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DEPARTMENT OF AGRICULTURAL ECONOMICS

**Purdue University
Lafayette, Indiana**

211(d) Annual Report

Purdue University

June 30, 1974

211(d) Annual Report
June 30, 1974

Title: Expansion of Competence in the Design and Execution of Ruminant Livestock Development Programs for the Tropics: With Emphasis on the Analysis of Systems of Production and Marketing.

Grantee: Purdue University, Lafayette, Indiana

Director: T. Kelley White

A. Statistical Summary:

Period of Grant: June 29, 1972 to June 28, 1977

Amount of Grant: \$400,000

Expenditures: For current year 1973-74, \$41,201
Accumulated, \$72,283
Anticipated for next year, \$100,000

B. Narrative Summary:

The first half of the 1973-74 year saw a continuation of negotiation with the Guyanese government relative to conditions under which the consortium could work in Guyana. These negotiations and a revised set of detailed work plans resulted in final agreement for the consortium to work in Guyana being reached early in 1974. Purdue's detailed work plan is presented in Appendix D. While the lengthy delay caused by prolonged negotiation with Guyana has been frustrating, it has also been beneficial. It became necessary to define more fully the goals of each consortium member as well as the mechanism by which individual activities would be integrated to further the objective of developing an integrated, multi-disciplinary approach to analysis of livestock systems. A much better appreciation of the

systems approach by all members of the consortium has resulted.

Field work in Guyana and in other Caribbean countries were conducted. Both primary and secondary data were collected as a basis for describing and modeling the livestock production-marketing system of Guyana. Part of the field work conducted by Purdue was in conjunction with a joint consortium data collection effort in Guyana. Construction of a common questionnaire used for the farm survey and agreement on a division of labor for field work demonstrates considerable progress by the member institutions toward development of a cooperative team approach.

Purdue participated in the Central West African Seminar in May and June of 1974. This experience combined with on-site activities in Guyana and other Caribbean countries contributed significantly to the accumulated experience of our faculty which is relevant to analysis of tropical livestock problems.

Grant funds have supported work to develop a more efficient linear programming algorithm. This new algorithm will facilitate the use of linear programming for large problems such as those encountered in modeling of livestock production-marketing systems.

Construction of an industry (macro) model for the livestock sub-sector of Guyana was begun. This work is being coordinated closely with herd modeling efforts by Texas A&M.

Relevant materials for tropical livestock analysis and systems modeling have been acquired for additions to our library. Slide sets based on grant sponsored travel in tropical countries were developed and are a means being used to integrate 211(d) experience

into the total program in Agricultural Economics at Purdue.

A portable computer terminal with tape storage capability was acquired with grant funds. This piece of equipment will facilitate closer interaction with other consortium members and with Guyanese in modeling the Guyanese livestock industry. It will also be used to train Guyanese in the use of systems models as an aid in evaluation of developmental policy and program evaluation.

C. Detailed Report

I. General Background and Purpose of the Grant

The overall purpose of Purdue's 211(d) grant is well summarized in the following quote from the grant document.

Purdue's grant is one of four that, "would explore the livestock industry from a total systems viewpoint, on the assumption that piece-meal attacks on a complex problem (nutrition, breeding, disease control, or credit) have been inadequate."

The primary objective of Purdue's grant is to strengthen our capability "to identify opportunities for significant livestock developments in LDC's, to analyze constraints to, and reasons for, such developments and to design programs to overcome constraints through an integrated, multi-disciplinary team approach."

Purdue has been awarded a supplemental grant in the amount of \$150,000 for the three year period beginning July 1, 1974. This supplemental funding is being provided to allow Purdue in its role as the economic and marketing component of the consortium to better support the biological production expertise provided by Texas A&M, Zuskagee Institute and the University of Florida. Four specific areas requiring expanded Purdue input were recognized. These are:

1. Expansion of the scope of the industry modeling activity to give greater emphasis to factor and product markets faced by livestock producers;
2. To participate in a consortium effort to apply the system approach to livestock development problems in a second country;
3. To exercise the integrator-catalyst role that is implicit in the industry modeling activity and;
4. To provide additional economics and systems modeling support to other consortium members.

II. Objectives of the Grant

1. Objectives Restated

The objective of the grant is to improve the capacity of Purdue University to assist AID, other developmental agencies, and countries in the analysis of ruminant livestock production and marketing systems in the different environments of the LCD's. Such analysis describes the system, indicates the factors that most seriously limit development, and suggests alternative policies and programs to remove limiting factors.

Steps to be taken to achieve these objectives include:

- a. Adapt systems approach to a specific tropical ruminant livestock production situation.
- b. Improve our analytical methodology.
- c. Increase the number of faculty with relevant experience (in systems analysis and tropical ruminant livestock production).
- d. To select a country, and
- e. Analyze its livestock industry so as to achieve a through c above.

2. Review of Objectives

The above objective and means of achievement remain relevant. However, as a result of a second year of experience, the supplemental grant to support expanded activities, and discussion during the 18 months review of the Purdue grant, it has become clear that there are in fact three objectives to be satisfied. The multi-dimensional nature of the objective set derives from the fact that grant activities involve three types of institutional responsibility: to satisfy the broad purpose of AID in funding grants to the four universities comprising the consortium; to the

consortium in achieving its objective; and to meet the objective of Purdue University as a member of the consortium.

The purpose of AID in making grants to the four consortium members is to increase its ability to assist LDC's in making rational decisions with respect to development of the livestock industry. If AID's objective is to be attained, consortium and individual university (Purdue) objectives must be consistent with the overall AID purpose. The consortium's collective objective may be stated as follows: to develop competence of consortium members to function as a cooperative, integrated, multi-disciplinary team to identify opportunities for significant livestock development in LDC's, to analyze constraints to and resources for such development and to design programs to overcome constraints. Attainment of this objective is dependent not only on each member expanding faculty expertise in tropical zone application of its own discipline, but also that a truly interdisciplinary team approach be developed.

The Purdue objective restated in II.1 above implies both a commitment to increase faculty competence in the application of economic analysis to tropical livestock development problems and a commitment to contribute positively to attainment of consortium and AID objectives. The original objective and associated steps for achievement are directed primarily toward the objective of increasing faculty expertise in application of economic analysis and systems modeling techniques to livestock development problems in tropical LDC's.

Responsibility to contribute to achievement of AID and consortium objectives while pursuing increased faculty competence requires that knowledge and experience acquired in grant related

activities be integrated into ongoing research and teaching programs. It is also critical that steps a through e in II.1 above be implemented in such a way as to promote maximum productive involvement of other members of the consortium and of appropriate representatives of the LDC hosting consortium activities. Integration of grant experience into ongoing programs will multiply the effect of increased Purdue faculty expertise in making available a larger pool of competent manpower to assist LDC's in rational decision making. Greater involvement of all consortium members will contribute realization of an interdisciplinary team approach, and to understanding and acceptance of the systems approach. Involvement of host country nationals will directly contribute to their ability to make rational decisions with respect to policy alternatives affecting livestock development.

III. Accomplishments

Accomplishments under the 211(d) grant will be discussed under the headings of steps a through e presented in Section II.1, and under the heading "integration of 211(d) experience" and "involvement of other consortium members and host country."

a. Adapt systems approach to a specific tropical ruminant livestock production situation (estimated expenses \$10,000).

Staff members White and May spent a total of four man-weeks in Guyana interviewing government officials and private entrepreneurs, collecting data, and visiting the various ecological regions of the country. Information obtained during these visits in combination with on site observations and literature review conducted during the first year of the grant provides a basis for

describing the livestock production-marketing system in Guyana. Trip reports and a preliminary description of the Guyanese livestock industry were prepared and are attached as Appendix A-C.

A revised work plan for Purdue activity in Guyana was prepared in December of 1973 and, along with revised plans from other consortium members, agreed to by the Government of Guyana as the basis for a cooperative effort between the consortium and the Guyana Ministry of Agriculture. The proposed approach for developing a systems model of the livestock industry is included in the work plan (attached as Appendix D).

Interaction with other consortium members on components of the systems model has continued through the year. Interaction has been most intensive with Tom Cartwright's group as we have attempted to insure compatibility between their micro (herd level) model and our macro (industry) model.

b. Improved analytical methodology (estimated expenses \$3,000)

This area still has not received a great deal of emphasis since permission to work in Guyana, and thus, to begin analysis of their livestock industry, was not received until early 1974. In addition to the seminar on modeling tropical beef production systems and the paper presented at the consortium's Georgetown seminar as reported in last year's report, two steps have been taken to improve methodology. The grant has provided partial support for development of algorithm is now in use at Purdue and substantially reduces solution time and core requirements for solving problems of the type that will be encountered in the systems model of the Guyana livestock industry. We have also

investigated a number of livestock sector models which have been developed for other countries. Their investigation identified weaknesses in existing models which we will attempt to avoid.

c. Faculty with relevant experience (estimated expenses \$12,201)

The breadth of faculty involvement in grant activities has been increased significantly during the past year. This has occurred partly as a result of permanent and temporary staff changes at Purdue and partly in an overt attempt to bring a wider variety of interest and training into the program. Three faculty members who had participated in grant activities during the first year are presently off campus. Will Candler has left the university permanently but he will still be associated with grant activities as a consultant. Bill Morris and Arlo Minden are on leave, in temporary endeavors which will add to our aggregate experience in tropical livestock and economic development, and will return to the university.

Four additional members of the faculty have become directly involved with the 211(d) project. They bring to the project expertise in production economics, marketing, farm management, quantitative methods, computer applications, economic development and systems modeling. In addition they participate in graduate and undergraduate teaching, research, and extension programs of the department. Thus, they not only bring necessary talent to the 211 (d) program but will be in an ideal situation to facilitate integration of 211(d) experience into the ongoing program of the department.

Arlo Minden, Kelley White, Bruce McCarl and Ralph May traveled to Jamaica, Trinidad, and Barbados. Contacts were made with government

officials, researchers, and private entrepreneurs associated with the livestock industries of those countries. Information on livestock production and marketing production obtained in these countries will be invaluable in construction of the Guyana industry model because (1) these countries represent a potential export market for Guyana beef and (2) production technologies were encountered which are not employed in Guyana but which appear to have potential (e.g. confinement feeding of beef in Jamaica and confith feeding in Barbados). The trip report and a list of people interviewed during the trip is attached as Appendix E.

Kelley White and Ralph May traveled to Guyana (May made two trips) to collect data, become acquainted with physical and institutional conditions, and discuss recognized problems and potentials with government and industry representatives. Information obtained is being utilized in model construction. Observations from these trips are presented in Appendices A through C.

Kelley White participated in the Consortium "seminar" in Central West Africa. This three week exposure to livestock production and marketing within the African environment was a very broadening experience. The observed contrast between African and South American conditions will aid Purdue and the consortium in taking a more general view in our efforts to develop systems models. A set of recommendations based on interviews and observations were made to AID with respect to content and orientation of the seminar for Africans planned later in 1974. This opportunity for representatives of the four universities in the consortium, each from a different

discipline, to travel and work together for three weeks was very enlightening. A greater degree of appreciation and respect for discipline other than our own was gained by all. A report on this trip is attached as Appendix F.

Bill Morris has been on leave this year. During this period, he has been employed by AID in Central West Africa to participate in development of programs to stimulate mid-and long-term recovery and development of livestock production in that region of the world. This exposure to African livestock development and the opportunity to work with AID and other development agencies will be exceptionally valuable to Purdue's 211(d) activities. He will return to Purdue and resume his role in 211(d) in September 1974.

Arlo Minden attended the "Seminar on Tropical America: Potential to Increase Beef Production," sponsored by CIAT in Cali, Columbia in February. He also served as consultant to the World Bank to participate in a review of Bank loans for livestock development in a number of Latin American Countries. He is presently on leave for one year to work with the Agricultural Economics and Sector Planning Division of the Technical Assistance Bureau of AID. These experiences will increase Arlo's ability to contribute to Purdue's development program in general and to 211(d) specifically.

We have gained additional experience in operating within the consortium framework and in dealing with U.S. and Guyanese governmental institutions. We have gained through experience, sometimes bitter, appreciation for the importance of planning far in advance for those activities requiring approval in Washington and/or Georgetown. We hope that in the future some of the long delays and last minute cancellation brought on by poor communication can be

avoided.

d. Choice of location for work (estimated expenses \$1,000).

While Guyana was chosen as the country in which the consortium would begin its work during the first year, more than half of the second year was gone before a final agreement was reached and we were able to physically operate in the country. After some early misunderstandings working relations with personnel of the Ministry of Agriculture have been good. The original reasons for selecting Guyana still seem valid and should lead to this being a valuable experience for both the consortium and Guyana.

e. Analysis of livestock industry (estimated expense \$10,000).

The long delay in obtaining final approval for the consortium to work in Guyana had its greatest impact on progress in this area. However, much of the foundation has now been laid and progress should be rapid during the first half of the coming year. Literature review and initial field work has been completed. This provides insight into the structure of the Guyanese livestock production-marketing system, and technical and economic data required for model development. Work has begun on conceptualization of the model framework to be used to simulate the livestock industry. Appendix G contains a graphic presentation of the system components and flows to be incorporated in the model. Most of the detailed modeling of livestock production per se will be contained in the herd simulator being developed by Texas A&M. Their model is being rewritten in GASP IV. so that it can be run on Purdue's computer. The herd model will then provide input for and utilize output from the industry model.

- f. Integration of 211(d) experience into ongoing program (estimated expense \$2,000).

Library materials relevant to systems modeling, tropical livestock production and economic development have been acquired and will become a part of our library resources. A list of materials acquired this year is presented in Appendix H. Also, a library of slides is being developed from staff travel in tropical countries. These will be available for use in the classroom, for seminars and for extension programs. The teaching staff involved in the 211(d) project are increasingly incorporating new examples and illustrations based on grant activities into their lectures.

- g. Involvement of other consortium members and host country (estimated expense \$3,000).

Other consortium members have been involved in several ways. Our revised work plan was distributed to all members. This work plan outlined the approach to be taken in industry model development and utilization in analysis of the industry. Representatives of the Purdue team visited Texas A&M to discuss the structure of both the herd and industry models, ways in which the two can be linked, and the addition of economic variables to the herd model. Close coordination has been maintained with Texas team members in converting the herd model to a language more compatible with our model and computer facility.

A cooperative data collection effort in Guyana was accomplished. Farm level data was collected under the supervision of the Tuskegee team using Guyanese interviewers. Purdue cooperated in the design of the questionnaire to include items necessary to provide economic data. Purdue also agreed to cooperate by contributing financial

support equal to two man-months of interviewer time. Ralph May worked closely with Mallory Davis of Texas in field work in Guyana.

Representatives of the Guyanese Ministry of Agriculture have been actively involved in developing work plans, have been kept informed through formal reports covering incountry activity, and through formal and informal meetings while we are in Guyana. Ministry personnel have participated by arranging contacts and when possible have participated in interviews.

A portable computer terminal with tape storage capability has been purchased to facilitate interaction with other consortium members and with the Guyanese in development and utilization of the industry model. The tape capability reduces the cost of long distance operations by reducing the time on line. This will make it feasible to work with Purdue computing facilities from one of the other universities or from Guyana. Thus, workshops utilizing the computer model can be held in Guyana. This will allow much wider participation than if they had to come to Purdue.

IV. Development of Institutional Capabilities

The impact of the 211(d) grant on Purdue's capabilities has been concentrated primarily on the human resource of the Department of Agricultural Economics. During the first two years of the grant eight individual faculty members have been directly involved in grant supported activities. Six of these staff members have been provided the opportunity to observe and study livestock production and marketing systems in one or more tropical LDC's. This exposure has substantially increased the awareness and knowledge of tropical livestock problems and potential, as well as, their key role in

the overall development process in these countries.

Of equal importance in building competence to treat problems of the type singled out by 211(d) has been the experience gained in team research. We have chosen to develop a team of agricultural economists who have different areas of interest and expertise but who will all have exposure to and competence in analysis of livestock development problems. This team then is a part of the larger consortium team which is multi-institutional as well as multi-disciplinary. This is a new experience for some involved and in the short-run presents problems. However, in the long-run we are convinced that this approach will have a much higher pay off as the complexity of problems continues to increase and is better recognized.

Additions to the library and to computer soft- and hardware with grant funds has contributed to the Department's capability. Also, the growing recognition of the potential spill over of 211(d) experience into domestic programs is helping to gain wider support for international programs within the faculty.

Temporary programs in which Bill Morris and Arlo Minden are engaged while on leave are contributing to the total faculty competence in the area of economic development programming and implementation. While these activities are not a part of the 211(d) grant, they are very complimentary. Prior involvement in 211(d) was instrumental in motivating both individuals to accept such temporary assignments. This is one of the objectives of the grant--to provide a human resource base on which AID and other development institutions can draw.

V. Utilization of Institutional Resources in Development

A significant proportion of the School of Agriculture's international activities has been involved in assisting in the development of the livestock sector in developing nations. These efforts are capsulized in the following paragraphs.

AID Contract 639 - Purdue-Brazil Technical Assistance Project

Since the early 1950's, staff from Purdue's Department of Animal Sciences have played an important role in initiating and developing teaching, research, and extension programs in animal sciences at the Federal University of Vicosa (UFV). This has included work in animal genetics, nutrition, production management, and range pasture management. In the early 1950's the UFV (then the UREMG)^{1/} initiated a Master of Science program in Animal Sciences. In 1973 a Ph.D. program was begun in this discipline. Eleven members of the Purdue staff have been directly involved in these successful efforts. Under the participant program several Brazilians have received M.S. and/or Ph.D. degrees at Purdue and other U.S. universities. Most of these have returned to the UFV where they are engaged in teaching and research activities.

Instituto de Lactcinios "Candido Tostes" (Dairy Technical School) at Juiz de Fora

Under the auspices of the AID Contract 639, Purdue's School of Agriculture also provided assistance to this post-secondary technical school. This assistance was provided in recognition of the acute shortage of trained Brazilian manpower in the area of dairy product processing and handling. Purdue staff assisted in curriculum development,

1/ Universidade Rural do Estado de Minas Gerais.

teaching and initiation of a very applied research effort. New processing equipment was purchased, installed and the staff students trained in its proper use. In cooperation with the dairy industry a successful work study program was begun. As in the case of the UFV project a major emphasis was placed on staff development with several participants receiving B.S. and graduate training in the U.S. A member of the Instituto staff (Mr. Samuel Hosken) is currently in residence at Purdue working towards an M.S. in Agricultural Economics.

Ford Foundation Grant - Institutional Development Program at the National University of the South, Argentina

An important objective of this grant was to assist the Faculty of Agronomy of this university in developing a teaching and research program in range and pasture management and animal nutrition. Four Purdue staff members were involved in this endeavor. Much of the research dealt with the potential of introducing and establishing improved varieties of grasses that would increase the carrying capacity of pastures in this semi-arid region. Funds made available by this project, the Organization of American States and various other sources supported the graduate study of several students from the University of the South at selected universities in the United States, Australia, and Europe.

Bureau of the Census contract--Population as a Variable in the Economic Development Process with Special Emphasis on Relationships with the Agricultural Sector.

The objective of this contract is to develop a conceptual model of economic development and demographic change and the interrelationships

between the two. The conceptual model was then transformed into an operational computer model. The agricultural sector, in the model, is disaggregated to provide for separate treatment of the livestock sub-sector. It is anticipated that the general structure of this model will be used as a basis for modeling specific LDC situation. The large scale systems modeling experience gained in this project is useful in 211(d) modeling.

Foreign Graduate Student Training

The Agricultural Economics Department at Purdue has for the past twenty years, made an important contribution to the economic development of many countries by providing advanced degree training to students from foreign countries. During the past three years, we have received applications from students in 38 foreign countries. Most of them from the less developed world. During the 1973-74 school year, we had enrolled students from Brazil, Canada, Argentina, Australia, New Zealand, Sweden, Mexico, Nigeria, Japan, Saudi Arabia, Iraq, and Guyana. Among students who will enter our program this fall are representatives from Nicaragua, Brazil, Philippines, Mexico, Malaysia, Peru, Ethiopia, and Guyana.

Thesis dealing with Livestock Problems in LDC's and Livestock Models.

Lattimore, Ralph G., Ph.D., August 1974, An Econometric Study of the Brazilian Beef Sector.

Ramalho de Castro, Jose P. Ph.D., May 1974, An Economic Model for Agricultural Research and a Zest for the Brazilian Economy.

Schwab, Gerald D. Ph.D., May 1974, A Computerized Decision-Making Model for the Beef/Forage Enterprise.

Smith, John L., M.S., May 1974. A Linear Programming Model for the Optimization of Management Decision on the Dairy Farmer.

Nores, Gustavo, M.S., An Econometric Model of the Argentina Beef Cattle Economy.

Nores, Gustavo, Ph.D., Quarterly Structure of the Argentina Beef Cattle Economy.

VI. Other Resources for Grant Related Activities

Physical facilities and general administrative overhead are provided by the University without charge. Incidental consulting with other staff members is also provided as a University contribution.

VII. Next Year's Plan of Work and Anticipated Expenditures

The following activities are planned for 1974-75:

- a. Complete model of Guyana livestock industry (estimated expenditure \$40,000).
The approach outlined in Purdue's Revised Plan of Work (Appendix D) will continue to be followed. This activity will require close liaison with other consortium members and Guyanese. Thus, travel to other institutions will be required and other members will be invited to Purdue for workshop sessions. It is possible that one trip to Guyana by one or two members of the team will be required for consultation and for additional data. Where possible additional data required will be requested of the Ministry of Agriculture. It is anticipated that outside consultants will be utilized in this phase.
- b. Application of model in analysis of policy alternatives in Guyana. (Estimated expenditure \$27,000).
Upon completion of the model a workshop will be held in Georgetown using our new remote computer terminal. Other consortium members will be invited to participate. The purpose of the workshop will be to expose Ministry of Agriculture personnel to the model, provide an opportunity for them to gain experience in the systems approach to problem analysis, and to examine the acceptance of model results by potential users.
- c. Seminar series in tropical livestock development problems (Estimated expenditure \$10,000).
Grant resources will be used to support departmental seminars dealing with various aspects of tropical livestock development in the world. Representatives of other consortium member institutions will be invited to present some of the seminars.

Authorities, American and foreign with experience in various parts of the world will be invited to give seminars. Also, one or more seminars will be presented on Purdue's 211(d) experience. Other departments of Purdue's School of Agriculture will be invited to participate.

- d. Graduate student support (Estimated expenditure \$12,000). Two Ph.D. students will be funded to conduct their research which will contribute to 211(d) objectives. These students may be either U.S. or foreign.
- e. Library support (Estimated expenditure \$500). Materials relevant to tropical livestock, economic development, and systems modeling will be acquired for the departmental collection.
- f. Second country (Estimated expenditure \$10,500). Purdue will participate in consortium efforts to select and begin work in a second LDC. It is anticipated that some international travel will be involved.

Table I. Distribution of 211(d) Grant Funds and Contributions From Other Sources of Funding

Review Period <u>1 July, 1973</u> to <u>30 June, 1974</u>					
Grant Related Activities	Period Under Review	Cumulative Total	211(d) Expenditures		Non 211(d) Funding Amount
			Projected Next Year	Projected to End of Grant	
Research	34,900	59,900	79,000	300,000	55,000
Teaching	3,000	3,000	10,000	40,000	20,000
Libraries	200	350	500	2,000	6,000
Publication- Duplication	600	620	500	5,000	5,000
Seminar	2,500	8,330	10,000	53,000	
TOTAL	41,200	72,200	100,000	400,000	

Table II. Expenditure Report

Under Institutional Grant #AID/csd 211(d) 3675

Review Period 1 July, 1973 to 30 June, 1974

Line Item	Expenditure to Data		Projected Expenditures			
	Period Under Review	Cumulative Total	Year			Total
			3	4	5	
Salaries	22,269	40,904	65,000	75,000	79,845	260,749
Fringe Benefits	1,571	4,700	7,000	9,000	9,330	30,030
Travel	8,500	16,370	13,000	16,851	16,000	62,221
Data Processing service & equip.	6,023	6,217	13,000	8,000	6,783	34,000
Supplies	2,838	4,092	2,000	4,000	2,908	13,000
TOTAL	41,201*	72,283*	100,000	112,851	114,866	400,000

*Includes \$3215 encumbered but not expended.

