ALASKA'S AGRICULTURE

An Analysis of Developmental Problems

by
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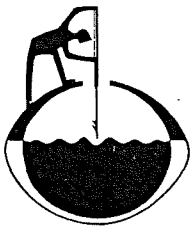

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While the present report is in part based upon his earlier work and other sources, its authorship is strictly that of Dr. Wayne E. Burton with appropriate assistance provided by ISEGR editor, James D. Babb. Technical consultation was provided the author by a number of persons including: Mr. Blaine O. Halliday, U.S. Department of Agriculture, Soil Conservation Service, on soil capabilities and production potential; Mr. Duane Skow, U.S. Department of Agriculture, Statistical Reporting Service, on agricultural statistics and geographic regions; Drs. Dana Myrick, Charles H. Rust, Walter G. Heid, Clarence W. Jensen, and William Lassey, Montana State University, on preparing his doctoral thesis "Alaska's Agricultural Production Potential: An Economic Analysis;" and Dr. Donald H. Dinkel, on horticulture and floriculture possibilities. Dr. Burton's work in preparing this report was in major part supported by the Institute of Agricultural Sciences, previously the Alaska Agricultural Experiment Station. The conclusions and recommendations are those of the author and do not necessarily reflect the views and policies of the U.S. Department of Agriculture, the State of Alaska, or the University of Alaska.

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INTRODUCTION

Questions regarding the future of agriculture in Alaska have been the topic of both casual conversations and intensive study for more than 70 years Research conducted by a number of study groups during the mid-1960's noted that Alaska's agricultural industry, small by any standard, and farming were steadily declining both in number of farmers and in total volume of products. One report summarized the situation:

> While it finds an acute awareness of the immediate problems of the farmer and the principal producing areas, it also finds an almost total lack of the type of economic analysis that would permit an accurate assessment of the long-range potential for food production in Alaska. Nor does it find any systematic search for new and novel methods of production in northern regions as distinguished from research into products which can grow and mature in such regions. . . . Farming in Alaska is still in a primitive state of development, faced with serious economic and climatic roadblocks . . . Federal and state governments might then follow one of two courses in their future involvement. The first course would be a continuation of the present yearly investment of men and money by the Federal and State governments, consisting of product research, experimentation, loans, statistical compilation, dissemination of new scientific information and other normal government assignments. These activities, diligently carried out by several Federal and State offices, have certainly aided the farmers and farming in general over the past few years; but, as we previously noted, the competitive odds faced by these efforts have meant a slowly losing battle. . . . A second possible course of action might be gradual withdrawal of the Government's agricultural activities to a minimum degree of involvement. This position would recognize that further agricultural programs and efforts are expenditures whose success are so questionable that they should not be made.[1]

[1] Federal Field Committee for Development Planning in Alaska, "Economic Development in Alaska: A Report to the President," Washington: Government Printing Office, 1966.

The Scope and Nature of This Study

The purpose of this study is to review the present status and appraise the future potential of the agricultural industry in Alaska, and then evaluate possible alternative directions that the industry might take in the development process. The research problem has a number of distinct facets: (1) availability of productive resources, (2) physical production potential by geographic area, (3) competitive posture of present farm firms, (4) future production and marketing potential within the framework of Alaska's economic and physical environment, and (5) social, political, and economic institutions that structure development of production and marketing firms.

Due to the scope and nature of the research problem, three major assumptions were made at the beginning of the study. They were: (1) there is to be an agriculture industry in Alaska with some degree of product diversification, (2) parameters of the study are to be production of agricultural crops sufficient to meet domestic food and indirect feed requirements, and (3) the competitiveness of non-agricultural industries for investment capital is to be disregarded.

Specific objectives of the study include: (1) to review past agricultural settlement efforts and resulting farm units, problems and obstacles to agricultural development, and scope of markets available to Alaska's producers, (2) to determine how Alaska's agricultural resources might be organized and combined to more successfully compete in potential instate markets, and (3) to focus attention on problems and possible solutions for developing farm and agricultural marketing firms in Alaska's subarctic and modern "frontier" economic environment.

The study was carried out in several identifiable but interrelated parts. It included the collection and review of published and unpublished data regarding the historical background of agricultural settlement, the sequence of development efforts, and actual development results. This effort was combined with an attempt to develop an understanding of attitudes, ideas, and opinions of people within and outside the state regarding needs of and potential for agricultural development in the future.[2] The topic was discussed with farmers, agricultural agency representatives, non-agricultural

[2]R.J. Hildreth and E.N. Castle, "Identification of Problems," in *Methods of Land Economic Research*, W.L. Gibson, Jr., *et. al.* eds., Lincoln: University of Nebraska Press, 1966, p. 23.

oriented persons, and other interested people. Active participation in the Federal Field Committee's Agricultural Task Force and the University of Alaska, Economic Research Service, U.S. Department of Agriculture, agricultural study group provided additional insight and understanding regarding the scope and urgency of problems and an appreciation for the conflicting and divergent beliefs and opinions regarding philosophies, goals, and objectives held by the many people and agencies that are involved in the many phases of agricultural development within the state. It was through these initial efforts that a perspective of the research problem was formed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Alaska's Agriculture

Alaska's Agriculture

PART ONE

THEORETICAL AND INSTITUTIONAL ASPECTS OF THE NEW-LANDS AGRICULTURAL DEVELOPMENT PROCESS

Why do new-land settlement and agricultural industry development occur with such varying degrees of success? This part of the study treats the philosophical and theoretical aspects of the settlement-development process. Chapter I examines the general Alaska situation. Chapter II treats goals and objectives that have in the past and will in the future tend to structure agricultural industry development within the state.

CHAPTER I

THEORETICAL ASPECTS OF LAND SETTLEMENT AND AGRICULTURAL DEVELOPMENT

> Land settlement, especially as a pioneering venture, has fired many people's imagination. As a measure for tackling land problems, it has had an almost universal appeal. There is hardly a country in the world which has not undertaken, at one time or another, a land settlement program. . . . The high rate of failures in land settlement projects would almost certainly have been reduced if past experience had been properly evaluated, lessons drawn, and guidelines established for future programs.[1]

The Alaska experience in land settlement and agricultural development has allowed comparisons of different types of settlement efforts, and has provided an opportunity to evaluate various factors that may cause different rates of growth among farm units or between farming regions. This chapter, using examples of structured and unstructured settlement efforts, discusses certain philosophical and theoretical aspects of the settlement-development process that apply to the Alaska situation.

