AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY
Batch 99

1. SUBJECT CLASSIFICATION

A. PRIMARY
Food production and nutrition AL00-0000-G208

B. SECONDARY
Animal production--Mali

2. TITLE AND SUBTITLE
Range management project, Mali; report of findings and recommendations

3. AUTHOR(S)
(100) Carter, M. G.; (101) U.S. Soil Conservation Service

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1966	26p.	ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
AID/AFR/USAID/Mali

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

9. ABSTRACT

10. CONTROL NUMBER
PN-AAG-477

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Livestock
Ranges
Mali
Sahel

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/AFR/USAID/Mali

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

C-354

TO: Mr. Peter K. Daniells
USAID, Bamako, Mali

FROM: Mr. Meril G. Carter, Area Conservationist, Soil Conservation Service, U. S. Department of Agriculture, Austin, Texas

SUBJECT: Report of Findings and Recommendations - Range Management Project, Mali

Observations and Background

In accordance with the assigned mission, I have made a study of present practices and livestock grazing problems in Mali and assessed the feasibility of developing range management projects. People contacted, location maps, notes on vegetation, current grassland research and other information are included in the appendix to this report.

This study is largely of the climatic zone known as the Sahel, having a rainy season confined to a 2 to 4 month period beginning June-July and generally ending in September. Considerable variation was found in the literature concerning average annual rainfall in the Sahelian zone. It appears to range from 150 mm (6") in the area east of Timbuktu at the transition to the Sahara to 700 mm (28") on the West at Nioro du Sahel. Considerable fluctuations in yearly rainfall occur and droughts are mentioned.

Vegetation of the Sahel is a reflection of rainfall and soils, and ranges from a woodland savannah (700 mm to 400 mm rainfall) with tall grasse to an association of mid and tall grasses (400 mm to 150 mm rainfall) with thorny trees and brush, mainly the Acacia types. Elevations are generally in the 250 to 350 meter range above sea level interrupted with a few mountainous areas ascending abruptly several hundred meters above the plains. Topography is moderately rolling to relatively flat, again with the exception of the limited mountainous areas and plateau escarpments. Imperfect drainage patterns occur in a large part of the Sahel and closed depressions are common. Such areas may either be permanent lakes or are temporarily inundated providing important sources of livestock water during varying periods after the rainy season. Both stabilized and active sand dunes appear along the Niger and in the Gourma area on the east. Active sand dunes are most likely caused by removal of protective grass cover from overgrazing.

Soils in the area visited along either side of the Niger particularly in the ancient inland delta of the Niger are typically river and lacustrian deposits of all textural classes with little horizon development. Elsewhere soils are predominately sandy with various but apparently small portions of silt and clay, except in depressions where clay and clay loams exist. Great areas of upland soils are underlain at various depths with iron-like lateritic crusts. These crusts are often exposed and little or no vegetation exists. In the Gourma area exposed crusts cover 15-20% of the surface.

The old lake and river deposited soils appear to be near neutral in reaction. Sandy soils in the higher rainfall areas are said to be acid. No large areas having visible salt problems were encountered.

The Sahelian zone is of major interest to Malian officials since it produces the majority of the cattle, sheep and goats for the interral and export markets. Cattle for meat and hide export is a major resource from which the government expects to increase its foreign exchange earnings critically needed for economic development purposes. Cattle, sheep and goats exist in great numbers in Mali. Consumer goods sufficient to interest the nomadic stockraiser to sell his cattle at current prices are lacking in the present state of the economy. This, coupled with the cost and difficulty of moving animals and meat to market and the inability to meet the price-quality-quantity derands of foreign markets are the prime reasons for the present depressed state of the livestock industry.

Traditionally, the nomadic herdsman counts his wealth in terms of number of head of cattle or other types of livestock. His herd is his walking capital so to speak and represents social prestige. Through the centuries, his herd or the products of his herd, have been used to pay his taxes when inescapable; buy clothes, sugar, tea, other basic foods, tobacco, jewelry, and to meet the expenses of religious holidays, marriage dowries and pilgrimages to Mecca. He is not market motivated and particularly so if the trade of livestock does not satisfy the foregoing needs. Just as important, he actually has few animals to sell since his increase in marketable animals is extremely low. Malian officials are aware of this situation and their plans consider the problems. It remains to be seen if they can resolve them. The major attack is focused on reducing nomadism to a practical mminimum. They propose to do this by providing desirable economic incentive as rapidly as possible, developing year-round livestock water supplies in relatively unused range areas, controlling disease, channeling marketable livestock in controllable corridors of movement to facilitate buying, vaccination, taxation and elimination of non-productive animals.

There is no question that a number of feasible range projects can be devised in Mali. The unanswered question is whether the results of such projects can be extended by the Mali Government to similar areas throughout the Sahelian region. The ability of the Malian Government to provide the economic climate, incentives and transportation facilities necessary to the proper development of the range resources and livestock industry will determine in the final analysis the success or failure of both the industry and any projection of range management schemes.

Feasibility of the present plans for development of the industry and the government's capability to carry them out is beyond the scope of this study. Yet decisions to embark upon AID range management projects should hinge on a determination of probable success or failure. Little would be

gained by underwriting projects having minimum probabilities of extension by the Mali Government once the experience and results have been demonstrated. Furthermore, a judgment of the outcome should largely determine the selection of projects from among the alternatives. For example, if a judgment indicates little chance of success of the government's plans, it may be wise to limit assistance to the education of promising young men in the field of range management, thereby awaiting a better climate for economic development. Should a decision indicate a reasonable chance of economic progress, the alternative of a full-scale project would be in order.

Appraisal of Range Conditions and Herd Management Problems Relating to Grazing in the Vicinity of Existing and Proposed Water Wells and Holes.

Soudanian Zone - No attempt was made to evaluate range conditions in the Soudanian zone of Mali generally considered to be the area having greater than 600-700 mm of rainfall. This zone is the area of sedentary subsistence type farming and raising of livestock for personal use. The better, more fertile soils are farmed regularly by means of hand tool cultivation or limited use of oxen. The less fertile soils are farmed a year or more and then a new area is prepared by fire and grubbing. In the area observed, most cultivatable soils had been or were being farmed with the temporarily vacated areas growing up to brush, trees and grass. Without excessive grazing or fire such areas appear to recover a satisfactory stand of grass in three to ten years. Malian officials having knowledge of this area indicate water erosion is severe on sloping land prior to the time cover is re-established. Grazing of crop residue by goats and cattle is common. The 'N'dama type cattle is the most common breed but mixtures of others including Zebu is evident. Milk is an important food item from these breeds. All livestock is herded but problems arise between farmers and neighboring herders. Soils are evidently low in organic matter. Fire is used continuously as a means to clear new areas, to dispose of crop residues and to promote green growth of grass. Such methods lead to poorly conditioned soils, and weakening of grass vigor and cover for the temporary advantages gained. Tsetse fly occurs in the higher rainfall areas of the Soudanian savannahs. Control of fire and the use of oxen to adequately cope with residues appear to be the best and most practicable methods of improving soil fertility and reducing erosion losses in the Soudan.

