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PROCEDURES FOR PLANNING INTEGRATED RANGE/LIVESTOCK PROGRAMS

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September 1974

PREFACE

This paper recognizes, correctly, that none of the Central West African countries has in its planning kit sufficient resource inventory data to do total national development planning -- i.e., the allocation of total available resources in the pursuit of priority-rated objectives, while at the same time there is an urgent need to get on with recovery and development. This is not inconsistent with sound development policy, in that certain national needs are well-known and would without doubt appear in any array of targets and in that certain potential projects areas which could address those targets are well-known. The range/livestock industry in the Sahel-Sudano-Guinea region is an example.

While the authors recognize the need for macro-data on natural resources, human resources, the national infrastructure and the economy for the marking and location of projects, they describe the information required to plan, implement and evaluate a range/livestock development project. In so doing they call for considerable information that otherwise would be collected for macro considerations and made available for project design, implementation and evaluation.

The paper is scrupulously limited to the range livestock industry. A complete document would probably follow this outline.

I. National Planning Data

A. Natural Resources

1. Land (capability tables and maps)
2. Rainfall
3. Rivers and Harbors
4. Timber
5. Wildlife and Recreation Resources
6. Minerals

B. Human Resources

1. Population and Growth Rate
2. Work Force
3. Literacy
4. Agricultural Skills
5. Health

C. Infrastructure

1. Transportation
2. Communications
3. Government Services

D. Production

E. Consumption

F. Trade

1. Internal Flows
2. Exports
3. Imports

G. Employment and Income

II. Project Data

A. Crops

B. Range/Livestock

C. Integrated Rural Development

D. Reclamation

E. River Basin Development

These chapters will no doubt be added on in future revisions.

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PROCEDURES FOR PLANNING INTEGRATED RANGE/LIVESTOCK PROGRAMS

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September 1974

PURPOSE AND BACKGROUND

The purpose of this report is to present guidelines for information gathering and the process of range/livestock development planning. The problem is immense when it is considered that the total land area of Africa is three billion hectares, of which 842 million hectares are permanent meadows and pastures. Rangelands transect several ecological zones with varied problems of use including those of soils, limited water, encroachment of bush fire and pests. Range forage production presently varies mostly by patterns of past impact by man, domestic livestock, fire, wind and water. Due to the long history of use by wildlife, man and his domestic livestock, much of the rangeland of Africa must be considered from a poly-climax standpoint in that cultivation and fire have played an important role in deriving vegetative types in Africa.

OBJECTIVE

The overall objective is to develop plans resulting in expanding present land capability to support the human and animal population at a sustained high level. This implies the design of long-term plans for the economic development of natural resources in accordance with their capability to produce food, timber, fuel, fiber, water and recreation at a sustained high level. The development of national infrastructure to allow human, animal and plant resources to express themselves in terms of production is also critical to the long-range economic utilization of replenishable natural resources. More specific goals are to:

1. Assess land use capabilities and provide necessary information on optimum economic development by removing constraints and providing guidelines for the necessary treatment and management for a sustained high level of production.

2. Assist national governments in formulating long-range plans for the economic development necessary to utilize natural resources according to their capability.

3. Assess plant and animal potential response to improved levels of management and their comparative advantages in various ecological zones.

4. Assess human response to social and economic benefits received from development programs in the various ecological zones.

5. Assess most beneficial areas of intervention in the various ecological zones or combinations of vertical and horizonal stratification most likely to relieve current population pressures on the Sahel.

6. Assess transfer potential of project design within and outside ecological zones.

7. Provide background information for specific project identification and design.

8. Provide background information for project implementation, management, administration and monitoring.

DESCRIPTION

As a result of the recent drought having underscored the very fragile nature of the ecological balance of the West African states, considerable agriculture and range development are expected to be undertaken in the region. In a joint endeavor with other donor agencies and African states, national and regional development planning requires as a basic point of departure, natural resource inventories, with baseline data on land, animals, and human resource components. This implies the necessary baseline inventory and evaluation, development plans, management plans, economic analysis, administration, monitoring, and impact analysis.

The scope of work set forth here shall deal only with the development of the range/livestock industry involving the survey and reconnaissance as necessary to develop national range use and livestock development plans providing for the maximum beneficial use which the area concerned is capable of supporting without further deterioration and decline in productivity. The planned development and bringing into production of lands now held in escrow by current constraints in use is essential to meet present and projected African food requirements. In the short-run these requirements can be met by bringing this escrow land into production, but in the long-run technological advances will be required to meet demands. This implies the planned land use of new lands opened to production with improved technology, while at the same time attempting to introduce new technology into current production areas.

I. LAND RESOURCE BASE

A. BASELINE SURVEY

From an agriculture viewpoint present forests and ranges are economic residuals, that is areas left after the more productive sites were converted to higher economic use. Much of Africa's croplands has been developed from forest and grasslands. Most rangelands suitable for cultivation have been converted to crop production. Some areas have reverted to non-cultivated status because of errors in selection, diminishing productivity, or climatic changes, often, an area is in rangeland because its ecological nature, economic conditions, or lack of irrigation water make it unsuitable for cultivation. Not all rangeland is grazed or potential cropland cultivated due to current constraints limiting its utilization. The comparative advantage of cheap forage on native grassland places the livestock producer in a favorable position. Rangelands have a potential for strengthening local rural economies and improving the economic welfare of rural families. Available data based on land use concepts is scarce in Africa, however, considerable data exists on the components such as: soils, climate, vegetation, and hydrology. It is proposed that present land use and land use capability classifications be made from existing taxonomic soils maps, hydrological and geological maps, agrostological, climatological data and through the utilization of past low altitude aerial photography and ERTS imagery. This information should be compiled and presented for two levels of utilization:

1. For national planning and program identification purposes.

2. For technical planning and implementation of project activities.

The first implies the identification of resource areas and their descriptions, while the second implies identification of production units with their respective potential utilization accompanying limitations, management, and treatments for sustained yields.