Structured and Unstructured Settlement

The agricultural settlement areas in Alaska lend themselves to the comparison of structured and unstructured types of settlement efforts. The Matanuska Valley settlement, starting with the Matanuska Valley Colony of 1935[2] and including the later homestead settlement in the valley, is characteristic of a structured type of settlement. The Kenai Peninsula settlement, with its spontaneous, individual homesteading, is characteristic of the unstructured type of settlement. Both areas had certain common features: considerable acreage suitable for farming, very limited agricultural

[1]D. Christodoulou, "Land Settlement: Some Oft-Neglected Basic Issues," *Monthly Bulletin of Agricultural Economics and Statistics*, F.A.O., Vol. 14, No. 10, October 1965, pp. 1-6.

[2]Kirk H. Stone, *Alaskan Group Settlement: The Matanuska Valley Colony*, U.S. Department of Interior, Bureau of Land Management, Washington, D.C., 1950.

experience in the area, little road development, sparse rural settlement, and very limited and undeveloped agricultural markets. Both areas were settled on the premise that settlers could initially develop subsistence farm units and could develop commercial farms later as population increased and markets developed. In both instances, farm development costs were very high, and settlers lacked the necessary capital to develop farms from raw wilderness. However, the approaches used in the two types of settlement were quite different.

The Matanuska Valley

The Matanuska Valley Colony planned for settlement and development to some extent. It provided a rather large group of settlers starting at one time with a wide range of community services, an agricultural service and supply center, an organized market for agricultural produce, and sources of agricultural credit. It became the focal point for development of all agricultural agency programs within the state. Since colony administration and subsequent agricultural agencies focused mainly on the valley, the "establishment" jealously guarded its position of dominance that had been attained by group settlement in the valley. Homesteading continued to expand around the colony due to the developed community structure and institutions.

Johnson and Stanton summarized the goals of the colony as:

> The Matanuska Colony was established for three purposes: (1) to take people off, or keep them off, relief as a result of depression in the United States; (2) to demonstrate whether or not Alaska provided a settlement frontier that could absorb excess population; and (3) to add greater support of the Alaskan economy by production of more locally produced food which would lessen dependence on costly and vulnerable water-borne transportation.[3]

Stone summarized topically some of the weaknesses of the colony effort:

> *Planning.* Plans for The Colony were made hurriedly. The project was too complex to design and start action in the six months between late 1934 and early 1935. Even more significant was the nearly complete lack of basic studies on the Matanuska Valley and summaries of experiences in group

[3]Hugh A. Johnson and Keith L. Stanton, *Matanuska Valley Memoir: The Story of How One Alaska Community Developed*, University of Alaska, Alaska Agricultural Experiment Station, Palmer, Alaska, Bull. 18, 1955, p. 50.

settlement elsewhere in the world. These two weaknesses—speed and lack of information—were demonstrated throughout all phases of colonization.

Administration. The Alaska Rural Rehabilitation Corporation, a private non-profit agency which was formed for the purpose, has guided the colonization. However, the use of the California Emergency Relief Administration until the ARRC was formed led to confusion. Too many administrators, in both Washington and Palmer, were inexperienced. Administration often was paternalistic and the control was too rigid.

Land. The Colony was developed on about 13,000 acres of better farming land in The Valley. All of the acreage was purchased by the ARRC and 17 percent remains unassigned. The 40-acre tracts were too small and the physical qualities of the land were too little known.

Settlers. The original colonists were 903 disadvantaged persons, nearly all of whom were from Michigan, Minnesota, and Wisconsin. Selection was hurried and resulted in the choice of too many people who were not sufficiently adaptable or experienced in farming to remain in The Colony.

Money. About $5,400,000 was granted for the colonization. The sum was nearly five times the estimated figure but at least 40 percent of it is still present in credits. Funds were spent hurriedly and were accounted for poorly. Direct and indirect grants to colonists were large.

Transportation Facilities. Only the Alaska Railroad and an open network of graveled roads were present at the start of The Colony. Improvement and extension of the roads concurrently with settlement produced confusion. Practically no facilities for transportation by aircraft were available.

Farm Building Program. Practically all housing had to be built and all wells drilled when The Colony began. Construction was poorly timed and control of the distribution of materials was weak. There was too little flexibility in plans for buildings. Many structures were poorly built and wells were expensive to drill because of lack of information on the water table.

Community Facilities. No facilities were present for servicing the colonists when they arrived. The construction of a complete village was poorly timed. Facilities were more than adequate at first. The Matanuska Valley Farmers Cooperating Association was forced on the colonists.

Clearing and Cropping. About 175 acres of the colonists' tracts were already cleared when the colonists arrived. Clearing and farming started late and progressed slowly. Many colonists were too inexperienced to farm under unfamiliar and partly unknown agricultural and marketing conditions. However, by 1948 there were about 8,500 acres of cleared land. Farming, though much was part-time, had become permanent.[4]

[4]*Ibid.*, pp. 84-85.

Although criticisms have been leveled at The Colony settlement effort, it did produce positive results toward developing a permanent agricultural production area. The valley has been the only permanent agricultural community in the state and has produced more than one-half of all agricultural products since production statistics have been collected. Population growth and market development in the Anchorage area has been a strong contributing influence.

The Kenai Peninsula

Johnson has aptly described the spontaneous nature of settlement on the Kenai Peninsula:

> (It was) . . . an Alaskan Mecca for many venturesome families newly from the States. They flock there each year searching for "free" land and fresh opportunity in a new country. . . . Most new arrivals know little about pioneering or Alaska conditions. They often have no experience in rural living. All too many find that Alaska is a hard bargainer, taking their savings and their hopes, and giving them in return a bit of land which they are powerless to use. Settlement continued to outpace farm development and even interest in farm development.[5]

Further, Johnson says that a more intensive private search for farmland and homestead opportunity has been carried out on the peninsula than in any other part of Alaska. The effectiveness of studies made by government agencies has been dissipated through failure to follow up with sound plans and development programs. Except for a limited number of land withdrawals that usually had a common opening date for homesteading, the settlement efforts on the peninsula were without planning. Community services were slow in coming. No organized agricultural produce markets were developed. Agricultural credit sources remained in Palmer, in the Matanuska Valley. Roads were few and primitive, and an adequate road system was not developed for many years. Agricultural service and supply firms were absent on the peninsula. Isolation was severe, both from the social and social institution standpoint, and from the agricultural information and technology standpoint.