LIST OF APPENDICES

- Appendix A Report of Activities in Guyana,-- T. K. White and R. D. May, Feb. 24, 1974-Mar. 4, 1974.
- Appendix B Summary of Activities and Comments on Visit to Guyana,-- R. D. May, May 6-May 22, 1974.
- Appendix C Observation on the Guyanese Livestock Industry, - R. D. May and T. K. White.
- Appendix D Revised Work Plan 211(d) - Purdue University.
- Appendix E Report of Activities in Jamaica, Barbados and Trinidad, - R. D. May, Bruce McCarl, Arlo Minden and T. K. White, January 20-27, 1974.
- Appendix F Report of Activities on 211(d) Consortium Trip to West Africa, - May 18-June 9, 1974.
- Appendix G Flow Chart of Conceptual Livestock Industry Model.
- Appendix H List of Library Materials Acquired.

APPENDIX A

ACTIVITY REPORT

Purdue 211 (d) Consortium Members

T. Kelley White and Ralph D. May

Arrival Date: February 24th 1974.

Departure Date: March 4th 1974.

Schedule of Activities:

Monday February 25th:

During the morning the Purdue Team met with Mr. B. W. Carter, Dr. Peter Fernandes, Mr. Irvin Telfer and Mr. P. D. Sookraj of the Ministry of Agriculture. Activities and operating procedures for the week were discussed. Then more detailed plans were worked out in conference with Telfer and Sookraj.

During the afternoon meetings were held with Dr. McKenzie of the I.B.R.D. Livestock Development Project and Mr. Arjoon of CARICOM. Arrangements were made to obtain data from both organizations, and current livestock development and trade situations were discussed. We were accompanied by Mr. Sookraj.

Tuesday February 26th:

During the morning the Guyana Marketing Corporation and the Food and Nutrition Unit of the Ministry of Agriculture were visited. Mr. Soul, General Manager of the G.M.C. was unable to keep our appointment, and our schedule did not permit another visit. At the Food and Nutrition Unit we discussed availability of consumption data, the current status of human nutrition, and plan for construction of abattoir at Matthews Ridge and Ebini with Mr. Clark.

In the afternoon a visit to Ebini was made by chartered plane. A tour of forage and grazing experiments were made. Potential for commercial cattle, sheep and goat production in the region was discussed with Mr. Holder and his associates. Availability of detailed experimental data was also discussed.

Wednesday February 27th:

The Purdue Team flew to Lethem aboard an aircraft chartered for a group led

by Mr. Mecurius, Permanent Secretary for Regional Development. In Lethem, we were met by Mr. Bovell, Livestock Officer, Ministry of Agriculture. Using the Chartered Aircraft, we visited the Dadanawa Ranch and interviewed Mr. John Frederick, Assistant Manager concerning beef production in the Rupununi. The manager of the Lethem abattoir was interviewed, slaughter records obtained, and the slaughter operation observed. The Ministry's Livestock station was also visited.

Thursday February 28th:

We returned to Georgetown, and after refueling the plane flew to Matthews Ridge where Mr. Edwards, Livestock Officer, met us. We observed land cleared by mechanical and hand cutting methods, forage production and cattle. Data on cost of land clearing, pasture establishment and beef production were obtained.

Friday March 1st:

We visited the Georgetown abattoir, observed the slaughter operation, interviewed the Chief Meat Inspector, and discussed beef marketing with a wholesale butcher and a representative of Meat Marketing Ltd. These discussions provided valuable information about beef marketing in Guyana. Cattle slaughter records for 1973 were obtained.

The Sun Belle Dairy (Milk Processing Plant) was visited and the Manager interviewed. This interview provided insight into supply and demand conditions for milk.

Mr. Greaves and Mr. Browne of Guyana Airways Corporation were interviewed to obtain rate charged for air transport of livestock production and agricultural inputs.

The Bel Air Dairy (Bookers) was visited and the manager interviewed concerning management practices employed, cost of inputs, and market conditions.

Saturday March 2nd:

Stabrook Market was visited to observe one type of retail meat market in the Georgetown area.

A Wrap-up session with the Deputy Chief Agriculture Officer, Mr. Chesney, Mr. Sookraj and other members of the economics staff was held at the ministry. Accomplishments during the week and future plans were discussed. Special emphasis was placed on ways of involving Ministry personnel in the application and analysis

phases of our work.

It was agreed that a more detailed report of our activities and impressions during this week in Guyana would be prepared after returning to Purdue and copies provided the Ministry.

As model development proceeds and data requirements become clear, these needs will be communicated to Mr. Telfer through Dr. Fernandes. Mr. Telfer will indicate which data are available from secondary sources and which will require primary data collection. This exchange will provide a basis for planning a longer period in Guyana by Mr. May to collect data.

The Purdue Team expressed its appreciation for the support provided by the Ministry during this visit. It was agreed that the most critical support that the Ministry can provide during future visits is identifying individuals and institutions which can provide needed information. In the interior it will be necessary for the Ministry to make arrangements for transportation, since most available is government-owned.

Sunday March 3rd:

The Kabawer Ranch (Bookers) was visited and the Manager and Assistant Manager interviewed about cattle production under coastal conditions.

Observations:

1. Ministry personnel made every effort to assist the Purdue Team in accomplishing its objectives. This was especially gratifying since several officials had to be out of the country for most of the week.
2. The Purdue Team, with support from the Ministry, was able to accomplish all its objectives during the week. In the Georgetown area it is possible to operate more or less independently when necessary. In the interior, because of the relative importance of government agencies, more support from the Ministry is necessary.
3. Livestock production systems and associated problems are unique in each of the four regions of the country. This makes it imperative that the model developed by Purdue and the consortium be able to capture these regional differences.
4. All four regions appear to offer potential for expanded livestock production. However, each faces impediments of both technical and economic nature. At

Ebini and Matthews Ridge one's first impression is that many of the technical production problems have been solved, but there are critical economic questions. On the coast and in the Rupununi there appears to be a need for development of improved production systems and analysis of their economic viability.

APPENDIX B

TO: Mr. Bernard W. Carter, Chief Agricultural Officer
Dr. Peter Fernandes, Principal Agricultural Officer, Veterinary and Livestock Science (also 211 (d) coordinator)
Mr. Irwin Telfer, 211 (d) Counterpart for Purdue University

SUBJECT: Summary of Activities and Comments on Visit to Guyana between May 6 and May 22, 1974.

FROM: Ralph D. May, Agricultural Economics Department, Purdue University.

May 6, 1974

- (1) I arrived on ALM 941 at about 8:30 p.m. and proceeded via cab to the Park Hotel, arriving about 10:00 p.m.
- (2) I talked by phone to J. M. Davis about his plans and how we could effectively work together to obtain the necessary information.

May 7, 1974

- (1) Mr. Davis, Dr. Howze, and I discussed briefly the questionnaire for the farm survey of Coastal and Rupununi Livestock producers.
- (2) Mr. Davis and I went to the USAID Memory Bank.
- (3) Mr. Davis and I purchased tickets for our weekend (May 10-13) trip to Lethem at Guyana Airways.
- (4) Mr. Davis and I went to Rupununi Development Company and Meat Marketing Limited and obtained information on the Pirara and Dadanawa operations from Dr. Frazier and Mr. Tiam-Fook respectively. We made an appointment through Mr. Tiam-Fook to visit the Dadanawa Ranch on Sunday, May 12.
- (5) Mr. Davis and I obtained information from Mr. Peter Frazier and his father at C & F Market about their integrated family owned business and set up an appointment to visit Mr. Jeff Frazier at his ranch on Thursday, May 9.
- (6) Mr. Davis and I got one last look at the final questionnaire from Dr. Howze.

- (7) Mr. Davis and I went to the Ministry of Agriculture to talk with Dr. Fernandes. I obtained information from him on the data sources for input markets and local transportation facilities.
- (8) Mr. Davis and I stopped at Mr. Sookraj's office and obtained some slaughter data that his group were keeping.
- (9) After working out what information I needed from Matthews Ridge, Mr. Davis and I got together to coordinate our plans for the rest of the week.

May 8, 1974

- (1) Went to USAID to make some phone calls to set up appointments and obtain information and check for data in the USAID Memory Bank.
- (2) Went to Ministry of Agriculture and met with P.D. Sookraj about my plans and to check on possible data sources.
- (3) Called Mr. Tiam-Fook from USAID to get cost of production figures on Dadanawa Ranch.
- (4) Talked with Basil Phillips by phone about our planned trip to the Rupununi.
- (5) Talked with Mr. Wilkins with respect to Mr. Davis and I visiting Kabawer and Golddiggings Ranches on May 9.
- (6) Talked with Mr. Davis by phone about his trip to Matthews Ridge and our future schedule.

May 9, 1974

- (1) Dr. Marti, (USAID), Mr. Davis and I went by hired car to Bushy Park to obtain livestock production data from Mr. Jeff Frazier.
- (2) We stopped along the road between Bushy Park and Blairmont Sugar Estate to take pictures of the cattle.
- (3) We met Mr. Dhaniram, the Manager of both Kabawer and Golddiggings since Mr. Humphrey has moved to Dadanawa Ranch, who took us by Golddiggings and up through Kabawer to the Abary Creek. We obtained information about the production of cattle and took pictures of the cattle.
- (4) Mr. Davis and I went by to see Dr. Fernandes at his home and obtained letters authorizing visits to Rupununi ranches and Amerindian villages. We also talked with Dr. Fernandes about how our work was progressing.

May 10, 1974

- (1) Mr. Davis and I flew to Lethem where we were met by Dr. Applewhaite. We discussed our proposed itinerary while in the Rupununi.
- (2) Dr. Applewhaite drove us by the Government Guest House where Mr. Davis and I had lunch.
- (3) After lunch Dr. Applewhaite picked us up and we proceeded about 80 miles north from Lethem past Good Hope. Mr. Davis spent several hours visiting (in Portuguese) with Sr. Newton Tavares, owner of Fazenda Guanabara Ranch. I took some pictures of his cattle and visited with Dr. Applewhaite because we couldn't participate in the conversation.
- (4) We visited a foot and mouth checkpoint on the river and took pictures of Mr. Gorinski's cattle along the Takatu River.

May 11, 1974

- (1) Mr. Davis and I went with Mr. Ranjen, the driver, to the Pirara Ranch and met Mr. Fung-On who showed us some cattle and gave us some production and cost data from the ranch.
- (2) We stopped at another foot and mouth station where Mr. Davis and Mr. Fung-On crossed the Takatu River and I stayed at the Rover to copy some data from records obtained from Mr. Fung-On.
- (3) We went by Buritizeiro and took some pictures.
- (4) We met Mr. Michael McTurk at Cajueira and talked briefly with him and looked at some of his cattle.
- (5) We spent the rest of the afternoon in Amerindian villages where we talked to the "Tushaws" to get information about their cattle: Toka, Yuyacari, Quotata, and Macacanabu.
- (6) We returned to Lethem via Manari to overnight there.

May 12, 1974

- (1) Mr. Davis and I left Lethem with Mr. Ranjen, the driver, and drove south to the Dadanawa Ranch, where we met Mr. and Mrs. Humphrey, Mr. Chan, Mr. Simpson, and Mr. Fredricks and talked about Mr. Humphrey's plans for the ranch.
- (2) After a very good lunch, we drove to Araqual outstation to see some cattle in a corral there.

- (3) We came by the sand creek Amerindian village and talked with the Tushaw there about their cattle.
- (4) We stopped at Santa Cruz but Mr. Anderson was not at home.
- (5) Finally returned to Lethem for the night.

May 13, 1974

- (1) Mr. Davis and I obtained some slaughter records from Mr. Dorn and talked with Mr. Lomas at his store in Lethem.
- (2) We paid Dr. Applewhaite for the gasoline and driver that he provided us during our visit and Mrs. Matthews for our meals.
- (3) We spoke briefly with Dr. Fernandes, Dr. Frazier and Dr. Howze at the Lethem airstrip prior to leaving for Georgetown.
- (4) Mr. Davis and I went to see Mr. Ritson at his office in Georgetown and obtained some production data and cost from him.
- (5) We then stopped for a long visit with Mr. Wilkins about Bookers cattle production plans etc.
- (6) We had supper with Mr. Simpson at the Georgetown Club.

May 14, 1974

- (1) I visited with Dr. Marti at USAID while Mr. Davis finished up some business in town.
- (2) Mr. Davis, Dr. Marti and I went by C & F Market where I obtained a price list of meats sold there.
- (3) Mr. Davis, Dr. Marti and I went by the Georgetown abattoir where I talked with the manager of operations since Mr. Fung-On was not there at the time.
- (4) Mr. Davis, Dr. Marti and I went to the Rupununi Development Company office and visited with Mr. Simpson and Mr. Tiam-Fook about Dadanawa Ranch.

May 15, 1974

- (1) Dr. Marti and I went to Guyana Stockfeeds Company and talked with Mr. J. Bacchus and Mr. Ivan Veerasammy about their operation and received both a retail price list and some input costs.
- (2) Stopped back at USAID, worked on getting some secondary data copied.

- (3) After an early lunch we went up the East Coast to Purina Feed Mill. Since Mr. Douglas was not available, we talked with Mr. Hilton Sullivan about the plant operations and received a price list for feeds. We also visited with Mr. R. A. Clark with respect to the construction of an addition to the existing facility.
- (4) On our way back we stopped at a small shop along the road and talked with Mr. Robinson who has only a couple of cattle up there.
- (5) We also stopped at Mahaica to look at the market.
- (6) After returning to USAID offices, I worked on some paper work that I was behind on.

May 16, 1974

- (1) I went over to USAID to make some phone calls and talk with Dr. Marti.
- (2) Dr. Marti and I went to the IBRD office to return some papers we had borrowed for copying.
- (3) We also stopped at the bookstore to buy some books about Guyana.
- (4) I went to the Georgetown abattoir and met with Mr. Fung-On and collected some information on livestock slaughter.
- (5) Returned to USAID and worked on my trip log.
- (6) Met and talked with John DeGrazio about rabies problems in Guyana.
- (7) Returned to hotel to read some papers I had borrowed from Dr. Marti.
- (8) I ate supper with and spent most of the evening visiting with John DeGrazio about bird problems in agriculture.

May 17, 1974

- (1) I went to IBRD office and met with Mr. Khan to obtain some information about how they developed their loan applications.
- (2) Also talked briefly with Mr. Ritson about livestock production in the Rupununi.
- (3) I then stopped by USAID and talked with Mr. Eason briefly and arranged for the typing of my trip log.
- (4) Then I stopped by to copy some data from the Rupununi Development records in Mr. Tiam-Fook's office.
- (5) I went to the survey office to purchase some maps of Guyana .
- (6) I stopped at Bookers and bought a carry on case for the return trip to the U. S.

- (7) I picked up Dr. Marti at USAID and proceeded with him to the Ministry of Agriculture.
- (8) We went by to see Dr. Mohamed Naseer, Mr. Sookraj, and Mr. Sing.
- (9) We returned to USAID where we talked with Dr. Fernandes and Mr. Wilkins briefly.

May 18, 1974

- (1) I went with Dr. Marti to do his food shopping.
- (2) I called Mr. Rahamm and obtained his price list for trucking.
- (3) Worked on trip log.
- (4) Went by to talk with Mr. Rahamm at his home.
- (5) Called Mrs. Danials about freight rates to Ebini and Matthews Ridge.
- (6) I stopped by to give my trip report to Dr. Fernandes.
- (7) I ate dinner with Dr. Marti at his home.

May 19, 1974

- (1) I'll take a cab to airport for departure for home.

Notes and Comments

I enjoyed my trip to Guyana very much. I feel that I have met some very interesting and informed people over the last 18 months. I'm looking forward to my next trip this winter to check out the model that we are currently developing at Purdue. All of the people contacted during the last two weeks were very cooperative which made my stay shorter and more enjoyable than expected. I have given Dr. Fernandes a copy of my last attempt at describing the existing livestock situation which will be revised on my return to the U. S. When the revision is complete, a rough draft will be forwarded to Dr. Fernandes.

Ralph Dewell May, Purdue University

APPENDIX C

Introduction

Two visits to Guyana were made by members of the Purdue 211(d) Team during 1974.^{1/} The purpose of these visits was to become familiar with the structure of Guyana's livestock industry, to collect data which would be useful in characterizing the industry, and to discuss with government and industry representatives the perceived problems and opportunities facing the industry. In this report impressions gained during these visits relative to the current state of the industry and development possibilities are presented.

This document is intended as an input to the growing body of information about the Guyana livestock industry being accumulated to serve as a basis for construction of an industry model. It is an attempt to summarize in an organized fashion the addition to our information base resulting from observations, interviews, and acquisition of secondary data during the two separate periods of physical presence in the country. It is not intended as a complete and balanced description of the livestock industry. However, in some instances previous reports^{2/} and secondary sources have been incorporated in order to provide perspective or continuity to the presentation.

Overview

Livestock production represents an important component of the total agricultural sector of Guyana. Sugar and rice are the most important sources of agricultural income with livestock in third place. Both sugar and rice are produced on irrigated land on the coast. Since expansion of irrigated land area is both expensive and limited by the quantity of suitable land, opportunity

^{1/} T. K. White and R. D. May during the period February 24 - March 4, 1974, and R. D. May during the period May 6 - May 19, 1974.

^{2/} Report on the Ruminant Production Situation and Prospects in Guyana, W. Morris and W. Candler is frequently drawn upon.

for increasing production of these products is somewhat limited.

Guyana has large areas of land which are not being exploited agriculturally. Much of this land is subject to long dry periods and has limited natural fertility. Other areas are heavily forested and isolated from major product and factor markets. It has been suggested that these large areas of unused land provide a basis for greatly expanding livestock, especially beef cattle, production. A market to absorb increased beef production exist both domestically and in neighboring Caribbean countries, almost all of which are net importers of beef.

Within Guyana there are four areas which are actually or are believed to be potentially important livestock production regions. These areas and their designation on Figure 1 are:

- (1) The Coastal Lands (Area 1 on Figure 1)
- (2) The Intermediate Savannahs (Area 2 on Figure 1)
- (3) The Northwest District (Area 3 on Figure 1)
- (4) The Rupununi District (Area 4 on Figure 1)

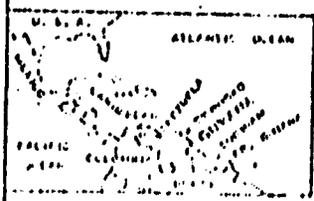
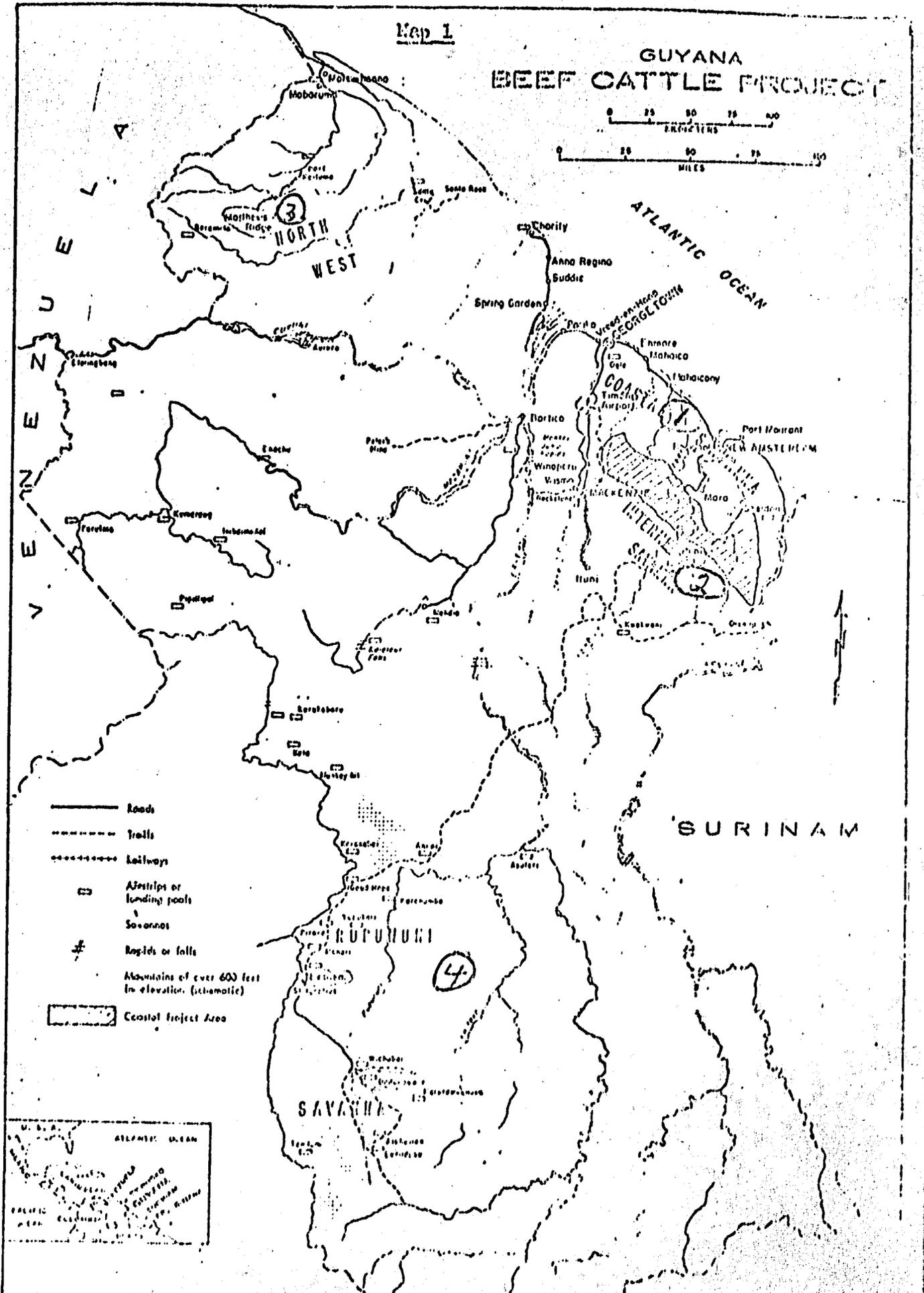
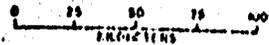
Commercial livestock production is concentrated in the Coastal Land and the Rupununi District. The Intermediate Savannahs and the Northwest District are areas believed to offer potential for beef production, but current production is limited primarily to government operated experimental and pilot ranches.

The Guyanese cattle herd reached a peak of about 300,000 head in 1965.^{3/} In contrast to the apparent potential for expansion, the herd had declined during the past ten years. It was estimated at 260,000 head in 1969 and has declined rapidly since then. While no recent official estimates of the national herd are available, one informed official estimated in early 1974

^{3/} IRBD, "Guyana Beef Cattle Output", World Bank, Washington, D. C., 1970.

Map 1

GUYANA BEEF CATTLE PROJECT



that the herd probably did not exceed 100,000, with approximately half being on the coast and half in the Rupununi.

In 1969 it was estimated that the coastal herd numbered approximately 180,000 with about 60,000 head in the Rupununi. The remainder were in minor producing regions. Thus, if the unofficial estimates quoted above are approximately correct, the major decline in the national herd has occurred on the coast. This rapid decline is attributed to low prices for both beef and milk, a trend toward double cropping of rice, and a very serious problem of cattle rustling.

Livestock production on the coast is characterized by a large number of small herds maintained primarily for milk production with beef as a by-product. Most of the small dairy herds are owned by rice farmers who employ a rather low level of technology. There is a small modern dairy sector and a very limited number of larger ranches on which beef is the primary product.

Production in the Rupununi is typified by extensive ranching operations. Few purchased inputs are used and technology has changed very little since cattle were first introduced into the region. Meat is the primary product with milk production being limited to that needed for on farm consumption and the small local markets that exist in the region.

Total beef production in the country is currently running at about 9.5 million pounds per year. The Rupununi produces approximately two million pounds. The remainder comes primarily from the coastal herd. Given a population of approximately 750,000 people and essentially no imports or exports this production level implies an average per capita beef consumption of approximately twelve pounds per year. Milk production is insufficient to satisfy demand and some 60 million pounds of milk equivalent is imported. FAO estimates recent milk production at about 45 million pounds. Thus total

consumption of milk in all forms is 100 million pounds.