Little interest was apparent among the Malian officials for a study of possible projects in the Soudanian zone. Their long range plans envisage an extension type program for improvement of plant varieties, use of legumes, better farming practices and conservation work.

Despite the apparent lack of interest in a range management project in the Soudanian zone, there are ample opportunities for successful projects. These are areas not regularly farmed due to nature of soils or lack

of water. Such areas could be set aside as project areas similar to the present 'forest' reserves. Several of the present forest reserves could be set aside as grazing reserves since the principal use is grazing. A program of Tsetse fly control would be a necessary part of any such projects.

Sahelian Zone - The herding practices of the Sahel have evolved over centuries of time as a response to climate, vegetation, availability of water and the customs of the migrating tribes. Such herding practices recognized no political boundaries unless forced to do so and still do not today. The way of life, known as transhumance, or nomadism, is conditioned quite rigidly by the periodic nature of the rainfall. Rains are confined to a two to four-month period. During this period grass and tree growth begins, depressions fill with water, and the weak wells revive. With feed and water available for his herds, the nomad moves out of the dry season pastures in the 'delta' of the Niger. He often takes herds belonging to sedentary farmers with him on consignment, consideration unknown, and searches for the priceless combination of grass and water. With the drying up of the water holes and shallow wells he again moves back to the Niger bottom areas as soon as the flood waters recede. A few herders eke out a hazardous existence by remaining at the few permanent watering points. Those who remain have herds far in excess of the carrying capacity of the range. Every blade of grass is used or trampled out for a distance of 10-20 kilometers. Trees and brush are cut for browse by the goat herders, leading to further denudation. The normal practice is to graze out to the limit of the animals' range for one 24-hour period or more, and then return for water. At all times livestock are either suffering from hunger or thirst, and often both. It is obvious the greatest disease of animals in Mali is the combination of hunger and thirst. Such conditions weaken the animals and many of them succumb to other diseases or remain in a weakened condition. What weight is gained in the rainy season is largely lost during the dry season. From information supplied by Malians, it apparently takes five to eight years to raise a marketable steer. Furthermore, the calf percentage is about 35%. Thirty percent or more of the calves die during the first dry season. Cows breed at about five years of age and calve about every second year. Obviously, the enormous herds necessary to produce a few marketable animals and provide for high death loss and replacements indicates the difficulty of producing beef and why the nomads have so few animals to sell.

Another aspect of nomadic herding is the concentration of stock in the Niger River zone of intermittent flooding and permanent lakes. As soon as the floods begin to recede, generally in November, the hungry and thirsty herds converge on these treeless grasslands from great distances. Migrating herds of 500,000 head were mentioned in the vicinity of Niono. Even before the soil is dry on the surface or grass growth begins, the herds are ready and waiting. There is no such thing as selecting a proper time to begin grazing to allow the grass to obtain a reasonable growth, and the grass is always in a weakened state due to overgrazing. Thus, the area of greatest grazing potential provides little but subsistence for the herds. Parasite

and disease problems are concentrated in this area. Problems also arise between the sedentary farmer trying to protect his rice crop and the nomadic herder in search of forage.

The foregoing cycle of movements goes on perpetually and any range management projects must take into account part, and preferably all of the cycle and provide for intelligent control based on the needs of the grass and protection of soil resources.

Essential Elements of a Project for Control of Grazing in the Vicinity of Watering Points

The elements of a range management project in the vicinity of watering points anywhere in the Sahelian zone would have essentially the same features. At present the normal grazing range of nomadic herds from water is 15 - 20 km (9 to 12 miles). This great range is achieved by watering the animals once a day or part of a day and then moving out, where forage is available, the next day or even two. A maximum travel distance of 6 to 8 km (4-5 miles) is desirable. The only way to do this is to develop additional watering points and limit the grazing area around a watering point to a maximum of 100 sq. miles in as near square shape as possible. Additional waterings are desirable and would be necessary if elongated areas were to be developed.

Since development of water is going to be a major cost, the possibility of developing a four-unit management area should be explored in each case. One type of project would cover a selected area of the Niger bottomlands along with adjacent areas of upland. Permanent water may already be available in the form of lakes and oxbows in the bottomland. Grazing unit number 1 in a four-unit grazing system would be the Niger bottom area and would be grazed for three months or more during the worst of the dry season (April-May-June). The stock would then be shifted to unit number 2 (upland) which could have natural depressions holding water in the wet season (July-August-September). Unit number 3 would then be grazed (October-November-December) and would need water development sufficient to last 6 months or more. Unit number 4 would require a permanent water supply since it would be used 6-9 months after the rainy season in January-February-March.

In my estimation, dugout type ponds would be the least costly type of water development. Their size will probably vary from 5,000 to 15,000 cubic yards depending on amount of water needed, evaporation, etc. Such ponds would be useless if herd numbers were not controlled since they would be drunk dry or destroyed by nomadic herds. Wells could also be used providing they have sufficient yield and above ground storage sufficient to water the entire herd in a few hours. In this respect the German plan for well development in the Gourma area would be expected to provide permanent water.

A second type of project would be one confined entirely to an upland area. Here the grazing unit areas would be more or less of the same size since forage production capacity of the range sites would be similar. The needed water developments would again vary in their degree of permanence with permanent water needed in the grazing unit scheduled for grazing in the dry season.

Admittedly the above plans have weaknesses since the same area would be grazed the same time each year. However, considering costs, it appears the most practicable scheme at this time.

After the project areas are selected the carrying capacity is determined by a trained range conservationist by first delineating the various range sites. Sites are merely areas of similar soils, vegetation, productive capacity and management needs. After the sites are determined he estimates the range condition of the sites and classifies them in terms of poor, fair, good and excellent based on how near the vegetative composition is to its climax or original state. For example, poor condition would have only 25 percent or less of the better, more productive grasses remaining on the site. Fair condition would have between 25 and 50 percent of the better grasses, etc. Using the condition classes, the acreages involved in each site, the rainfall belt and his knowledge of forage production capacity, a table of carrying capacity is arrived at. A sample of such a table follows:

Range Site	Hectares per Animal Unit by Condition Class - Rainfall 300 mm				
	Poor	Fair	Good	Excellent	KEY PLANT
Deep dune-like sands	22	17	14	12	Panicum turgidum
Sandy Loam	26	21	17	14	Cenchrus biflorus
Clay Loam	30	23	16	12	Andropogon gayanus

From the table a carrying capacity for the grazing units can be determined. The grazing plan would then restrict the number of animals, by permit to the determined amount. As a means of checking the degree of grazing use, one or more 'key' species are selected for observation. Key plants are those in abundance that produce the major part of the forage grazed by livestock. Using key plants to estimate the grazing use simplifies the complex problem of determining use on the entire vegetative composition.

