop destruction and where the offending herdsman admits guilt, interpersonal agreement may be reached. Depending on the extent of the damage, compensation (varying in amounts) is often demanded and paid. Where minimal crops have been destroyed and the herdsman showed some concern, only a warning not to allow a repeat performance was given. This is a situation where pastoralists and farmers have co-habited for a long time. In such cases the herdsmen speak the local language very fluently, thereby enhancing social integration and good neighbourliness.

There are other instances where farmer/pastoralist interpersonal relationship is not very cordial. Conflicts that arise in such situation are not usually resolved by personal intervention. The village head and the head of the herdsmen (*ArDOS*) are usually involved in settling disputes. This is the most frequent form of settling disputes, because the farmer whose crops have been destroyed usually asks for outrageous and unrealistic compensation. The herdsmen, on the other hand is not prepared to give in to the demands of the aggrieved farmer. A combined effort of the village/district head and the *ArDOS* is often used to arrive at a reasonable compromise. Most farmer/pastoralist conflicts are resolved in this way.

The method of dispute resolution adopted by His Royal Highness, the Agbana of Isanlu (Kogi State) is to first assess the extent of damage to crop in the company of the *ArDO* before the amount of compensation is determined. We were at the tail-end of our field work in Kogi State when, a *M'Bororo* who grazed on an okra farm was brought before the traditional ruler. Similarly, a conflict between a herder and a fisherman had just been resolved by the traditional ruler at Gossol (Taraba State) before our group interview.

On the whole, the most hated mode of conflict resolution is the police/court, and it is rarely used. *ArDOS* tend to believe that the police often finds a way to exploit the Fulani herdsman in the event of a reported conflict and often brutalise Fulani in order to extort them. If and when police is involved, the *ArDOS* would prefer their cases to be handled by high-ranking officers who seem to be better placed to handle conflicts than the other ranks who harass the Fulani. Pastoralists do not always like to be dragged to court or police stations, because they alleged they end up paying more in both legitimate and unofficial fees and fines. Said a pastoralist:

"They (the public) see us as very rich people and so expect us to pay whatever fine is imposed on us, guilty or not guilty."

Where the conflict is beyond the competence of community leaders and traditional leaders local government is often brought in. This is when the conflict constitutes significant threat to law and order.

In Kogi State, for example, two Standing Committees specifically set-up in each of the local government areas to handle crisis of this nature have been put in place. The first is the Area Stockman Grazing Committee headed by the Area Veterinary Officer in the local government areas. Other members of the committee are the Veterinary Officer, *ArDOS*, Community Leaders, the paramount ruler in the area, and the District Police Officer. This committee mediates between the herders and farmers. The other committee, tagged Area Security Committee, set-up for peace and security, also has an identical composition. This type of arrangement would seem to be peculiar to Kogi State.

The states may find it expedient to intervene in cases where a conflict constitutes threats to peace and stability of the state. The recent farmers/ herdsman conflicts in Isanlu (Kogi State) attracted the presence of the State Security apparatus. In Plateau State, the sporadic conflicts between the pastoralists and the Tiv in the three local government areas bordering Benue State have led to the stationing of Mounted Troops at Kaderko. The presence of Mounted Troops notwithstanding, the herders and farmers have not been utilizing the resources there freely.

Cultural and resource constraints to livestock management

The main resource constraint to livestock management in all the States is accessibility to dry season grazing and

watering points. This constraint will be more pronounced when the fadama project takes of. Some of the fadama lands not being presently utilised for cropping, but for dry season grazing by pastoralists, will be denied the herdsmen. The herdsmen will be forced to relocate to previously unknown and less productive places. This will place a lot of stress and uncertainty on herdsmen. They may not be familiar with the traditions and customs of the new area. A process of acculturation will have to be undergone by the relocating pastoralist.

If pastoralists are not completely displaced, they may have to put up with a lot of production bottlenecks. Their grazing orbit will be drastically reduced if they do not split or reduce their herds. Pastoralists will not readily reduce their animal holding. This may be due to reasons associated with security of stock, especially in years of disasters when rebuilding of herds may be very difficult.