Both milk and meat consumption is concentrated geographically in Georgetown and the heavily populated coastal region. Thus, expanding production in other regions is going to present assembly and transportation problems. There is, at present, little processing of either milk or meat. Most milk is consumed as unpasteurized milk and meat is consumed fresh - within two or three days after slaughter.

Cattle Production in the Coastal Area

The coastal region of Guyana consists of several types of land. The narrow strip of empoldered and drained clay soils which is intersected by rivers has been reclaimed at considerable cost. Annual maintenance cost is also high. Practically all of these soils are under cultivation. It is well suited to sugar and rice production which yield, given current world prices, much higher returns than would production of forage for livestock. There are also a few areas of sandy soil (especially in the east) which are used primarily for coconut production. Cattle are grazed in coconut groves.

In addition, there is a limited area inside the dyke that tends to be affected by salinity, and thus is not suitable for cultivation. Behind the cultivated clays are more extensive areas of land that have not been drained. Much of this land is likely to be subject to problems of aluminum toxicity if fertilizer is applied without the addition of lime.

Livestock production in this area is, for the most part, a means of utilizing the surplus forages that grow when other crop production is not possible. After the rice harvest there has been a considerable amount of grazing the stubbles. The adoption of double cropping of rice reduces the time available for this. However, it would still seem that the straw could be saved for the cattle. Rice bran and rice polishings are also available,

although they can also be used for pigs and poultry.

Expansion of cattle production on the coast cannot be economically achieved at the expense of cane and rice acreage. Instead it must depend on more complete utilization of crop residues, more intensive forage production on existing grazing areas and extending cattle production into areas not being utilized at present.

Discussion with R. Brinkman, who participated in the soil survey of Guyana, indicated that the area between the Canje and Courentyne rivers has the highest potential for development for cattle production. A survey for FAO of the agricultural potential by Hunting Technical Service^{4/} describes the possibility of an irrigated crop and livestock development. At that time there were 31,000 head of cattle in the Canje scheme areas, 11 percent of the national herd.

The report states that in the dry spell in 1963/64 many cattle died from starvation and/or thirst and in the wet season much of the grazing land is inundated. The cattle using it then poach the soil severely.

River valleys in the coastal region subject to flood can, if carefully managed, be satisfactory for cattle production. There remains a risk of loss when the water rises rapidly. The flood plain stands in two to four feet of water for four to five months of the year. Young calves born during the flooded season very seldom live through to the dry season. In order for calves to be born in the best part of the dry season, the cows must be bred during the wet season when the flooded pastures make it almost impossible for the bulls and cows to mate.

The most stress on the adult cattle comes from the mud that is present when the water recedes from the land. This mud requires large amounts of energy for the animal to pull itself through in order to graze the pastures. This

^{4/} FAO, "General Report Survey of Canje Reservoir Scheme", Ministry of Information Library, Georgetown, Guyana, 1965.

results in a loss of weight and sometimes, in loss of livestock themselves due to their poor physical condition. The Creole cattle currently living on the flood plains have adapted to the area and can live and reproduce under these conditions. World Bank farm plans are able to show a profit on these flood plains, using native cattle. Some ranchers in the coastal flood plains have considered importing water buffalo for raising in the wet areas, but the cost of breeding stock is so high that it does not seem economical.

A rapid decline in the size of the coastal herd has occurred since 1965. Even though no recent estimate of herd size is available, the severity of the depopulation process is evident from slaughter data showing that by late 1973, cows and heifers accounted for 75 to 80 percent of total slaughter in the coastal area. To prevent further destruction of the breeding herd a law prohibiting slaughter of female animals was enacted. This law, which went into effect early in 1974, and its impact will be discussed in more detail below.

Cattle rustling and a shortage of pasture are the primary causes of this massive selling off of breeding stock. Land prices along the coast have risen very rapidly, due to the increased demand for housing and the higher returns to sugar and rice production. These alternative land uses and the rustling problems have resulted in farmers either selling off their herd or moving the cattle into the flood plain behind the cropping belt. A free market price of milk could result in at least , a decline in the rate of decrease in livestock population on the coast. Higher milk prices also should induce others to enter the dairy business, thus increasing the coastal livestock population.

A large portion of the cattle on the coast are owned by small farmers. Herds of two to ten head graze on public land during the day and are closed up in the yard at night. A law was recently passed requiring farmers to contain their cattle. Failure to keep your cattle contained results in a fine of \$10

per head each time the cattle are caught running free. These fines increase the incentive for a farmer to divest himself of his cattle during a period of short grazing on owned land. Lands along the coast are fenced now so that the cattle are contained in communal pastures in the salt flats during the wet season and on higher ground during the dry season. A fenced area may contain animals that are owned by as many as 10 to 15 families. Detailed information concerning production and marketing practices employed by small coastal producers has been collected in a sample survey conducted under the direction of Tuskegee Institute. Results will be summarized in a subsequent report.

Cases of large scale beef cattle production are rare on the coast. Two such ranches are operated by Bookers Estate which has extensive coastal land holdings. They produce sugar cane on land which has been ditched for drainage and irrigation. Cattle are produced on two ranches (Golddiggings and Kabawer) occupying unditched land. They currently have 14,000 acres of land allocated to cattle production, but are in the process of preparing 3,000 acres for sugar production which will reduce the cattle unit to 11,000 acres. Most of the land used for cattle production is not ditched, so water stands on it for five to six months of the year. The ranch managers agree that ditched land will be used for crop production, so as they drain more land, cattle production will be curtailed.

The Golddiggings section of the cattle operation is used to upgrade the breeding herd (using artificial insemination), to grow out the dairy bulls, and to raise dairy replacements. There are 270 cattle at Golddiggings on improved pasture receiving molasses and urea (some three percent and the others six percent).

rice bran or wheat middlings is fed as a concentrate supplement. The improved pasture is fertilized with urea (enough to provide 100 pounds of N per acre). An average of four artificial insemination attempts is required per calf born, producing an annual calving percentage of about 90 percent in 1973.

Seasonal breeding is attempted in order to have calves born at the end of the

rainy season. This allows the calf to gain strength before it goes into the water and mud. Brahman cattle have been found to perform best in the conditions existing here. Charolais bulls were tried, but produced severe calving problems so they are no longer used. Hereford cattle were also tried, but tended to be too short to be able to get around during the rainy season. The manager of Golddigings would like to cross water buffalo with the native cattle to improve their performance during the wet season.

Weight loss by cattle is pronounced during the rainy season when pastures are flooded and is even more serious as flood waters recede and mud becomes deep and heavy. This period of heavy weight loss is also the period of highest mortality, especially among the old cows and young calves. When the water is two to three feet deep, the only grass available to the animals is Bamboo grass, which grows out above the water. Low dry matter content of the grass and increased energy required for the animal to move about in water and mud combine to produce rapid weight loss and high mortality. Supplemental feeding on flooded pasture is not considered practical.

The biggest obstacle to cattle production at Golddigings is theft. Even though all cattle are brought into pens near the house every night, five head were stolen from Golddigings in February, 1974. The improved pastures are fenced (cost - \$1400 per mile, with a life expectancy of five years). Rotational (six weeks rotation) grazing is used with some adjustments during the wet season. Weaned calves are separated from the cows once per year. Calves are also shipped to Golddigings from Bel-Air Dairy at about one week of age, in loads of 15 calves at a cost of \$80 per load. The same truck and rate is used for shipments of cows and steers in either direction. The truck used will haul nine cows or eleven slaughter steers. Until the calves are mature enough to consume concentrate and pasture, they receive milk replacer at a rate of one

pound per day, at a cost of \$.55 per pound.

The Kabawer section of the cattle operation is under extensive range conditions where 3500 cattle are on 11,000 acres of range land. The range cattle reach slaughter weight (682 pounds) in 37 months (see Table 1). The steers are sold to Bookers Supermarket during the dry season (200 plus last year) because this is the only time the steers can be collected for shipment to Georgetown Abattoir. For working the cattle on the range, the ranch has a total of 70 horses (about \$500 each) and 10 full time men. During round-up each man is provided with three trained working horses.

The average death loss for adult cattle under range conditions is seven to eight percent and occurs primarily during the wet season. Scours during the wet season is one of the contributing factors to the large death loss. The cows lose strength during the wet season due to scours and the high water content of the low quality grasses and are too weak to survive in the muddy conditions. From May, 1972 through December, 1972, flooding caused a loss of about 1500 head from drowning and associated causes.

Table . Average Age and Weight of Steers Marketed From Kabawer Ranch, 1967 Through 1973.

Year	Age (months)	Live Weight (pounds)
1969	39	778
1970	39	720
1971	36	619
1972	36	596
1973	<u>33</u>	<u>696</u>
Average:	37	682

Source: Roy Wilkins, of Bookers, Ltd., Georgetown, Guyana.

Losses attributed to theft are estimated to be eight percent per year, or about equal to death losses. The cattle that are stolen usually are forced to swim either the Berbice or Abary rivers. Those that go across the Berbice are usually sold in Surinam, and the others are sold (with their skins and head removed) to the Georgetown meat markets. The primary disease problem is rabies. The bull-cow ratio on the range is one to ten. Labor costs are \$33 to \$36 per week and workers and their families receive some foodstuffs. The calving percentage on the range is estimated to be about 70 percent, but the death loss is about 50 percent during the first month after birth.

The Kabawer unit is a cow-calf operation with no seasonal breeding on the range. Cows produce their first calf at about three years of age and calves are weaned at about nine month of age. Upon weaning, steers and heifers are separated from the herd for growing out.

The Intermediate Savannas

The Intermediate Savannas is an area of about 3800 square miles which does not flood during the wet season, but does have a pronounced dry season. The climatic conditions are better suited for livestock production than most other parts of the country. Improved pasture and feed crops can be produced on these lands. Commercial livestock production has never been implemented in the area, but results of experiments at Ebini Livestock Station demonstrated that modern livestock production is technically possible. Relatively high fertilizer applications are required. The experimental operation at Ebini has not been demonstrated to be economically viable.

Most of the research on beef cattle production in Guyana has been centered at Ebini. Ebini was originally a staging station, the end of the trail from the Rupununi, where the cattle were rested and loaded on boats. Prolonged grazing (over two to three months) at Ebini was observed to produce fertility problems

and a high mortality rate. In 1941, a research station was set up to study this and other problems with a view to providing the basis for economic cattle production in the Intermediate Savannas. The initial recommendation was to feed a mineral mix and this was found to overcome the major problems of reproduction and survival.

In 1957, another approach was started which has been continued to date; research and development of a highly intensive system of production based on improved or exotic pastures.

The Station has 2,000 acres of improved pasture out of an allotment of some 50,000 acres of range land.^{5/} The fertilization rate is 200 pounds of N and 200 pounds of P per acre. Fertilizer is transported from Georgetown to Ebini by boat, at a cost of \$2 per ton. Legumes have been mixed with most of the grasses in an attempt to reduce the fertilizer requirements. Pasture experiments are currently underway to check the nitrogen fixing ability of different legumes to see how much the fertilization rate can be reduced. Cattle perform better during the dry season on a mixture of grass and legume because legumes tend to get ahead of the grass during the wet season and do not get as fibrous as grass during the dry season. This results in continual weight gain and growth throughout the year. The improved pasture is fenced into paddocks so that rotational grazing is possible and is used on a four-week rotation. Ebini Station has a total of about 2,000 head of cattle in their improved pasture paddocks. Little,

^{5/} Holder, Noel L., "Supplemental Feeding of Beef Cattle Grazing Pangolagrass Pastures on the Intermediate Savannas of Guyana", unpublished Masters Thesis, University of Florida, Gainesville, Florida, 1972.

if any, use is made of the large area of native pasture available for the Station use.

Seasonal breeding is used for part of the cattle herd and the rest of the females run with the bull at all times. The cows in the seasonal breeding program calve during the dry period, from September through November. They have been trying a Charolais bull on a group of cows and have been weaning the calves at 500 pounds (about seven months of age). The primary problem has been a lower calving percentage (90 percent) than the average for the herd (92-96 percent, best in dry years). A low calving percentage has also been the primary problem with using Brahman bulls at Ebini.

The seasonal weather patterns for Ebini are as follows:

- (1) Short Wet - November-January
- (2) Short Dry - January-April
- (3) Long Wet - April-August
- (4) Long Dry - August-November

The long rainy season accounts for 50 percent of the annual rainfall, but Wagenaar classified the area as a rainforest climate, "continuously moist".^{6/} Wagenaar also stated that a drought usually occurs at five year intervals.

Goats and sheep are being moved from the coast (in relatively poor condition) to Ebini, where breeding to pure-bred males is being used to improve the national herd. The annual carrying capacity of the native range is two acres per sheep or goat, but the goats tend to do better on the range than do the sheep. On improved pasture they are currently running three sheep or goats per acre. The sheep and goats on both the native and improved pasture receive mineral supplements due to the inherent shortage of soil minerals. Some of the goats are

^{6/} Wagenaar, G. A. W., "Report on the Soil Survey Project, British Guiana II Soil Management", FAO, Rome, Italy, 1965.

being fed in a feedlot type situation, using kitchen waste to supplement the improved pasture. The sheep and goat herd currently is composed of about 170 goats and 330 sheep. Due to the large number of East Indians in Guyana, the retail price of mutton is about twice that of beef.

The annual rainfall in the area is about 90 inches per year, but unlike most of the cattle producing areas in the country, this area of about 3800 square miles does not flood during the wet seasons. The absence of flooding makes this area potentially more attractive for the commercial production of sheep, goats and cattle.

The underlying problems in the Intermediate Savannahs are that land clearing and pasture establishment and maintenance costs are high. Soil types in the area have very low natural fertility. Fertilizer costs are high, and so far, profitable combinations of grasses and legumes have not been identified. Pangola grass production, especially under low levels of fertilization, has been depressed by a stunt virus, and unfortunately, the calving rate on the Pangola pastures are relatively low.

On the natural range land, the cost of ranch development is still quite high per head of off take. The calf mortality and calf disappearance, as well as deaths in the cows, greatly lower the potential yield and depress the live weight production per breeding cow per year.

If livestock production is to be commercialized in the Intermediate Savannahs, the labor and management personnel must be enticed to move from the cities along the coast. This lack of population in the area is a problem that possibly can be alleviated by completion of a year-around road to connect this area to Georgetown. With adequate transportation facilities, a dairy industry located in this area could supply a large portion of the population of the country.

Northwest District

The Northwest District is mountainous and heavily forested. Rainfall is heavy and more evenly distributed throughout the year than in other regions of the country. Temperatures are moderate due to the higher altitude. Crops can be grown 12 months of the year. The area is very sparsely populated and has undergone little economic development with the exception of some scattered mining.

The only livestock production in the area is located at Matthews Ridge, where a Government-owned farm is in operation. The lack of population in the area and the high cost of capital cost in clearing land tend to be the primary constraints to livestock production. The accessibility of the area to the heavily populated coastal area is not as good as the Intermediate Savannahs area, but much better than the Rupununi Savannahs. This lack of accessibility tends to make an area less desirable to the people who must be enticed to move there, if livestock production is to be increased in the area.

Matthews Ridge is an area in the Northwest District of Guyana near the Venezuela border, where jungle is being cleared to enable production of crops and livestock. The livestock production unit there has 1050 acres of improved pasture and 200 acres of native grazing. Initially the clearing was done with bulldozers at a cost of \$164 per acre of established, fenced Pangola grass pasture. Land packing due to the weight of the machines resulted in a major problem with sedges crowding out the Pangola grass. Pastures required re-establishment every six to twelve months. This packing problem resulted in a change to hand-clearing of the underbrush (\$40 per acre, or almost two man-weeks of labor), burning during the dry season, and sprigging in the grass in the unplowed soil (\$25 per acre establishment - estimate). Currently hand-clearing and two burnings at Moblissa, is contracted for at a cost of \$125 per acre.

Marketable trees are left when the underbrush is cleaned out and cut later for commercial sales, or for use by farmers in building farm buildings. Fencing costs \$700 per mile and is expected to last for about four years before reposting is required. The stumps of the trees remain in the ground so they present some problems when tractors are used to maintain the pastures.

In order to alleviate the sedges problem, a different grass is now being used (Tanner grass) that seems to be better able to compete with the sedges. A rotational grazing program (four-six week cycles) is also used to prevent overgrazing of the pastures (minimum height of 5"). This gives the grass a better chance against the sedges. Grazing is begun on newly established pasture about three months after sprigging-in is completed. About two acres of Pangola grass pasture is required to carry one animal on a year-around basis. Sedges tend to be more of a problem in the lower area where water stands during the rainy season.

Improved pasture is fertilized at a rate of 150 pounds of triple super phosphate and 150 pounds of urea per acre. Triple super phosphate cost is \$280 per ton and urea cost \$214.50 per ton. The government livestock farm pays its' labor \$5.50 per day, which tends to be a little above the going wage in most areas, in spite of the fact that this includes no food or housing benefits. One herdsman is required for every 40 head of cattle.

The government ranch at Matthews Ridge currently has a total of 757 head of cattle, some imported, but the current policy is to purchase female cattle from the coast and move them to Matthews Ridge to increase their herd size.

The existing herd composition is as follows:

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Herd Bulls	12
Brood Cows	480
Calves Born 9/73-4/74	157
Steers Not Sold	57
Heifers Not Yet Bred	43
Young Herd Bulls	<u>8</u>
Total Herd	757

A Santa Gertrudis bull is bred to native stock to improve quality. Future plans are to purchase the small immature stock from the coast and ship them by boat to Matthews Ridge for finishing on improved pasture, corn and soybean supplement. Corn yields at Matthews Ridge have been about 2500 pounds per acre. It is customary to get two corn crops per year. The boat used to transport cattle from the coast will accomodate 30 head and takes about 24 hours of travel time. The target is to bring in cattle and keep heifers to try to get a herd size of 2000 head at Matthews Ridge.

Canadian Cane Consultants have developed a machine for separating sugarcane into wax, rind, and pith (confith). The pith or pits and ground tops can be used as a high energy feed for livestock in areas where sugar cane is efficiently produced. High protein supplements or urea is added to make a complete feed for finishing cattle. It is anticipated that Canada AID will give Guyana a Confith machine, which will be installed at Matthews Ridge to provide feed for the immature cattle brought from the coast and the steers produced from the herd there. It is estimated that with Guyana cane yields (40 tons per acre), one acre will provide enough confith for five animals. Another firm, in Florida, has developed a process of producing a complete pelleted feed for livestock, using a high percentage of cane in the process. The above two alternatives for

cattle finishing will be included in the study.

Cattle tend to perform better on pasture during the dry season because the water content of the grass is so high during the rainy season. The annual rainfall at the cattle ranch is about 85 inches per year and rain occurs throughout the year but it does get dry enough for burning during March.

Grass and legume mixtures have produced better gains than grass alone; grass and legume 1.5-2 pounds per day and grass (alone), .9 pounds per day. The cattle receive a high phosphate mineral supplement (2 oz. per day) called "133", which costs \$19.51 per 112 pound bag.

Steers produced at Matthews Ridge reach slaughter weight at about two years of age. Santa Gertrudis and Brahman bulls are used on cows and a Charolais bull was tried, but didn't produce a good calving percentage; so he was removed. The average calving percentage last year (including the out-of-condition cows from the coast) was 62.5 percent. The herd death loss (adult cattle, in condition) is about three percent. The last group of cows brought from the coast (199 head) experienced an eight percent (15 head) death loss before they were in condition.

Experience indicates that some form of rotation between pasture and crops could produce the best results. The GOG is very interested in the formulation of a farm plan that could be used to provide an annual family income of \$3600 at Matthews Ridge.

The Rupununi Savannahs

The Rupununi Savannahs in the southwest comprise an area of 5,000 square miles of low fertility soils with low nutritional status and low base exchange capacity. The FAO Soil Survey reports, "No intensification of agriculture can take place in the immediate future on the Rupununi Savannahs."^{7/} In

^{7/} FAO., "Report on the Soil of British Guiana (FAO, SF: 19BRG), 1966.

contradiction to this view, the World Bank is experimenting with Townsville Lucerne, in the hope of substantial increase in carrying capacity.

Cattle were introduced from Brazil in about 1860, using an open range system of production. The cattle used to be driven along the trail to Ebini and shipped from there to Georgetown at a cost of about \$3 per head. Now the higher grade carcasses are flown to Georgetown at a cost of about \$30 per carcass. Lower grade carcasses are consumed locally. The by-products have not been well utilized, but a planned meat cannery should improve this.

The Rupununi trail has been blocked to prevent the movement of cattle from the foot-and-mouth disease prone area to the area free from it in the Intermediate and Coastal regions. The last outbreak occurred in the Rupununi in September, 1973.

In the future the Rupununi will be accessible by road from Boa Vista, Brazil, to Georgetown. However, the shipment of live cattle to the coast from the Rupununi is not likely to be permitted if Guyana is to export meat to the Commonwealth Caribbean. Spread of foot-and-mouth disease to the coastal dairy herd would have a very serious effect on production. The new roads will greatly reduce the costs of getting inputs to the Rupununi and getting the meat to Georgetown, the major consuming center.

The natural pastures in the Rupununi have the typical problem of tropical pastures with a long dry season; their protein content is insufficient for a major portion of the year. Attempts to introduce Pangola grass have been unsuccessful and with fertilizer having to be flown in, its use is not practical. So far, tropical legumes have not been successful but attempts to establish them are being continued. There is a research station at St. Ignatius, currently more or less inactive, at which much of the research has been done. Carcasses of 400 pounds plus have been produced at 3 1/2 years of age, under

experimental conditions.

There are about 52,000 head of cattle in the region and the off take reaching Georgetown is about 5200 head a year (two million pounds in 1972), about 21 percent of the supply in Georgetown. The 1973 slaughter from this area was greatly reduced due to an outbreak of foot-and-mouth disease in the south Rupununi.

A herd of 60,000 head might be expected to have the following composition, mortality and sales (IBRD Guyana Beef Project, 1970 Annex 10[45]):

<u>Approximate Composition, Mortality and Sales for Rupununi Cattle Herd</u>			
	<u>Head</u>	<u>Mortality</u>	<u>Sales</u>
Cows	24,000	1,700	1,250
Bulls	1,250	100	50
Calves Weaned	9,300		
Heifers 12-24 mo.	4,650	300	200 237 on 60,000 AU
24-36 mo.	4,350	300	200 237 on 60,000 AU
Steers 12-24 mo.	4,650	300	
24-36 mo.	4,350	300	4260 on 60,000 AU
36-48 mo.	4,050	300	3,600 (900 lb. 1.w.)
48 + mo.	<u>2,800</u>	<u>150</u>	
Average	60,000	3,450	5,300
	50,700 AU		

Note that the cull cows are mostly consumed locally, so that by this estimate from IBRD only 75 percent of the estimated supply (6,000 head) would come from 60,000 head of cattle in the Rupununi; under present conditions, effective calving rate is 38 percent, mortality rate of adults is seven percent, and culling rate for cows and heifers is five percent. The meat canning plant will be able to use cull cows and provide canned meat for the Georgetown market.

In 1972, because of the very low annual variable cost (about \$107 per animal sold), and modest fixed cost (about \$3.50 per animal sold), a net revenue of about \$108 remained on each animal sold. In late 1973, the price of carcass beef at Lethem increased from \$.75 per pound to \$1.05 per pound. The above cost and revenues were calculated on 1972 prices, at which time the average price

received was \$.50 per pound. These higher prices for meat will be slightly offset by increased costs, but it looks as though the profitability of livestock production in the Rupununi has increased.

Bat-transmitted rabies causes more fatalities than any other disease. Most of the larger ranches in the area have a vaccination program to control rabies, but many of the Amerindians and smaller producers only vaccinate when they observe problems in their herd.

Livestock production in the Rupununi will for some time, remain on a very extensive basis (about 40 to 60 acres per animal), because of heavy fertilizer requirements for improved pasture production and high cost of fertilizer. A \$.15 per pound air freight charge for fertilizer shipped in will eliminate its use until a road transportation facility is completed (estimates are from one to three years). Last year an annual legume was planted by the IBRD in the Rupununi, but it was not at all successful.