If key plants are properly grazed (usually half of the annual growth by weight) the range manager can be assured the range is being properly used and needed improvement is taking place. Adjustments in stocking rates are in order as the degree of use of the key plants is seen to be too much or too little or if droughts occur.

The job of determining carrying capacity and making adjustments as experience dictates, followed up by absolute control of herd numbers and season of use of the grazing units is crucial to the success of a management plan. Certain other features should also be incorporated in the plan; among these are the need to stop the practice of watering herds one day and grazing the next. In effect this causes a double grazing load since one herd is always being watered and another being grazed to the detriment of the animals and the range. Mineralized salt should be used to supply minerals and to get better grazing distribution by locating it in underused areas. Disease control should be built into the plan since herds will be readily available for

inspection and vaccinations. Fire education and control will be necessary. Old and weakened animals should be rigorously culled, and also cows that are not consistent producers of calves. Inferior bulls will also need to be eliminated.

Since Mali has an apparent surplus of cotton seed meal, grain sorghum and millet, supplemental feeding of nursing cows should be initiated, particularly in the dry season. On the hoof drives of marketable animals should be avoided, particularly in the hot and dry seasons. Shrinkage on such drives may reach 25 percent.

An association of Malian counterparts, tribe leaders and Malian project employees would be necessary to discuss operating rules and procedures, set fees, disseminate animal husbandry information, make recommendations and settle disputes.

Organizational Requirements of a Range Management Project

Mali has the plan of a central government with elected representatives from one political party. The country is then divided into six regions, each headed up by a Governor appointed by the President. The Regions are further subdivided into Cercles headed by a Commandant du Cercle. Cercles are divided into Arrondissements headed by a Chef d'Arrondissement. As nearly as I can tell, police powers are normally carried and confined to each of the administrative levels. All land is under the control of the government with individuals, families and tribes using the land as a hereditary custom.

Under the cabinet position of Minister of Development are located the various services concerned with land, livestock and rural developments.

As presently organized there will be, apparently, three services involved in any range management project. The animal husbandry service (Service de L'Elevage) is in charge of all livestock activities including veterinary, disease control, experimental farms and ranches (livestock oriented) and is the organization which has the greatest interest in range projects. The water and forest service (Eaux et Forêts) administers all forest reserves and makes inspection of all areas and carries out studies including those in range areas. The hydrologic service (Service Hydrologique) is responsible for water developments in range and forest areas, among other duties. A Cartographic Service is also involved in the field of gazetting.

There is apparently no provision under present laws for setting up grazing reserves similar to that of forest reserves. It is recommended that such a law be suggested or the present law modified to provide for the concept of multiple use as they become pertinent, but mainly to focus attention on grazing land use, which next to farming, is the most important land use in Mali.

As repeated several times, control of herd numbers is necessary to any project a nd therefore it is recommended that this feature be fully explored and positive means of enforcement assured before any project is initiated. It may be possible to deputize Veterinary Officers or any suitable counterparts to AID range men autherizing them to issue grazing permits and enforce grazing regulations, otherwise normal administrative police powers should be used.

The personnel organization of a project similar to those described above would involve the services of an AID range conservationist with a Malian counterpart who would have the authority to carry out all aspects of the project on the Malian side. Additional Malians would be needed to supervise movement of livestock in grazing units, issue permits (confirmed by ear tags), develop water supplies and to work with herdsmen and their leaders on all aspects of grazing control, animal husbandry, fire control and use of watering points.

Conclusions and Recommendations

One or more range management projects are technically feasible in Mali. They may also be administratively and organizationally feasible provided the Government of Mali demonstrates its capacity to organize a suitable operating structure with powers to act, provide sufficient personnel and finances, and setup workable enforcement and control provisions. In this connection the animal husbandry service (Service de l'Elevage) under Dr. Ibrahima Konaté appears to be the best organized, motivated and equipped to carry out such projects.

In my estimation, the plan developed by Mr. Damien, Agriculture Adviser to the Governor of the Gao Region, is the most far reaching range development plan encountered during this study. This plan, described elsewhere in this report, provides for development of relatively unused range land in the Gourma area by the development of watering points, development of veterinary stations, concentration of movement of nomad herds and market corridors. From the standpoint of protection of the range resource, the weaknesses of the plan are the far too optimistic estimation of carrying capacity, and in some cases the distances between watering points which would have the effect of serious overgrazing in the vicinity of water. A certain lack of definite plans for control and enforcement of herd numbers was apparent.

Despite these weaknesses, a map study of the proposed wells and existing water locations shows an area having sufficient watering points to develop a range management project.

The following projects are considered feasible:

1. The Niono farm and ranch located near Niono 109 kilometers north of Segou, can be developed as a combination range management project coupled with irrigated pastures on the farm for finishing. The ranch is 8 x 14 km in size, approximately 45 sq. miles, average rainfall 400 mm (16"). The ranch is watered by a canal which would have to be deepened in places for permanent water. As much as 650 hectares (1625 acres) of irrigated pasture can be developed on the farm. Irrigation water is available from the Office du Niger and many of the canals and control gates are already installed.

   Estimating it would take about 25 acres to support an animal unit, the ranch could run about 1200 head of cattle.

   The essential future of the plan would be to divide the ranch into grazing units of approximately equal size by constructing fire lanes which would serve as unit boundaries since all cattle would be herded. The stock would be grazed in unit A during April-May-June, unit B in July-August-September, and unit C in October-November-December and unit D in January-February-March.

   The animals destined for market would move to the irrigated farm in the dry season for finishing and supplemental feeding. As the permanent pastures are developed on the farm, a plan would be worked out to graze most of the ranch herd, or at least the nursing cows, on the irrigated farm during the worst of the dry season (April-May-June). During the other seasons hay or silage could be put up for use of the dairy herd now on the farm or for supplemental feeding.

   Commodity assistance needed would be irrigated pasture seed, ear tags, mineralized salt and nitrogenous fertilizer to aid in establishing pasture. Technical assistance would be needed in developing and operating the irrigated pastures with attention to proper irrigation water use. Many U.S. range conservationists have sufficient experience to carry out the pasture and irrigation development work as well as the ranch project.

   Assistance would also be necessary to furnish tractors and seeders for the farm and heavy equipment for water development on the ranch.

2. A range project incorporating a portion of the Niger River bottom along with a contiguous upland area is feasible. The essential feature of this project would be to demonstrate the feasibility of dry season grazing (April-May-June) in the Niger bottoms having a high grazing potential, and upland grazing at other times of the year. Again a four unit deferred rotational scheme would be used.