B. RANGELAND

The following is a brief outline of the methods utilized in preparing range development and management plans: (A more detailed description is presented in Range Development and Management in Africa, Annex #1.)

1. Conduct a detailed range survey, using conventional procedures:

a. Range site mapping and narrative description, including soils, precipitation, vegetation, present and potential erosion, livestock water present and potential with limiting use factors such as biting insects (tse-tse), seasonally wet soils, availability of water, and seasonal palatability of forage.

b. Range condition and trend survey, including plant composition, percent of key forage species dominant, plant density, plant vigor and reproduction, kilos of available forage in each site and its respective condition classes per hectare, tree and bush canopy, soil erosion, invasion or increase of undesirable, injurious or poisonous plants. Determination of present degree of utilization and reduced vigor due to improper grazing or drought conditions.

2. Prepare range management plan:

a. Study existing grazing patterns and ascertain reasons practices followed.

b. Prescribe grazing management on year-round basis including appropriate deferred use, seasonal use, rotational grazing as appropriate to improve existing use.

c. Determine proper stocking rate in animal units by types per hectare and plan grazing units to balance available forage with water for animal requirements during the period of planned use.

d. Make proposals for control or suppression of burning including plans for controlled burning if necessary for bush and tick control.

e. Plan for mechanical treatment, as appropriate, such as water spreading, range pitting, reseeding.

f. Describe method of annual range use checks and procedure for adjusting animal units to remaining forage available.

3. Prepare range development plan with estimated quantities and cost per unit of construction:

a. Inventory existing water supplies, including quantity and time available.

b. Plan and locate site for development of additional temporary and permanent supplies to balance available water with forage available for animal use at planned season of use as prescribed in the range management plan.

c. Delineate grazing block boundaries, firebreaks, access roads and stock routes.

d. Locate sites and plan physical facilities and support installations:

(1) Administrative centers.

(2) Storage points for equipment and supplies.

(3) Livestock handling facilities.

(4) Veterinary control parks.

(5) Experimental nurseries.

(6) Permanent check points on range trend and ecological change by use of exclosures, permanent line transects with photogrid plots.

e. Consider multiple use of larger permanent water supplies for food production from fish and vegetables.

4. Establish costs for fixed investment:

a. Total development by years.

b. Recurrent over 5 years including maintenance.

5. Identify key indicators for monitoring range resource condition and trend change over time:

a. Permanent line transects with photogrid plots to be measured and recorded at 3 to 5 year intervals.

b. Rainfall condition and trend indicators.

c. Range condition and trend indicators.

d. Annual carrying capacity and stocking rates related to rainfall.

e. Fire control manifestations.

f. Reclamation of deteriorated land.

g. Tree and bush canopy.

II. LIVESTOCK RESOURCE COMPONENT

The different species of livestock and associated breed-types found in a given ecological zone reflect both the nature of the environment and the background, traditional values, and expressed socio-economic needs of the herdsmen themselves.

A. BASELINE INVENTORY AND EVALUATION

A baseline survey of the livestock industry common to a proposed project area must consider:

1. Relationship of breed-types and management practices to other better known production systems in the same or other closely related ecological zones.

2. Relationship of the different livestock species and sub-types by estimated number and socio-economic importance:

a. Cattle

(1) Zebu or humped.

(2) Taurine or humpless.

(3) Crosses between Zebu and Taurine.

b. Sheep

(1) Long-legged desert eco-type.

(2) Shorter-legged more sedentary type.

c. Goats

(1) Long-legged desert eco-type.

(2) Shorter-legged village type.

3. Description of the different sub-types:

a. Physical characteristics:

(1) Average mature size by sex:

(a) Weight.

(b) Wither height.

(2) Predominant color patterns.

(3) Conformation:

(a) Body shape.

(b) Appendages - horns, ears, hump size and placement when present.

(4) Chief trademark or most outstanding characteristics.

b. Functional characteristics:

(1) First breeding age.

(2) Generation interval.

(3) Reproductive rate.

(4) Mortality rates.

(5) Disease tolerance.

(6) Milking ability.

c. Overall genetic merit and estimated improvement potential under improved conditions by:

(1) Selection within breed-types.

(2) Upgrading by crossing.

(3) Value in upgrading other breed-types.

4. Systems of production:

   a. Degree of mobility:

      (1) Nomadic.

      (2) Semi-nomadic.

      (3) Sedentary.

   b. Stage of development:

      (1) Scavenger.

      (2) Subsistence.

      (3) Developed or commercial.

   c. Herding management:

      (1) Communal.

      (2) Cooperative or association.

      (3) Individual.

   d. Herd and flock size.

   e. Livestock ownership patterns:

      (1) Local resident.

      (2) Absentee:

         (a) Extended family.

         (b) Investor.

   f. Primary purpose served by species:

      (1) Milk:

         (a) Home consumption.

         (b) Sale.

(2) Meat:

(a) Regular home consumption.

(b) Ritual and ceremonial.

(3) Farm traction.

(4) Transport:

(a) Riding.

(b) Pack.

(5) Manure.

(6) Savings and/or investment.

(7) Cash income.

(8) Bride price.

(9) Status symbol or prestige.

5. Existing herd (and flock) profile:

By definition a herd or flock profile comprises herd composition (i.e., number and/or precent by sex and age) and technical or reproductive/productive coefficients. A herd profile in respect of cattle includes:

a. Herd composition:

(1) Females:

(i) Mature brood cows.
(ii) Calves under one-year.
(iii) Heifers 1-2 years.
(iv) Heifers 2-3 + years.

(2) Males:

(i) Stud bulls.
(ii) Calves under one-year.
(iii) Bulls/steers 1-2 years.
(iv) Bulls/steers 2-3 + years.
(v) Other (draft oxen, etc.).

b. Technical coefficients:

(1) Bull to cow ratio.