[5]Hugh A. Johnson and Robert J. Coffeman, *Land Occupancy, Ownership and Use on Homesteads in Alaska's Kenai Peninsula*, University of Alaska, Alaska Agricultural Experiment Station, Palmer, Alaska, Bull. 21, 1956.

Johnson, when traveling through the farming areas on the peninsula in 1958 reported:

> . . . But, beneath this bustle over oil, I was saddened by the numerous signs of decay in settlement on the Kenai Peninsula. Place after place where I had observed the operator make a start at farming now was vacant. Hundreds of acres had been cleared by bulldozing but never broken or seeded to crop. A preponderance of the few acres where settlers had planted crops now were reverting to native grass and brush.
>
> At one place, where I knew the family, the wife briefed me about several neighbors. Most had given up and moved to Anchorage or gone back to the States. She mentioned that eight couples who had settled in that vicinity had broken-up. Generally the wife could not take the isolation, the loneliness, and the crude living conditions of the homestead. Most of the men had worked away from home.[6]

The Kenai Peninsula was settled by a fairly high percentage of bachelors and families without children. Johnson reported for both 1950 and 1955 that the proportion of bachelors (28 per cent) and couples with not more than two children (25 per cent) remained approximately the same. Between the two dates, the proportion of couples without children increased by 7 per cent and the proportion of families containing five or more members dropped 7 per cent. Living conditions apparently were not attractive to families with children.

Although there were large numbers of settlers on the Kenai Peninsula, the hardships and isolation of the unstructured settlement took a heavy toll. Agriculture did not develop with any degree of permanency. The cost in human and capital resources was high for so little accomplishment.

In an initial evaluation of the Alaska settlement, one need only refer to Christodoulou's discussion of the much neglected issues of agricultural settlement and growth in the less well-developed regions of the world to find an accurate summarization of the Alaska experience. He suggests that the following issues are particularly serious when the primary goals for settlement are: (1) the settlement of unpopulated or underpopulated frontier areas, and (2) the increase or diversification of agricultural production.

[6]Hugh A. Johnson, "Notes and Observations Made on Trip to Alaska, 1958," Unpublished report.

> . . . Even when land in the possession of the government is to be used for settlement, the cost of bringing it under cultivation must be carefully assessed. . . . A common fault in land settlement programs is to give each settler a holding too small for successful farming and thus incapable of providing an income of the average level found in the rural areas of the country concerned. . . . Many settlers are grateful to start and even do well at the beginning, but when the pull of industry or other more remunerative employment is strong, they may be tempted to (and often do) leave the holding. . . . The task facing settlers on the land is often colossal. Men with little managerial experience (or at best with experience under different conditions) and in too many cases with no farming experience are usually expected to practice a new type of agriculture with techniques with which they are unfamiliar and on land of whose characteristics they are ignorant. When "new" land has been reclaimed in a region where agriculture has not been practiced before, ignorance of the agricultural conditions sometimes extends also to the scientist and the agricultural advisory service. . . . Newly arrived settlers face acute problems of adaptation to their environment and of building up a harmonious, organic and constructive community life. In many cases, the maximum provision made for them is elementary social welfare, the underlying assumption being that, once put together, they should be able to build up their relations, public life and their communal institutions spontaneously and unaided. . . . Finally, successful community building and a stable human society cannot be promoted by settling people in conditions of isolation from the main stream of the country's economic, social, and cultural life. Such isolation will lead to poor subsistence farming and economic hardship, and to an impoverished social and cultural life which will stagnate because of nonrenewal. . . . An often-neglected subject, however, is the method and spirit with which land settlement authorities approach and handle the human and social problems of land settlement. The most prevailing spirit is one of authoritarianism.[7]

Christodoulou's summarization, while describing problems and issues directly applicable to the Alaska experiences with perception, does not explain causes for differential rates of settlement-development success.

The Conflicting "Philosophies"

The diversity of philosophies, values, and beliefs held by various people and groups is often overlooked in the appraisal of differential rates of success for agricultural settlement and industry growth. Philosophical conflicts that arise tend to have direct effects on the success of settlement and development efforts.

[7]Christodoulou, *loc. cit.*

Three distinct schools of thought are involved in an ongoing philosophical conflict regarding Alaska's agricultural settlement and development efforts. They are: (1) the "Blood, Sweat, and Tears" philosophy, (2) the "Family Farm" philosophy, and (3) the "Long-Range Planning" philosophy. Each has a very different specific emphasis and a particularly partisan support.

The "Blood, Sweat, and Tears" philosophy is directly oriented to the individual, spontaneous, "homestead"-type of settlement. The "Family Farm" philosophy is the basis for an existing agriculture and institutional structure with only "natural" growth of the industry. The "Long-Range Planning" philosophy underlies a programmed type of "new-lands settlement and development" of major project proportions.

The "Blood, Sweat, and Tears" philosophy of agricultural settlement and development is the primary goal of the individual homesteader, who seeks out a remote and difficult location, "the last frontier," to prove his own worth to himself and his peers. Such an individual would hold the yeoman farmer in high regard and, at the same time, want to be a self-made man himself. Thus, the greater the difficulty, the higher the status attained. This individual wants no interference from anyone, but demands his status recognition when expressing desires or opinions.

This philosophy is widely accepted. It is supported mostly by city people who may or may not have come from farms, by townsmen who have lost contact with "the beautiful and quiet repose of country life," and by rural people who want to continue the pursuit of virtues of the rural life that Richard Hofstadter has so aptly described:

> . . . Its hero was the yeoman farmer, its central conception the notion that he is the ideal man and the ideal citizen. . . . The yeoman, who owned a small farm and worked it with the aid of his family, was the incarnation of the simple, honest, independent, healthy, happy human being. Because he lived in close communion with beneficent nature, his life was believed to have a wholesomeness and integrity impossible for the depraved population of cities. His well-being was not merely physical, it was moral; it was not merely personal, it was the central source of civic virtue; it was not merely secular but religious, for God had made the land and called man to cultivate it. . . . [8]

[8]Richard Hofstadter, *The Age of Reform: From Bryan to F.D.R.*, (New York: Alfred A. Knopf, 1956), p. 24.