   A study of the German plan for the Gourma indicates the wells, combined with temporary watering points in the rainy season would provide a suitable project area. This area would have 7 permanent wells spaced

inland from the Niger and grouped so that travel distance would not be excessive. The well location points are known as Tin Enerin, Toufebet, Tin Echab, Tin Aba, Tin Dacua, Tin Tafara and Tin Ounan shown on the Tombouctou-Est map 1:200,000, Republique du Mali, Feuille NE-30-IV. The area would cover approximately 2,000 square miles or a smaller area could be selected encompassing fewer wells. This project would be the most difficult of all due to size, remoteness, lack of roads and facilities. Control of herd numbers and movement of nomadic herds would be most difficult since the area is a natural route of livestock movement to rainy season pasture. It would, however, fit in with the long range plans of the Mali government.

3. The Djebok ranch - 40 km east of Gao. In my estimation there are numerous depressions on this ranch where dugout type ponds could be constructed. There is a large resident herd at all times on this ranch. The ranch is approximately 162,500 acres in size or 254 square miles. Rainfall is about 200 mm (8"). Carrying capacity would be low for a while until presently overgrazed areas improve. Possibly 50 acres to an animal unit would be a trial stocking rate. At this rate something like 1,000 cows or equivalent could be grazed.

The Veterinary Service is developing a vaccination station at the main well on this ranch. Again, a four unit pasture system is recommended since water development costs will be high. The grazing units will need to be marked with fire lanes. An adequate road exists to the ranch.

4. A somewhat different project could be developed at the Tasseguela well on the road between Doro and Gossi, west of Gao. Here assistance would take the form of reworking the well from windmill operated to gasoline motor power. Ample storage tanks and drinking troughs are already in place. The changeover is recommended because there is very little wind movement in the dry season and the mill is no longer operative. The Malians plan to develop a vaccination station here and a full-time operator could maintain the pump motor.

It may be possible to work out a management project based strictly on the carrying capacity of the range within a half day's walking distance from the well (3-4 miles). The season or seasons of use should be during the time of stock movements since the well is in the 'corridor' mentioned in the Gourma plan for moving stock to the Gao abattoir. The water surface in the well is 70 meters, operated by one of the largest type American windmills made. Therefore, a gasoline motor of equivalent power and capacity (10 cubic meters per hour) would be needed.

5. While apparently of little interest to the Malians, many good projects could be developed in the Soudanian zone of Mali. The management principles would be the same as in the other projects. The Faya forest reserve 50 km east of Bamako, could be readily developed as a project.

Cooperation with the Forest Service (Eaux et Forets) would be necessary. Other forest reserves are scattered throughout Mali and may represent some of the best opportunities because they are already reserved land.

The principle and results demonstrated from any of the foregoing projects can be projected to similar areas in Mali. Such projections should be a high priority for the Mali government.

An additional project is also feasible and should receive serious and priority consideration. As near as I could learn there is not a single professionally trained range science specialist in Mali. One or more high potential Malians should be selected for full college training leading to bachelors or masters degrees in range management. These should be supplemented with U.S. training for range technicians for periods of one to two years combining both scholastic and actual work experience, particularly in the southwest United States.

Purpose and Objectives of Range Management Demonstrations

1. Create interest and demonstrate feasibility to Malian officials and herdsmen of a project that would be expected to protect or improve the range resource by controlling the time, degree and intensity of grazing.

2. Provide for the training of selected Malians both academically and on-the-job so that they are competent to plan, organize and follow through on future range management projects.

3. Provide a practical demonstration of the effects of sound range management on livestock nutrition, improvement in calving percentage, earlier maturity and breeding, better quality carcass and reduction of death loss.

4. Demonstrate that proper range management coupled with good animal husbandry and veterinary practice can produce a sustained yield of acceptable quality marketable beef over a long period of time and at the same time improve or maintain the range and soil resources.

5. Provide an area or areas available for training of Malian officials and leaders in the practical application of both range and livestock management.

6. Set a pattern of range and livestock management that can be followed in similar areas of Mali.

Probable Sequence of Development of a Project

1. Malian administrative and technical officials together with the concerned chiefs and leaders of the herdsmen should agree on the location, size and purpose of the project, the plan for water development and system and time of grazing. It is crucial at this point to gain positive agreement among all parties concerned on the requirements for control of numbers of livestock, issuance of grazing permits confirmed by ear tags, manner of enforcement and means of settling disputes.

2. Develop formal plan and project agreement with appropriate signatures.

3. Prospect, locate and develop surface water supplies based on number of head of livestock, size of grazing units and distance to water.

4. Construct wells if surface water cannot be developed.

5. Construct roads and boundaries of the grazing units within the project. Such roads and boundaries, constructed by bulldozer and/or maintainers will also serve as fire breaks.

6. Establish headquarters site for storage of materials and equipment, personnel accommodation, office space and veterinary facilities as needed.

7. Issue grazing permits and commence grazing plan.

8. Maintenance of water developments, roads and boundary lanes, and initiate organized fire control.

9. Establish mineralized salt feeding particularly to supply trace elements, especially iodine.

10. Establish supplemental feeding in dry season for nursing cows.

11. Provide for trucking of market animals to abattoirs if possible and on the hoof if necessary.

12. Maintain cooperative technical and administrative relations with herdsmen and their chiefs and make adjustments in numbers or season of use as the condition of the range indicates. This will also be a means to disseminate animal husbandry information involving vaccination, sanitation, salting, supplemental feeding, selling animals at appropriate age, eliminating non-productive stock and establishing reasonable cow-bull ratios.

In summary, the only feasible way to develop the beef industry in Mali is to reduce widespread hunger and thirst, increase calf percentages, assure breeding at earlier ages, reduce death losses and reduce the age class of the marketable animals by proper nutrition.

Improvement of any of these aspects of livestock production will have an immediate and large effect on the cost of production and the numbers, quality and weight of marketable animals. It is conceivable that a marketable animal can be developed in three years weighing 700-750 pounds instead of in 5 to 8 years weighing 500 pounds, calf percentage increased to 50% or more from 35%, breeding age reduced from the present 4 or 5 years to 3 years, and death losses drastically cut. A range management project can be expected to demonstrate such improvements to be obtainable and practical.

Without the generous assistance and kindness of Dr. Ibrahima Konate my mission would have been most difficult, if not impossible. To him and to Yves Arcelin, I owe a debt of gratitude.

In closing, I would like to extend my most sincere thanks to all those of the United States Mission to Mali who aided me in so many ways, even to sharing their food. Particularly would I like to thank Peter K. Daniells and Arthur Milot. Any success of the mission is due in large part to the efficient assistance of R. H. Ellert-Beck, who as my guide, interpreter and friend made all things possible.