(2) Age at first breeding by sex.

(3) Calf drop based on number of breeding age cows in herd during breeding season.

(4) Calfhood mortality to one year.

(5) Post-calfhood mortality by sex and age.

(6) Culling rates by sex and age.

(7) Replacement rate (i.e., mortality rate plus culling rate under constant sized herd) by sex.

(8) Herd offtake % or extraction rate based upon average herd size during the year.

(9) Composition of offtake by sex, age and size.

(10) Annual herd inventory change based on beginning of year and end of year numbers (also express as animal units).

6. Existing herd projection and production model (for cattle).

The baseline herd profile, when projected over time, yields a production model descriptive of traditional management outputs. While such a model lends itself to computerization, it can be readily accomplished by simple hand procedures.

Annex II depicts a simulated cattle herd projection and production model, using hand calculator methods, that demonstrates required stock variables (i.e., herd composition and technical coefficients) and inventory flow over time. Although the worksheet is quite simple and more or less self-explanatory, a number of comments are judged appropriate.

The main left hand column of the Annex lists the various stock variables, or herd composition, by sex and age. The five major columns repeated under each year shows, apart from mortality rates by sex and age, inventory flow during said timeframe. That is, an opening inventory, additions during the year due to births (or other sources), outright losses due to death (or other causes),

offtake or herd extractions (including sales, home consumption, etc.) and finally, a closing inventory for the year. The closing inventory for a given year becomes the opening inventory for the immediate succeeding year. However, it is to be noted that with the exception of mature animals (set at 3-4 years in this example), all classes are advanced in age by a full year as they proceed from one year to the next. In practice opening inventories would include animals in the 0-1 year range, but for the sake of simplicity in the present exercise, all such animals have been advanced in age by a full year in passing from the previous closing inventory.

Attention is also called to the eight technical coefficients shown at the bottom of Annex II. These and other pertinent calculations are either used in making or can be made from the herd model. Moreover, by assigning monetary values to herd extractions, the production model becomes an economic model of baseline cattle production.

7. Constraints in production phases by species:

By definition all constraints in production can be enumerated under five major phases or production factors, and in turn improvement can only be affected by intervening therein. The chief constraints in the production phases must be identified for each of the species concerned by order of importance:

a. Breeding - pertaining to the genetical makeup of an animal, herd, or population, which may be good or bad depending upon observed performance under a given set of environmental conditions and management practices.

b. Nutrition or feeding - covering the sum total of nutritive intake or requirements.

c. Health - including disease incidence and control measures.

d. Management - concerning basic husbandry or day-to-day care.

e. Marketing - as concerns the orderly and timely offtake of surplus animals.

B. LIVESTOCK DEVELOPMENT PLAN

The broader aspects of livestock production and development will be dictated by the grazing system of the range management and range development plan, while much of the basic husbandry and herd management

must be based on traditional practices and owner understanding, which can be ascertained only in connection with overall project implementation.

The general livestock development program should be aimed at intervening or correcting the chief limiting constraints previously identified in the five production phases (i.e., breeding, nutrition, management, health and marketing). These are dynamic forces and always subject to change, but an effort must be made to maintain a reasonable balance between them, taking into account the cost of intervention, expected returns, and the livestock owner's willingness to accept a given technological intervention or improvement practice.

It is significant that development or improvement implies change, and in this instance it means making a subsistence industry more commercial as regards production inputs and marketable offtake, or production outputs. The following is suggested as a guide in formulating a range livestock development plan, within which on a priority basis, emphasis should be placed on species potential as regards socio-economic needs, market requirements and rational land use as dictated by the grazing management plan.

1. Livestock management.

As herein employed, management denotes both the day-to-day care or husbandry of project livestock and their mass handling, movement and distribution as required by the established grazing management plan and in keeping with the overall livestock development plan. Major considerations include:

a. Identification of project animals necessary in controlled grazing:

(1) Hot iron brands.

(2) Ear notching.

b. Mustering of livestock:

(1) Periodic or seasonal movement.

(2) Mass treatment.

c. Formation of grazing herds:

(1) Composition.

(2) Ownership.

(3) Size.

d. Herding management:

(1) Watering interval.

(2) Night camps.

e. Special management practices:

(1) Castration.

(2) Dehorning.

(3) Seasonal breeding.

(4) Milking.

2. Animal Nutrition

The level of nutrition enjoyed by adult project livestock will be almost entirely determined by the availability of water and the condition of range provided under the grazing management plan. However, other possible interventions in this production phase may include (subject to cost/benefit):

a. Salt/mineral supplementation on a herd-wide basis.

b. Concentrate feeding on a selective basis.

c. Special grazing on a selective basis.

d. Consideration of nursing young.

Inadequate nutrition of nursing young resulting from subsistence producers taking milk for home consumption and/or outside sale poses a special problem. While there seems to be no long-term advantage in directly supplementing the diet of young animals with purchased foodstuffs, much can be done in terms of increasing milk flow of lactating animals and in improving human

nutrition through promoting the production of more nutritious subsistence crops, thereby reducing human dependence on milk.

3. Animal Breeding

This phase of production refers to the genetic makeup of project animals, their suitability to total environmental conditions, and the extent to which it is desirable or even readily possible to improve their genotype in keeping with improved project conditions. Certainly something can be done in the realm of breeding through selection of stud bulls and the castration of inferior males. However, any program of breeding intervention should be broadly based, limited to a minimum number of traits, simply constructed, easy to apply, well understood and dictated by local producer needs and preferences. Such a breeding program might take the following form:

a. Establish breeding goals based on local conditions and socio-economic requirements, but limited to only a few traits:

(1) Milking ability.

(2) Size for age.

(3) Trademark characteristics (i.e., color, horns, etc.) only if demanded by producers.

b. Promote or exert selection pressure toward established breeding goals:

(1) Castrate and/or cull obviously undesirable animals.