Reduced grazing will force pastoralists to adopt management strategies which will maximise feed utilisation of animal. They will have to use more non-conventional feeds as well as supplement animal feeding. Increased use of crop residues will be made and pastoralists may in some instances grow more rain-fed crops in order to produce and utilise crop residues. In this situation, improved feeding techniques including the establishment of fodder banks would be encouraged. The cultivation of dual purpose legumes for both human and livestock consumption could be encouraged with packages. Other properly organised extension resources such as watering points and cattle routes may be denied herders if the fadama project is not properly planned. This will increase the potential for conflict in the project areas.

Women in Agriculture

Women in agriculture (WIA) is a very important component of the extension programme of the ADPs. The need was realised that productivity of the women folk in agriculture must be enhanced. In Taraba and Plateau States, over 60% of the women work force are engaged in various agricultural activities ranging from crop and livestock production, fish farming, poultry production to food processing, storage and marketing.

The activities of the ADP staff in women in agriculture is geared towards improving the livelihood of rural farming women by providing extension outreach for women. They also educate and train women farmers on available technologies relating to food crop production, processing storage and marketing. WIA programmes also attempt to broaden the knowledge base of women in livestock rearing practices as well as vegetables and fruit tree cultivation. All these aim at improving the livelihood of the rural women and her household. All the zonal offices of the ADP are headed by Zonal WIA in agriculture (subject matter specialist). At the block level, the WIA Agents perform similar extension activities as their male extension agents.

WIA is active in all the States. In all allocations visited, women farmers have been organised into farming groups with each group comprising of members ranging between 8 and 30. In Taraba State, for example, 230 women groups in Gembu alone have been registered since 1992, while some 25 and 12 groups have been registered in Plateau and Kogi States respectively. Some of the groups have been registered specifically as Fadama Users' Association, although their activities are not restricted to irrigation farming. In Taraba and Plateau States, women groups have purchased inputs such as pumps and improved seeds. The women in all cases complained of lack of such inputs like fertilisers which they pay prohibitive prices for. Other constraints include timely land preparation. They depend on the male folk or the tractor hiring service which is not timely. Labour is another constraint mentioned. When there is glut of agricultural produce, women are faced with the problem of attracting good price for their produce. Agricultural credit to meet farm demands was frequently mentioned as a major hindrance. Land tenure systems in most places do not recognise the right of women to own land. In some instance the men folk are said to have expressed the fear that if women are allowed to own land their authority base as household heads would be threatened. This has serious implications for women with the advent of the fadama projects, especially where men farmers may want to withdraw their land from the women folk.

The fadama project however, will greatly enhance dry season income of women farmers. Farmers interviewed stated that additional income generated from irrigation farming will be invested in grain purchase at harvest time so that they can store and sell when the price is good. Some mentioned the fact that such additional incomes will enable them better attend to the needs of their children and wards in educational institutions. Some of the groups mentioned that they would start credit and loans scheme for their members, especially those that need financial assistance. In all, the women group farmers said they would be able to supplement the family diet with their increased involvement in Fadama farming.

MITIGATION MEASURES

This section outlines some mitigation measures against the potential impacts of the National Fadama Development Project (NFDP) in the Middle Belt, Nigeria.

Impact on Pasture

The NFDP is expected to lead to a drastic reduction in the Fadama pasture, the source of the dry season grazing. The following mitigation measures are recommended:

- ② To ameliorate the conflicts between the farmers and the pastoralists, about 20 percent of the Fadama land should be set aside specifically for grazing.
- ② The pastoralists should be given land use rights to enable them to manage such land for pasture development or practice livestock integration as the case may be.
- ② The project design should encourage livestock/crop integration in order to persuade fadama farmers to adopt production of crops whose residues could be used as fodder.
- ② Farmers, especially fadama farmers and pastoralists should be encouraged to embark on fodder bank production. Towards this end, the ADPs should endeavour to set up demonstration plots and run them for a number of years before they are turned-over to the beneficiaries. This is very important if the beneficiaries are to be persuaded to adopt fodder bank production