APPENDIX

People contacted:

Ambassador C. Robert Moore, Bamako, Mali
Mr. Oliver S. Crosby, Deputy Chief of Mission, Bamako, Mali
Mr. Charles Steedman, Economic Section, Bamako, Mali
Mr. James T. McGloin, CAMO Administrative Section, Bamako, Mali
Mr. Peter K. Daniells, AID Affairs Officer, Bamako, Mali
Mr. Arthur Milot, USAID Controller, Bamako, Mali
Mr. Rodolphe Ellert-Beck, USAID Program Office, Bamako, Mali
Mr. Allison S. Davis, USAID Program Office, Bamako, Mali

Dr. Salif Sidibe, Director of Cabinet, Ministry of Development, Bamako
Dr. Ibrahima Konate, Service de l'Elevage, Bamako
Dr. D. Sylla, Veterinary Laboratory, Bamako
M. Jean Keita, Director, Water and Forest Service, Bamako
M. Mamadou Traore, Asst. Director, Water and Forest Service, Bamako
M. Yves Arcelin, Agronomist, Sotuba Station, Bamako
Dr. Wanis Semerdjian, United Nations, Bamako
M. M. V. Poisson, United Nations, Bamako
Dr. M. Bourdic, United Nations, Bamako
Dr. Zangua Coulibaly, Rural Economic Institute, Bamako and Niono
Dr. Hans Walter, Engineer, Germany and Bamako
Dr. Peter Bensch, German Embassy, Bamako
M. Thiry, Engineer, Office du Niger Segou
M. Diadure, Animal Husbandry Service, Niono
M. Garba Toure, Chef de Cabinet, Segou
M. Mamadou Gologo, Minister of Information
Dr. N'Golo Traore, Director, Sahel Farm, Niono
M. Kone, Production Manager, Office du Niger, Niono
M. Bernard Du Breuil, Agronomist, French Assistance Program, Niono
M. De Plaen, Soil Scientist, Segou
M. Bertin, French Assistance Program, Bamako
Dr. Gakou, Chief Veterinary, Bamako
Mr. and Mrs. Daniel Zimmerman, Baptist Mission, Gao
M. Fofana, Veterinary Service, Mopti
M. Maiga Abdoulaye, Vet. Coordinator, Gao
M. Pierre Damien, Agriculture Advisor to Governor, Gao
M. Maiga Almouzar, Director of Abattoir, Gao
M. Nouhoum Kassembara, Regional Governor, Gao
M. Carl Macher, Inspector of Forests, Gao
M. A. Bocoum, Chef d'Arrondissement, Gossi

APPENDIX

Itinerary

The first week was spent in interviews with AID, U. S. Embassy, United Nations, foreign government and Malian officials and technicians. These interviews supplied the technical, social and economic background necessary for an understanding of problems and a reas of project interest and feasibility. Short trips were made in the Bamako vicinity to visit the abattoir, Sotuba Experimental Station, Samanko Experimental and Training Farm, Vaccine Laboratory, and local livestock yards. Without exception, all persons interviewed were extremely helpful. Their kindness and courtesy were very much appreciated.

The second week was spent in the field visiting the Faya forest reserve, Ségou, Markala, Office du Niger irrigated areas and the experimental farm and ranch at Niono. This trip gave a view of both the Soudan region of the mixed savannah woodlands and farming areas and the range areas located in the Sahel near Niono.

The third week was an extensive air and truck trip through and over a large part of the Niger 'delta', Mopti, the Gourma range areas, and the proposed experimental ranch in the vicinity of Djebok, east of Gao. Watering points and the range areas of Lac Gossi, Doro and Tasseguela, west of Gao, were covered by landrover.

Several days were spent in Nigeria with AID officials to review the work being done in range management in that area. Unfortunately, political unrest, pillage and rioting denied an opportunity for a visit to going projects. Despite this, much helpful information was gained from Frank Abercrombie at Kaduna.

Notes on Observations Made by Air in the Gourma Area

The trip by air covered the Gao, Bamba, Gourma-Rharous, Gossi vicinities. Only remnants of grass are evident for a distance of 10-15 km from the Niger River and from all permanent watering points. Wind erosion has blown sand into hummocks along the Niger. 15 to 20% of the Gourma area is composed of dark lateritic crusts without grass. Coarse sands in stabilized formations appear to have abundance of tall, climax grasses away from water. Range sites vary from a majority of deep sands and sandy loams to clay and silty clay depressions and intermittent stream courses. Numerous depressions occur, apparently with water in rainy season. The coarser sands appear to be most productive, probably due to favorable water relationships.

One concrete dugout, one embankment type pond, one windmill and well, were evident from the air. All appeared dry and unused at the time. Mr. Maiga Abdoulaye, Veterinary Coordinator at Gao, and a representative of the national government Yves Arcelin, and R. H. Ellert-Beck accompanied me on the plane trip. Mr. Abdoulaye has intimate knowledge of the area.

I believe ponds can be developed by proper selection of site and soil type. If control of numbers cannot be achieved there is little point in developing additional water anywhere in the Gourma or Saheïlian area since the grass resource would be quickly destroyed.

Notes on Trip by Landrover to Doro, Tasseguela and Gossi in the Gourma Area

All grass is overgrazed or non-existent for 5 km from the Niger. Extensive area of coarse sands along river and extending inland for 15-25 km appears highly productive. Thorny brush and trees mainly Acacias associated with all range sites except the dune-like sands. Most Acacias lose leaves in dry season. Extensive areas of thin sandy soils, occasionally gravelly, underlain by a crystalline quartz-like rock said to be schists. Such areas seem to be less productive than the deeper sands and are predominantly occupied by a stand of medium height Chloris and Aristadas with colonies of taller grasses such as Cenchrus biflorus on more favorable soils.

Entire area as far as Doro, a distance of 100 kms, is reported without underground water. Occasional depressions inundated in rainy season. The hand-dug wells in the Doro depression obtain water at 15-25 feet and water is hauled up by hand in leather sacks. Enormous herds of cattle, sheep, goats, camels and donkeys waiting to be watered at these wells. No vegetation except trees in the vicinity. A nomadic chief indicated that 10,000 head of cattle watered at the wells. Many cattle weak and thin. All age classes of cows (Zebu type mainly) and scrub bulls. Females are apparently never sold for market and are used entirely for replacements.

The Tasseguela well is windmill operated, constructed in 1961, and has a capacity of 103 meters per hour with a water level of 70 meters. Apparently the leather washers wore out 3 or 4 years ago and were not replaced. The mill was never shut off and apparently the gears are now stripped. This is a good well. The Malians want to install a gasoline motor pumping unit. The nomads recognize that water from wells is free of disease, unlike the surface waters in the Niger pastures.