(2) Select stud bulls.

c. Consider introduction of males from better breeding herds or local cells of superior germplasm as regards traits in breeding goals:

(1) Bull distribution program.

d. Identify demonstration breeding herd(s) to:

(1) Serve as a model.

(2) Supply better bulls.

(3) Test production practices.

4. Animal health or disease control

The animal health protection programs throughout Africa were given early attention by colonial authorities, and are reasonably well developed compared with the other production phases. In general animal health programs are the basic responsibility of local veterinary services, but must be incorporated into and considered a part of the overall livestock development plan. In particular it is essential to site needed veterinary facilities, allow for scheduling en masse treatment of project animals and specify types of statistical data that should be collected to facilitate adherence to the range management plan.

A special anomaly of most disease control programs in Sub-Sahara Africa, is that they are chiefly directed at cattle with little or no attention allowed the smaller ruminants such as sheep and goats. Efforts should be made to rectify this circumstance in balanced development programs.

5. Marketing project offtake

In the classical sense, marketing concerns all of the transactions between the farm gate and the ultimate consumer. As herein used, marketing is considered to be the last phase of production with the view of assuring that project offtake is timely and equitable for the producers. In the final analysis, marketing is the key in balancing livestock numbers against available forage supplies and assessed range carrying capacity.

The strong demand for butcher stock and short supply of slaughter and breeding animals in Sub-Sahara Africa effectively make for a seller's market. However, within and between some countries there are pricing policies and trade barriers that detract from a free market system.

It is not expected that the usual range livestock project need be overly concerned with national and regional marketing systems per se. Rather, it is suggested that such undertaking concentrate on:

a. Encouraging the pooling of project animals scheduled for sale and bringing would-be buyers and sellers together.

b. Promote the use of scales and market grades in sales negotiations.

c. Plan for the establishment of new, strategically located markets within or without project area where none now exist.

d. Provide for records of project offtake relative to market class, grade, weight and sale value as the base for economic analysis (see Annex III, Cattle Herd Offtake Market Classification Form).

C. ESTIMATED COST OF LIVESTOCK DEVELOPMENT PLAN

Increases in productive efficiency to be achieved by the use of new technology, if it is to be economically feasible, must exceed the cost of that intervention. These costs include:

1. Total development cost by years.

2. Recurrent cost for life of project including maintenance cost.

D. DEVELOPED HERD PROJECTION AND PRODUCTION MODEL (For Cattle)

After considering interventions in the production phases and expected changes in herd profile (i.e., herd composition and production coefficients) resulting from the development plan, a new or developed herd projection and production model can be prepared. This production model should be tailored to fit the established stocking rates of the range management/development plan. The method for preparing this model is the same as explained above in the case of the pre-project production model.

E. KEY INDICATORS FOR MONITORING PROJECT LIVESTOCK PRODUCTION PERFORMANCE

It is expedient to maintain surveillance of ongoing projects as a guide to any needed mid-course corrections and evaluations, and finally, in measuring project impact over time. Key indicators should be identified as a part of project design to meet this requirement. Annex IV, Summary Format For Comparing Pre- And Post-Project Cattle Herd Production Models, depicts types of information required for cattle. Similar data are needed on small ruminants (i.e., sheep and goats) and of course the relationship between species and breed-types is in itself an important indicator of change. For example, goats tend to be a good indicator of poverty and degraded land resource base.

Annex V, Dynamic Parameters and Their Relationship in a Constant Sized Cattle Population at Different Stages of Development, is a useful tool in evaluating cattle herd performance, as well as in conducting baseline surveys. These data were assembled from the analysis of many different cattle herds in both developed and

emerging countries and reflect expected average performance at a given stage of development. Another specific use is that by observing the classification (i,e., age, sex, etc.) of animals on markets and at abattoirs over a period of time, it is possible to draw rather exact inferences about a given national herd production coefficients and composition. In turn, if a reasonable estimate of a breeding herd profile is at hand, the required annual offtake can be accurately estimated, assuming herd size to remain constant.

III. ECONOMIC ANALYSIS

Improving livestock production in the Sahel/Sudano/Northern Guinea Zones implies the need for significant modification of traditional production practices in order to develop an industry which is more commercial in nature. This can be accomplished through the introduction of new techrological inputs which have specific and demonstrable values, and the stratification of the industry in order to utilize comparative advantages of each Zone. Land now in escrow through constraints of use such as presence of tse-tse fly and lack of adequate water supplies will be brought into sustained economic production to fully utilize the available resources to meet ever increasing human demands for food. Interventions in the traditional production system not only increase quantity but also quality of the products produced. These quality products must find ready access to markets capable of paying for the cost of interventions to produce (if to have immediate economic feasibility) these higher quality products. Thus, the degree of intervention and consequent cost to the producer must be related to the quality of product and price received. However, there are cases where government frequently subsidizes the production cost as an immediate expediency. A major requirement for acceptance of such interventions by the producers involved will be that sufficient benefits are derived from the program to induce them to appropriately change their behavior with respect to livestock production. Thus, the plan must insure that the incremental benefits generated by the program is economically viable. It is imperative that the program planning process includes the collection of the best possible economic data, reflecting current conditions in the project area, on projected production and economic benefits to be generated by the program. In this context the planners will define, collect and analyze relevant economic and production data needed for analysis at the producer, village, regional, and national level. Such data will include:

A. BASELINE ECONOMIC EVALUATION

1. The cost of production inputs, both variable and fixed for each production activity.

2. Prices received for each quality product at various seasons by the producer, intermediaries and those paid by the consumer.

3. Annual production returns in cash and kind:

   a. Livestock (cattle, sheep, goats, camels, donkeys, etc.).

   b. Crops (cash and food).

   c. Migratory labor.

   d. Poles, wood, charcoal.

   e. Wildlife and fish.

   f. Others (specify).