This central theme of agrarianism, combined with beliefs encompassed in the work ethic, as expressed by John Brewster[9] some years back, provides penetrating insight into the philosophy adhered to by many of the individual "homesteaders" who came to Alaska seeking the "last frontier."

The most adamant supporters of the "Blood, Sweat, and Tears" philosophy adopt the goals of the unique individual searching for the opportunity to express his individualism to the utmost. He looks for an undisturbed natural environment, where he will be free from social coercion. The pursuit of this philosophy is manifested by individuals scattered in spontaneous settlement patterns without structured social and economic institutions.

Those who disagree with this philosophy argue that the socio-economic conditions of our society have changed so rapidly and so completely that we cannot afford the luxury of having individuals in our society who do not assume the responsibility of contributing fully to the attainment of society's goals and objectives. These critics regard subsistence settlers as psychological misfits in our modern day society and, consequently, society has the responsibility to "help" them adjust to the modern world as it "actually exists."

Due recognition has been given the "Blood, Sweat, and Tears" philosophy by politicians, policy makers, and many agency people, as well as by individual settlers, and has been excused by saying that modern society needs it as a safety valve. However, the resultant type of settlement acts as a deterrent to attaining the goals associated with an accelerated rate of settlement in the fringe areas of the subarctic regions.

The "Family Farm" philosophy, as espoused in Alaska, is oriented to the maintenance of existing farm units and existing government agencies in a status quo situation. This philosophy concentrates on small farms that have difficulty remaining economically competitive, and generally does not consider new entry or the development of larger commercial farms that can take full advantage of economies of scale and capital intensive technology. It perpetuates an "old mature agricultural community" with those institutions that presently exist, and retards the pursuit of new settlement and development.

[9]John W. Brewster, "Societal Values and Goals in Respect to Agriculture," in *Some Selected Papers on Goals and Values in Agricultural Policy*, Ames Conference, June 27-29, 1960, Center for Agricultural and Economic Adjustment, Iowa State University.

The socio-political philosophy underlying the "Family Farm" ideology is strongly associated with agrarianism, with certain additions.

> People in rural America are generally characterized by a conservatism and resistance to change. The spirit of individualism is strong, and nowhere is there a stronger sense of tradition and conservation.... The prevailing economy, together with its land tenure system and other supporting institutions, has social, political and racial, as well as economic, complications. There is a deep attachment to the agrarian way of life, and the habits and institutional patterns of the region are deeply embedded in the thinking and behavior of the people.[10]

One sees the idyllic yeoman farmer (as well as the supporters of the "Family Farm" philosophy) somewhat tarnished by traditional conservatism and strong resistance to change, clinging to the old, resisting the new. The family farm is interpreted as a relatively small unit that requires scrimping and saving for success. There is a critical distinction made between the family farm and the commercial farm that results in a small industry oriented to a semi-subsistence status quo. The philosophy thus does not encourage growth, particularly in a frontier environment.

The "Family Farm" philosophy of agricultural settlement is excused by saying that since the family farm was the predominant form throughout the frontier migrations, and was unquestionably successful, it is the only suitable way to settle the rural areas of Alaska.

Policy makers and agency people of the United States Department of Agriculture are the strongest proponents of this philosophy. An agriculture of predominantly family farms has been a dominant goal of public policy concerning the structure of agriculture in the United States for a long time. The Homestead Act of 1862, the Federal Land Bank Act of 1916, the Resettlement Administration and the Farm Security Administration of the 1930's, the Farmers Home Administration, the Federal Extension Service, and many of the later government agencies have had as a primary objective the maintenance of the "family farm." The belief that nothing must impinge upon the values of the family farm has always been foremost in basic policy.

Those who disagree with the "Family Farm" philosophy point out that the social, economic, and political environment of the modern frontier

[10]L.J. Norton, *et. al*, "Adjustments in Southern Agriculture with Special Reference to Cotton," *Journal of Farm Economics*, 1946, pp. 341-379.

settlement areas is so different from the frontier of the great western migration that a different approach is needed to successfully deal with the settlement problems in the subarctic regions of Alaska. They remind us that people of the mid-twentieth century are conditioned to the good life and are totally unsuited to the hardships that our grandfathers took as a matter of course. They also point out that such an inefficient means of settlement brings about a malallocation of human and capital resources because so many settlers sink all of their capital, and several years of their time, in an attempt to develop a family farm, but fail in the attempt to develop a production unit. The settler must then accept his losses and start a new life. The continuing dream of eventually developing a family farm causes the individual to hold the land and other capital resources in an undeveloped state and thus precludes the uniform development of the area. The sporadic settlement that results makes the cost of providing public services to individuals residing in those rural areas very high.

Alaska's structured settlement and agricultural development efforts have been influenced strongly by the "Family Farm" philosophy and, while a permanent agricultural community has resulted, it has rapidly taken on the characteristics of "an old mature agricultural community" with a primary emphasis on maintaining the "status quo." This type of settlement thus deters an accelerated rate of settlement and agricultural industry growth and development, and opposes programs or projects associated with it.

The "Long-Range Planning" philosophy of agricultural settlement and growth is mutually exclusive with the two previously mentioned philosophies. It is oriented to a programmed settlement and development effort to most rapidly and efficiently attain land settlement and agricultural development goals.

The "Long-Range Planning" philosophy of agricultural settlement-development is an organic approach to planning in which program goals would be formulated after a methodical review of all interests: individuals, organized groups of people, agencies, political subdivisions, and state and national governments. Once final goals for settlement were determined by agency planners, scientists from appropriate disciplines could be drawn upon in laying out plans for settlement. The scope of the settlement plans would determine the administrative structure for coordinating and integrating the overall program. Information and technology needs would determine scope and structure of research programs. State and federal governments would

provide means and legal structure for implementing and continuing the settlement program in order to attain the goals initially determined.