Mr. Darien stated that the area around the windmill had been denuded while it was in operation. In the three or four years of rest since then, the area has recovered a fair to good cover of grasses. This observation plus others indicates the predominately sandy soils have a rather rapid vegetative recovery rate even with high temperature and low rainfall. This is probably due to the favorable soil-moisture relationships, viable seed in the soil and rainfall concentration in a period sufficient to germinate and establish seed.

The Lac Gossi is a long, narrow permanent lake of varying widths. The sedentary herd staying through the dry season lined the banks for as far as the eye could see. Overgrazed Paspalums occupy temporarily flooded shore lines and Echinochloa above high water. Inland no grass is visible on the ground.

The Chef d'Arrondissement at Gossi says there are 50 - 70,000 cattle, 100 - 140,000 goats and sheep plus some camels and donkeys in the Gossi arrondissement. Apparently this is the sedentary herd which is supplemented by great herds in the rainy season. A group discussion was held on the feasibility of setting up simple deferment systems by dividing the corridor for market-bound stock from Gossi-Tasseguela-Doro to Gao by using the road as a boundary between the north and south areas. There was not much enthusiasm due to the difficulty of controlling nomad herds but agreement was reached that any system of deferment for grass protection and growth would have to be as simple as possible because fencing is not feasible. It was suggested that stock movements be confined to as narrow a corridor as possible to prevent trampling over a wide area, that stock waiting to be watered be confined as near to the wells as possible, again to prevent trampling, and that when moving out to graze the herds move for several kilometers before being permitted to graze. Also suggested, where movements of stock are difficult to control, that watering points be closed by enforcement if necessary when the grass has been grazed to a reasonable height. It was apparent that considerable thought was given to this proposal with political problems foremost in mind.

The German Plan for Well Development in the Gourma

A German engineering firm has made a large scale study of the geology and feasibility of developing livestock water wells in the Gourma area. The detailed report of the German study is on file at USAID Bamako. With the exception of the northeastern 1/3 of the Gourma area, underground water is available for development. The plan as finally agreed upon by the Malian and West German governments would be partly financed by Germany (15%) and partly by a loan to Mali (85%). Twenty-four dug wells with watering troughs would be constructed with all water to be hoisted by the primitive means of camel or manpower using a pulley mounted in the fork of a tree branch. This feature was insisted upon by the Malians because of their experience with the many windmills and mechanical hoists now inoperative due to lack of maintenance and technical know-how.

The cost of well development is 461,000,000 Malian francs, approximately $1,840,000 or $76,600 per well. There are presently six permanent watering points in the Gourma and 144 of temporary nature. Temporary waterings are mainly natural depressions, intermittent lakes, pot holes in stream courses and hand dug wells retaining water in the rainy season, and rarely more than 1 - 4 months after.

Notes on Conference Held at Gao May 19, 1966

In attendance:

Mr. H. Macher, Inspector of Forests - Gao
Mr. Pierre Damien, Agriculture Advisor to Governor - Gao
Mr. Maiga Almouzar, Abattoir Director - Gao
Mr. Maiga Abdoulaye, Veterinary Coordinator - Gao
Mr. Yves Arcelin, Agronomist - Sotuba
Mr. R. H. Ellert-Beck, USAID/Bamako
Dr. Curtis Williams, Veterinarian, USAID/Bamako
Mr. Meril G. Carter, USDA, Austin, Texas

The conference was called to review the plans developed for the Region of Gao covering range water development, range use, areas of stock movement and development of a corridor for movement of livestock to market. Mr. Damien reviewed the study made by Mr. Macher on the broad range sites, their carrying capacity and estimations of additional areas that could be used by development of water. Also reviewed was the action necessary to put the plan into effect.

Mr. Macher divides the range areas of Gourma as follows:

1. Good pasture - sandy soils with some clay - having 85-87% vegetative cover composed of 70% grasses and 30% browse. Rainfall average of 260 mm. Plots were used to determine dry weight yield cut at ground level. Apparently the browse yield was determined by cutting palatable twigs and leaves. The plots yielded the equivalent of 1000 kg/hectare (dry weight basis). Using this figure and dividing by a forage unit developed by the French, a carrying capacity of 6 hectares per animal unit was determined. It must be pointed out that all of the forage yield was used to determine carrying capacity, on the premise that that was the way the herds would use it. This, of course, leaves nothing for protection of the soil from wind and water erosion, return of organic matter for fertility and ignores the growth needs of the plant. Based on extrapolated information from similar rainfall areas and soils in Texas, Mr. Macher's carrying capacity figures agreed with mine if the number of hectares per animal unit were doubled. The principle of leaving 1/2 the annual forage growth by weight for soil protection and growth needs of the grass was discussed at some length in this and subsequent conferences. I believe this concept was accepted by the group.

   An animal unit as developed by the French is 1 cow (200 kg) = 10 sheep = 12 goats = 1 horse = 6 donkeys.

2. Mediocre pasture - sandy with some clay, having 65% vegetative cover and the remainder lateritic crust on slopes averaging 15%. Vegetation is composed of 65% grasses and 35% browse. Total forage yield 600 kg/hectare converted to a carrying capacity of 10 ha/A.U.

3. Poor pasture - 25% vegetative cover on 12 to 25 degree slopes with severe wind and water erosion. Vegetation cover is 90% Cenchrus biflorus, 5% Aristada and 5% Panicum Turgidum. Forage yield is 350 kg/hectare converted to a carrying capacity of 18-19 ha/A.U.

4. Non-useable pasture - due to lack of water. No carrying capacity.

Mr. Macher said his studies were preliminary, not duplicated, and a plus or minus 20% margin of error is possible. My estimation of the study is that it is sound with the one exception of using total forage yield to determine carrying capacity. No doubt greater refinements in determining range sites and rainfall belts can readily be developed by a trained range conservationist. The group was in agreement that the study was a point of departure on which to plan but that adjustments would need to be made as on-the-ground results dictated.

The Region of Gao covers 70 million hectares, of which 46 million may ultimately be developed for range use. Practically at the moment 16,600,000 hectares are useable with an additional 8,700,000 hectares that can either be reclaimed by proper range use or by developing water, for a total of 25,300,000 hectares. The total carrying capacity, using Mr. Macher's figures, is 1,400,000 animal units. By developing the 8,700,000 hectares now unuseable, or in poor condition, an additional 200,000 animal units could be carried.

Proposed Plan of Action to Develop Range Resources in the Gao Region

1. Improve poor condition pasture by limiting carrying capacity.

2. Increase number of cattle by feeding in confined area. (This plan was not clear to me.)

(The above measures would eventually develop a carrying capacity of 1,700,000 animal units. It is proposed the plan be developed during the period 1966-70.)

3. Develop wells in the Gourma so that controlled grazing can be progressively developed. The administrative census of animal units in the Gao region is now 620,000. Estimations based on vaccinations and veterinary observations indicate there are actually 2,200,000 A.U.s. This amount is already in excess of the estimated carrying capacity of 1,400,000 by 500,000 A.U.s.