4. Economic incentives and discentives:

   a. Subsidies.

   b. Services and amenities (including markets for sales and purchase of food and supplies).

   c. Land tenure.

   d. Security.

   e. Increased value of base herd.

   f. Increased value of product produced.

   g. Availability of credit.

   h. Payment of taxes.

   i. Payment of user fees.

   j. Potential loss of access to land.

5. Comparative advantage between existing cropping and grazing systems.

6. Comparative advantage between milk for human consumption or sale and that allowed for the nursing young resulting in increased quality and quantity of beef for sale and purchase of food grains.

7. Interventions to increase quantity of livestock outputs also increase the quality and consequent value of the product produced.

8. Employment generation and income distribution through project development.

B. ECONOMIC BASELINE INVENTORY

1. From baseline data assembled on present production values should be assigned to each commodity generated annually:

a. Assumptions can be made that inflationary influences will have the same effect on both inputs and outputs over time.

2. Present and projected production values over the expected life of the project (without interventions) should be substracted from value of future benefits received over the life of the project. Thus, only incremental benefits are considered in cost/benefit analysis.

3. Present availability of capital required to make interventions in production:

a. Availability of credit through present government and commercial lending agencies.

b. Extended family system in which sons and relatives are loaned animals or work for shares.

c. Investments from migratory labor or sales of livestock and cash crops.

4. Monetary values for product and services both animal and crops utilized for humzn subsistence will be obtained from human resource baseline data.

C. INVESTMENT COST

1. Fixed capital costs:

a. Vehicle and equipment:

(1) Number units.

(2) Unit cost.

(3) Total cost.

(4) Expected working life.

(5) Replacement charge per year in development.

2. Development:

a. Item:

(1) Units.

(2) Number units.

(3) Unit cost.

(4) Total cost.

3. Interest on principal long-term capital.

D. OPERATIONAL CAPITAL COSTS

1. Vehicle and equipment:

a. Operation.

b. Maintenance.

2. Annual structure maintenance.

3. Consumable supplies:

a. Drugs.

b. Vaccines.

c. Salt and minerals.

d. Supplementary feed.

e. Office supplies.

f. Rentals.

g. Replacement charge per year on vehicles and equipment.

4. Services

a. Salaries.

b. Labor.

c. Technical and legal.

5. Livestock purchases (if applicable):

a. Type animal.

b. Number.

c. Average live weight.

d. Average price per kg. or pound.

e. Total live weight.

f. Total value.

6. Depreciation fixed development:

a. Item.

b. Number units.

c. Unit cost.

d. Rate expressed as percentage.

7. Interest on short-term capital.

8. Producer contribution:

a. Livestock:

(1) Type.

(2) Sex and age.

(3) Value.

(4) Total value.

b. Labor.

E. INCREMENTAL CASH BENEFITS

1. Annual livestock sales:

   a. Type animal.

   b. Number.

   c. Average live weight.

   d. Average price per kg. or pound.

   e. Total live weigh t.

   f. Total value.

F. CASH FLOW BY YEAR

1. Development cost:

   a. Grace period.

   b. Years to repay.

2. Interest on investment:

   a. Grace period.

   b. Rate of interest.

3. Annual operation and maintenance cost:

   a. Grace period.

   b. Rate of interest.

4. Livestock purchases:

   a. Grace period.

   b. Rate of interest.

5. Producer cash extractions:

6. Livestock sales.

7. Subsidies and grants.

8. Accumulative net return.

G. CREDIT REQUIREMENTS

1. Principal payment development cost.

2. Interest on investment.

3. Livestock purchases.

4. Operating expense.

5. Interest on operating capital.

6. Producer subsistence extraction.

7. Accumulated net return.

8. Deficits long-term capital by year.

9. Deficits short-term capital by year.

H. SALVAGE VALUE OF DEVELOPMENT STRUCTURES AND EQUIPMENT

1. Item:

a. Original cost.

b. Percent value remaining.

c. Total.

d. Present value.

I. RESIDUAL INCREMENTAL VALUE OF LIVESTOCK

1. Type.

2. Age and sex.

3. Value.

4. Total.

5. Present value.

J. INTERNAL RATE OF RETURN

1. Based on expected life of project 20 years or more.

2. Both inputs and outputs converted to present value.

K. IN ADDITION, THE ECONOMIC ANALYSIS WILL IDENTIFY AND DEFINE

1. Possible economic phenomena which may need to be restructured to facilitate project implementation:

a. Commodity procurement.

b. Contractural arrangements.

c. Funding arrangements.

d. Lending agencies.

2. Possible need to restructure funds generated from livestock related activities to operation and maintenance of ongoing projects and development of new projects.

3. Identification of economic constraints:

a. Government pricing policy.

b. Import and export tariffs.

c. Excessive transport charges and losses in movement of products to market.

d. Availability of livestock for production purposes at reasonable price.

IV. RANGELAND ADMINISTRATION

Range administration is probably the most critical area ultimately determining success or failure of range livestock projects. The ability of government to continue ongoing projects and plan and develop expansion of demonstration models is, in the long-run, in direct relationship to the infrastructure and manpower developed within government.

A. GOVERNMENT ACTIONS

1. Establishment of infrastructure:

   a. Range/livestock planning.

   b. Range/livestock development.

   c. Range/livestock extension and services.

   d. Range/livestock administration.

2. Establish positions for required manpower.

3. Train manpower for established positions.

4. Duties and responsibilities of range administrators:

   a. Land tenure - development of a land tenure system which is compatible with socio-political conditions existing within a country or region:

      (1) Legislation - enactment of new legislation or adaptation of existing legislation to enable right of occupancy.

      (2) Adjudication - allocation of geographic boundaries for right of occupancy by:

         (a) Individuals.

         (b) Groups.

         (c) Cooperatives.

         (d) Companies.

         (e) Communal.