This philosophy is predicated on an almost mystical faith in the "technology ethic." The ethic is based on the commonly expressed belief that technology can extricate us from any difficulty if proper planning and research are carried out and implemented with the needed technology and increased capital requirements. The increased capital requirements and associated technological development require sound management decisions for success. The ethic as expressed in settlement areas also encompasses the belief that government should be the guiding force in such a social and economic endeavor, and that government is the only entity large enough to carry out such a program.

Based as it is, primarily on anticipated physical research efforts, the ethic generally excludes social goals and programs, as well as individual goals and aspirations, from the planning frame of reference. Overall goals and program components are too often determined by the proprietary interests and attitudes of administrative authoritarianism. When the planning group is separated from people in the settlement area, mutual alienation can easily occur.

Proponents of the philosophy believe the "facts" from their agencies and disciplines can be organized into a body of knowledge adequate for the specific purpose at hand. First, one must plan a program of settlement and then research all of those problems identified by the physical scientists involved as "appropriate" and empirically researchable. It is assumed that scientists are special entities who can disregard social problems "that cannot be researched anyway." Thus, the resulting "research facts" can be put in "the Plan" and settlement and development will occur. If such does not occur, government can make the plan work.

Critics of the "Long-Range Planning" philosophy point out that such plans are seldom comprehensive enough to include all the problems of settlement and development. They continue to point out that the social aspect of the private sector of the economy in question is not considered, and that even though rural people are rapidly taking on characteristics of an urban society, they still retain characteristics that can act as stimuli for settling a frontier. A further major criticism is that personal goals and objectives of the individual

in settlement programs are not considered, a critical factor for successful settlement. Finally, planning efforts are most often not problem oriented. Research, service, and institution plans are oriented to planners' preconceptions rather than to the unique, empirical problems of the particular situation being considered.

In reviewing Alaska's agricultural settlement and development experiences, one must conclude that each of the philosophies discussed includes certain desirable facets; however, none alone can provide the successful attainment of goals regarding settlement of underpopulated areas or materially increasing agricultural production. If the primary goal is for accelerated settlement and rural development, then an extended effort must be made to resolve the apparent philosophical conflicts and move towards a philosophy conducive to more rapid accomplishment of the goals in question.

Theoretical Aspects of Agricultural Development in Newly Settled Regions

The question, "Why is it that certain newly settled regions appear quite successful, and others fail so completely, in becoming economically developed in their agricultural sector?", is relevant to the Alaska settlement-development experience. It behooves one, then, to give some thought to the necessary preconditions for agricultural development. Parker, in discussing priorities for development and investment in new development efforts, refers to the complexity of the problems faced:

> The complexity of the process is further illustrated by Millikan's six preconditions for agricultural development. There must be: (1) The will to develop agriculture present in the minds of at least some of the national and local leadership; (2) At least some modicum of political stability and continuity in the country; (3) A minimal corps of administrative and organizational talent and competence; (4) A corps of nationals trained in agriculture; (5) Expanding markets for the products of agriculture; and (6) Both domestic and foreign resources available to supply the necessary inputs for agricultural modernization.[11]

[11] F.W. Parker, "Priorities in Agricultural Development and Investment," in Iowa State University Center of Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, p. 176.

Christodoulou suggests, however, that "very rarely is it realized that land settlement projects are intrinsically multipurpose undertakings."[12] Many people with widely diverse interests, values, and beliefs are critically involved. Consequently, many issues and problems, both social and economic, must be given due consideration to understand which will contribute to or detract from the development program.

When existing programs are being reviewed or new settlement or development programs are being considered, it is first necessary to: (1) clarify the purpose of the settlement or development effort, (2) recognize and review the full range of objectives of all persons, agencies, and levels of government involved, and (3) resolve or reconcile the conflicts. When this is completed, the planning process may be effectively started. Christodoulou summarized this initial step, "sound advanced planning should include setting out, in clear terms, the purpose of the project, the reconciliation of conflicting objectives, and the setting up of priorities."[13]

When evaluating the potential for success of development programs, many factors besides direct inputs of a project must of necessity be considered. "Land holding has a special fascination, encouraging exaggerated expectations which often cloud realistic assessment of the chances of success."[14] Planners as well as settlers often let their enthusiasm override realistic expectations, but the opposite can and does happen. Development progress of an unplanned nature does occur, as in some instances of "Blood, Sweat, and Tears" homesteading. Hendrix attributes the unique success of such development to "their own will and commitment to progress and . . . their own policies and programs."[15] Such a factor may be nebulous and difficult to recognize, and may be nearly impossible to measure, but this does not alleviate the critical importance of including it in assessment of projects or programs.

[12]D. Christodoulou, "Land Settlement: Some Oft-Neglected Basic Issues," *Monthly Bulletin of Agricultural Economics and Statistics*, F.A.O., Vol. 14, No. 10, October 1965, pp. 1-6.

[13]*Ibid.*

[14]*Ibid.*,

[15]William E. Hendrix, "The Experience of More Rapidly Developing Countries," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, p. 24.

One further inclusion needs to be made in this initial stage. That is: "These changes will come about from within in a form and manner consistent with the values, culture, and aspirations of the people. Imported capital, technology, and institutions can constitute important catalysts to institutional change, but . . . "[16]

McPherson expands upon the same general thought:

> . . . but in low income countries productive new inputs as well as the distributive system and demand for these inputs remains to be developed. . . . Land, technology, and capital are important—but in order to be productive they must be developed, organized, and operated. These functions can be performed only by humans.[17]

Thus, the stimulus to develop and to sustain development will come only from the human resource. Moreover, it will occur effectively only within the cultural parameters of the region in question. Ignoring cultural limitations or parameters will result in less than desired results in the development efforts.

Lyle W. Shannon, in discussing cultural restraints, focuses on the determinants of production:

> It has frequently been said that land, labor, and capital are the determinants of production. These factors place certain limitations on production, particularly agricultural production. With a given amount of land, labor, and capital, the manner in which people are organized will determine the level of production. Economic development is the process of organizing people for increased production, more efficient distribution, and increased consumption.[18]

If one accepts Shannon's thesis, then the process of development is the process of development of the human resource input. Shannon, however,

[16]John F. Timmons, "Agricultural Development Through Modifying Land Tenure Arrangements," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*. Iowa State University Press: Ames, Iowa, 1965, p. 97.

[17]W.W. McPherson, "Input Markets and Economic Development," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 99-117.