4. Regulations will be proposed for range protection including carrying capacity, protection of trees and shrubs from cutting for browse, fire protection, etc.

5. After regulations are passed enforcement will take place.

6. The entire plan hinges on the development of 24 wells (called the German Plan) in the Gourma area, followed by control of herd numbers and their movements. The market corridor from Gossi to Tasseguela to Goro to Gao for animals destined for the Gao Abattoir must also be developed. Due to distance (100 km) the cattle will have to be trucked from Goro to the Gao abattoir to prevent death and weight loss.

7. The well at Tasseguela will be re-developed using a gasoline motor rather than the windmill, and a vaccination station will be set up. The map of stock movements concentration areas and the market corridor is included in this report. The plan not only controls grazing and movement but it will also provide an adequate census and taxation point, facilitate disease control and assist the movement of stock to the abattoir. Illegal crossing of the border will also be prevented.

The plan further envisages range seeding with native grasses preferred and development of forage reserves.

On Saturday, May 4, 1966, a conference was held with the Governor of the Gao Region, Mr. Kassambara. The results of the tours were reviewed with the group and the foregoing plan discussed. He is apparently in full accord with the plan. I spent considerable time discussing the absolute necessity of controlling stock numbers before any range development plan could be a success and that the carrying capacity estimate should be cut in half to allow for soil protection, reduce loss of rainfall by run-off and evaporation, and to promote grass vigor.

The Governor is seriously concerned about the depredations of goat herders and said he would like to reduce the number of goats in relation to the number of cattle.

In conclusion I asked the Governor what measures or projects he considered most needed and feasible. In priority he stated, the development of the 24 wells in the Gourma area first, then the development of the Tasseguela well and station. He also indicated he would very much like to have assistance to educate young men in the United States in range science. I explained that I would make my report and recommendations to USAID and that discussions on any U.S. assistance would be made by that organization.

Current Grassland Research

At present, current grassland research is concentrated at the Sotuba Station, near Bamako, under the capable direction of Yves Arcelin, Agronomist. Plot trials of up to one hectare in size, covering propagation, production and forage value of both natural and exotic tame pasture and range grasses and a few legumes are being carried out. Rotation grazing of a Digitaria pasture is also underway. Research on fertilizer response is also being initiated. Andropogon gayanus, Pennisetum ciliare and Panicum maxima seem to be outstanding on the Sotuba Station.

Actual research in range management, carrying capacity and the like is still in the planning stage. These activities will be concentrated at the Niono ranch and farm and at the Djebok ranch east of Gao.

At the farm and ranch at Niono Dr. Konate hopes to initiate a research project using the ranch and farm in combination. At present, a few small plots of grasses have been planted on the farm for observation. Other work is being carried out in connection with breeding, selection, milk production, feeding of cattle, and crop varieties.

Other than the veterinary station at the Djebok ranch, no research has yet been undertaken.

The nearest approach to actual range research is that carried out by Mr. Macher in the Gourma area, described elsewhere in this report.

I am fully in accord with Dr. Konate that range research is important and should be supplemented with actual demonstration. A USAID range conservationist could be of much help in suggesting appropriate research.

Personnel and Equipment Needs

A number of factors will need to be considered in staffing and supplying personnel for a range management project in Mali. It is 213 miles to the experimental farm at Niono. The road between Markala and Niono is probably impassable during the rainy season. The distance to Gao is 748 miles, of which 300 miles is largely a track with few watering points. Due to the distances and difficulty of travel a project in the Sahelian area would require the full time assistance of a range conservationist. A project at the Niono ranch and farm would require at least half the time of a range conservationist. Supply of gasoline, spare parts and food will be difficult. To be most useful, AID assistance should be stationed in or near any project sites. Men selected will need to be self-reliant and willing to live away from most comforts. Temperatures are high and health facilities are nearly non-existent. It would be especially difficult for wives and young children, and perhaps a single man could best adapt to the conditions.

APPENDIX

Transportation should be a 4 x 4 - 3/4 ton P.U. with a self-contained camper mounted on it with extra tires and wheels, gas tanks, water tanks, complete supply of usual tools. Some provision should be made for a refrigerator in the camper. A command of French is necessary, and even then an interpreter will be needed with various tribes and herdsmen.

APPENDIX

Plants Found in Rangeland

Andropogon gayanus

Pennisetum pedicellatum

Panicum spp. (resembling blue panic)

Cenchrus Biflorus

Panicum turgidum

Pennisetum spp. (similar to buffelgrass)

Aristada adscensionis

Pennisetum violaceum

Aristada papposa

Latipes senegalensis

Balanites aegyptiaca

Cyperus esculentus

Eragrostis tremula

Tribulus terrestris

Chloris Prieurii

Combretum glutinosa

Aristada spp.

Acacia flava

Acacia raddiana

Acacia stenocarpa

Acacia Senegal

Cymbogon spp.

Chloris spp.