The Dadanawa Ranch has about 27,000 cattle on 2,065 square miles in the southern part of the Rupununi District. This represents approximately one-half the cattle population of the District. The 1970 herd composition is presented in Table 2 . The calving percentage of the cows on the range is estimated to be 28 percent per year, with calves born throughout the year. In the past, the cattle at each station were rounded up once per year for branding, castration, ear marking, vaccination against rabies, and separation of the large steers that will go to market within the next year.

The market steers are placed in six paddocks between Dadanawa and Manari, according to size, for a later trail drive to the Manari Outstation near the abattoir until the meat is needed in Georgetown. Plans are now contemplated for a monthly round-up to attempt to tame the cattle and have a better idea of their

performance. The holding stations between Dadanawa and Manari can accomodate about 220 steers. Calves are all over one year old before they are weaned from the cows and are slaughtered at about 400 pound carcass weight (an average of five years of age).

Table 2 . Dadanawa Ranch Hers Composition by Type of Animal, 1970.

<u>Type of Animal</u>	<u>Number</u>
Bulls	328
Cows	9,717
Calves	4,859
Heifers (9-24 mo.)	2,175
Steers (9-24 mo.)	2,175
Heifers (2-3 years)	1,810
Steers (2-3 years)	1,958
Steers (3-4 years)	1,762
Steers (4-5 years)	1,586
Replacement bulls (9-24 mo.)	0
Cull Cows	<u>874</u>
Total Herd	27,244

Source: Johnny Fredricks, and the World Bank Loan Work Sheets for the Dadanawa Ranch.

Due to the extensive production system used, it has not been practical to supply salt and minearls to the range cattle. The only veterinary services provided have been for the expensive imported stock since a veterinarian must be flown in for the service. A breed improvement herd of 880 head is kept in fenced paddocks where controlled breeding is used to produce improved parent stock. This herd does receive salt and minerals and is tamed so that they are easily handled.

The fencing costs on the ranch are calculated to be \$1,214.40 per mile, using redwood posts and unbarbed wire. Fences usually will last until someone burns it down during the dry season. People working on the ranch receive their food and housing and about \$2.50 per day. The Dadanawa Currently employs 106 people to repair fences and herd cattle. The ranch usually has other people working on construction projects (fences, buildings, etc.), who are hired on a

contract basis and not considered permanent employees. The primary responsibility of the 106 permanent employees is to care for the cattle and do some repair work.

In order to provide food for the employees, both permanent and contract people, the ranch slaughters an average of 45 old cows and wild steers each month. Each of the 12 outstations report their meat consumption on a monthly basis and according to these reports, an average outstation with six men, slaughters two animals per month.

Cattle lose weight during the dry season because of the long walk to water and scarcity of forage. During the wet season, large areas of the savannahs are flooded, which results in stress on the adult cattle and death to the calves born during this season.

The ranch has received a loan from IBRD to improve their cattle production and plans to establish improved pasture during the next year. Most of this land will be used to graze the herd-improvement, breeding cows. The breeding is done by using good Brahman blood to upgrade the quality of the cattle herd.

The price received by the ranch in 1973 was \$1.05 per pound on a carcass weight basis. The carcass beef is sold mostly to Meat Marketing Limited, but Guyana Marketing Corporation also buys meat from the Lethem Abattoir.

The ranch has a total of 900 horses of which just over 200 are working horses. The rule of thumb over most of the country is that each person working during round-up should have three horses at his disposal.

Annual steer sales of the Rupununi Development Company, 1967 through 1974 (Table 3 .), indicate the effects of the outbreaks of foot and mouth disease on the Company's sales. Reduced sales in 1969, 1970, 1973 and 1974 are due to the bans placed on shipments from the area when outbreaks of foot and mouth disease were discovered. These effects on gross income to the company are illustrated in Table 4 ., which reports the slaughter information by month for 1971 through

1974. The increasing price levels reflected in both Table 3 and Table 4 should provide incentives for development of the livestock industry in Guyana.

Table 3 . Approximate Price Received, Number and Average Carcass Weight of Animals Sold by the Rupununi Development Company, 1967-1974.

Year	Number Slaughtered	Total Carcass Weight (lbs.)	Average Carcass Weight (lbs.)	Average Price Received*** (¢/lb.)
1967	2555	1,131,049	443	37.5
1968	2775	1,242,916	448	39
1969*	707	291,587	412	39
1970*	1211	506,207	418	46
1971	3172	1,414,004	446	46.4
1972	2723	1,103,618	405	50.5
1973**	1892	719,748	380	63.2
1974**	74	27,738	375	105.0

* 1969 reports only the first three months, due to the outbreak of foot and mouth disease. Missing data and 1970 sales are from August through December because of slaughter restrictions due to continued presence of foot and mouth disease.

** An outbreak of foot and mouth disease in September, 1973, stopped slaughter of most cattle from the ranch until late May, 1974.

*** Weighted average of prices received throughout the year.

Source: Rupununi Development Company Records.

Table 4 . Number, Total Carcass Weight, Average Carcass Weight and Price Received for Animals Sold by Rupununi Development Company, by Month, January, 1971 through April, 1974

Month	Number Slaughtered (head)	Total Carcass Weight (lbs.)	Price (¢/lb.)	Total Value (\$)	Average Carcass Weight (lbs.)
<u>1971</u>					
Jan.	204	83,469	45	37,561	409
Feb.	200	86,487	44	38,054	432
Mar.	362	109,961	44	48,383	304
April	104	42,056	40	16,822	404
May	126	54,865	47	25,787	435
June	210	106,830	46	49,142	509
July	313	162,756	47	76,495	520
Aug.	326	168,121	47	79,017	516
Sept.	236	104,150	48	49,992	441
Oct.	325	144,110	48	69,173	443
Nov.	445	184,991	47	86,946	416
Dec.	<u>421</u>	<u>166,208</u>	<u>47</u>	<u>78,118</u>	<u>395</u>
Total	3172	1,414,004	46.4 ^{1/}	655,490	446
<u>1972</u>					
Jan.	342	138,034	45	62,115	404
Feb.	201	74,757	47	35,136	372
Mar.	352	132,111	47	62,092	375
April	226	84,370	49	41,341	373
May	170	64,986	49	31,843	382
June	141	57,074	49	27,966	405
July	161	78,841	51	40,209	490
Aug.	249	113,090	51	57,676	454
Sept.	158	71,404	53	37,844	452
Oct.	188	78,027	55	42,915	415
Nov.	284	107,466	55	59,106	378
Dec.	<u>250</u>	<u>103,458</u>	<u>57.5</u>	<u>59,488</u>	<u>414</u>
Total	2722	1,103,618	50.5	557,731	405
<u>1973</u>					
Jan.	262	110,805	60	66,483	424
Feb.	160	62,343	60	37,406	390
Mar.	184	69,790	60	41,874	379
April	289	111,096	63.2	70,213	384
May	190	69,813	65	45,378	367
June	169	66,479	65	43,211	393
July	299	107,392	65	69,805	359
Aug.	303	108,511	65	70,532	358
Sept. ^{2/}	35	13,258	75	9,944	379
Oct.	1	261	75	196	261
Nov.	0	0	0	0	0
Dec.	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	1892	719,748	63.2	455,042	380

Table 4. (Continued)

Month	Number Slaughtered (head)	Total Carcass Weight (lbs.)	Price (¢/lb)	Total Value (\$)	Average Carcass Weight (lbs.)
<u>1974</u>					
Jan.	0	0	0		0
Feb. ^{3/}	59	22,061	105	23,164	374
Mar. ^{3/}	15	5,677	105	5,613	378
April	0	0	0	0	0
Total	<u>74</u>	<u>27,738</u>	<u>105</u>	<u>28,777</u>	<u>375</u>

1/ Weighted average price received for the year.

2/ Outbreak of foot and mouth disease in September, 1973 stopped shipments of cattle to slaughter.

3/ Disease-free cattle were trucked to Lethem in February and March, 1974.

Source: Rupununi Development Company records.

Table 5 . Herd Composition of Rupununi Ranches, by Type of Animals, Size of Ranches, and Type of Producers, 1974.

Types of Animals	-----Commercial Ranches-----			Amerindian # 4
	# 1 (2065 sq. mi.)	# 2 (100 sq. mi.)	# 3 (93 sq. mi.)	
	-----percent-----			
Bulls	1.2	7.8	7.6	.5
Breeding Cows	35.7	38.4	34.1	30.1
Calves	17.8	12.7	14.3	9.6
Heifers (9-24 mo.)	8.0	11.6	7.3	25.3
Steers (9-24 mo.)	8.0	7.5	8.8	4.8
Heifers (2-3 yrs.)	6.6	9.1	14.6	14.5
Steers (2-3 yrs.)	7.2	4.1	4.6	8.4
Steers (3-4 yrs.)	6.5	6.3	8.8	4.8
Steers (4-5 yrs.)	5.8	2.7	0	1.9
Replacement Bulls	0	0	0	0
Cull Cows	3.2	0	0	0
Total Herd (head)	27,244	1,200	1,096	415

Source: World Bank Work Sheets.

The primary difference between the Dadanawa Ranch and the other relatively large ranches in the Rupununi is their stronger financial position. This allows them to hold their steers until they reach a heavier weight, whereas smaller ranches tend to sell cattle when they need money, resulting in lighter carcass weights. This tendency is illustrated by the herd composition data presented in Table , which indicates a significantly larger percentage of the herd at Dadanawa in the older steer group. The Amerindian herd had the largest percentage of the herd in the groups of steers over three years' old. The 1973 slaughter records from the Lethem Abattoir indicate the existence of the same problem in

that the carcass weights are about 25 pounds difference between # 1 and # 2, almost 100 pounds difference between # 1 and # 3 and about 75 pounds difference between # 1 and # 4. Much more detailed economic information would be required to determine exactly the best age to sell the animals from the economic point of view.

Beef Slaughter

Abattoir slaughter data and operation information were obtained for the Georgetown Municipal and Lethem (government owned) abattoirs. These two facilities reported a total slaughter of 19,255 animals out of a country-wide total of 33,539 slaughtered in 1973 in inspected abattoirs. In 1971 and 1972, the reported country-wide slaughters were 32,768 and 32,516, respectively. These figures indicate a relatively constant meat supply. The 1973 slaughter exceeded both 1971 and 1972 slaughters even though the Lethem Abattoir was severely restricted for the last four months of the year by the foot and mouth disease ban in the south Rupununi area. The reduced slaughter at the Lethem Abattoir was "made up" at other plants on the coast. Slaughter data from the Georgetown Abattoir (Table) indicate that many of the additional animals slaughtered were heifers and cows. Therefore, the coastal cattle population has been decreased

Table . Livestock Slaughter by Month and Type of Animal, Georgetown Municipal Abattoir.

	Oxen	Bulls	Steers	Cows	Heifers	Calves	Total
	-----head-----						
<u>1973</u>							
Jan.	1	472	70	472	178	5	1198
Feb.	0	525	75	454	164	6	1224
Mar.	7	509	116	541	161	1	1335
Apr.	2	501	70	498	167	15	1253
May	1	468	65	513	193	4	1244
June	6	422	95	508	197	5	1233
July	5	375	100	400	157	3	1040
Aug.	12	399	142	556	214	7	1330
Sept.	2	359	97	596	188	10	1252
Oct.	1	260	44	741	275	11	1332
Nov.	5	379	212	699	230	5	1530
Dec.	5	322	232	649	209	3	1420
Total	47	4991	1318	6627	2333	75	15391

Table 6 (Cont'd.)

	Oxen	Bulls	Steers	Cows	Heifers	Calves	Total
	-----head-----						
<u>1974</u>							
Jan.	0	247	104	822	271	6	1450
Feb.	6	220	192	392	74	3	887
Mar.	6	285	160	206	8	0	665
Apr.	4	460	119	349	55	0	987

Source: Georgetown Abattoir Slaughter Records.

in the last few years, particularly during late 1973.

The following law was passed on February 9, 1974, and placed in effect on February 18, 1974 at all slaughter facilities in Guyana:

An Act Providing for the Control of the Slaughter of Cattle

A.D. 1974 Enacted by the Parliament of Guyana: --

Short Title 1. This Act may be cited as the Slaughter of Cattle (Control)

Act 1974.

Interpretation. 2. In this Act---
"cattle" means any bull, ox, steer, cow, heifer or calf;

"veterinary officer" means the Principal Veterinary Officer and includes any veterinary officer, livestock officer or livestock assistant of the Department of Agriculture authorized in writing by the Principal Veterinary Officer to perform the functions of the Principal Veterinary Officer.

Prohibition 3. No person shall, without the permission in writing of a veterinary officer, slaughter or caused to be slaughtered--

(a) any cattle with less than one permanent incisor tooth; or

(b) any cattle of the female sex.

Skin and skeleton of the head to be retained 4. Where a person slaughters or causes to be slaughtered any cattle he shall retain the skin and skeleton of the head (including the horns) of cattle for forty-eight hours after it has been slaughtered and during that time he shall, if so required, produced the skin and skeleton of the head (including the horns) to a veterinary officer or a police constable.

Powers of entry of veterinary officer and police constable 5. (1) A veterinary officer or a police constable may, at any time, enter a place where he reasonably believes that there is a carcass or other things in connection with which this Act applies and examine the carcass or other things found therein and take samples thereof.

(2) A veterinary officer shall be furnished with a prescribed identification card and on entering any place pursuant to subsection (1) shall, if so required, produce the card to the owner or occupier thereof.

(3) The owner or occupier of a place entered by a veterinary officer or a police constable pursuant to subsection (1) and every person found therein shall give the veterinary officer or a police constable all reasonable assistance in his power and furnish him with such information as he may reasonable require,

**Seizure and
detention of
carcass, etc.**

6. (1) Whenever a veterinary officer or a police constable believes on reasonable grounds that this Act has been contravened he may seize the carcass and other thing in connection with which he reasonably believes the contravention was committed.

(2) The carcass and other thing seized pursuant to subsection (1) shall not be detained after the expiration of fourteen days from the day of seizure, unless before that time proceedings have been instituted in respect of the contravention in which event, the carcass or other thing may be detained until the proceedings are finally determined.

**Compensation
to owner**

7. Where a veterinary officer or a police constable in exercise of his powers under this Act has taken a sample of any thing and it appears from any examination or investigation by the veterinary officer or the police constable that there has been no contravention of this Act in respect of the sample, the owner of the sample shall be entitled to compensation from the veterinary officer or the police constable for the sample if it cannot be returned to the owner without prejudice to the owner.

Forfeiture

8. Where a person has been convicted of an offence against this Act, the court may order that the carcass and any other thing in connection with which the offence was committed be forfeited to the State and upon such order being made the carcass and other thing may be disposed of as the Minister may direct.

**Obstruction
of veterinary
officer and
police
constable**

9. (1) No person shall obstruct a veterinary officer or a police constable in the exercise of his functions under this Act.

(2) No person shall make any false or misleading statement either verbally or in writing to a veterinary officer or a police constable engaged in the exercise of his functions under this Act.

**Offence and
penalty**

10. Every person who contravenes, or fails to comply with, any of the provisions of this Act is liable on summary conviction, to---

(a) a fine of not less than five hundred dollars nor more than one thousand dollars and to imprisonment for not less nor more than twelve months in the case of a first conviction; and

- (b) a fine of not less nor more than one thousand dollars together with imprisonment for not less nor more than twelve months, in the case of a second or subsequent conviction.

Passed by the National Assembly on the 29th of January, 1974.

The long term effect on the meat supply of the ban on female and immature slaughter in Guyana will not be evident for some time to come, but the immediate effect is shown in Table

Georgetown Municipal Abattoir

The Georgetown Abattoir is owned by the city and operated as a service to the city. Operating cost of the Abattoir is estimated to be \$50,000 per year, not including inspectors' salaries. Inspection at the Abattoir is done by city inspectors who devote about one-quarter of their time to work at the Abattoir. Inspectors' salaries cost the city about \$40,000 per year in total. Slaughter facility use and inspection fee is \$5.00 per head and is paid by the wholesale butcher or marketing concern owning the animal at the time of slaughter. Slaughter labor is contracted for and paid by the wholesale butcher, who purchases the live animals and owns them until they are sold as carcass beef to the supermarket or retail butchers.

Annual medical examinations are required for all slaughter labor at the Abattoir. Slaughter contracts are not all alike, but they are usually in cash terms (\$5-\$6 per head), or some cash (\$2.50) and the trimmings and tripe from each animal slaughtered. The slaughtermen usually work in teams and contract with a butcher to kill his cattle. These contracts are usually on a one-time basis.

The capacity of the Abattoir is about 30 head per hour and the Abattoir is usually open for seven hours per day. From the annual slaughter data (Table), it is evident that the Abattoir is not operating near capacity.

The tripe is processed in a tripery at the back of the Abattoir by people

who purchase the tripe either from the butcher or the slaughterman. A new tripery is currently being built in the Abattoir itself, which will be open for use at a daily charge of 25¢ per person utilizing the facility. The people who clean tripe either sell it on their own in the retail market, or sell the cleaned tripe to a vendor. An average animal yields between 25 and 35 pounds of tripe. Current market price of tripe is about \$1.00 per pound.

Carcass weights of animals slaughtered are not recorded by the abattoir, but a sample analyzed by the Ministry of Agriculture indicated an average carcass weight of about 270 pounds. This light weight of stock was explained because many of the cows sold were out of condition and steers and bulls are sold before they reach maturity because of the high incidence of cattle rustling in the coastal area. In May, 1974, the chief inspector at the Georgetown Abattoir stated that he believed that the average carcass weights had increased to 350 pounds since the law restricting slaughter was imposed.

Cold storage facilities are available in Georgetown at the ice plant near the Abattoir. The World Bank proposal reported in 1969 that cold storage facilities in Georgetown would handle 260,000 pounds of meat. We were informed that some of the wholesale butchers stored some meat prior to the ban on female slaughter.

Lethem Abattoir

The abattoir at Lethem (Rupununi District) is owned by the government and rented to the Abattoir manager, who pays a rental fee of \$.48 per head. Since the rent was established in the 1950's, inflation has continued with no change in cash cost of facility use. Current plans are for the rent structure to be changed and fees will be paid at the rate of 1¢ per pound of carcass weight. Meat inspection is done at the Abattoir after slaughter, and again at the Georgetown Abattoir, prior to sale in the markets.

The Abattoir now employs 12 slaughtermen (16 to 18 are on the wage rolls, but only 12 work at one time), two cleaning girls and four employees who bury offal and train for work as slaughtermen. These employees are paid by the manager, who receives the slaughter fee (\$100 per plane load - regular time) from the purchaser of the beef in Georgetown. Each slaughterman receives \$4 per plane load (6500 pounds) and \$6 per plane load on overtime. Overtime is defined as all loads after the first, in any one day for a single purchaser. Overtime is not charged, regardless of how many loads are processed in any one day, unless a single purchaser gets more than one load and then the overtime rate is paid on all loads for that particular purchaser, after the first plane load.

Each slaughterman catches his own animal in the lot and kills and processes that one animal before he starts on his second animal. One plane load of meat can be worked up in about four hours, so that at least three plane loads per day could be processed.

The slaughter records from the Lethem Abattoir (Table 7), indicate a much heavier slaughter weight than is believed to exist on the coast. Most of the animals slaughtered here are steers, about five years of age.

Future plans are for meat to be processed in the area where it is produced when the production location is a considerable distance from the consumption area. Next year the meat from the Lethem Abattoir will be shipped as boned beef, corned beef, and chili and beans. The planned chili and bean plant will be capable of utilizing about 6,000 pounds of carcass weight beef. The production of pickled beef in the interior would contribute greatly to the Guyanese economy, since the average importation has been about 2,000 bars per year. The increase in meat processing outside Georgetown will be difficult to administer because there are currently only two food technologists in the country.

When the cattle are sold to Meat Marketing Limited, the manager of the Lethem Abattoir receives the cattle for the Company and pays the rancher about one week later, when the money is delivered from Georgetown. The dealers in the area usually pay for the cattle when they arrive at Lethem.

Table 7. Number, Carcass Weight, and Average Carcass Weight of Animals Slaughtered at Lethem Abattoir, by Month for 1968, 1969, 1972, and 1973.

	Number Slaughtered (head)	1968	
		Carcass Weight (lbs)	Average Carcass Weight (lbs.)
Jan.	486	188,500	388
Feb.	422	151,000	358
Mar.	336	128,000	381
Apr.	458	185,000	404
May	435	178,400	410
June	349	137,000	393
July	387	174,200	450
Aug.	405	159,500	394
Sept.	412	166,700	405
Oct.	486	212,800	438
Nov.	601	217,500	362
Dec.	560	204,600	365
Total	5337	2,103,200	394
		1969	
Jan.	315	117,800	374
Feb.	407	154,700	380
Mar.	586	220,800	377
Apr.	499	198,000	397
May	365	159,400	437
June	365	170,500	467
July	528	244,000	462
Aug.	316	144,500	457
Sept.	446	188,300	422
Oct.	567	220,900	390
Nov.	Closed due to outbreak of foot and mouth disease		
Dec.			
Total	4394	1,818,900	418

(Continued - next page)

Table 7 . Continued.

Month	Number Slaughtered (head)	<u>1970</u>	
		Carcass Weight (lbs.)	Average Carcass Weight (lbs.)
Jan.			
Feb.			
Mar.			
Apr.		Closed due to outbreak of foot and mouth disease	
May			
June			
July			
Aug.	144	63,383	440
Sept.	437	181,295	415
Oct.	586	218,683	373
Nov.	696	271,738	390
Dec.	537	206,234	384
Total	2,400	941,333	392
		<u>1971</u>	
Jan.	444	169,248	381
Feb.	440	179,366	408
Mar.	547	202,843	371
Apr.	471	187,421	398
May	441	163,853	372
June	444	192,622	434
July	454	209,458	461
Aug.	481	227,029	472
Sept.	453	184,454	407
Oct.	619	255,550	413
Nov.	673	256,374	381
Dec.	688	257,196	374
Total	6,155	2,485,414	404
		<u>1972</u>	
Jan.	585	218,700	374
Feb.	549	195,800	357
Mar.	490	181,000	369
Apr.	380	138,400	364
May	413	149,900	363
June	228	84,100	369
July	329	138,400	421
Aug.	427	161,800	379
Sept.	296	116,900	395
Oct.	401	153,200	382
Nov.	520	190,300	366
Dec.	598	223,100	373
Total	5216	1,951,600	374

Table 7. (Continued)

Month	Number Slaughtered (head)	1973	
		Carcass Weight (lbs.)	Average Carcass Weight (lbs.)
Jan.	491	184,200	375
Feb.	377	137,000	364
Mar.	433	154,300	356
Apr.	515	180,000	350
May	336	114,600	341
June	348	122,300	351
July	462	160,600	348
Aug.	496	169,000	341
Sept.*	190	70,200	369
Oct. *	16	4,800	300
Nov. *	80	25,900	324
Dec. *	142	40,400	285
Total	3886	1,363,300	351
<u>1974</u>			
Jan.*	55	20,608	375
Feb.*	163	61,852	379
Mar.*	227	83,332	367
Apr.*	159	60,374	380

* Another outbreak of foot and mouth disease was found in the south Rupununi District, which resulted in a quarantine of the cattle from south of Lethem (this included the Dadanawa Ranch).

Marketing of Beef

In 1969, about 75 percent of the retail meat sold in Georgetown moved through the municipal markets and small butcher shops with only 25 percent going through the supermarkets. A trend toward supermarket purchasing has resulted in a current (1974) sales split of 60 percent going through supermarkets and only 40 percent through the municipal markets and butcher shops. This movement toward supermarket purchasing of all staple food items could lead to a more fully integrated marketing system for livestock and livestock products. Bookers Supermarket, for example, currently sells all of the beef that the company-owned ranches (Gold-diggings and Kabawer) on the coast produce. However, these two ranchers produce only a small portion of the supermarket's total beef sales.

Retail beef prices have recently increased very rapidly (see Table 8) and the law enacted in February, 1974, which outlawed the slaughter of breeding females and immature stock, should result in even more upward movement of prices. It is estimated that this new law will result in a decreased slaughter for 1974 to about one-third the number slaughtered in 1973 at the Georgetown Abattoir. If demand for meat is not curtailed, this reduced supply will result in an even faster acceleration in the price level. Further pressure is being exerted on the price level by a very tight import restriction policy imposed by the government in an attempt to improve the country's balance of payments.