      (3) Forms of land tenure:

         (a) Recognition of existing grazing rights by ethnic groups:

            (i) Land held in trust by government for ethnic groups, villages or councils.

(b) Granting land title to individuals, cooperatives, cooperatives, companies, or groups.

(c) Short-term lease of government held lands to individuals, cooperatives, or foreign investors.

(d) Long-term lease of government held lands to individuals, cooperatives, corporations, companies or foreign investors.

(e) Establish grazing reserves, or forest reserves with accompanying grazing rights by individuals from villages, or ethnic groups.

(f) Establish government or parastatal grazing units.

(4) Providing long-term development and short-term operation and maintenance capital:

(a) Grant development and operational capital.

(b) Services provided by government:

(i) Animal health.
(ii) Pumping water.
(iii) Maintenance, structural development.
(iv.) Project technical management.

(c) Long-term development loans.

(d) Short-term operational and maintenance loans.

(5) Provision of means of revenue generation to government:

(a) Direct tax.

(i) Land.
(ii) Livestock pole tax.
(iii) Human pole tax.
(iv) Income tax.
(v) Livestock sales tax.
(vi) Livestock slaughter tax.
(vii) Livestock export tax.
(viii) Carcas export tax.

(b) Land lease:

(i) Long-term.
(ii) Short-term.

(c) Fee charge:

(i) Grazing - recorded project animals, migratory herds with legal seasonal rights, transit animals.

(ii) Water - recorded project animals, migratory herds with legal seasonal rights, transit animals.

(iii) Service - user fees for all services provided both mandatory or optional including animal health, supplements, marketing, operation and maintenance.

(d) Indirect benefits:

(i) Reduced foreign exchange outflow.
(ii) Increased foreign exchange earnings.
(iii) Employment generation.
(iv) Conservation of natural resource base.
(v) Increased protein for human consumption.

5. Duties and responsibilities for project management:

a. Provide technical services for project operation, management, and maintenance.

b. Intermediary between government administration and project coordinating committee or producers:

(1) Assist in securing government services, loans, leases, titles, livestock purchases and sales.

(2) Serve as technical member of committees, boards or associations.

(3) Assist in securing legal defense of project bylaws.

c. Gather data through analytical methods of project impact on livestock, range, and human resources.

d. Assist project committee in conducting annual range use check and adjusting animals to available forage.

e. Assist in planning and organizing annual maintenance program.

B. PRODUCER ACTIONS

1. Establish an authority:

a. A legally constitutional body to:

(1) Develop bylaws.

(2) Register members.

(3) Obtain land tenure.

(4) Adjudicate boundaries.

(5) Register member's livestock by type.

(6) Issue right of occupancy for accepted animal units.

2. Responsibility

a. Establish committees:

(1) Represent members with government.

(2) With authority to borrow capital for long-term development and short-term operating capital.

(3) With authority to assess members fees for repayment of loans and operation and maintenance costs.

(4) With authority to regulate the management of the grazing area as prescribed in the range/livestock plan and the activities that may be carried out therein.

(5) Impose penalties for breach of established rules and regulations and represent the producers in legal actions arising from such breaches.

(6) Conduct regularly scheduled meetings pertaining to project activities and producer reaction for which the committee has the power to mediate disagreements and recommend change.

(7) Amend bylaws as may be necessary and agreed to by government and members.

(8) Form cooperatives for mutual benefit to the producers in marketing and purchasing necessary supplies and commodities.

(9) Hire necessary staff to perform functions which will provide services to the members not otherwise available.

(10) Allocate designated land areas for special purposes such as food grain production.

(11) Determine compensation for removal of prior land use not compatible with grazing program prescribed or proper land use capabilities.

(12) Charge fees to non-members for goods and services provided from the project area as agreed to by members and government.

(13) Assist in obtaining necessary data on socio-economic aspects of project for planning and analysis purposes.

V. HUMAN RESOURCE BASE

The inhabitants and users of the land resource base in proposed integrated range livestock programs are assumed to be the chief beneficiaries thereof. From the standpoint of project relevancy, the human element must be taken into account to assure that the land use plan includes a production system and a form of land tenure that is consistent with the expectations and expressed needs of the population for survival and the stewardship of these resources for future generations.

Knowledge of the human constitutents is also fundamental to mid-course project evaluation and impact analysis over time. Recognition of this concept in project design is of recent vintage in the range livestock field and is less than fully understood by most such development planners. Although the human element is equally as complex as either the land resource base or animal resource component, the following is only a minimum outline of needed human considerations in range livestock project formulation, implementation and evaluation.

A. SOCIO-ECONOMIC BASELINE SURVEY

Apart from a review and analysis of all existing sociological information on the peoples in a proposed project area, an initial reconnaissance,

followed by a more detailed socio-economic survey are required to fully assess the human components of an integrated range livestock project.

1. Sociological reconnaissance

This survey should be conducted at the same time or even in advance of that for the land resource base, and be undertaken by a rural sociologist or similarly orientated social-anthropologist. Such a study would normally be expected to take one to three months and have as a primary goal determinations relative to present patterns of land use, animal management practices and social systems. It would also flag special problem areas to be avoided or solutions indicated. A feedback of this information would foster relevancy in the design of the land use plan and livestock production program. The required information involves identification of:

a. Socio-ethnic and special groups:

(1) Systems of livestock production:

(a) Patterns of mobility:

(i) Nomadic.
(ii) Semi-nomadic.
(iii) Sedentary.

(b) Stage of development:

(i) Scavenger.
(ii) Subsistence.
(iii) Commercial.

(c) Herding management:

(i) Communal.
(ii) Cooperative.
(iii) Association.
(iv) Extended family.
(v) Individual.

(2) Area used by homogeneous groups:

(a) Wet season grazing.

(b) Dry season grazing.

b. Role and status of livestock:

(1) Animal density per square kilometer by species.