Impact of NFDP on Conflict

NFDP is likely to intensify the existing competition for the available fadama resources between the various rural land users. This competition will generate conflicts. The following mitigation measures are recommended:

- ② More Grazing Reserves should be created while the existing ones gazetted and properly managed. For the pastoralists to be encouraged to patronize the grazing reserves, pasture, veterinary and other supportive services should be provided.
- ② Cattle routes should be surveyed, gazetted and protected.
- ② In cases of actual conflicts, community leaders such as the Ardos and traditional rulers should continue to mediate in conflict resolution between the various land users.
- ② Appropriate Institutional Framework for conflict resolution at both the local and state level should be evolved. The idea of the area Livestock Grazing Committee as it is in Kogi State could be replicated in the other parts of the study areas.

NFDP and Bio-diversity

Some of the Fadama plants, fruits and flowers are used for food, medical, and household purposes. These naturally occurring fadama products together with fadama pasture constitute the bio- diversity of the fadama environment which will be affected significantly by the NFDP. The mitigative measures have been separated into four distinct categories: Farmers' level, ADP level, National level and International level.

Farmers' Level

- ② *Crop/Livestock Interaction:* Farmers should be encouraged to keep livestock in order to further enhance the understanding between crop and livestock farming. Farmers will be able to get introduced to the use of draught animal power to improve and increase crop yields. Transportation of farm input to the farm from the homestead will be facilitated by the use of animal traction. Animal traction should be emphasized over and above tractors.
- ② *Fencing Farmlands* Farmers in conflict prone areas should be encouraged to fence their farmlands. The use of live fencing should be encouraged and preferred to expensive wire fencing which individual farmers may not be able to easily afford. However, in places where Fadama Users Associations (FUAs) exist, the farming group can be encouraged and supported in providing perimeter fencing round the group's farm. The cost in such fencing by the group will not be as high as individual farm fencing. Conflict between farmers and pastoralists will be greatly reduced as a result of fencing farmlands.
- ② *Security/dispute:* Committees should be set up at village, council, state and national levels to settle dispute that may arise from resource use. Such committees should draw membership from recognised groups or agencies. It shall be charged with the responsibility of fostering harmonious co-habitation of livestock and crop farmers; ensure peace and order in the area, resolve (adjudicate) conflicts where such may arise, meet regularly for the purpose of achieving set goals and objectives.

The Forum should be comprised of the following persons drawn from across the spectrum of the different

community levels.

- ② *Village/District level*: Area veterinary officer, Area Agriculture officer, Local Government Chairman (or Representative), Village/District Head, one representative of herders and one representative of farmers.
- ② *Local Council Level*: Divisional Veterinary officer, Divisional Agriculture officer, Local Government Chairman, Traditional Council Chairman, the District Police office, one representative of herders and one representative of farmers
- ② *State Level*: Chief Veterinary officer, Chief Agriculture officer, Representative of State Chief Executive (Governor), State Chairman of Traditional Council, State Commissioner of Police, one representative of herders and one representative of farmers.

ADP Level

The extension outfit of ADPs should be strengthened to provide needed services to farmers. This includes extension messages, training and retraining of extension agents and farmers in the use of improved technologies, etc.

River Basin Authorities: The activities of the RBDAs should be harmonised with those of the ADPs. In this regard, water production for use in fadama irrigated farmlands can be jointly executed by ADPs and the RBDAs. In some instances, irrigation infrastructure of the RBDAs can be put into good use by the ADPs.

Partial Opening up of Fadama Land When the project comes on stream, only a part of the existing fadama land should be opened up for cropping activities. No more than 80% of the total fadama potentials should be put into cultivation. This will allow for gradual phasing of pastoral activities in dry season grazing areas. Furthermore, time will be taken to appraise land use pattern that will emerge as well as have some safety valve within which to operate. Tension and conflict can be further checked between farmers and pastoralists if parts of fadama lands at strategic locations are designated grazing refuge for livestock use as well as providing corridors for animals to have easy access to watering points. Such areas should be left untouched during the rainy season so as to allow for regeneration of grasses and legumes for pastoralists' use in the dry season when conflict and social tension is more likely as a result of resource use competition.