[18]Lyle W. Shannon, "Overcoming Cultural Restraints," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 66-79.

views development from the very narrow perspective of a fixed resource base in a static situation. Land, labor, and capital are not fixed, because man's influence is ever changing. Man's introduction of technology, institutions, changing education and skills, and the ability to bring about changes in other resources means there is no simple solution in deciding what the determinants of production are. One must agree with Shannon, though, that change comes about from the efforts of the human resource input toward the whole process of development. One might say, then, that economic development is the process of using the accumulated output of the development of the human resource in the process of organizing all resources for increased production, more efficient distribution, and increased consumption to benefit the peoples of a given economic society. The pursuit of knowledge of the development process appears, then, to be the pursuit of knowledge regarding the development of those inputs resulting from the human resource.

Johnson emphasizes that there is no simple solution to the problem of transforming traditional agriculture, and no magic mix that will work in all places at all times. "However, the combination that can be adopted to environmental conditions and which will succeed in a particular area can be learned."[19] He lists two requisites: (1) understanding how traditional agriculture functions in different areas within each country and the "why" of present conditions, and (2) finding out what is known about potential combinations of improved technologies that can serve as a basis for field programs to improve production and marketing in a specific area. One must agree with the need for such steps; however, one would expect certain deficiencies in current knowledge, the resolution of which, through research, must also be included in program planning.

Moseman reminds us that, "Well-planned research can and should demonstrate the potential for progress in the agricultural sector and encourage, as well as guide, increased national investment in agricultural development."[20] Well-planned research should isolate the critical problems

[19]Sherman E. Johnson, "Combining Knowledge, Incentives, and Means to Accelerate Agricultural Development," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 209-33.

[20]Albert H. Moseman, "Research Needed for Technological Knowledge in Agricultural Development," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 224-37.

that inhibit agricultural development before it can provide knowledge to resolve those problems. The success of such an approach has been effectively demonstrated by the United States Department of Agriculture and land grant universities. The ultimate goal of a development program is to institutionalize agricultural progress, and this requires a steady increase of research knowledge. Flows of basic, applied, and adapted knowledge are all critical components of this indispensable input. New knowledge is created by basic research and is almost indispensable to applied research. Applied research, however, produces what we generally call "new technology," and it is the new technology that becomes incorporated into the production process.[21]

Research must deal with actual development problems if it is to contribute to the development process. Moseman suggests that coordinated and integrated efforts are undoubtedly necessary:

> Some innovations may be derived from adaptive research, to fit more productive materials and methods from advanced agriculture to new soils and climatic conditions. In some instances, where past research and production experience has been deficient, integrated, interdisciplinary research programs will be undertaken to deepen and broaden understanding of agricultural production processes. . . . The slow and costly "cut and try" procedures for adapting innovations must give way to studied and guided modification of materials and methods.[22]

Researchers recognize the importance of ascertaining the need for fertilizer use and other approved practices and, thus, they stress the need for well-rounded research programs. Some, however, are real pessimists about the possibility of achieving any progress in the undeveloped areas on the basis of current knowledge. One is often left with the impression that progress will have to wait for the development of new research that is vastly more productive than inputs now available. Unfortunately, though, not even that which is known has been made available to farmers in a usable form.[23]

There are certain cautions that must be kept in mind when considering the research input in the planning of development programs and projects.

[21]Lee R. Martin, "Basic Considerations in Transforming Traditional Agriculture," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 48-65.

[22]Moseman, *loc. cit.*

[23]Johnson, *loc. cit.*

> Too often the well-trained scientist in a country with primitive agriculture feels that he must be concerned with so-called fundamental research in order to maintain his stature in the international community of scientists. He suspects that he might be downgraded if he devotes his research efforts to producing something useful.[24]

One must keep in mind that:

> The information processes most urgently needed in the intermediate and long-run future are information adaptation and applied research. . . . that, in their requirements for human talent, applied research and information adaptation are as demanding, or almost so, as basic research and human capital formation. . . . that greater individual initiative is a prerequisite for dramatic increases in agricultural output. . . . the interactions among scholars are an important source of stimulation and creativity; this implies that a critical mass of scholarship is necessary before the required volume and quality of results are forthcoming. . . .[25]

Basic research for northern agricultural regions may not vary greatly from that of more temperate zones; however, there must be different emphasis, depending on differences in climate, resources, and economic factors. In all new development areas, there is a great need for research to develop policies and knowledge to utilize natural and other resources efficiently and economically. Alaska has faced many problems of communication, education, civic and social development, and supply of consumer goods and markets, as well as those concerned with resource utilization. Problems of agricultural development and growth have most often been overlooked due to emphasis placed on more pressing military or other programs.

Agriculture has made some progress in Alaska, but the institutions that characterize a mature and stabilized community have not developed steadily.

Aamodt describes the Alaska situation:

> The situation is not greatly unlike some of the countries emerging as independent states in many parts of the world that were formerly controlled or governed by colonial powers. These emerging countries have much in common with Alaska in developing institutions that will guide and fortify the new governments and their expanding independent economies. In all of these new states there is a great need for research to develop policies and patterns,

[24]Moseman, *loc. cit.*

[25]*Ibid.*

> to utilize the natural resources efficiently and economically. Whether a country is "underdeveloped" or "advanced", is a relative matter and frequently refers to a particular field of development. It is usually applied to countries, or areas, that have not had time, or have failed to develop their resources and modern institutions. . . . The transition period from territorial exploitation to progressive and stabilized statehood requires assistance from the governing powers in the same spirit that colonial powers and other advanced countries are now providing assistance to former colonies and other underdeveloped states. Alaska has been granted political equality but labors under a burden of past inaction in the development of instututions basic to an independent cultural, social and economically balanced state.[26]

In view of Aamodt's discussion of the Alaska situation, it is necessary to take a brief look at institutional services and the part they play in the development process. Booth describes one viewpoint of the part that institutions play:

> Empirical theorizing typically consists in searching economic history for generalizations concerning conditions that have stimulated, and barriers that have inhibited, economic growth. The discovered stimulants and barriers have as often been institutions of society and states of nature as they have been economic variables. . . . Barriers to economic growth are more institutional in character. Or, rather, institutions can easily become barriers since they are static and usually invented to fit a given environment.[27]

There are numerous reasons for believing that the character of class structure and other features of social organization would have a strong influence on attitudes, incentives, and motivations of structuring both social and economic institutions relevant to the development process. However, as the topic of institutions is being pursued from an economic viewpoint, the search is for those conditions which may influence entrepreneurship, capital accumulation and development, technological change, and resource development.[28]

[26]Olaf S. Aamodt, *Northern Agriculture Research*, An address given at the 14th Alaska Science Conference, Alaska Division, American Association for the Advancement of Science, Anchorage, Alaska, August 27-30, 1963, pp. 13-14.