(2) Ratio of livestock to humans.

(3) Primary purpose served by species.

(a) Milk.

(i) Home consumption.
(ii) Sale or barter.

(b) Meat:

(i) Regular home consumption.
(ii) Ritual and ceremonial.

(c) Farm traction.

(d) Transport:

(i) Riding.
(ii) Pack.
(iii) Drayage.

(e) Manure.

(f) Investment.

(g) Live animal cash sale.

(h) Bride price.

(i) Prestige or status symbol.

(4) Ownership patterns:

(a) Owned outright.

(i) Local resident.
(ii) Absentee.

(b) Possessed through loan arrangement.

c. Organizational structure

(1) Institutionalization:

(a) Authority roles and incumbents.

(b) Influence roles and incumbents.

(c) Legitimizing judgement roles and incumbents.

(d) Service roles:

(i) Aides to power.
(ii) Informer roles and incumbents.
(iii) Innovative demonstrator roles and incumbents.
(iv) Livestock medicine roles and incumbents.
(v) External communication roles and incumbents.

(2) Values related to property and experience:

(a) Ownership.

(b) Experience.

(c) Skills.

(3) External linkages:

(a) Non-project area migrants

(b) Other ethnic groups in area.

(c) Central government.

(d) Outside world.

d. General constraints to development

(1) Government infrastructure:

(a) Communication.

(b) Transportation.

(c) Technical.

(2) Socio-political

(a) Attitude toward government.

(3) Other.

2. Socio-economic survey

The information to be collected in this instance must be obtained by a detailed questionnaire, and based on a family or head of household interview. These data will provide a socio-economic description of the inhabitants prior to project implementation, permit mid-project evaluations and finally an overall project impact analysis over time. This survey would include a regular census at the height of inhabitation:

a. Sociological:

(1) Demographic variables:

(a) Age.

(b) Sex.

(c) Fertility.

(d) Health.

(e) Mobility.

(f) Migration.

(2) Labor force:

(a) Employment.

(b) Skills.

(c) Education.

(d) Work habits.

(e) Salaried:

(i) In-kind.
(ii) Self-employed.
(ii) Cash wage.

(3) Organization:

(a) Division of labor.

(b) Partition and use of resources:

(i) Farmland.
(ii) Water.
(iii) Grazing.
(iv) Function of livestock.
(v) Family units.
(vi) Household composition.

b. Housing characteristics:

(1) Construction materials.

(2) Condition.

(3) Contained facilities.

(4) Ownership patterns.

(5) Costs.

c. Economic status

(1) Material goods:

(a) Household.

(b) Personal.

(c) Other.

(2) Livestock by species:

(a) Owned.

(b) Possessed.

(3) Food production capabilities:

(a) Plant.

(b) Animal.

(4) Costs of production:

(a) Plant.

(b) Animal.

(5) Income distribution:

(a) Head of household.

(b) Distribution by social groups.

(6) Expenditures:

(a) Food.

(b) Clothing.

(c) Travel.

(d) Other.

(7) Value of agricultural and other sales:

(a) Farming.

(b) Livestock.

(c) Fishing.

(d) Forestry.

(e) Bees.

(f) Other.

d. Miscellaneous questions:

(1) Expectations.

(2) Problems.

(3) Other.

B. MAJOR HUMAN CONSTRAINTS TO PROJECT IMPLEMENTATION

The initial selection of a proposed project site should be based upon a sociological reconnaissance survey and comprehensive knowledge of the land, people, livestock, and other relevant issues. Even then more detailed socio-economic studies should divulge information on problem areas to be considered in facilitating project implementation. While such constraints can hardly be codified in advance, they must be identified and evaluated. For example, it is important to determine which forms of behavior and patterns can be readily changed and chose which cannot.

C. KEY INDICATORS FOR MONITORING SOCIOLOGICAL CHANGE

Suggestions for maintaining surveillance of sociological change fall under the following major headings:

1. Demographic:

   a. Age.

   b. Life expectancy.

   c. Mobility.

   d. Morbidity and mortality.

   e. Population growth rates.

2. Social and organization:

   a. Family/community cohesiveness.

   b. Traditional customs.

   c. Patterns of land and water utilization.

   d. Patterns of ownership.

3. Economic:

   a. Income.

      (1) Level.

      (2) Distribution.

   b. Expenditure patterns.

4. Administrative/political organization:

   a. Patterns of local leadership (non-project related).

   b. Pattern and effectivenss of project administration.

   c. Relationship between inhabitants and government in project area.

   d. General attitude toward government.

VI. MONITORING AND IMPACT ANALYSIS PROCEDURE

Since most range livestock projects are of a pilot nature and involve a number of complex entities, close monitoring and periodic evaluation of progress are essential. More precisely, the primary purpose of such surveillance and analysis is to: 1) correct short-comings in or make adjustments to ongoing projects dictated by time and/or changing conditions; 2) evaluate and measure change resulting from project implementation; and 3) finally, determine project impact over time and transfer potential.

Apart from comparisons of pre- and post-project data and reviews of key indicators of change identified in each of the project's main components, a relatively similar area should have been designated as a control at the outset. The control area should be non-contiguous to the project and have been initially surveyed as to baseline conditions regarding land, people, and livestock. This baseline study and later reconnaissance surveys of the control area would serve as a benchmark for measuring change in the ongoing or completed project.

In general, this is a facet of integrated range livestock project design requiring further refinement and development. However, under the assumption that the inhabitants and land users of project area will accept and follow the dictates of project design, any number of illustrative hypothesis can be tested relative to impact under the following main headings: 1) economic activities; 2) social structure and interactions; 3) institutional activity; and 4) physical resource and general ecology.

While project design and implementation personnel would, as a matter of routine, be involved in mid-course evaluations, the final project impact analysis should be made by a team of experts independent of the project itself. This course of action would tend to remove personal bias, but would require the early establishment of precise procedures for such assessment.