Retail price data were also collected from one of the best meat markets in Georgetown (Table 9). It is difficult to compare the detailed prices in Table with the aggregated price data in Table 8 . However, due to higher quality meat and more choice as to cuts, the better meat markets receive a higher retail price than do the traditional markets. Unlike the U. S. meat markets, in Guyana there is very little price differential between beef, pork and poultry at the retail level.

Table 8. Retail Meat Prices in the Georgetown Market, by Month and Cut of Meat, 1973 and 1974.

Year - 1973	Rib and Round Steak	Brisket
	-----\$/lb.-----	
January	.953	.899
February	.999	.919
March	.996	.939
April	1.021	1.008
May	1.042	1.015
June	1.102	1.006
July	1.194	1.082

Table con't

Table 8. (Cont'd.)

<u>Year - 1973</u>	Rib and Round Steak	Brisket
	-----\$/lb.-----	
August	1.131	1.179
September	1.326	1.226
October	1.400	-----
November	1.500	-----
December	1.700	1.500
<u>Year - 1974</u>		
January	1.750	1.600
February	1.950	1.600

Source: Guyana Ministry of Agriculture.

The meat market visited is a family-owned integrated operation with one brother responsible for the retail outlet and the other producing beef cattle, hogs and eggs to supply the store. The farm is also utilized to produce rice as its primary cash crop. Poultry production was an integral part of the operation until recent feed price increases made it no longer profitable to carry on poultry production. The farm currently produces all of the eggs sold at the store and about half of the hogs. But the current herd of about 360 cattle can only supply less than ten percent of the store's demand. Demand for mutton is very high, but very little is available in the country.

Prior to the recent large price increases, the store was selling 5000 to 6000 pounds of beef per week, but sales have fallen off to about 2000 pounds per week. Whenever possible, the store purchases most of its beef from Meat Marketing Limited. Meat from Lethem is currently selling for \$1.30 per pound and when it is not available, coastal meat is bought at between \$1.45 and \$1.50 per pound.

The carcasses from the Rupununi are much larger (350 to 400 pounds) than those from the coast and also more uniform in quality. Sales slips of beef produced on the family-owned farm show an average carcass weight of about 325 pounds. Most carcasses bought from other coastal ranches are considerably smaller than the ones from the family-owned farm. No one interviewed was able to provide an explanation for the apparent price discrimination against Rupununi beef in the Georgetown market.

The Georgetown market is supplied, for the most part, by the inspected slaughter facilities at Lethem and the municipal abattoir in Georgetown. Inspected slaughter facilities are also available in Linden and New Amsterdam and are used to provide beef to the respective marketing areas. Plans are currently underway for the construction of slaughter facilities at Ebini and Matthews Ridge, to process meat for export to the other CARICOM countries. These two areas were selected because of the higher quality livestock that currently are produced there and the areas' disease free status, which makes the meat acceptable to the importing countries. The CARICOM countries will not accept meat produced in an area that is not completely free of foot and mouth disease. The Rupununi area has had two outbreaks of foot and mouth disease in recent years.

The Lethem Abattoir (Rupununi District) supplied about 30 percent of the Georgetown market for inspected beef in 1973. This percentage would have been slightly higher if the outbreak of foot and mouth disease during the last four months of the year had not forced a reduction in slaughter.

Animals slaughtered at Lethem are flown to Georgetown in plane loads of about 6000 pounds each. Under normal conditions (whenever foot and mouth disease is under control), the carcass, trimmed hides, dumped intestines and tongue are sent to Georgetown, but when foot and mouth disease is prevalent all except the carcass is buried to avoid spreading the disease to other areas in the country.

Table 9. C & F Retail Meat Market Prices in Georgetown, May 7, 1974

<u>Cut</u>	<u>Price</u> (\$/lb.)
<u>Beef Products</u>	
Round steak	.2.10
Brisket	1.78
Ground beef	2.15
Ground round steak	2.65
Cow heel	1.20
Sirloin tip roast	2.88
Boneless rib roast	2.70
Tongue	1.95
Kidney	1.80
Liver	2.25
Sirloin steak	2.45
Club steak	2.36
T-Bone steak	2.45
Cow shin	1.75
Dog bones	.40
<u>Pork Products</u>	
Fat	.40
Scraps	1.12
Shoulder	2.30
Leg roast	2.50
Hocks	1.85
Chops	2.50
Shoulder chops	2.50
Spare ribs	2.00
Fresh shoulder bacon	3.58
Lard	1.70
Ham (cured and sliced)	4.50
<u>Chicken Products</u>	
Legs	2.25
Whole chicken	1.85
<u>Fish</u>	
Salt fish	1.65
Prawns	4.25
Fish steak	1.65
Red snapper	2.00
Crab meat	4.20
<u>Other</u>	
Franks	3.03

Source: C & F Meat Market, Georgetown, Guyana

Meat from Lethem Abattoir is delivered to the Georgetown Abattoir for inspection before it can be sold in the Georgetown markets. A fee of \$2.00 per carcass is charged, which is paid by the current owner of the meat, (Meat Marketing Limited). Meat Marketing Limited pays the air freight (\$330 per 6,000 pounds) and a transportation cost of \$40 per load (approximately 6,000 pounds) to get the meat from the Georgetown airport to the Abattoir. After inspection, the shipped-in meat is distributed through the same channels as the meat produced on the coast, but usually at a lower price.

Meat Marketing Limited markets most of the beef produced in the Rupununi, but Guyana Marketing Corporation also buys meat from the area. The Georgetown purchaser pays the farmer on carcass weight basis, pays slaughter and inspection fees and freight charges. Current farm prices paid are \$1.05 per pound of carcass weight. Meat Marketing Limited buys the beef according to quality, but Guyana Marketing Corporation buys all meat at the same price irrespective of quality.

Most of the cattle received at the Lethem Abattoir are trail driven by horse, from up to 160 miles south and 90 miles north of Lethem. Most of the cattle are sold by the rancher directly to the Georgetown buyer, but a few dealers operate in the District, buying cattle from the Amerindians and smaller producers for resale to the Georgetown buyers.

Horse-driven cattle cover a distance of about 20 miles per day, requiring up to eight days driving time from the distant ranches in the south. The lack of adequate roads and high cost of fuel make truck transportation infeasible except when more rapid movement is essential.

Cattle dealers on the coast purchase cattle from the small farmers, collect them in a truck (usually owned by the dealer), and sell them at the Abattoir to a wholesale butcher. These dealers buy the cattle from the farmer by sight (on the basis of dollars per animal), and sell them to the wholesale butchers. Most of the larger coastal ranchers sell their cattle to Meat Marketing Limited, or

directly to meat shops, who pay differential prices according to the quality of the carcass. Guyana Marketing Corporation does not buy cattle directly from the coastal farmers. The wholesale butcher, or marketing firm has the animal slaughtered and sells the carcass beef to the retail butchers and supermarkets in Georgetown.

Prices were obtained from sources representing different stages of the marketing channel in an attempt to establish marketing margins for the 1973 beef industry in Guyana. From the variety of information obtained, margins of \$.50 between farmer and wholesale butcher and \$.35 from the wholesale butcher to consumer prices seems to be realistic.

Milk and Milk Products

Guyana has only one milk pasteurization plant. It is located in Georgetown. Most of the milk in Georgetown, and all of the milk sold outside the Georgetown area, is sold in the raw state. The discussion in the following section is limited to information obtained in the coastal region.

Milk Pasteurization and Processing

The milk plant (owned by Guyana Marketing Corporation) has facilities to pasteurize milk (500 gallons per hour) and to process milk into cheese (currently not used due to the shortage of milk). The pasteurization facility is currently receiving only 500 gallons of milk per day, down from a high of 2,000 gallons per day in 1969. Part of this decrease in milk received is due to farmers' selling off their milking herds for the reasons discussed earlier. A more important reason is that the price paid by the plant is fixed by government at a level considerably below the market price for raw milk. The plant increased its price paid for milk at the farm to 80¢ per gallon last year, but this price is still substantially below the price paid for raw milk on the street (30¢ per pint).

The plant currently has no direct purchase contracts or supply guarantees with milk producers. However, they offer to pay 1¢ per gallon premium if the farmer will sell all of the milk he produces to the plant. Collection stations

have been established along the coast to hold and cool the milk prior to shipment to the plant in bulk tank trucks. The collectors are paid a fee of 12¢ per gallon for all milk picked up and delivered to the plant. The lower price and lack of formal contracts leads to most milk being sold in the raw milk market, with only excess milk being sold to the plant.

Animal health inspection is not required for dairy herds producing milk for the plant. Tests on milk received are made to check for watered milk, which has presented quite a problem here. Milk produced from a TB tested herd (Bookers) is usually completely sold out at the farm in raw milk form.

In an attempt to provide milk for the Georgetown area the plant is currently importing powdered milk and fat from the U.S. and Canada and reconstituting about 800 gallons per day. The whole milk and reconstituted milk are sold separately, but at the same retail price. Due to the shortage of milk, butter is imported from New Zealand and Australia, but margarine is produced in a plant located in the Georgetown area. The lack of an adequate supply of milk has also resulted in importation of cheese, even though there are cheese producing facilities at the plant.

Pasteurized milk sold at the plant for 80¢ per gallon is produced at a cost of \$2.08 per gal. Production cost of reconstituted milk is even higher than pasteurized milk, but it is sold at the same 80¢ per gallon price. From the above selling price and associated costs, it is evident that there is a large government subsidy provided by the Government of Guyana. Milk sells in the supermarket for \$1.04 per gallon and is delivered to the home at a price of \$1.20 per gallon. Part of the milk is sold as chocolate milk and peanut punch (a mixture of peanut butter and milk).

Milk Production

The dairy industry comprises a large traditional sector and a small modern

sector. The traditional sector has a large number of small herds owned by rice farmers on the coastal belt of marine clays. The cattle graze and manure the rice stubbles and at other times of the year graze on the public domain or on rather poorly managed communal pastures located on the sandy strips in the marine clays or in the areas unsuitable for rice production just inland from the irrigated clays. In recent years, rice production has changed to a two-crop system, thus eliminating a large portion of the grazing land and resulting in large reductions in herds owned by the rice farmers on the coast. The cattle production on communal pastures and public lands is by far the most widely used system on the coast.

A major problem in increasing milk production is assembly. At present most of the fluid milk has to be brought to Georgetown by truck, boat, cart or bicycle. Milk plants have been proposed for other areas. However, conventional milk plants have such a high overhead that it is difficult to develop sufficient supply rapidly in a new area. The possibility of adding a UHT pasteurization unit to a sugar factory with no increase in managerial or laboratory service would overcome this; and the long shelf-life of the resulting sterile dairy product would avoid problems of getting the milk to the market. Milk prices must be allowed to increase to the level of the raw milk market before any rational farmers can be persuaded to sell their milk to the existing or newly constructed plants.

There is also a small modern dairy sector including a state unit at Mon Repos (potential for 1,000 cows), and a private dairy of Bookers, just south of Georgetown. These demonstrate the feasibility of modern dairying and more projects are planned. The largest of these projects involves 9,000 cows in 60 x 200-acre cooperative dairy units, each with 150 cows. Past experience with cooperatives among the Hindustani farmers have not been very successful and it is doubtful that this proposal can be executed. However, it is possible that in private or corporate form, given land tenure, protection from larceny, and credit, a substantial

number of new modern dairy units could be established.

Information has been collected from a sample of small farmers on the coast concerning milk production. This should provide insight into the traditional dairy industry. Results of this survey conducted by Tuskegee Institute will be presented in a separate report. The remainder of this discussion will concentrate on the small modern dairy sector.

Bookers owns a relatively large dairy farm on the outskirts of Georgetown, milking an average of 125 (3/4) Holstein cows per day. Their total herd of 170 cows graze on 250 acres of Pangola grass fertilized at an annual rate of 200 pounds of fertilizer per acre, at a cost of 15-18¢ per pound. Since 1967, Bookers has been using artificial insemination (imported frozen semen from the U.S. and Canada) for two services and if the cow doesn't conceive, she is then put with a bull and given one last chance. This breeding method has resulted in an increase in the quality of the herd and a calving percentage of about 60%. The cows in the milking line receive four pounds of concentrate per gallon of milk produced. The concentrate is composed of wheat middlings, rice bran, salt, and copra meal and is fed in conjunction with 3% Urea-Molasses.

Due to high land prices (\$5,000 per acre) in the Georgetown area and the relatively high returns to milk production, the dairy calves are moved to Golddigings (a beef cattle ranch owned by Bookers'), at 3 weeks of age in order to give the milk cows all of the pasture at the dairy. The bull calves are grown out and sold through Bookers' supermarket as beef and the heifers are bred at about two years of age and returned to the dairy for milking. Currently about 25 head of young milk cows are returned to the herd as replacements for old cows (cows usually produce until about 10 years of age) whose production is no longer profitable. As excess replacements become available, plans are to utilize the extra heifers to replace some of the less productive cows in the herd in order to increase the average production (currently 22 pints per day). These lower

producing cows will be moved to Golddigings to be used as brood cows in the beef production unit.

Milking is currently done twice per day with a pipeline milking unit that was purchased in 1962 to replace bucket type milkers which were used from 1957 to 1962. The cows are milked beginning one week after the calf is born and the calf receives four pints of Denkavit (a milk replacer used twice per day, at a cost of \$1.50 per day, per calf), until they reach three weeks of age, at which time they are moved to Golddigings.

The greatest loss of animals from the dairy farm is theft (nine animals lost in six weeks). Milking herd death loss was estimated to be about 5% and the death loss of calves at the dairy has been only 3 1/2% (116 born and 112 sent to Golddigging at 3 weeks of age). The milking herd has been tested and is currently free of TB. The incidence of Mastitis is very low and is currently not considered to be a problem. Due to the wet conditions (two inches of rain in 24 hours produces standing water and mud), foot rot is the primary health problem in the milking herd.

Currently all of the milk produced on the farm is sold raw from a cooler at the milking barn for 30¢ per pint and people stand in line to purchase it. The manager said that they could make a profit at this price, but if they delivered their milk to the pasteurization plant for 15¢ per pint, they would not be operating at a profit. Bookers has checked on contracting with the pasteurization plant, but were only offered a one cent per pint premium to deliver a constant amount of milk each day. If Bookers decided not to finish out their bull calves, they could sell them to cattle ranchers on the coast for about \$40 per head at one week of age.

Hired labor is separated into permanent employees (5) who work in the milking barn and temporary employees hired to maintain the pastures and fences. The

permanent employees are paid \$38 per week for new employees, and more for the experienced laborers. Double time is paid for Sunday and triple time for holiday work. The employees arrange their work week so that they all receive adequate time off and some of the accelerated-pay work.

The manager of Bookers' dairy said that corn silage was tried in the coastal area, but molasses had to be added to enable fermentation to take place. Citrus pulp is not saved for cattle feeding at the mill. Prices of purchased feed inputs were given as follows:

Rice Bran	7 1/2¢/lb.
Brewers' grain	4 1/2¢/lb.
Wheat middlings	6¢/lb.
Urea	15¢/lb.
Molasses	34¢/gal.

The Government has started development of two dairies at Moblissa and Mon Repos, to increase the country's milk and dairy animal supply. Land clearing and renovation has begun so as to provide adequate pasture for the cattle. Dairy calves (578) were imported and sent to Mon Repos for acclimatization and immunization prior to being placed on the farms. During August a feed shortage resulted in a death loss of less than 5% on the last group imported. Before the calves arrived, the station at Mon Repos sold 178 animals to farmers throughout the country. As these high quality dairy animals are distributed to the farmers, the country's milk supply should increase to a level nearer self-sufficiency if prices are allowed to reflect market condition.

Input Costs and Freight Rates

Industrial by-products and imported complete feeds are available from the feed dealers in Guyana. The following farm price list was obtained from the Agricultural Economics section of the Ministry of Agriculture, farmers and feed dealers:

Rice Bran	7 1/2¢/lb.
Wheat Middlings	11¢/lb.
Urea	11¢/lb.
Molasses	34¢/gal.
Mineral Salt	\$255/ton

At least 90 percent of the mixed feed produced in Guyana comes from two feed mills. Guyana Stock Feeds in Ruimvelt (south of Georgetown) is the largest mill, producing 2,500 tons of feed per month. The other mill, Check-R-Mix Stockfeed Factory, is located in Belmonte, Mahaicony (east of Georgetown), and currently produces about 445 tons of feed per month. The monthly output of the Check-R-Mix Stockfeed Factory will be increased to 1225 tons per month upon completion of construction which is now underway.

Guyana Stock Feeds uses locally produced by-products, imported Wayne concentrate, imported corn and imported minerals (bone meal and/or Cura-Phos (14% P, 21% to 36% CA, and 0.5% Floride. They purchase the following by-products in the local markets: (1) rice bran at 5-6¢/lb., (2) brewers grain at \$9.00/cwt., (3) molasses at 36¢/gallon (one gallon = 14.5 pounds), and (4) wheat bran at \$7.00 per cwt. (bought in bulk). The mill saves \$100 per day by having the facilities to purchase and utilize wheat bran in bulk. Most of the corn used at the mill is imported directly from the U.S. at a cost of 21¢/lb. Corn produced locally can be purchased at a price of 25¢/lb. Wayne Milking 40, special concentrate, is imported at a cost of \$345 per ton for use in mixing the cattle feeds. The existing plant can produce 100 tons of bulk feed per 12-hour-day.

All cattle feed sold in bags is packaged in 100 pound containers and is sold according to the following price list:

Calf Ration (20% protein)	\$12.90
Milking Feed (16% protein)	13.00
Cattle Feed (12% protein)	8.31
Male and Donkey Feed (11% protein)	9.80

Bulk feed is sold at a 30¢/cwt. discount from the bag process listed above. Cartage and freight charges are not included in the above prices and a minimum delivery EX factory is 1,000 pounds.

Check-R-Mix Stockfeed Factory only manufactures between 200 and 300 bags (100 pounds) per month. They use Purina concentrate, local by-products, locally produced corn and imported minerals to make their feeds. Wheat bran, rice bran and copra meal are purchased from local processing mills. Large amounts of broken rice are also used in manufacturing their feed because the Guyana Rice Board owns and operates the mill. Corn produced on the Berbice River supplies all of the needs of the existing facility.

The protein content of their feeds was not available, but with their heavy reliance on rice, it is believed to be lower than the feeds from Guyana Stock Feeds. One of the worker's indicated that the protein content of the feeds was about 10%.

All cattle feed is sold in 100 pound bags at the following prices:

Calf Ration	\$8.59
Milking Feed	8.64
Cattle Feed	8.31

Cartage and freight charges are not included in the above prices.

The unsubsidized air freight charges are 15¢ per pound to Lethem and Matthews Ridge, and the charges would be between 1/3 and 1/2 that amount to Ebini. Government subsidies are paid to help cover the cost of transporting some of these products. Subsidized Air Freight Rates: Georgetown-Lethem

1. Meat - Less than 5,000 lbs.	10¢/lb.
More than 5,000 lbs.	5 1/2¢/lb.
2. Meat bags	6¢/lb.
3. Fuel	12¢/lb.
4. Empty drums	\$3.00/drum
5. Food stuff	9¢/lb.

Export freight rates are calculated from Georgetown to the Islands (Caribbean), so more than likely the meat for export would be flown to Georgetown in the DC 3 and transferred to the DC 6 for further movement. Example rates are:

Georgetown - Port of Spain, Trinidad	58¢/Kilo
Georgetown - Grenada	62¢/Kilo

The carrying capacity of the DC 6 is 30,000 pounds of freight and one trip is made from Georgetown per week

A large portion of the trucking business is done by a large trucking firm in Georgetown. The basic rate structure of the firm is presented in Table 10. These rates are charged to single trip and short term customers. When longer term transportation is required, the firm will contract at rates substantially below the listed rates.

Plans are already underway for a regularly scheduled freight delivery to Lethem when the road is finished. The firm plans to build three truck stops for service and rest stops between Georgetown and Lethem and equip all trucks with radio communications for emergency. Refrigerated trucks with independent cooling units are to be purchased for storing carcass beef at the Lethem Abattoir and transporting it to Georgetown. Estimated rates for meat transport from Lethem is 7¢/lb.

Table . Trucking Cost on Coast by Size and Type of Truck.

Description	Rate for first two hours*	Rate after two hours* (\$/hr.)
4 1/2 ton	\$ 25	10
7 ton	35	12
10 ton	40	15
15 ton (without sides)	40	18
20 ton (with 5 ton chain)	60	25
Truck and trailer	45	18
15 ton Low Boy	60	25
50 ton Low Boy	200	50

* The above rates are not contract prices where work is steady. Longer term freight hauling contracts result in rates substantially below the above costs.

Source: Meer S. J. Rahaman, RaHamon's Transport.

Credit Available to the Livestock Sector

This report will not attempt to completely describe the credit market. Only a few specific sources of credit that are of primary importance to the livestock sector are included in this discussion.

In 1969, the Ministry of Agriculture started to look at the capital requirements for developing a long term plan to increase Guyana's livestock production potential. An initial proposal was submitted to the IBRD (World Bank) for a loan of \$US8 million, but the amount loaned was reduced to \$US4 million because the IBRD felt that the larger amount could not be utilized by the livestock sector. This money was to be loaned to ranchers and cooperatives (15) on the coast, who could provide 2000 head of cattle to start cattle production, and to ranchers and cooperatives in the Rupununi District (12), who could provide 1000 head of cattle to initiate production. The original intent of these loans was to establish new ranching operations, but due to the unavailability of breeding stock, the loans are being made to established ranches in the areas.

The International Development Association (IDA), soft loan window of the World Bank, made the \$US4.4 million loan to the Government of Guyana through its fiscal trustee, the Bank of Guyana, at 3/4 of 1% interest. The Bank of Guyana in turn loans the money to commercial banks at a rate of six percent. The commercial banks then make loans to individual ranchers for a term of 12 years at a rate of 9 1/2 percent. Loan repayment is deferred until the fifth year, when payments start and run through the 12th year.

The IBRD loan procedures are as follows:

1. The rancher applies to the commercial bank for a loan to improve his existing beef operation, or to establish a new beef production unit.
2. The application is sent to the IBRD office in Georgetown for processing and review, which consists of writing a long-term lease (if lease is needed), acceptance of the manager of the ranch by the IBRD Director, and a report on the conditions existing and forecast for the ranch.
3. The IBRD report on the application is sent to the Project Executive Committee (made up of representatives of the Ministry of Agriculture, Ministry of Economic Development, Governor Bank of Guyana, and the

Project Director), which either approves or rejects the application.

4. If the application is accepted, the commercial bank can make the loan. The funds are provided by the commercial bank (20%), the IDA livestock funds (60%), and the sub-borrowers (20%).
5. After the loan is made, the IBRD technicians visit the ranch at least once each month to check on the progress and provide assistance when needed.

Several problems have been encountered in attempting to administer the loans. Historically land tenure has been based on an annual lease arrangement with no guarantee of continued renewal to the ranchers.. This lack of adequate assurance of continued land use was viewed by the IBRD as a severe restriction to successful livestock development. The GOG agreed to rewrite the leases with ranchers for a term of 25 years with one guaranteed renewal, resulting in an effective 50 year lease, which was considered to be adequate to stimulate land development. The advent of the long-term lease agreement required the setting of boundaries on lands where no established boundaries existed. The initial impression was that the surveying could be accomplished in short order. These impressions turned out to be wrong so that long delays were encountered in getting the leases written and loans made. Coastal livestock are for the most part in herds of 2-10 animals per farm. In order for a rancher or group of ranchers in the coastal belt to receive a loan they must collect 2000 head of cattle, which turned out to be almost impossible. IBRD administration has found that one of the largest constraints has been a lack of education of the ranchers.

The social implication of cattle as a status symbol or store of wealth rather than a commercial enterprise, has severely limited the ability of the banks to make loans. The people just do not understand the idea of giving a mortgage on their cattle to receive money from the bank. The Extension

Service of Guyana is relatively small and already loaded with work without the additional work required to administer these loans. The IBRD has established its own technicians to work with the ranchers in order to strengthen the ranchers' capabilities as livestock producers.

In 1966, USAID and the Government of Guyana provided the funds (\$US? and \$G3 million, respectively) to establish the Private Investment Fund (PIF). PIF loans are made through the commercial banks who act as co-lenders and carry the credit risk, but the funds are furnished entirely by the PIF. Interest rates charged on the loans are determined by the trustees.