[27]E.J.R. Booth, "The Present State of Knowledge About Economic Growth," in *Optimizing Institutions for Economic Growth*, Proceedings from conference held at Gainesville, Florida, May 5-6, 1964, sponsored jointly by Agricultural Policy Institute of North Carolina State and the Southern Land Economics Regional Committee.

[28]W.W. McPherson, "Overview of Southern Economic Growth," Proceedings from conference held at Gainesville, Florida, May 5-6, 1964, sponsored jointly by Agricultural Policy Institute of North Carolina State and the Southern Land Economics Regional Committee, pp. 26-27.

Parsons expresses the belief that institutions function in economic affairs as the systemizers of social action and explains this belief by saying:

> Perhaps the simplest way to suggest the approximate nature of institutions is to note that institutions are the procedural or social aspects of an economic system of which the input/output, resource-commodity transformation functions are the substantive aspect.[29]

Emphasis is often placed on deliberate change in institutions, particularly as supplements to, as adaptations of, or as substitutes for existing institutions. One must take a bit broader perspective, as Aamodt has suggested, for Alaska, because the agricultural industry lacks some institutions completely and existing ones are underdeveloped for a variety of reasons. One of the most effective barriers to modification or development of institutions in such a situation is vested interests that grow up around any institutional configuration when economic interests are reinforced by political power and social status.

Moseman, in discussing field programs for agricultural development, suggests that certain external institutional services may have direct bearing on the development process. They are: (1) basic and applied research (as previously discussed); (2) education and training; (3) farm supply facilities; (4) credit facilities; (5) marketing facilities; (6) price assurances; and (7) in some instances, large-scale land and water improvement projects.[30] One cannot disagree with Moseman that the services of such institutions are of primary concern in the planning or evaluation process when reviewing preliminary plans for development projects and programs or reviewing those already in existence. As Johnson also reminds us, " . . . a field development program needs administrative understanding and support at the highest levels of government, and clean channels of authority and responsibility for program operation."[31]

[29]Kenneth H. Parsons, "Institutional Innovations in Economic Development," Proceedings from conference held at Gainesville, Florida, May 5-6, 1964, sponsored jointly by Agricultural Policy Institute of North Carolina State and Southern Land Economics Regional Committee, pp. 81-87.

[30]Moseman, *loc. cit.*

[31]Johnson, *loc. cit.*,

Baker, in discussing the effect of capital restraints on production, emphasizes the importance of institutions with regard to credit and capital development. He expresses the belief that,

> To transform agriculture from subsistence to a commercial state, farms must use better quality managerial skills and capital than are used in traditional agriculture. Both are required. When capital alone is added or improved, the new capital is misused and is not as productive as expected. Similarly, improvement in the human agent alone generates selective migration from agriculture, a migration that leaves a low quality of managerial skills in agriculture itself. . . . [32]

Baker argues further that capital restraints, resulting from institutional policies and beliefs, are strategic in attracting capital into or keeping capital out of the agricultural industry. The principal implication of Baker's discussion is that research and education in finanacial management must accompany research and education in technical production and farm management in order to alleviate the restrictive institutional effects.

Heady counters with the belief that technical knowledge may be more of a limiting factor than capital. Heady expresses his belief:

> We have posed the hypothesis that the supply of capital and its price is more important than restraints in the supply of technical knowledge in bringing forth greater productivity in some regions of "less developed" agriculture . . . Capital is not the dominating restraint on all farms which employ techniques resulting in low productivity of particular inputs. If capital were expanded moderately on the average cultivator unit . . . for example, restraints in technical knowledge would soon dominate. Capital and technical knowledge can be substituted for each other only to a limited extent.[33]

In discussing the difficulty and cost of obtaining knowledge about the production sector, Heady focuses more and more on the situation as it exists in Alaska. Knowledge can be obtained, but "it always has some cost attached

[32]C.W. Baker, "Limited Capital as a Restraint on Agricultural Development," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 118-31.

[33]Earl O. Heady, "Priorities in the Adoption of Improved Farm Technology," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 155-74.

because time and other outlays are required to 'go fetch it'." The relative cost certainly increases as the supply is restricted, and the cost is definitely greater in distant and undeveloped locations than in areas of advanced and mature agriculture. "There is need and reason, therefore, why the supply of knowledge should be increased relatively more in undeveloped than in developed agriculture."[34]

Discussions of agricultural development often focus on the settlement aspect or on development of the production sector through research and education or credit restraints, or even on the management input. If marketing is considered, the emphasis is generally placed on improving marketing facilities or lowering costs of marketing. Collins and Holton, however, concentrated on a different aspect of the marketing problem. They initiate their discussion with:

> Rarely, however, is it recognized that industrial and agricultural sectors in turn are dependent on the development of a distributive sector to bridge the gap between producer and ultimate consumer. In a sense the goods are not fully "produced" until they reach the hands of the final buyer; new production goals cannot be considered successfully achieved in any viable long run sense unless firm and continuous contact is made with markets. . . . Plans for economic development normally assume that this link between products and ultimate buyers will be provided more or less automatically as marketing firms spring up in response to price incentive.[35]

One must concur that the implied theory of "spontaneously arising markets" is open to serious question. It is not certain, "that such firms will necessarily appear, or, if they do, that they will always provide the kind of marketing services most appropriate for the new production situation," according to Collins and Holton. This is especially true in the case of agriculture. Most development plans, as previously mentioned, give attention to simple cost-reduction problems and call for improved physical distribution facilities and new storage and marketing facilities at central wholesale markets, coupled with some form of pure control. Most often the need is for a change in organization and operation of the distributive sector, coupled with a much improved liaison with the production sector, thus:

[34] *Ibid.*

[35] N.R. Collins and R.H. Holton, "Programming Changes in Marketing in Planned Economic Development," in Carl K. Eicher and Lawrence W. Witt, *Agriculture in Economic Development*, McGraw-Hill Series in International Development, McGraw-Hill: New York, 1964, pp. 359-69.