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TOTAL					

ANNEX II SIMULATED CATTLE HERD PROJECTION AND PRODUCTION MODEL

(Numbers and %)

HERD COMPOSITION		YEAR - 1						YEAR - 2						YEAR - 3					
		Mortality-%	Opening Inv.	Additions	Losses	Offtake	Closing Inv.	Mortality-%	Opening Inv.	Additions	Losses	Offtake	Closing Inv.	Mortality-%	Opening Inv.	Additions	Losses	Offtake	Closing Inv.
Females	Brood cows	7	5,000	-0-	350	750	3,900	6	5,000	-0-	300	450	4,250	5	5,000	-0-	252	500	4,296
	0 - 1 Year	25	-0-	1,500	375	-0-	1,125	23	-0-	1,575	362	-0-	1,230	23	-0-	1,640	377	-0-	1,263
	1 - 2 Years	7	1,140	-0-	80	-0-	1,060	6	1,125	-0-	68	-0-	1,057	5	1,230	-0-	62	-0-	1,168
	2 - 3 Years	5	1,050	-0-	52	-0-	998	4	1,060	-0-	42	-0-	1,018	4	1,057	-0-	42	-0-	1,015
	3 - 4 Years	3	1,000	-0-	30	20	950	3	848	-0-	25	25	798	3	1,018	-0-	30	30	958
Males	Stud bulls	3	250	-0-	8	42	200	3	250	-0-	8	42	200	3	250	-0-	8	42	200
	0 - 1 Year	25	-0-	1,500	375	-0-	1,125	23	-0-	1,575	362	-0-	1,230	23	-0-	1,640	377	-0-	1,263
	1 - 2 Years	7	1,140	-0-	80	-0-	1,060	6	1,125	-0-	68	-0-	1,057	5	1,230	-0-	62	-0-	1,168
	2 - 3 Years	5	1,050	-0-	52	-0-	998	4	1,060	-0-	42	-0-	1,018	4	1,057	-0-	42	-0-	1,015
	3 - 4 Years	3	1,000	-0-	30	920	50	3	998	-0-	30	918	50	3	1,018	-0-	30	938	50
Total or Average		12.4	11,630	3,000	1,432	1,732	11,466	11.2	11,466	3,150	1,307	1,435	11,908	10.5	11,908	3,280	1,282	1,510	12,396
Technical Coefficients	Calf drop - %	60						63						65					
	Bull to cow ratio	1:20						1:19.4						1:20.2					
	Age at first breeding	±3 Years						± 3 Years						±3 Years					
	Cow replacement rate	15%						15%						15%					
	Bull repl't rate	20%						20%						20%					
	Herd offtake - %	15%						12.3%						12.4%					
	Herd inventory change	-1.4%						+4.9%						+4.1%					
	Age/weight of steers	3 - 4 years/290 kilograms						3 - 4 years/295 kilograms						3 - 4 years/300 kilograms					

ANNEX IV. SUMMARY FORMAT FOR COMPARING PRE- AND POST-PROJECT CATTLE HERD PRODUCTION MODELS

	Herd Composition by Age and Sex Classes	Animal Unit Rate	Baseline Herd				Under Project for Given Year				% Change Due to Project			
			Mortality %	No. of Head	% in Herd	Total Animal Units	Mortality %	No. of Head	% in Herd	Total Animal Units	Mortality %	No. of Head	% in Herd	Total Animal Units
Females	Brood cows													
	Calves (0 - 1 year)													
	1 - 2 years													
	2 - 3 years													
	3+ years													
Males	Stud bulls													
	Calves (0 - 1 year)													
	1 - 2 years													
	2 - 3 years													
	3+ years													
TOTAL OR AVERAGE														
Technical coefficients														
Bull to cow ratio														
Calf drop - %														
Age at first breeding														
Bull replacement rate - %														
Cow replacement rate - %														
Herd offtake rate - %														
Age/weight market steers														
Herd inventory change - %														

ANNEX V. AVERAGE DYNAMIC PARAMETERS AND THEIR RELATIONSHIP IN A CONSTANT-SIZED CATTLE POPULATION AT DIFFERENT STAGES OF DEVELOPMENT

Stage of Development	Reproductive Rate-%			Offspring Needed as Breeding Replacements-%		Age at First Breeding in Years	Generation Interval in Years	Required Annual Offtake-%	% of Required Total Annual Offtake by Sex and Relative Age					
									Male			Female		
	Calf Drop	Calf Mortality	Effective Rate	Male	Female				Young	Old	Total	Young	Old	Total
Highly Developed	90	5.0	86	3.0	45	1.50	4.5	37	57	3	60	20	20	40
	85	6.0	80	4.0	50	2.00	5.0	28	31	31	62	18	20	38
Developed	76	8.0	70	5.0	60	2.50	5.5	21	21	44	65	16	19	35
	68	12.0	60	6.0	70	3.00	6.0	16	13	56	69	13	18	31
Developing	60	17.0	50	7.0	80	3.25	6.5	12	8	66	74	9	17	26
Subsistence	55	28.0	40	9.0	90	3.50	7.0	10	4	76	80	5	15	20
	45	35.0	29	12.0	100	3.75	7.5	8	1	86	87	0	13	13

EXPLANATORY NOTES:

1. Sex ratio at birth assumed to be 50:50.
2. Calf drop expressed as a percent of total breeding age females in the breeding herd during the breeding season.
3. Effective calving rate equals calf drop minus calf mortality to one year, expressed as a percent.
4. Offspring needed as breeding replacements based on effective calving rate.
5. Generation interval is the average age of parents when their offspring are born.
6. Required annual offtake (exclusive of all losses) or extraction rate (based on average herd size during the year) if herd size is to remain constant.
7. A higher or lower annual offtake at a given stage of development would be reflected in a reduced or expanded total population, as the case might be.