The commercial banks receive a fixed three percent to cover risk and administration of the loan.

The Guyana Credit Corporation is a government-owned lending agency established to provide medium and long-term financing for agricultural and private home construction. Most of the agricultural loans have been made to finance purchases of machinery and equipment and not for general farm and ranch improvements.

The privately held (life insurance companies and savings and loan associations) agricultural loans have been primarily to large corporations who can offer substantial real assets as collateral security on the loan. In 1969, the Agricultural Loan Ordinance was passed which allows creditors to take a lien on crops as security for a loan, but this, as was pointed out in the problems faced by the IBRD staff, will take some education of the farmers before they will be willing to borrow against their crops and animals.

Short-term credit is usually obtained from the commercial banks which have about 70% of their loans written to mature in less than one year. Another source available is the Guyana Marketing Corporation which provides credit in kind such as livestock feed and fertilizer to small farmers.

Current Livestock Research Activities

The livestock Development Project (World Bank), USAID, and the Ministry of Agriculture have implemented livestock and forage production projects in the Ebini, Matthews Ridge, and Rupununi Areas. Areas of research emphasis include forage production and management, breed improvement, and animal feeding.

Breed improvement has made significant strides at Ebini over the last few years. Data are presented in Table 11.

Table 11. Comparison of calving percentage, calf mortality, and weaning weights by breed between 1969 and 1973 at Ebini Livestock Station.

<u>Breed</u>	<u>Year</u>	<u>Calving Percentage</u>	<u>Calf Mortality</u>	<u>Weaning Weight</u>
Zebu	1969	35	15	295
Zebu	1973	64	8.1	388
Santa Gertrudis	1969	51	35	250
Santa Gertrudis	1973	70	9.0	415
Zebu-Santa Gertrudis	1969	45	23	300
Charolais	1973	87	6.2	495
Hereford	1973	81	6.5	450
Short Horn	1973	85	6.4	326
Jersey	1973	48	7.0	398

Source: "1973 Annual Report of the Livestock Science Division", Guyana Ministry of Agriculture.

Significant improvements were obtained in calving percentage, calf mortality, and weaning weights for Zebu and Santa Gertrudis between 1969 and 1973. Also, the introduction of Charolais, Hereford, and Short Horn has resulted in an even higher average calving percentage and weaning weight and a lower calf mortality over the entire herd.

Grazing trials were carried out on five digitgrasses by placing heifers on them for 337 days to derive the daily liveweight gain, stocking rate, and liveweight gained per acre. The results of the trial are presented in Table 12.

Table 12. Livestock Performance on Improved Pastures at Ebini Livestock Station, 1973.

Grass	Daily Live-Weight Gain (lb.)	Stocking Rate (heifer/acre)	Liveweight Gain Per Acre (lb.)
Pangola (D. documbens 111110)	.90	1.0	304.04
D. Pentzii 299752	.86	1.07	309.19
D. Detivalva 299795	.81	1.06	290.27
D. Milanjiana 299704	.55	.80	147.84
D. Valida 299885	.52	.80	139.78

Source: "1973 Annual Report of the Livestock Science Division, Guyana Ministry of Agriculture.

Studies are currently underway to analyze the effect and profitability of supplemental feeding of ruminant livestock after weaning. Table . presents the results of these feeding experiments at Ebini.

More information about the above trials will be required to analyze the possible impacts on the livestock sector of Guyana. We must know the number of acres of land associated with each experiment, the set-up of the feedlot and more specific rate of gain with respect to age of animal for a better comparison.

A confith (sugar feeding) experiment is scheduled to begin at Matthews Ridge in the near future. Plans are to utilize the confith to feed out calves for slaughter at the abattoir to be built at Matthews Ridge.

Research work carried out at both Ebini and Matthews Ridge indicate that for sheep production to be profitable: (1) all animals must be wormed every two to three weeks, and (2) pastures should be rotated and should not have been grazed before by cattle without subsequent renovation.

A Dairy Feasibility Study has been contracted between USAID and Experience Incorporated, for completion in late 1974. Their data and results should provide the Consortium with some valuable insight into the Guyana dairy industry.

The Guyana Extension Service is to begin data collection on animal husbandry and production problems in Guyana. This data bank should provide at least a starting point for future livestock research in the country.

Table . Performance of Livestock in Supplemental Feed Trials at Ebini, 1973.

Treatment	No. of Animals (head)	Initial Wt. (lbs.)	Final Wt. (lbs.)	Wt. Gain (lbs.)	No. of Days	Average Daily Gain (lbs.)	Supplement Conversion Rate (lbs. feed/lbs.gain)
Pangola	16	349	686	337	280	1.20	
Pangola	18	222	567	325	280	.84	
Pangola + Rice Bran	16	356	760	404	280	1.44	19.38
Pangola + Copra Meal	15	382	815	433	280	1.54	11.32
Pangola + Rice Bran, Copra Meal, Molasses-Urea	16	346	793	447	280	1.59	10.79
Pangola + Molasses-Urea (3%) (1% body wt./day)	16	382	693	257	280	.91	
Pangola + Molasses-Urea (3%) (4 lb./head/day)	18	319	618	299	280	1.06	13.93
Pangola + Molasses-Urea (3%) (ad. Lib.)	18	318	588	270	280	.96	33.58
Pangola + Molasses (ad. Lib.)	17	301	528	227	280	.81	
Pangola + Molasses (4 lb./head/day)	18	324	571	247	280	.88	51.13
Feedlot (Copra Meal + Molasses-Urea)	20	417	554	137	84	1.63	6.33

Source: "1973 Annual Report of the Livestock Science Division", Guyana Ministry of Agriculture.

APPENDIX D

REVISED WORK PLAN 211d

PURDUE UNIVERSITY

Introduction

As stated in the initial proposal for funding of the 211d grant, "The primary objective of this set of grants is to strengthen capabilities of four U.S. universities to identify opportunities for significant livestock development in LDC's, to analyze constraints to and resources for such development, and to design programs to overcome constraints through an integrated, multi-disciplinary team approach". During our first year of operation, the Consortium members decided that a large contribution could be made by utilizing a systems modeling approach to study these problems in a host country. This approach would require close cooperation and coordination between all members in building both the conceptual and operational models to be used in the host country.

This multi-disciplinary approach to systems modeling should result in better (more realistic) data base and a more complete (with respect to inclusion of important information) model than any one discipline alone could produce. Interactions among the interests of the various disciplines should become more evident and benefits to a coordinated research effort should be derived.

Purdue's Role in the Consortium

Purdue will contribute to achievement of the overall

Consortium objective in two principal ways. First, Purdue is responsible for developing an aggregate, interregional model of the livestock production-distribution-marketing sector descriptive of conditions in the wet-dry tropics in general and of Guyana in particular. Second, by close and continuous interaction with other Consortium members in developing the "industry model" Purdue will serve as a catalyst in intergrating the activities of the various disciplines represented in the Consortium into a systems approach to analysis of problems involved in the development of the livestock sectors of countries in the wet-dry tropics.

Purdue's Specific Objectives and Anticipated Output

The specific objectives of Purdue's Consortium activity and the anticipated output of each are as follows:

1. To gain an understanding of livestock production-distribution-marketing system in Guyana and other countries of the wet-dry tropics. Attainment of this objective will provide a basis for developing industry models.
2. To develop, in close collaboration with Guyanese and other Consortium members, an aggregate, interregional model of the livestock production-distribution-marketing industry of Guyana. Attainment of this objective will provide a model useful for identifying impediments to development of livestock production and for evaluating

alternative actions aimed at reducing these impediments. This model will provide a basic framework which can be modified for application in other countries. Model development will provide a vehicle by which the expertise of the various disciplines represented in the Consortium can be shared and focused in a systematic way on problems of tropical livestock development.

3. To test the usefulness of the industry model (and the systems analysis approach) in identifying obstacles to livestock sector development and evaluation of alternative actions (policies) and research in alleviating these obstacles in Guyana. This will provide a means of evaluating the model and the approach in development assistance to countries in the wet-dry tropics with livestock development problems.
4. To test the applicability of the industry model, and more importantly, of the multidisciplinary team approach to systems analysis of livestock development problems in a second wet-dry tropical country. Attainment of this objective will aid in evaluating the transferability of both the model developed in Guyana and the cooperative team approach utilized in its development.
5. To further increase the breadth and depth of faculty expertise in analysis of tropical livestock development problems by sponsoring seminars, lectures and workshops

by improving the Purdue library's collection of relevant literature, and by integrating the experience gained from the 211d research into the ongoing teaching and research programs at Purdue University.

Plan for Work in Guyana during 1974

Specific work in, and associated with, Guyana during 1974 will focus on accomplishment of objectives 1 and 2 above. The livestock production-distribution-marketing system in Guyana will be studied and this knowledge integrated with input from other Consortium members and used to develop an aggregate, inter-regional model of the livestock industry.

The industry model will consist of two sub models - an assembly-processing-delivery sub model and an interregional production sub model. In addition, the model will contain a macro variable accounting component to indicate the impact of adjustments in the livestock sector on variables such as trade balance, GNP, per capita income, employment, and regional and personal income distribution.

Industry Model Development

Integration of livestock assembly processing-delivery and production activities into a systems model of the livestock sector of a host country in the wet-dry tropics will provide information on constraints to the development of the livestock sector. Information will be gained from both the model building exercise and the solutions of the model. The model building

exercise, per se, will also provide a learning experience for the Consortium members in systems modeling and research management.

Model development will require that Consortium members cooperate in defining relevant variables and coordinate their data collection activity. Variable definition, by a multidisciplinary group, should result in a better understanding by each discipline of livestock development constraints of primary interest to the other disciplines involved. A coordinated data collection and model development activity should broaden each discipline's knowledge of the total problem and provide a priori information with respect to limiting factors.

Solutions to the model should provide significant insight into the constraints limiting livestock production, but model conceptualization and data collection should provide a substantial amount of information also. The information obtained from model development is a by-product of the model itself because, though not obtained from the solutions of the model, the modeling technique provides the information by forcing the Consortium to take a structured look at the overall livestock sector problems.

It should be emphasized here that the completeness of the industry model will depend on the amount of interaction within the Consortium during the development stage of the systems modeling exercise. For the model to be complete, each area of specialization must contribute information on

both the relevant variables to be considered and realistic coefficients to best represent the variables in the model.

The characteristics of the model and the planned research approach to be used during 1974 are discussed below for each of the two sub models.

Assembly-Processing-Delivery System

Development of livestock production potential in the absence of consideration of associated needs for efficient assembly-processing-delivery systems can render production development efforts ineffective. It is planned that the industry model(s) developed by Purdue and others in the Consortium will attempt to integrate production systems and associated input requirements with appropriate assembly-processing-delivery alternatives. Such an integrated model will (it is hoped) yield guidelines for development of an economically viable livestock sector geared to economic and social situations existing in developing nations.

Research Approach:

- A. Available studies and data will be reviewed, major findings specified and problem areas defined. This will involve the host country and selected countries with similar conditions and problems.
- B. On-going livestock programs in the host country will be studied with the aim of

discovering major system limitations which may precipitate need for change in the marketing-processing-distribution system.

- C. A survey will be made of existing marketing-processing-distribution systems with specific emphasis given to quantifying capacity, costs, seasonality, pricing, resource-utilization, investment and profitability. Representatives of each sector of the livestock industry in the host country, producers, processors, butchers, marketing boards, government, retailers, and consumers will be included in this survey.
- D. An appropriate model will be developed to integrate the data collected with the specific intent of generating information necessary for identifying development bottlenecks and formulating recommendations.
- E. Data relating to the market system and alternatives will be integrated with that obtained from the production oriented activity to provide a total beef system analysis.

Consideration will be given to:

1. Institutions
2. Legal and governmental policy (security or ownership)
3. Market information

4. Physical slaughter facilities, location, number and size
5. Transportation and storage
6. Marketing-grades-cuts-packaging-inspection.

F. Pending adequate potential to support export of beef from the host country, it is proposed that the marketing activity also include a survey of beef demand and sources of supply for the CARIFTA markets and other more developed marketing systems in other countries. This will provide a basis for defining production-marketing system alternatives with adequate flexibility to accommodate the export of beef if that alternative becomes viable.

Some input of a general nature, from other members, will be required in the assembly-processing-delivery section of the model, but these are not easily defined without a complete model description (which is forthcoming). An example of general information required could be the existence of disease, type of breed, and forage available along a truck route contemplated as an alternative for moving livestock to slaughter.

The Livestock Production Submodel

The livestock production component of the industry model will be a product of the coordinated efforts of all members of the Consortium. The following discussion will identify potential contributions of Consortium members by their area of specialization rather than by institution.

The objective of the livestock production submodel is to represent the livestock sector of Guyana in such a way as to be able to:

1. Describe existing production systems within each of the important production regions of the country.
2. Describe each region in terms of characteristics which serve as constraints on livestock production within that region including alternative production opportunities.
3. Describe existing patterns of interregional (and international) movement of livestock products and factors of production to include regional demand for product and supply of factor.
4. Quantitatively measure the impact of changes in production technology, nature of factor supply condition, level of absolute and relative product prices on regional and national production and resource employment by the livestock sector.

Research Approach:

- A. Existing and potential livestock production systems will be defined in an aggregate sense (as opposed to firm level production). Some of the important characteristics to be used in identifying production systems include:
 1. Breed and quality of livestock produced within an area by method of production.

2. Type of disease and parasite control system employed.
 3. Feeding and management system employed (a) natural pasture, (b) improved pasture, (c) supplemental feeding and/or confined feeding) in livestock production.
 4. Social and educational characteristics of the livestock producers with respect to their acceptance of technical change implemented through agricultural extension efforts.
- B. Information required to characterize production systems within a region will be obtained through:
1. Observation of the producers, livestock, and production conditions existing in the area.
 2. Research results in the host country and in other countries having similar conditions.
 3. Information obtained by other Consortium members from their survey and modeling work in the host country.
 4. Expert judgment by members of the Consortium and in-country professionals where the available data falls short.
- C. Individual regions within the host country will be described with respect to the physical factors which are actual or potential constraints:
1. Type, quality and accessibility of land available for livestock production.

2. Regional climatic conditions affecting feed, forage and animal performance.
 3. Management and labor supply (by season), in terms of quality, quantity, and costs, available for livestock and related production activity.
 4. Existing and projected infrastructure, including product and factor markets, transportation, credit institutions, research and extension organizations.
- D. Information identifying these factors of production limitation will come from:
1. Observations
 2. Secondary data
 3. Information from the assembly-processing-delivery components of the model
 4. Government officials and producers in each region.
- E. Interregional and international movement of factors and products relevant to the livestock sector will be determined from:
1. Observations
 2. Secondary data
 3. Assembly-processing-delivery component of the model
 4. Information obtained from government officials and livestock producers.

- F. In addition to product and factor movements, information will be required on constraints to the movements such as:
1. Product and factor demands (regional, national and foreign)
 2. Transportation (capacity and cost)
 3. Institutional restrictions on movements and constraints (taxes, quotas, health regulations, price fixing, etc.)
- G. If the development of a viable livestock sector is to be coordinated with the objectives of the host government, some more aggregate or macro type issues relevant to the industry model must be considered.
1. Returns to factors of production for alternative uses in the economy.
 2. Distribution of income among regions and groups of people within the country.
 3. Creation of industry employment and utilization due to the development of the livestock sector.
 4. The effect on the international trade balance of factor purchases and product sales in the import and export markets.
 5. The effect of changes in the level of employment and the distribution of the labor force created by developments in the livestock sector.

Other Modeling Considerations

Industry Model Testing and Alternative Solutions

The first test of the model will be made with the current situation as inputs to check results for the reality of solutions. The input data and resulting solutions will be evaluated by members of the Consortium and GOG in an attempt to derive a model with emphasis placed on all facets of production and marketing.

Input and coefficient changes reflecting improvements in selected areas of production and marketing will be included and solutions obtained to measure the effect of alternative development programs. Combinations of these tests will provide information on various alternatives for improving the livestock sector of the host country's economy.

Contribution to Guyana's Development Goals

During the first year of our Consortium activity, we selected Guyana as a data base for our first attempted coordinated effort. The Consortium realizes that if we are going to assist a country in developing a livestock industry, we must pay careful attention to the objectives of the host country to insure consistency between our research emphasis and the goals of the host country. The five goals of the Guyanese government with respect to development of the agricultural sector are:

The Guyana Agricultural Sector Development goals for the planning period 1972-1976 are: "(1) to increase the production and marketing of specified agricultural commodities to a level of domestic self-sufficiency, (2) to maximize the export of agricultural

commodities for which Guyana has a competitive advantage with emphasis upon the CARIFTA marketing community, (3) to allocate development investments equitably among the geographic regions of Guyana, (4) to create 10,000 new agricultural employment opportunities, and (5) to increase and distribute income in the agricultural sector more equitably between small and larger agricultural producers."

Since meat is one of the specified agricultural commodities referred to in goal (1) above, the development of a viable livestock industry in Guyana would be consistent with the goals of the country. The domestic self-sufficiency goal also restricts the development of the livestock sector, in that resources must be allocated to satisfy domestic demand for other desired agricultural commodities.

The current domestic deficit of meat in Guyana indicates that large increases in the production of livestock would be required before exporting becomes a viable alternative. For the purposes of the Consortium's work, and in particular Purdue's activities, the second goal may restrict resources available for livestock sector development to those either unused, or yielding a low return in their current use.

Livestock development could lead to a better geographic allocation of investment, if it is profitable to utilize idle resources in currently undeveloped regions. The Consortium systems modeling work should point out not only the most profitable regions and techniques for livestock production, but also the feasibility of bringing undeveloped areas into production.

New employment opportunities would be created both in livestock production and service industry by developing a viable livestock sector. Employment increases should be considered as one of the primary objectives of our study. The model will provide a means of evaluating alternative production systems and policy actions with respect to their impact on regional and total employment, and indicate the trade off between modernization, in the sense of increased capital intensity, and employment.

The distribution of income goal should be taken into consideration as the alternative production techniques are formalized. Contributions to this goal of development of the livestock sector will depend, in part, on the extent of economies of scale in the production systems considered

Purdue's industry model will contribute to Guyana's development goals by providing a systematic way of identifying obstacles to further development of their livestock industry and for evaluating alternative means of reducing their impact. By evaluating alternative actions within a total systems framework, the Government of Guyana will be made aware of trade-off involved in stimulation of livestock production. Thus, policy makers will be in a better position to make rational decisions.

Firm Level Production Model

Texas A & M will develop a firm level model emphasizing the very specific technical production coefficients for geographic regions of the host country. Purdue plans to contribute to the

economic inputs and evaluation of results of the firm level model. Both the firm and industry models will be most useful when used interactively. Thus, it is critical that Purdue and Texas A & M coordinate activities closely during the model development stage to insure compatibility of their models.

APPENDIX E

Trip Report

Participants: Ralph May, Bruce McCarl,
Arlo Minden, Kelley White

Dates: January 20- January 27, 1974

The four members of the Purdue 211(d) visited Jamaica, Barbados and Trinidad for the purpose of (1) aiming familiarity with livestock production and marketing systems in that part of the tropical world, (2) observing and collecting data on beef confinement finishing operations in Jamaica, and (3) investigating the availability of data useful in determining the potential demand for Guyana beef in the Caribbean region. This travel was originally planned to include one week in Guyana for preliminary data collection. However, clearance for travel to Guyana was not given and that part of the trip was canceled.

The report which follows summarizes some of the data, observations and conclusions resulting from interviews conducted in the three countries. A partial list of individuals interviewed in the three countries is attached. No attempt is made to associate information with sources in all cases. All prices and values cited are in U.S. dollars and were converted from local currency values using the approximate exchange rates prevailing at the time of the visit.

Livestock Production In Jamaica

The cattle population of the island is about 250,000 animals where 90% of the farmers have 10% of the land (small farmers - 10 acres or less) and 10% of the farmers have 90% of the land (mostly in farms of 500 acres or more). Most large ranches feed all of their cattle and would buy other calves if they were available. Cattle usually go into feedlot at 650-700 pounds, at 14-16 months of age and remain in the lot for a minimum of 100 days and are sold at 900-1000 pounds. The conception rate on cattle (with three services) is about 80% with good management and about 60% average over the country. The average death rate between birth and weaning is about 5-10%. Dr. Richards sees this high death rate as a major problem which should be worked on while training the farmers.

About 20% of the beef produced in Jamaica is finished in small, independent feedlots. Grain produced in Jamaica, or imported, is used for human consumption so little is available for cattle feeding. Commercial livestock feeds are produced by Master Mix (Central Soya) Purina, Plumrose and Laurel Feeds. Feedlots use primarily by-products: (1) cocoanut meal, (2) citrus pulp, (3) brewer's yeast, (4) wheat middlings, (5) rice meal and (6) molasses. Jamaica's rice production is very erratic, which results in a supply of rice meal for cattle feeding which is not dependable. Current feedlot use of molasses is being curtailed due to a high export demand for rum. Grasses produced for both pasture and "zero-grazing" feedlot use include: (1) Guinea grass, (2) Pangola grass, (3) coastal Bermuda grass, and (4) Bahia grass.

The supply of by-products available for cattle feeding is rather limited. Recent availability is approximately as follows:

<u>By-Product</u>	<u>Annual Production</u>	
Brewer's grain	2,000 tons	Foreign Origin
Wheat Middlings	11,000 tons	Foreign Origin
Citrus Pulp	4,500 tons	
Cocanut Meal	6,000 tons	
Sugar Cane Pith	Should be no limit	
Molasses	160,000 tons	

The land bought by the Bauxite companies came with the restriction that the total agricultural output from the land must be maintained at a level at least as great as before mining started. Cattle feeding operations are in existence on mined out land to help meet this restriction through production of beef from these lands.

ALCAN's feedlots are currently selling the fed animals (800-850 pounds) at a price of \$.43 per pound. They are getting an average daily gain of 2.4 pounds per day at a feed cost of 23¢ per pound gained. Their concentrate mixture is composed of:

54% Citrus Pulp
20% Brewer's Grain
24% Wheat Middlings
1% Urea
(Molasses is fed free choice)

The comparable cost, if fed on corn rations, would be 25¢ per pound of weight gain. Currently, plans are to start a corn silage feeding program at the ALCAN LOTS using XJ304 with six cwt. of fertilizer per acre. The cattle receive Pangola grass along with the concentrate mix. Fourteen acres of Pangols fertilized at a rate of 300 pounds per acre, is maintained for each 200 head of cattle on feed. The annual through-put is 1400 head for their total feeding operation.

Calves that are not fed will be sold as weaners for 43-45¢ per pound. The cattle are kept in lots 50' x 30' which ALCAN charges off at a rate of \$2 per head, per year to construction cost. They keep 30 to 40 head of

cattle per lot and it requires two men to care for 180 to 200 head. Most of the beef produced in the lots go to the cities (50% to Mandeville and 50% to Kingston), but it is sold to the butchers who come by regularly. One butcher reported back that his dressing percentage on cattle bought from ALCAN was 54%. Performance in the feed lot has been about the same from dairy bulls as it is for beef-type bulls. There is no price differential in the market between feedlot cattle and grass produced cattle. ALCAN feeds its cattle to speed up finishing (gains are 1-1 1/2 lbs. per day on grass and 2.4 lbs. per day in lot). ALCAN does not use zero-grazing for its lot:

The Ministry of Agriculture has constructed feedlots at Boles which are 50' x 24', at a cost of \$400 per head capacity. Each lot holds 12 animals and is about 1/3 under shed and 2/3 in full sunlight.

While in the feedlot at Boles, the cattle are fed molasses, by-products and grass (primarily Pangola). Cattle enter the feedlot at about 450 pounds and are sold at about 1000 pounds. The bulls are not castrated, but receive Vitamin A, black leg vaccine and are wormed when they enter the lot. The annual average daily gain was calculated at 2.2 pounds per day at a concentrate cost of 12¢ per pound of gain, fed at a rate of 1.2 to 1.55 percent of body weight. The rate of gain is better during Nov.-Feb., even though the protein content of the grass is lower during this season (difference is about .5 pounds per day). With high fertilizer (1800 pounds per acre of 21% N), the land will yield about 10-12 tons of dry matter per acre with a protein percentage of 9 to 17. The 'zero-grazing' pastures are irrigated with 2' of water every fortnight.