National level

Cattle routes must be well demarcated, gazetted and protected from encroachment of any sort. Provision for transhumance corridors within project site should be considered.

Livestock service and animal health centres should be provided for the convenience of herders. Reliable veterinary clinics where herders can buy genuine animal drugs should be established and run on cost recovery basis. Human health clinics are also a necessity for both farmers and herders.

Other social infrastructure such as roads, marketing etc., will enhance productivity of farmers and benefits to be ripped from irrigation agriculture.

International level

Neighbouring nations should form committees to monitor livestock disease movements and provide early warning.

THE ZERO-ALTERNATIVE OF THE IRRIGATION PROJECT

Fadama farming activity is at present very low and restricted to rainy season cropping while the greater part is left fallow for dry season grazing. The greater limiting factors for fadama farming are lack of irrigation facilities remoteness to the marketing and urban centres and the relatively newness of dry season fadama production in this environment. NFDPP plans to remove these bottlenecks.

Without NFDPP, however, the level of fadama farming will presumably remain low as it is now. Consequently, fadama pasture will continue to be the major source of available fodder during the dry season. This, however, does not in any way negate the need to establish fodder banks and significant improvement in the livestock management practices as suggested earlier in this report. Conflicts between the various rural and users over access to and the control of fadama resources will also remain as it is presently.

One of the most immediate impacts of the zero-alternative on the fadama environment will be the preservation of its bio-diversity. As a result, some of the fadama plants, fruits and flowers used for food, medical and household purposes will, under *ceteris paribus* conditions, be better preserved. These naturally occurring fadama products together with the fadama pasture constitute the bio-diversity of the fadama

environment which need to be preserved.

Furthermore, natural soil fertility of the fadama would be left intact as the land is not put under continuous cultivation. The danger of erosion as a result of further opening up fadama land all year round will not be contended with if the NFDP were not to be implemented especially in fragile ecological zones. Chemical fertiliser use which would be necessary to raise and/or maintain nutrients and productivity could increase the incidence of water (surface and/or underground) pollution. This could adversely affect aquatic life which in turn may translate to reduced food and income for communities that depend on fishing for their livelihood. Drinking water sourced from streams and other surface waters would not have a high risk of contamination if the project were not in place. In general, the zero-alternative of the project can be viewed in the light of conserved fadama flora and resources.

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BIBLIOGRAPHY

Arntzen, L. W. (1991). Natural resources and rural agriculture: In balance or imbalance? The example of Botswana's rangelands. ALPAN Network Paper No. 28. International Livestock Centre for Africa, Addis Ababa, Ethiopia.

Craig, P.S. (1982) "The management of a small holder cattle fattening credit in Nigeria". In : Osinowo *et al.* Beef Production in Nigeria: Proceedings of the National Conference on Beef Production in Nigeria, pp. 380-398.

F. A. C. U. (1991). Report on the Environmental Impact Assessment of National Fadama Development Project (NFDP) for the Northern states. Federal Department of Agriculture, Federal Ministry of Agriculture and Natural Resources, pp. 1 - 169.

F.E.P.A. (1991). Guidelines and Standards for Environmental Pollution Control in Nigeria. Federal Environmental Protection Agency, (FEPA), Nigeria.

Gefu, J. O. (1987). "Land Use in Nomadic Pastoralism and the Issue of Sedentarization". In Mortimore, M *et al.*(Eds) *Perspectives on Land Administration and Development in Northern Nigeria*.

Gefu, J. O. (1992). Livestock Credit in Nigeria: A case of the small holder Fattening Scheme, ILCA, Addis Ababa.

Gefu, J. O., H. U. Ahmed, E.O. Otchere and S. A. S. Olorunju (1990). Observations on animal power utilization in the farming systems of Northern Nigeria. In: P. H. Starkey and A. Faye (Eds). *Animal traction for agricultural development*. Technical Centre for Agricultural and Rural Co-operation (CTA). The Netherlands. pp. 382-386.