Combretum incanthum

Crotalaria retusa

Bauhinia rufescens

Ziziphus juba

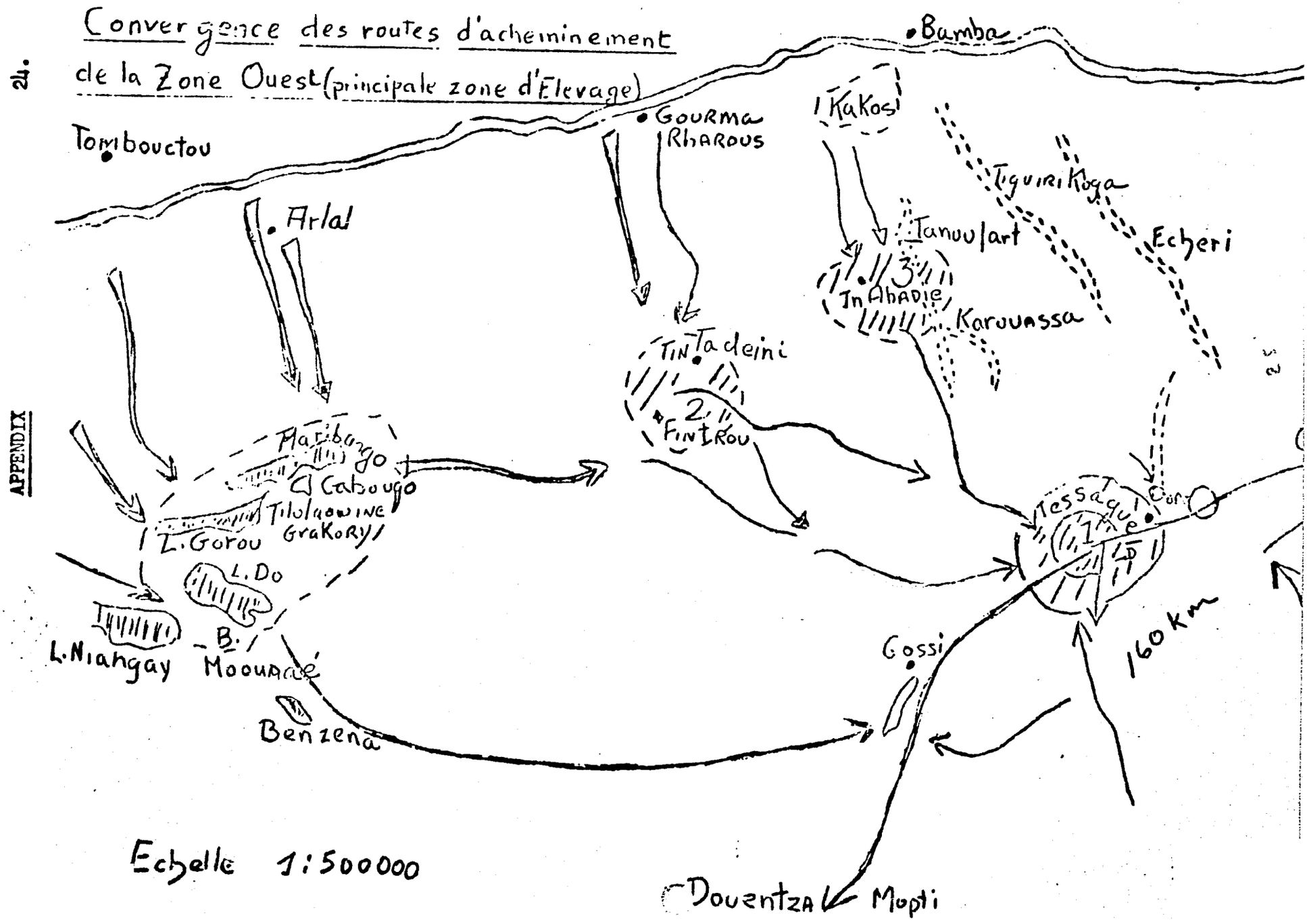
Leptidenia spartium

Oryza berthii

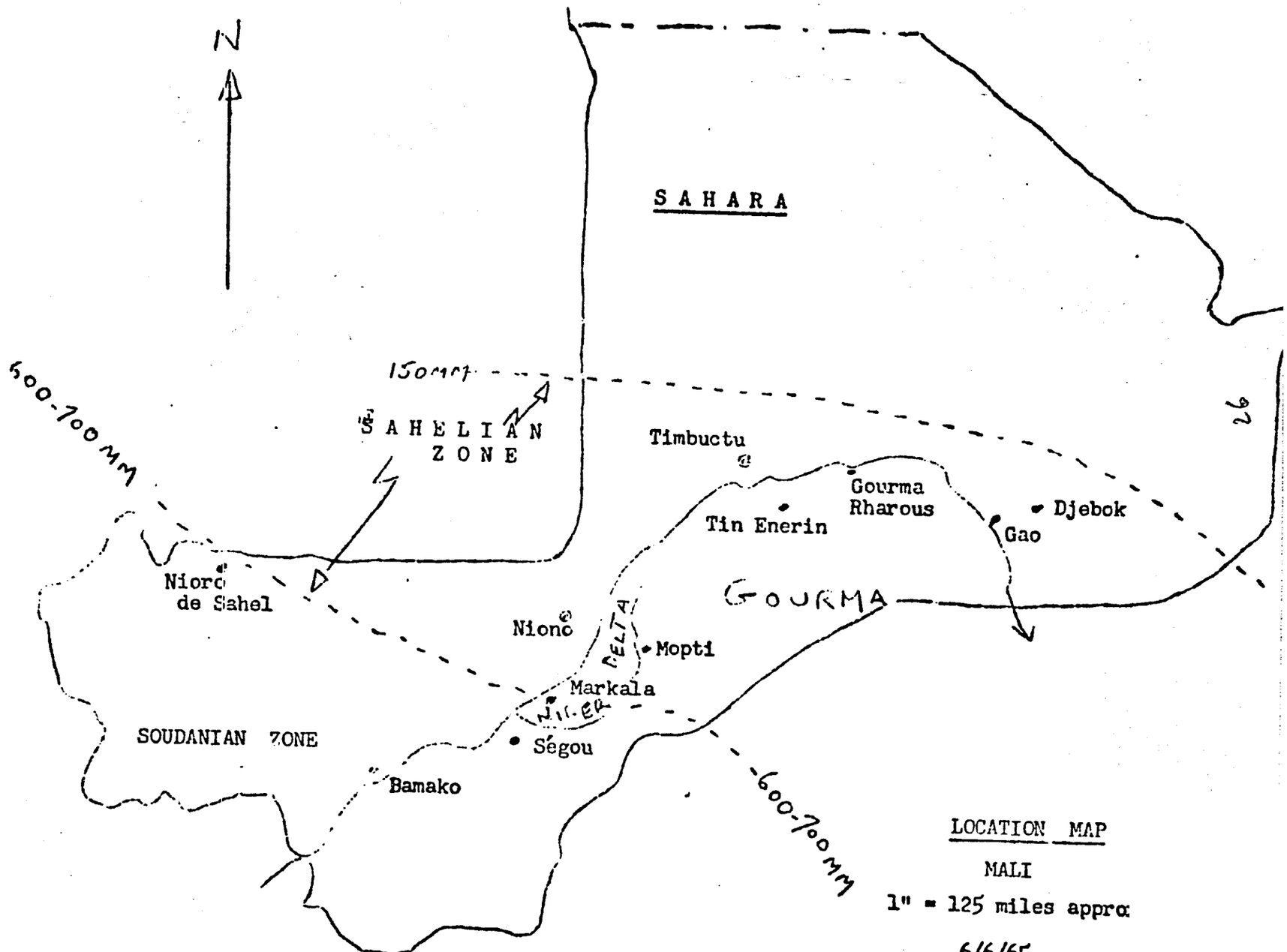
Paspalum spp.

Echinocloa stagnina

Euphorbia balsamifera.


Convergence des routes d'acheminement
de la Zone Ouest (principale zone d'Elevage)
Bamba
Tombouctou
Arlal
Gourma Rharous
Kakosi
Tiguiri Koga
Tanou/art
Echeri
In Abadie
3
Karouassa
Tin Tadeini
2
Fin Irou
Mariango
Cabougo
Tilolaouine
Gra Kory
L. Gorou
L. Do
B.
L. Niangay
Mouaraé
Benzena
Tessaqui
Gossi
160 km
Echelle 1:500000
Douentza
Mopti

APPENDIX



LOCATION MAP

MALI

1" = 125 miles approx

6/6/65
MGC