The following results of feeding trials from Boles are summarized from, "Grass and Industry By-Products for Fattening Yearlings," by F. M. Dixon.

Five different levels of Pimola and concentrate were fed as a ration to cattle in confinement. Grass was fed free choice.

Eighty (80) animals were divided into 5 treatment groups of 16 animals each and housed in 24' x 50' feed pens of eight animals each. The initial average weight was 576 pounds. Each animal received 40 days requirement of Vitamin A,D and E by injection prior to entering the lot. The animals were fed only one-fourth of the concentrate ration for the first seven days, until they were used to the ration.

The feeding trial was carried out in two sections: (1) the first 84 days on the first set of rations (Table 1), and (2) the second 42 days on the second set of rations (Table 2).

Table 1. Composition of Diets Fed for First 84 Days of Feeding Trial

Group	Diet	Pimola* (% body wt.)	Concentrate** (% body wt.)	Grass
1	A	1	.4	ad lib
2	B	1	.8	ad lib
3	C	1	1.2	ad lib
4	D	.7***	.8	ad lib
5	E	.7***	1.2	ad lib

* Pimola - 65 parts molasses, 33 parts pith and 2 parts Urea.

** Concentrate - 60 parts Brewers' Grains, 30 parts Wheat Middlings, 9.5 parts ground corn, .5 parts Fish Meal.

** Urea/Molasses was fed as a supplement in place of Pimola; 2 parts Urea and 98 parts Molasses.

Table 2. Composition of Diets Fed for Last 42 Days of Feeding Trial

Group	Diet	Pimola (% body wt.)	Concentrate (% body wt.)	Grass
1	A1	.4	1.0	ad lib
2	B1	.8	1.0	ad lib
3	C1	1.2	1.0	ad lib
4	D1	1.2*	.8	ad lib
5	E1	1.2*	1.2	ad lib

* Urea/Molasses was fed as a supplement in place of Pimola; 2 parts Urea and 98 parts molasses.

Management Procedure - The diets were fed at 8:00 A.M., with chopped Pangola given at about 9:00. Water and a high phosphate mineral mixture (Mineral

Chum) were available at all times. Animals were weighed every 14 days and adjusted weights of ration were established.

Table 3. Cattle Performance for First 84 Days of Feeding Trial

Diet	A	B	C	D	E
Length of feeding (days)	84	84	84	84	84
Average Initial Weight (lbs.)	580	571	576	574	582
Average Final Weight (lbs.)	708	741	763	750	744
Average Daily Weight Gain (lbs.)	1.53	2.02	2.23	2.08	1.93
Average Daily Feed (lbs. of dry matter)					
Pimola	5.03	5.11	5.25	0	0
Concentrate	2.26	4.60	7.09	4.66	6.95
Grass	8.34	7.47	6.54	9.12	6.25
Urea/Molasses	0	0	0	3.35	3.34
Total Dry Matter Consumed Per Day	15.63	17.18	18.88	17.13	16.54
Feed per 100 lb. Gain					
Pimola	328.8	259.9	235.4	0	0
Concentrate	147.7	227.7	317.9	224.0	360.1
Grass	545.1	369.8	293.4	438.4	328.8
Urea/Molasses	0	0	0	161.0	173.0
Total Ingredients - lb./100 lbs. gain	1021.6	850.4	846.7	823.4	856.9
Cost of feed per 100 lbs. gain*	\$14.20	\$14.25	\$16.40	\$10.80	\$15.10

* The cost of grass is not included

Table 4. Feed Quality and Cattle Performance During First 84 Days of Feeding Trial

Diet	A	B	C	D	E
Productive energy of diet (calories/lb)	554	607	640	745	755
Crude protein (percent)	11.5	13.6	15.1	14.6	16.0
Average daily dry matter intake					
per animal (lbs.)	15.63	17.18	18.88	17.13	16.54
Dry matter from grass	8.34	7.47	6.54	9.12	6.25
Percent of dry matter from grass	53.4	43.5	34.7	53.2	37.8
Productive energy intake from					
diet (calories/day)	4105	5896	8012	6017	7815
Average daily gain (lbs.)	1.53	2.02	2.23	2.08	1.93
Feed conversion (lbs. feed to produce					
1 lb. liveweight gain)	10.2	8.5	8.5	8.2	8.6
Cost of feed per 100 lb. of gain*	\$14.25	\$14.25	\$16.40	\$10.80	\$15.10

* The cost of grass is not included.

Table 5. Cattle Performance for Last 42 Days of Feeding Trial

Diet	A1	B1	C1	D1	E1
Length of feeding (days)	42	42	42	42	42
Average initial weight (lbs.)	694	734	767	734	713
Average final weight (lbs.)	789	838	869	838	821
Average daily gain (lbs.)	2.26	2.48	2.42	2.48	2.58
Average daily feed (lbs. dry matter)					
Pimola	2.34	4.96	7.73	0	0
Concentrate	6.56	6.56	7.25	5.54	7.94
Grass	9.31	7.27	6.53	9.17	7.26
Urea/Molasses	0	0	0	6.84	6.81
Total dry matter consumed per day	18.21	18.79	21.51	21.51	21.81
Feed per 100 lb. gain					
Pimola	103.5	200.0	319.4	0	0
Concentrate	290.3	264.5	299.6	223.4	307.7
Grass	411.9	293.2	269.8	369.7	273.6
Urea/Molasses	0	0	0	275.8	263.9
Total ingredients -lbs./100 lb. gain	850.7	757.7	888.8	868.9	845.2
Cost of feed per 100 lbs. gain*	\$11.60	\$14.30	\$18.00	\$13.80	\$16.00

* The cost of grass is not included.

Table 6. Feed Quality and Cattle Performance During Last 42 Days at Feeding Trial

Diet	A1	B1	C1	D1	E1
Productive energy of diets (calories/lb)	695	643	610	735	744
Crude protein (percent)	17.14	15.20	13.8	11.8	13.4
Average daily dry matter intake per animal (lb.)	18.21	18.79	21.51	21.55	21.81
Dry matter from grass (lb.)	9.31	7.27	6.53	9.17	7.06
Percent dry matter from grass	51.1	38.7	30.2	42.5	32.4
Productive energy intake from diet (calories/day)	6250	7775	9284	9153	11024
Average daily gains (lbs.)	2.26	2.48	2.42	2.48	2.58
Feed conversion (lb. feed to produce 1 lb. liveweight gain)	8.0	7.6	8.9	8.7	8.4
Cost of feed per 100 lb. gain*	\$11.60	\$14.30	\$18.00	\$13.80	\$16.00

* The cost of grass is not included.

Factors Limiting Grass Intake:

1. The quantity of feed given before grass is presented.
2. The energy value of the feed.
3. The bulkiness of the feed.

The Tulloch Estates' livestock operation is primarily dairy and Brahman breeding stock production. The Brahman are produced primarily for export and do not perform well in the feedlot. The dairy bulls are the primary source of

feeder animals for the lots. They only feed their own bulls (100-120 per year). The butchers (3 or 4) come by to try to buy the cattle (last group went for \$.40 per pound). The dairy heifers are also kept in the feedlot for growing prior to first breeding. They have found that the heifers that are placed in the feedlot grow to a larger size, produce more milk and calve at 2 1/2 years of age (non-fed heifers calve at about four years). The average composition in the feedlot is about 1/2 bulls and heifers and about 1/2 slaughter bulls.

The lots are 32' x 16' and are stocked at a rate of one animal per two feet of trough space, or eight head per pen. The animals enter the lot at 400-450 pounds and were sold, in 1972, at an average age of 17 months and an average weight of 1075 pounds. The average rate of gain is about 2.8 pounds per day. The cattle are dewormed the first week and again the third week after they enter the lot. Most of the slaughter bulls stay in the feedlot for about 10 months and receive 7-10 pounds of feed daily. All slaughter bulls are weighed fort-nightly, and remain in the lot until their rate of gain slows down. The Brown Swiss bulls perform better in the feedlot than the Holstein, but they tend to have more foot problems in the wet climate. Three full time men could handle the labor in the feeding operation. The lots are 1/3 covered and 2/3 open, which seems to be appropriate in this climate.

The grass is produced and harvested (zero grazing) on 39 acres for the lot. Nine cuttings per year are obtained from the pastures fertilized at a rate of 120 # N, 40 # P, and 60 # K. One of the major problems encountered with the feedlot is the availability of by-products to mix a consistent ration. The Estate tries to have two months' supply of feed on hand at all times, and even then they usually are required to change the proportional mix in their feed. Because of the seasonal production, citrus pulp is purchased

once per year (last price was \$61 per ton). The mixed feed currently costs \$73 per ton.

The dairy herd has an average conception rate of 65 percent. Milk reduction averages 912 gallon per year, with a high of 1440 gallons. Farm price for milk are:

Fluid milk - 20¢ per quart
Processing milk - 13¢ per quart

Tullock Estates fed two lots of cattle last year for comparison of the available commercially mixed (Mastermix Beef Supplement 12%) feed to the Tullock ration, which consists of 50% beef supplement, 22%, and 50% citrus pulp. The animals were all bulls and a combination of Brown Swiss, Holstein, and Charolais crosses from the milk herd. The bulls were kept on feed for a total of 98 days, from 12/17/72 to 3/25/73.

Results:

	Mastermix (8 animals)	Tullock Ration (10 animals)
Average starting weight	431 lbs.	461 lbs.
Average finishing weight*	638 lbs.	744 lbs.
Total Liveweight gain	1656 lbs.	2830 lbs.
Average daily liveweight gain	2.11 lbs.	2.88 lbs.
Total feed consumed	4800 lbs.	10,500 lbs.
Feed conversion ratio**	2.89 lbs.	3.71 lbs.
Cost of concentrate (@\$129.50/ton)	6.5¢ per lb.	3.2¢ per lb.
Cost per lb. liveweight gain	18.79 cents	11.9¢

* Finishing weight refers to weight at end of trial, not the weight at slaughter.

** In terms of pounds of concentrate per pound of liveweight gain.

In addition to the above rations, the bulls received chopped grass daily (harvested from the "zero grazing" land).

Worthy Parks Estates' produces sugar (has it's own mill), citrus, cocoanuts, and livestock (no dairy). Sugar takes first preference on the flat, fertile land. They produce 40 percent of the sugar for their mill, but in recent years the other producers have cut back sugar production, resulting in the loss of good land from the livestock part of the Estate. Since most of the good flat land (900 acres) is in Pangola grass, they are plowing up the Pangola to plant sugar cane. In order to maintain the livestock operation, they are trying to find acceptable land for Pangola on the remainder of the land allocated to livestock production (2600 acres).

The cattle enter the feedlot at 450 pounds and are implanted, wormed three times (every two weeks), and leave the lot at about 800 pounds. The lot produces about three batches of fed animals per year. The cattle gain at about 2.6 pounds per day while in the lot and sell for about 43¢ per pound. Approximately 20 percent of the dry matter consumed is grass, which is fed to the cattle in the lots (zero-grazing). About 400 head are fed out and sold each year from a cow herd of 1500. No cattle are currently purchased for the feedlot. A cross of Brown Swiss-Brahman is being used currently because of the higher milk production (calves are in much better condition at weaning than the Brahman alone). The feedlot requires about four men to supply the required labor. In 1972, the calving percentage was about 78 due to problems associated with an infected bull, but now Mr. Dinnon thinks they are running 87 percent. Mr. Dinnon also stated that their off-take is about 1/3 from all herds. They have five registered Brahman herds and seven commercial herds. They would like to sell more of their registered Brahman stock.

The annual rainfall at the Estate is about 60 inches per year. The wage rate paid to labor by the Estate is \$1.65 for boys, \$1.99 for men and \$2.22 for senior men per day worked.

Most of the finished stock is sold to wholesale butchers who transport the cattle to Kingston for slaughter.

There is a milk processing plant located in Kingston, but a large portion of the milk marketed in Jamaica is delivered in the raw state. It is estimated that there are about 40,000 head of producing dairy cows in Jamaica. The government is importing Holstein cows from Canada, keeping them for one year, and selling them to small farmers who have been trained to care for them. These farmers lease 30-35 acres of land which is promised to them and/or their families as long as development is continued.

Beef is typically purchased by butchers who travel through the countryside to collect cattle for slaughter. The butchers transport the cattle to municipal slaughter plants (Government requires inspection), where the cattle are killed but not cut up. A few large plants have facilities for chilling the meat but most small plants handle the meat warm. Most frozen stew meat is imported from New Zealand. There is a law on the book in Jamaica which prohibits the slaughter of females under two years of age.

Existing slaughter facilities are not modern and are not equipped to utilize the animal by-products. There are plans to construct modern slaughter and by-product facilities to better utilize the available livestock production. Poor slaughter facilities, lack of uniformity, and the erratic supply conditions result in the hotel trade importing their meat from the U.S. and Canada. Local meat consumption is supplied by domestic production and importation of New Zealand beef.

Retail prices for meat are freely determined for cut meat at a supermarket price for steak of about \$2.27 per pound and a country price of \$1.14 per pound. Cheap cuts are controlled at a price of \$.40 per pound. Live cattle prices were controlled until recently at 25-30¢ per pound. When price controls were lifted the live cattle price moved up to a level of 43-45¢ per pound. There is no import tax levied on imported beef.

Barbados Livestock Production

Most of the cattle production in Barbados is dairy with one to two cattle owned by the farmer for milk and many of the calves are slaughtered as early as a few days old so that the milk can be sold. Out of a total cattle population of about 20,000 head, only four or five ranches have as many as 100 head of cattle. All abattoirs are municipally owned and inspection is required for all beef sold. The butchers go around the island to collect culled cows and the few beef cattle. The cattle are sold by sight and on a per head basis. In the market beef sells for about \$.90 per pound. Barbados like most of the West Indies' will not import beef from Guyana because of the presence of foot and mouth disease in the Rupununi. A small amount of beef has been shipped to a couple of the islands from Guyana, but it was raised on the coast. Most, if not all, of the hotel beef consumed in Barbados is imported from the U.S. and Canada.

Canadian Cane Consultants have been working with a machine to separate sugar cane into three components: (1) fiber (to be pressed), (2) wax, and (3) comfith. The comfith is being fed to cattle as a high energy feed with the addition of protein supplements. The machine costs about \$35,000 and can produce four tons of comfith per hour. Urea, cocoanut meal, linseed meal, rape seed meal and fish meal have been added to the comfith as a protein supplement. The dry season effects on the sucrose content of the cane is creating a visible slow-down in the rate of gain of the animals in the feedlot. It was estimated that five to ten percent of the cane produced in Barbados could feed out enough beef to meet the current demand. Sugar cane requirements are such that 350 acres of cane could produce enough comfith to feed out 1680 bulls to slaughter weight in 18 months from birth. Tests are now

underway on using the comfith in both pig and dairy rations. They have been able to add urea to create a 50-60% crude protein mix for beef and a 33 1/3% crude protein mix for dairy.

The following feeding experiment was conducted by the Consultants in Barbados. Since most of the male dairy calves are slaughtered soon after birth, the Consultants bought calves at 2-days of age and fed them on commercial type feed until they reached 200-250 pounds. They entered the feedlot at 200-250 pounds and were sold at 1000-1100 pounds. They were able to feed these calves out at an average cost per pound of gain of 23-25¢. In order to improve the finish on the calves, they added corn to the ration toward the end of the feeding period. Rates of gain were two pounds per day on comfith without corn, and two and a half pounds per day when corn was added to the ration. At completion of this test, they had a trial auction where some of the hotel owners bought some of the beef at 40-42¢ per pound. The auction was tried because they wanted to see the reaction to this selling technique since all regular beef is bought by the butcher on a per head basis.

Comfith CT is the comfith with the leaves ground up in it and is composed of 75% comfith and 25% leaves by weight. The comfith is not easily stored because it must be dried before it can be stored for any length of time. Studies are underway on the possibility of making silage of comfith and storing it in this way.

The University of the West Indies

The group of Purdue Agricultural Economists visited the Barbados and Trinidad branches of the University of the West Indies. We met with scientists working in the livestock production and marketing areas in the West Indian countries. The remainder of this paper is composed of the information obtained during these meetings.

Plans are to put in a large scale feedlot using comfith as the primary energy source in Mexico. Trinidad also plans to experiment with a commercial sized feedlot, feeding comfith, in the near future. Success in the commercial use of comfith is highly dependent on the world market for sugar cane, since sugar production is the most profitable use of the cane and cane land in the West Indies. In addition to the opportunity cost of producing sugar, the inability of comfith to withstand storage for any period of time is a major constraint because the soluble sugar of current cane varieties drops, during the rainy season from 62% to 55%, requiring molasses and corn supplementation during this period. New animal feed varieties could possibly be developed to reduce this drop in soluble sugar during the rainy season but the problem still exists of trying to harvest the cane from a wet and muddy field. We need additional information on the performance of cattle on differing sucrose levels in their feed to guide the development of new animal feed varieties of sugar cane. Preston, in Cuba, has done a good study of the effect of sucrose content of molasses on animal performance.

Most cattle and swine feeds in the West Indies comes from by-products of sugar and imported grains. Molasses and bagasse (pith with sugar removed) are the by-products of the sugar industry used here. In Jamaica, Pimola (a mixture of bagasse, molasses and urea) is used as a cattle feed. Trinidad has its own source of urea from the offshore oil producers here. The by-products

of the brewers in all of the West Indian countries is dried and fed to livestock as brewers grain. Wheat middlings and bran are available as a by-product of the bread industry. Locally produced cocoanut meal is also utilized as a livestock feed. Citrus pulp, a by-product of juice production, is available once per year and must be dried and stored if it is to be a viable part of a feed ration on a year-round basis. Granda is now in the process of experimenting with silage made from citrus pulp as a year-round feed source. Rice stubble is not usually grazed in Trinidad. It is thought that Guyana would have substantial quantities of rice bran because of their relatively large acreage of rice production.

CIAT is carrying on tropical legume research this year in Belize and Antigua. Pangola is used for grazing throughout the West Indies and no problems have been experienced yet with the stunt virus around Trinidad. Oaks went to Africa and brought back several species of tropical grasses to Puerto Rico for breeding and development of good grasses for the Caribbean. Townsville Stylo would be a good forage to harvest but it is poor to mix with other grasses or even establish alone for grazing. High levels of management are required for legume production as a harvested crop and it is impossible to manage legumes when used for grazing.

A very important research area that has been neglected is the determination of the energy content of tropical grasses. In 1957, P. N. Wilson introduced Pangola grass to the West Indies. Pangola's acceptance was based on its agronomic characteristics with little knowledge or emphasis on its nutritional value for livestock production.

Caroni, Limited, in Port of Spain has been working on selective breeding of water buffalo to develop a good blood line for meat production. They have been using a feedlot to finish the buffalo and have produced slaughter animals

that have a dressing percentage slightly less than cattle. The water buffalo are very well adapted to production in very wet, low lying areas such as the river valleys of Guyana. Most of the beef currently produced in Trinidad is a product of the dairy industry and the bulls are slaughtered at a very young age. Holsteins are the dominate breed used in Trinidad. The conception rate of dairy cows is very low in Trinidad (about 50%) with the current AI processes. The calving interval is estimated to be about 15 months. Trinidad has a law that requires government approval for the slaughter of any cows which results in only slaughter of very old cows. Bull calves are usually slaughtered at about 18 months of age, at a weight of 400 to 500 pounds. These young bull calves could be bought (if a market existed) by a feeder and finished to a heavier weight. Due to the lack of vast land areas, most of the West Indian countries will be required to produce livestock on a very intensive basis.

Edmond has done some research in Trinidad on production and utilization of maize silage in livestock production. Collas utilized small vacuum kits store pre-wilted Pangola grass for a small number of cows. Since protein supplement is required during the dry season, Dr. Williams feels that farmers must go to silage or some stored forage to survive. The small islands must aim at one cow per acre in order to produce their own dairy products and meat. Some hay is now being used at Barbados and Antigua for feeding during the dry season. It is believed that maize can produce 40 tons of silage per acre, per year in the West Indies.

Jamaica, Guyana and Belize are the only countries in the trade group that have land areas large enough for beef cattle production. Guyana has the problem of foot and mouth disease in the Rupununi (there was an outbreak reported at Lethem in December, 1973), which has resulted in the islands

refusing to import Guyana beef. Some islands have recently accepted Guyana beef that was produced on the coast. Some of the small islands could possibly be self-sufficient in beef, but in order to do this they would generate a very bad balance of payments problem due to the reduction in production of exportable goods. In most of the West Indies, the lack of adequate farmer training is a major obstacle to increased livestock production. Jamaica has a very good farmer training program and also has well trained personnel working in the Ministry. North American technology and management has taken over rapidly in the poultry industry (vertically integrated) but has not been accepted in the production of other livestock. Foreign control over the stock feed industry along with government controls over the prices has been, and continues to be seen as a problem for the livestock sector. An example was cited: "A Colombian ship loaded with soybeans had to sit at the docks for an extended period of time because none of the foreign controlled feed companies could get permission to purchase the beans." Self-sufficiency in the production of meat is a more difficult goal due to the increase in demand resulting from the ever-increasing per capita income. In Trinidad the division of Extension and the University does not lead to the best farmer training program. The extension section is completely independent of the University and vice versa. Only the Minister can direct the government Extension staff to release any information given out by the University. Much of the research either stops short of completion, or the results are not transmitted to the farmers. Dr. Williams thinks that there could be some potential use of single cell protein (methane) in Trinidad livestock production.

The Crown Lands Dairy Development scheme is to give a farmer 20 acres of land which is to be divided into paddocks for one month cycle, year-round grazing for 20 dairy cows. Each cow is to receive four pounds of concentrate per gallon of milk produced, regardless of the amount or quantity of grazing available. Production tends to vary between three gallons per day during good grazing to one gallon per day during the dry season. The paddocks are fertilized with sulphate ammonia (one to two applications) and some P and K are added. Approximate rates are as follows: (1) P - very little used, (2) K - land not very responsive, so little is used, (3) N - 200 pounds per acre, per year. Experiments in Puerto indicate that grass is responsive to N up to 800 pounds per acre, per year. The N is usually applied during the early part of the wet season which is probably wrong because it is eroded from the soil and gives very little response. Adequate N is used during the establishment (first year) but is probably cut back to save money in later years. Cows are milked twice per day and the average production has been 1.8 gallons per day. The problem of short lactations probably exists but is not reported because the cows are milked as long as any milk can be squeezed out. No irrigation is used but could possibly be tried. One problem is that the soil is very non-permeable, so that rain results in flooding.

Butchers or dealers drive around and buy the animals by the head, take them to the municipal abattoir, and pay the slaughter fees to the abattoir and slaughterman. The slaughtering is done with hand equipment and the carcasses are inspected but not to USDA standards. The meat must be sold to the consumer within one day after slaughter. Meat is meat so that no premium is paid for quality meat. Imported beef (New Zealand) sells for \$1.25-\$1.50 per pound, whereas locally produced meat is sold at the controlled price of

75¢ to 90¢. A black market does exist for locally produced meat. The profits made from the black market are usually received by the butchers or dealers. A typical dealer would buy ten animals per day and sell the meat on his own stalls in the market. The live price for cattle is about \$.30 - \$.33 per pound. Very little of the offal from the slaughter of beef cattle is utilized and the skinning is so poor that the hides are of little value.

Most of the islands are in good shape with respect to diseases. Guyana, Trinidad and Belize have some problems with rabies in cattle. Guyana's primary problem with respect to exporting of beef is the presence of foot and mouth disease. Dr. Williams feels that tick-spread diseases are among the worst problems facing the cattle producers in the Caribbean.

About 65% of the meat consumed in the West Indies is imported. The only meat product to be produced in any sizable amount is poultry, and it is produced from imported feed grains. With a continual increase in disposable income, the demand for meat (especially beef) has been on a continual increase.

The biggest problem with livestock production in most of the islands is the imported feed industries. In Trinidad there is no potential for development of a beef for export, two barriers exist to them supplying the Caribbean with beef: (1) foot and mouth disease, and (2) inadequate transportation facilities.