Gefu, J.O. (1992). Pastoralist Perspectives: The Fulbe of Udubo Grazing Reserve. Research Report No. 89. Scandinavian Institute of African Studies. Uppsala, Sweden. 119pp.

Goldman, C. R, (1976). Lokoja Hydroelectric Project, Environmental Impact Assessment. National Electric Power Authority (NEPA), Lagos, Nigeria.

Hall, P. (1977). *Bull. Nig. Orn. Soc.*, 13 13 (43), 15-42, 66-79.

- Hjort af Ornas, A. (1990). Production versus environment? Planning resource management and ecological adaptation in Kenya drylands. In: M. Bovin and L. Manger (Eds). *Adaptive strategies in African Arid Lands*. Uppsala: Scandinavian Institute of African Studies.
- K. A. D. P. (1992). *Underground water studies in Fadama Areas of former Kwara State, Vol. 1. Final Report* Wardrop Engineering Inc. with Mai Associates Ltd.
- Keay, R. W. I. (1959). *An outline of Nigerian Vegetation*. 3rd edition., Federal Ministry of Information Printing Division, Lagos: pp. 46.
- Kolawole, A. (1991). Economics and management of Fadama in northern Nigeria. Part 3a. In: Scoones, I (ed) *Wetlands in Drylands: agroecology of Savanna Systems in Africa*. Drylands Programme, International Institute for Environment and Development (IIED), London.
- Kolawole, A, M. O. Awogbade and J. P. Voh (eds) (1993). *Sustainable use of fadama in northern Nigeria. Proceedings of the National Policy Workshop (Abstracts) held in Maiduguri*. Centre for Social and Economic Research and International Institute for Environment and Development (IIED), London.
- McCracken, J. A., J. N. Pretty and G. R. Conway (1988). *An introduction to Rapid Rural Appraisal for Agricultural Development*. Sustainable Agriculture Programme. International Institute for Environment and Development (IIED), London.
- Misari, S. M. and Owonubi, J. J. (1990). The implication of large scale irrigation on the incidence of pests and diseases. *Proceedings of a National Workshop on Farmer participation in irrigation development and management, Zaria, May 7-8, 1990*, pp. 157-165.
- Olayide, S. O. (1976). *Economic Survey of Nigeria*. Ibadan, Aromolaran Publishing Company.
- Olayiwole, M. B. *et al.* (1981). "Intensive fattening of indigenous cattle in Nigeria" *World Review of Animal Production*, XVII pp. 70-77.
- Oxby, Clare (1984). "Settlement Schemes for Herders in the sub-humid Tropics of West Africa: Issues of Land Rights and Ethnicity". *Development Policy Reviews* 2 (2): 217-233.
- P.A.D.P. (1988). *Investigation of Shallow Aquifers for Lowland Irrigation in Plateau State. Vol.1. Main Report*. Water Surveys (U.K.) Ltd.
- RIM (1992). *Nigerian Livestock Resources, Vol. II: National Synthesis*, Resources Inventory and Management Ltd.
- Scoones, Ian (1992). *Wetlands in Drylands: Key resources for agricultural and pastoral production in Africa*. Dryland Networks Programme, Issues Paper No. 38. International Institute for Environment and Development (IIED), London.
- Spore, (1993). *By-products link crop and livestock production*. Page 5.
- Steinbach, J. (1996). *Personal Communications*.
- Turner, B. (1977). *The Fadama Lands of Central Northern Nigeria: their classification, spatial variation, present and use*, Unpublished Ph.D. Thesis, University of London.
- Waters-Bayer, A. and Bayer, W. (1992). The role of livestock in rural economy. *Nomadic Peoples*. 31: 3-18.
- WCED (World Commission on Environment and Development) (1987). *Our common future*. Oxford University

Press, London.

Winrock International Institute for Agricultural Development (1992). Assessment of Animal Agriculture in Sub-Saharan Africa. Morrilton, Arkansas.