Individuals Interviewed During West Indies

Trinidad

Dr. K. Archibald - Livestock Science
Dr. S. C. Birla - Agricultural Economics
John Cropper - Agricultural Economics
Professor David Edwards - head of Agricultural Economics
L. Liverpool - Agricultural Economics
Dr. P. O. Osuji - Livestock Science
Dr. Holman E. Williams, - head of Livestock Science
Mr. E. F. Unsworth - Livestock Science

Jamaica

Don Turner - Tulloch Estate
Brian DaZidon - AICAN Jamaica
George Dinnon - Worthy Park Estates
F. M. Dixon - Ministry of Agriculture
Dr. L. E. McLaren - Ministry of Agriculture
Dr. J. A. Richards - Ministry of Agriculture

Barbados

Mr. John M. Mayers - University of the West Indies, Barbados
C. K. Lanrie - Canadian cane consultant
Dr. Caspar Warnars - Canadian cane consultant
Lionel A. James - Canadian cane consultant

APPENDIX F

Report of 211(d) Ruminant Livestock Consortium Trip
to West Africa--May 18 to June 9, 1974

Participants: Dr. T. C. Cartwright, Texas A&M University
Dr. Joe H. Conrad, University of Florida
Dr. George Cooper, Tuskegee Institute
Dr. T. Kelley White, Purdue University

Objectives: To familiarize members of consortium with livestock-production-marketing in Central West Africa,
To discuss with African livestock officials the forthcoming seminar for Africans on management systems for arid rangeland in the U.S. to determine their priorities for content and focus, and
To provide a basis for consortium participation in seminar or management of arid range management.

Chronological Summary of Activities:

- May 18: Departed for Paris
- May 19: Arrived Paris, France early Sunday morning. Mr. Helman, USAID was contacted and we were informed of an appointment with Dr. Robinet on Monday morning.
- May 20: Met with Dr. Robinet for a brief discussion of conditions and problems in the Sahel of Africa. Our program for the trip was discussed and arrangements were made for Dr. Robinet to join the group on May 28 in Ouagadougou, Upper Volta. Departed Paris at noon and arrived at Bamako, Mali in early evening.
- May 21: Met Mr. Rex Henry (USAID Dakar) at airport with intention of flying to Kayer as per schedule. Henry informed us of a change in schedule. During remainder of morning and most of afternoon we discussed the livestock situation, drought, development plans and programs and our best use of the time in Mali. Visited Dr. Diaoure, Chief Veterinary and Animal Industry Officer in Mali. He briefed us on the situation and government plans and programs, and suggested that we cancel trip to Kayer and instead travel by car into the cattle areas north of Bamako.
- May 22: Morning was spent trying to arrange for a Landrover for the trip. Afternoon drove to Segou, visited with personnel in the local Livestock Office and visited a feedlot being operated by the government. Continued on to Niono.

- May 23:** Visited the Livestock Service experiment station at Niono. Discussed research program of the station and conditions in the region. Toured a ranch operated by the Station, observing range conditions and condition of cattle. Also observed confinement feeding experiments being conducted and bulls being used for herd improvement.
- In the afternoon drove to Nara stopping along the way to visit with a migratory herdsman, to observe range conditions and watering points.
- May 24:** Met with personnel of the regional livestock office for a general discussion of livestock production and marketing in the area. Observed a herd which had been brought in for vaccination and interviewed the owner of the herd. Returned to Bamako observing range, water and livestock (both nomadic and sedentary herds) conditions along the way.
- May 25:** Visited the large livestock market at Kati. Observed age and sex composition of animals on the market, collected information on price, origin and destination of cattle being sold, and interviewed a veterinarian and a group of cattle owners. Rex Henry returned to Dakar after having traveled with us for a week.
- May 26:** Sunday was a free day but we did visit the small goat and sheep market in the city. Also visited two city markets (fruit, vegetable, meat, fish, clothing, etc.) one an outdoor market and the other an indoor market.
- May 27:** Visited the Sotuba Livestock Research Station near Bamako. Observed breeding and feeding experiments and obtained data of feeding experiments. Also observed a pilot silage operation.
- May 28:** Departed Bamako and arrived in Ouagadougou, Upper Volta at noon. During the afternoon we met with U.S. Embassy personnel for a briefing on the livestock situation and to plan our activities while in Upper Volta. We were given access to background materials from Embassy files and spent some time reviewing these materials. Dr. Robinet arrived from Paris and joined us for the remainder of the trip.
- May 29:** A short planning session was held with Embassy personnel to make necessary in-country travel arrangements. We had conferences with a number of officials in the national livestock service, visited the old (operating) slaughterhouse and associated hide processing facility, visited the new slaughterhouse which is nearing completion, and visited the government school for training veterinary assistants.

- May 30:** We flew by small plane to Gorom-Gorom where the local livestock market was visited and two French veterinarians conducting a study for the USAID-MIT contract were interviewed. We then drove to Markoy, a ranch established by USAID to demonstrate range improvement and controlled grazing. There we toured the ranch, observed the striking contrast between range and conditions inside and outside the ranch and interviewed the National Director of Livestock and Veterinary Services who was also visiting the ranch.
- May 31:** Traveled by car from Markoy to Dori where we attended a meeting at which government officials were explaining government programs for drought relief and responding to criticism from local people. We attended a luncheon given by the local military commander and had a brief session with the Minister of Agriculture. We returned by plane to Ouagadougou.
- June 1:** Traveled from Ouagadougou to Yaounde, Cameroon. We had an opportunity to talk about an hour to Dr. Bill Morris of Purdue University at the airport in Abidjan.
- June 2:** Sunday--free time.
- June 3:** Met with AID personnel to discuss plans and for discussion of livestock situation. Visited with the director of animal production in the Ministry. Discussed livestock production and marketing and general economic situation with Dr. Ferguson, member of Southern University AID contract in Yaounde. We took the overnight train from Yaounde to Ngaoundere.
- June 4:** Visited the Wakwa Experiment Station near Ngaoundere. We were briefed on the research and extension programs of the station, and the general livestock situation in the region. A number of pasture management experiments were observed, as were results of breeding work and forage trials. We departed Ngaoundere for N'Djamena, Chad.
- June 5:** Met with Embassy personnel to arrange schedule in Chad. We expressed a strong desire to visit two areas in the interior of the country, but after much effort these plans had to be abandoned because of government red tape and political unrest in the country. We had very informative meetings with representatives of the French Mission and with the director of livestock services in Chad. We visited and talked with a number of scientists at the Farcha Laboratories. A meeting was held with members of the staff of the Lake Chad Basin Commission, an international organization for the purpose of stimulating regional development.

- June 6: The group toured the feed mill operated by the Livestock Service and interviewed the director of the mill, had a second meeting with the Director of livestock services for Chad, visited the Executive Director of the Lake Chad Basin Commission and two members of his staff, and toured the livestock market at Massaguet, about fifty miles from N'Djamena. On the return trip we stopped at a watering point and interviewed a local cattle owner.
- June 7: Toured the slaughter house and cold storage facility and interviewed the manager. We visited the school for veterinary assistants and interviewed the director. The afternoon was utilized to write a report requested by the Embassy.
- June 8: A final meeting was held with Embassy personnel and our report on activities in Chad submitted. We departed Chad for Paris at noon and arrived in Paris late in afternoon.
- June 9: Departed Paris for U.S.

List of Names and Addresses of People Contacted:

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Bamako, Mali

Mr. Rex Henry, Project Manager, Regional Livestock,
 USAID/Dakar

Dr. Alassane Diaoure, Chief Veterinary and Animal Industry Offices
 Dr. Bobacar Sy, Head Meat Marketing Board
 Dr. N'Galo Traore, Head Economics Institute

Niono, Mali

Livestock Experiment Station
 Dr. Taoure, Sector Veterinarian
 Dr. Magi, Veterinarian in Charge of Experiment Station

Nara, Mali

Livestock Station
 Dr. Tall, Sector Veterinarian

Sotuba Experiment Station near Bamako

Dr. Samba, Veterinarian in Charge of Experiment Station

Ouagadougou, Upper Volta

Mr. Donald L. Atwell, AID Representative for Drought Programs
USAID/Ouagadougou

Mr. Mark Johnson - Consul/American Embassy

Dr. Nakure, Minister of Agriculture (Met at Dori)

Dr. Coulibaly, Director of Veterinary and Livestock Services
(Met us at Markoy and Dori)

Dr. Bere, Deputy Director

Dr. Tall, Executive Secretary Economic Commission
Met him at Hotel Independencia

Dr. Nicholas, French Veterinarian

Two French Veterinarians on MIT Contract surveying small ruminants
at Gorom-Gorom

Abidjan, Ivory Coast

Dr. William H. Morris, Purdue/AID

Yaounde, Cameroon

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Dr. P. H. Lhoste, Director-Zootechnician

Dr. Enguelegule, Director of Extension

Dr. J. Pierson, Veterinarian

Dr. G. Rippstein, Pasture and Forage (Agrostologist Swiss)

Institut d'Elevage et de Medecine Veterinaire des pays Tropicaux

I.E.M.V.T. Centre de Wakwa, Ngaoundere, Cameroon

N'Djamena, Chad

Ambassador Edward W. Mulcahy
 Mr. Donald Hester, Vice Consul also AID
 Monsieur Rene Guilbaud, Chief French AID Mission
 Mission D'Aide et de Cooperation
 N'Gardoum Djidingan, Minister of Agriculture (didn't meet)
 Dr. Mahamat Touade, Director of Livestock
 Dr. Albert Mamadou, Director of Slaughterhouse and Cattle Export
 Dr. Mayer, Drought Coordinator at Ati

Lake Chad Basin Commission (Commission du Basin du Lac Chad)

Mr. Benson O.Towne, Executive Secretary (Nigerian)
 Dr. Renard, Chief of the Livestock Sector
 Dr. Crouail, Director Assale-Serbewel Project
 Dr. Vallat, Chief Assale Sector Project (Chad)
 Mr. Scotty Deffendol, Chief Serbewel Project (Cameroon)

Dr. Jean Vandenbussche (Feed Mill)
 Directeur du Centre de Modernisation des
 Productions Animales, Farcha

Farcha Laboratories

Dr. G. Tacher, Deputy Director (Directeur Adjoint)
 Newly appointed deputy director of
 International Livestock Center for Africa (ILCA)
 at Addis Ababa, Ethiopia
 Nokoury, DVM, Deputy Director
 Monsieur A. Gaston, Agrostologist
 Dr. J. Gruvel, Entomologist studying tsetse fly

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Summary Observations and Conclusions:

1. We were in Africa at the very end of the dry season. Rains were just beginning. Thus forage conditions were poor but we were informed that this is not abnormal. Most cattle observed were in surprisingly good condition given the apparent shortage of forage. We were informed that cattle were in better condition than at same time the year before because grazing pressure had been reduced.
2. Estimates of reduction in cattle herd due to drought are generally in the neighborhood of 30%. The reduction includes loss from death, forced sale for slaughter and migration to the south where feed is more available. Actual death loss is believed to account for less than half of the herd reduction. The long-run effects of drought induced herd reduction cannot yet be determined. It is generally believed that present cattle numbers are more nearly in line with range resources than was the pre-drought herd. The age and sex composition of the herd has been changed by reduced calf crops and death and slaughter of younger stock and females.
3. There is difference of opinion as to which is more limiting--feed or water. However, it is obvious that where water is available the range is badly overgrazed and where water is not available there is unused forage. It appears that more water, without a means of controlling grazing, will lead to more overstocking and overgrazing.
4. Most government officials talk of plans for restocking the range. This action must be carefully evaluated and a means of controlling stocking rates and managing forage found. Otherwise this action will lead to another crisis.
5. The current crisis and the associated encroachment of the desert often attributed to mismanagement of resources. Recent weather has not been abnormal for the region. Too much pressure had been placed on the ecological system.
6. There are striking examples of what can be done when good management practices are employed. The practices necessary are rather obvious. What is not obvious is a set of policies which will lead to adoption of these practices. One of the most serious obstacles appears to be that land is considered to be community property so that there is no way for the individual herdsman to reap the return from better range management or range improvement.
7. Research and extension activities under the French system has been concentrated on disease control. Its success in this area has contributed to the overstocking problem. Much good basic research has been conducted. There is an apparent failure to train local people to replace the French technicians. There is a great need for broader and more practical research and extension programs--a total systems approach.

8. Tax policies have made effective extension programs difficult because herdsmen distrust all government officials. The head tax on cattle does nothing to encourage more economic marketing of cattle.
9. Nomadic herdsmen consider cattle more a store of wealth than a productive enterprise. This leads to retaining old less productive animals and reduces productivity of range resources. Forced sedentarization of nomads is often proposed as a solution to this problem. This would appear to have inherent risk since much of the range is better suited to nomadic grazing. There may also be high social cost to such a forced change.
10. The market system seems to be operating relatively efficiently. However, government market interference has in cases led to severe distortions.
11. It is essential that the systems approach be utilized in formulation and evaluation of future policy toward livestock in this part of Africa.

APPENDIX G

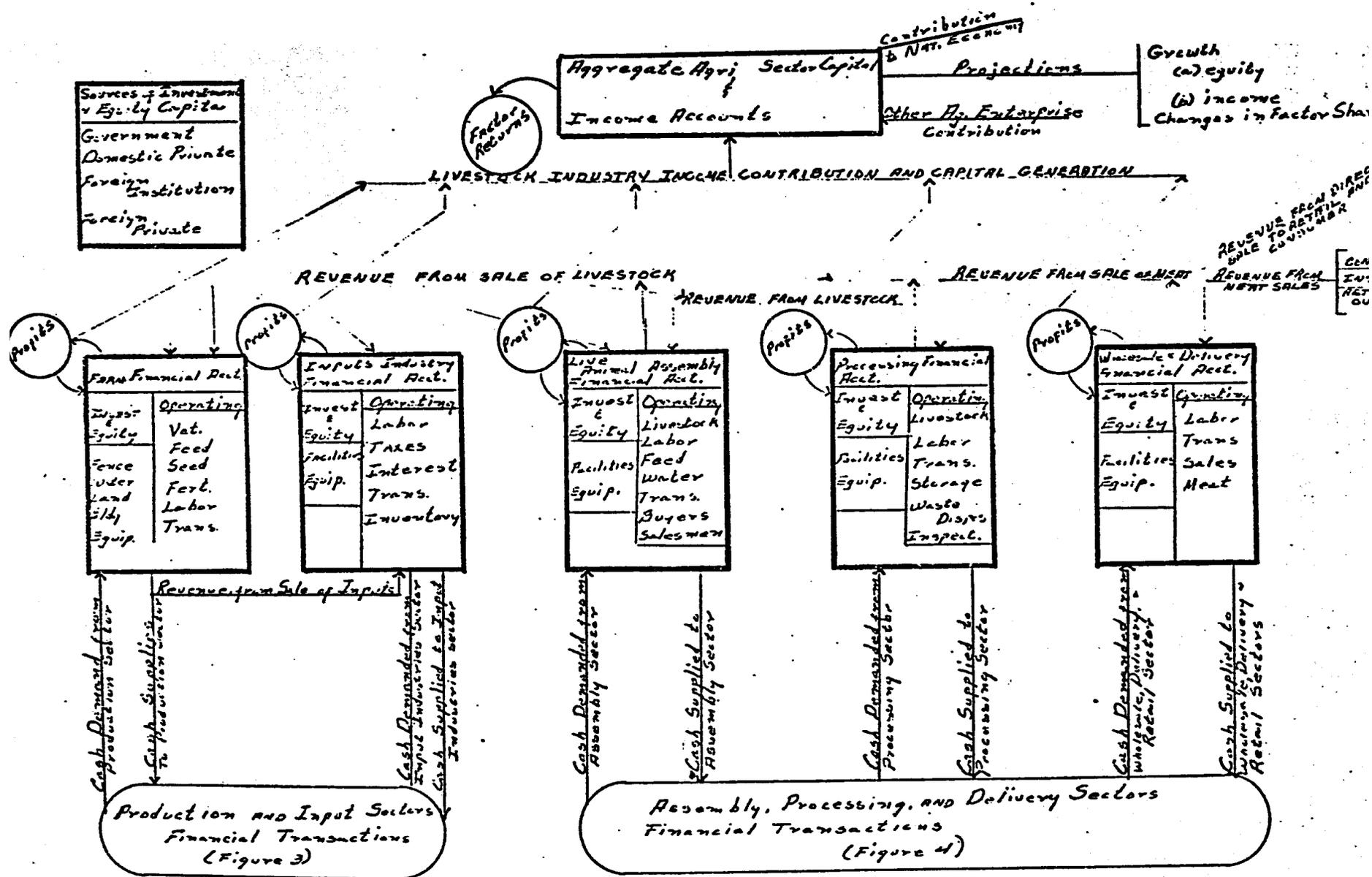


Figure 1. Functional flow diagram of the financial section of the Macro Tropical Livestock Model

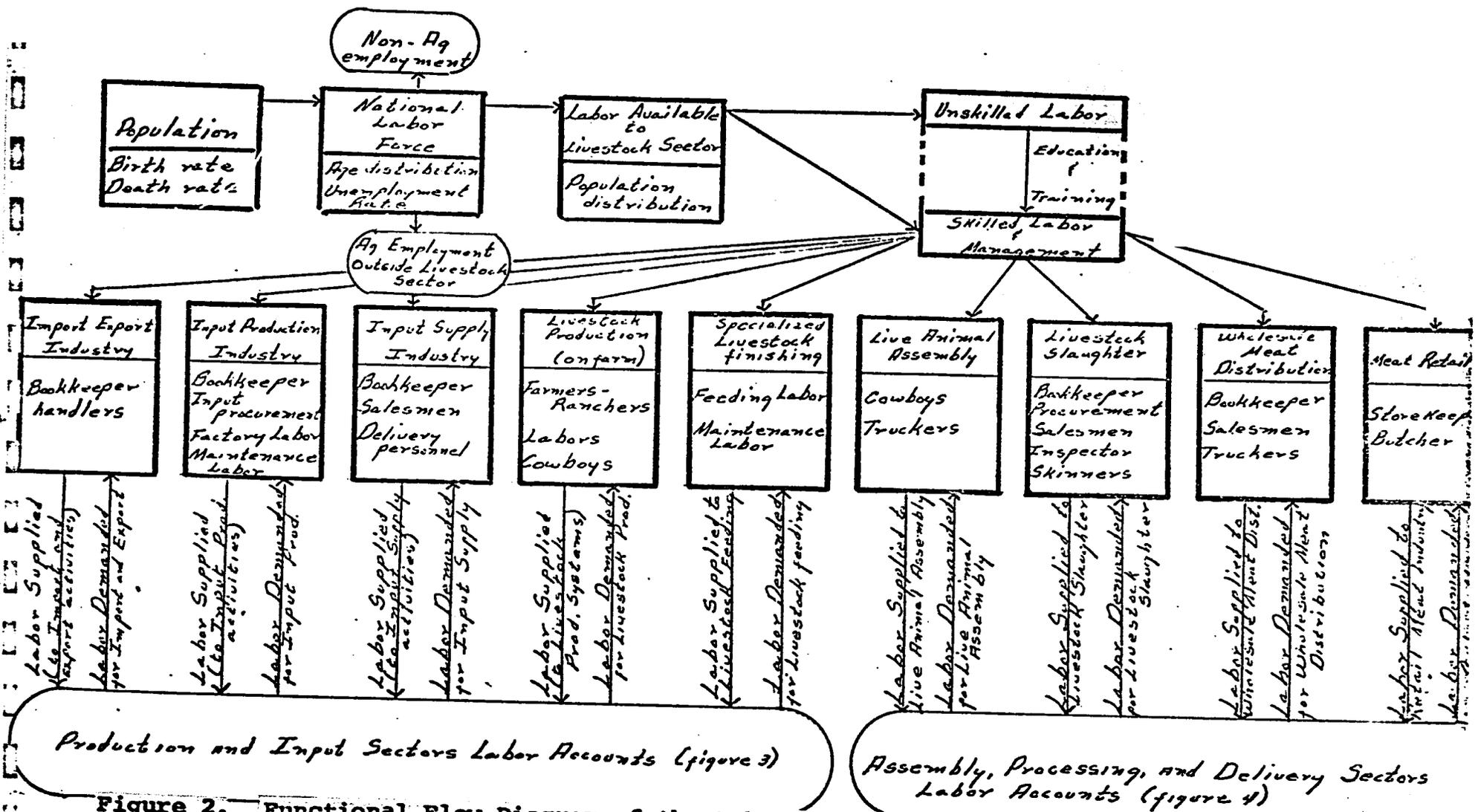


Figure 2. Functional Flow Diagram of the Labor Sector

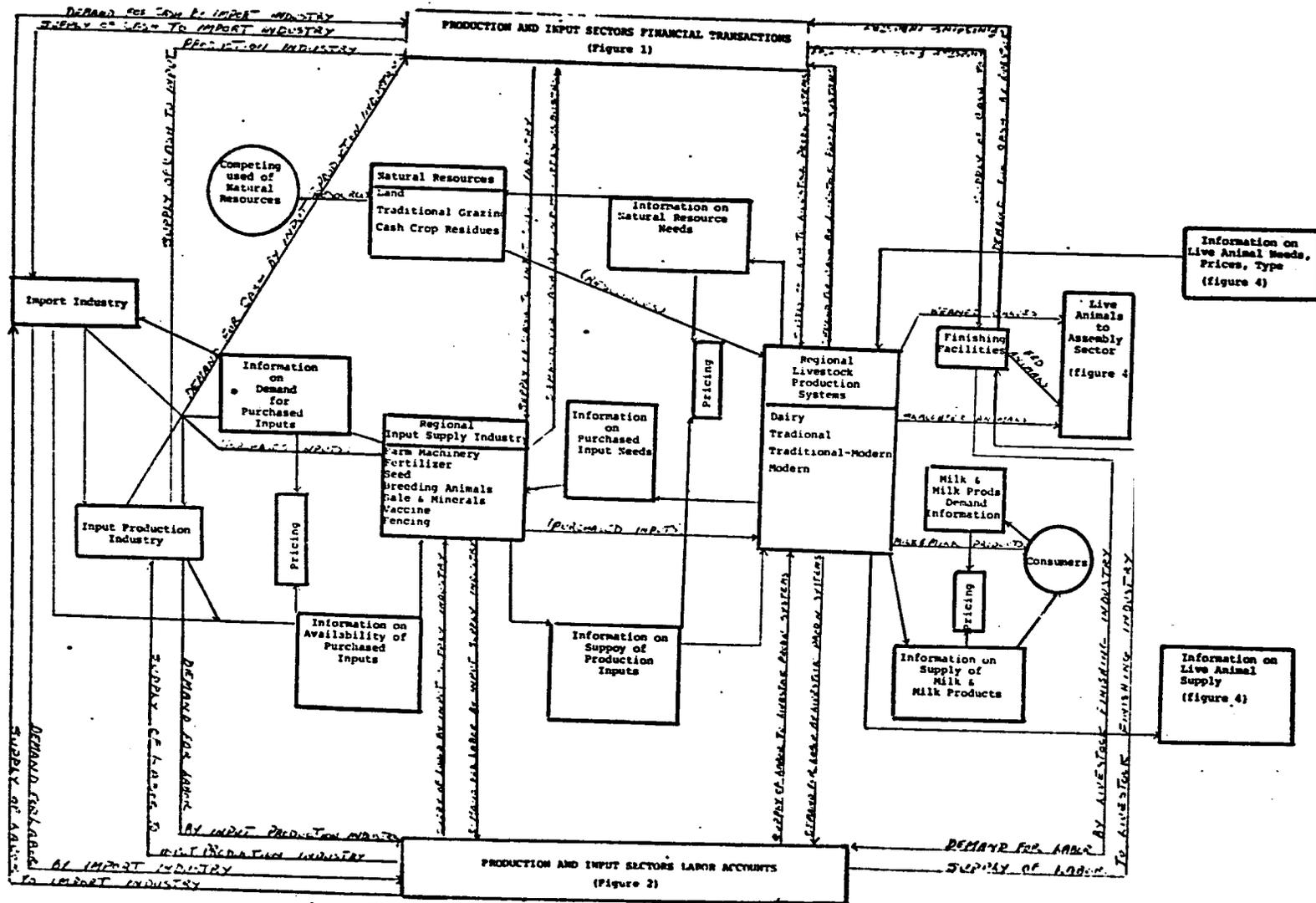


Figure 3. Functional Flow Diagram of the Production and Input Sectors.

APPENDIX H

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