> Effective planning for economic development, then, must recognize that expansion of agriculture or agricultural based industries may call for correlative changes in the organization and practices, not just in physical facilities, in the distributive sector.[36]

Fletcher also recognizes and emphasizes the belief that marketing can serve as a leading sector in economic development:

> Marketing is strategically situated to serve as a "leading sector" in the economic development of agriculture . . . that perhaps the most important reason why marketing is not optimally developed is the absence of necessary marketing services . . . Special efforts will be required to transform the market sector to meet development goals.[37]

It is interesting to note the implication in most development planning that the distributive sector plays only a passive role in development. Emphasis is placed on removing obstacles in the marketing process or reducing the "too high costs of marketing and distribution." Marketing (the distributive sector) can play a very positive role, under certain conditions, by changing demand and cost functions in agriculture and manufacturing in such a way as to encourage their expansion noticeably.[38]

It is necessary at this point to go from discussion of questions at the overall settlement or program level to issues and problems at the individual firm level to gain additional insight into development and growth differences.

Acquiring and Combining Economic Resources Into Viable Farm Firms[39]

Traditional economic theory presupposes profit maximization as the goal of any economic endeavor and also disregards other goals on the basis that

[36] *Ibid.*

[37] L.B. Fletcher, "Commodity Markets and Marketing," in Iowa State University Center for Agricultural and Economic Development, *Economic Development of Agriculture: The Modernization of Farming*, Iowa State University Press: Ames, Iowa, 1965, pp. 132-41.

[38] Collins and Holton, *op. cit.*, p. 360.

[39] Discussion drawn heavily from a paper presented by the author at the 17th Alaska Science Conference, Alaska Division, American Association for the Advancement of Science, Anchorage, August 31, 1966.

they do not have a dollar value. Farm families have many goals that fluctuate in order of priority, sometimes even on a daily basis. However, carefully thought-out goals are needed to provide a framework for planning the future development of the farm firm and for evaluating progress. Bostwick aptly describes this relationship:

> Management has been defined as the process of selecting appropriate means to a preferred end. If there are no well defined goals, management becomes impossible. These goals must be reasonably explicit if there is to be any logical construction of plans and management decision. . . . After he has established his goals, the manager can begin to shop around for some means to satisfy them. It would be nice if a strategem could begin and end with consideration of only the appropriateness of a given strategem for a given hierarchy of goals. As it is, the manager might begin with such considerations, but must then modify the strategem according to the demands of individual habits and attitudes, social and economic pressures, restrictions placed by available institutions, and so on.[40]

The selection of goals for the farm business firm and the farm family is critical. Economic survival has highest priority. If it is not attained, other goals matter very little. Other factors that may affect the goals structure of the farm firm are: the stage in the family life cycle of the operator(s), particular interests of members of the family, social status, participation in community and church activities, and other pressures for social, political, and economic conformity. The critical relationship between family and firm goals and managerial efforts is often overlooked or misunderstood. Research by Nielson[41] and Slocum and Brough[42] points out this critical relationship. They reported that families that made a conscientious effort to think out and articulate goals made significantly more economic progress than comparable families who did not. It would appear that farm families who gave considerable thought to composite family and firm goals may have deferred spending and turned more of their resources to capital formation. An interesting sidelight to the Washington study[43] was the indication that,

[40]Don Bostwick, "Research on Financial Management of Firms," in *Management Strategies in Great Plains Farming*, Proceedings of Great Plains Workshop, Great Plains Council Publication, No. 19, August 1961, p. 71.

[41]James Nielson, *The Michigan Township Experiment: The Farm Families—Their Attitudes, Goals and Goal Achievement*, Michigan State University, Agricultural Experiment Station, Tech. Bull. No. 287, 1962.

[42]W.L. Slocum and O.L. Brough, Jr. *Family and Farm Changes Associated with Farm and Home Planning in Washington*, Washington Agricultural Experiement Station, Bull. No. 663, May 1962.

[43]*Ibid.*

as goals became more clearly defined, there was a movement away from joint sharing of responsibility for decisions and towards the assumption of final responsibility by the farm operator. One would assume this indicated an increase in managerial ability and confidence.

Management

Bostwick has defined management in a manner compatible with a theory of firm growth:

> I define management as the art of combining facts and reasonable expectations into a picture of several possible results, and planning actions toward the results most preferred. Under this definition, a good manager is one who most nearly succeeds in correlating expectations and plans to achieve his preferred results. The poor manager is the fellow who misses the boat because of ignorance of the facts, unrealistic expectations, or too little control over his actions.[44]

Thus, the manager is primarily concerned with acquiring and combining economic resources into a developing farm firm. Management, as an economic resource or factor of production, poses a difficult problem for discussion, particularly so, because of the emphasis on development of firm goals and strategems for attaining them.

Agricultural firm management in Alaska has diverse interests and degrees of competence. All stages of production, processing, and distribution may be included in a single firm structure. Problems of management are compounded by a limited and immature agricultural service and supply industry, limited transportation services in many areas, an almost nonexistent marketing structure for most agricultural products, and an absence or inadequacy of many of the institutions that compose a mature agricultural industry.

There is often confusion in distinguishing between management and labor as a resource input in a one-man farm business when the farm operator is both management and labor. Thomas and Amick have provided a very useful definitive separation of the human input into various resource classes:

[44]Bostwick, *loc. cit.*

> There are three distinctly different and mutually exclusive services—labor, supervision, and management. These services may be provided by different people or by one person.

They continue with:

> *Labor* is the physical implementation of the production process. It includes all human energy inputs in transforming production factors into products. *Supervision* includes all activities associated with assuring that resources are utilized in accordance with production plans. This is an administrative function of bringing together resources and making arrangements for their utilization in the quantity and kind, at the time and place, and by the method and techniques set forth by the manager. *Management* consists of making decisions relative to the allocation of the farm's resources. It is the solving of a particular complex of problems . . . determining the product or product combinations to produce, the combination of factors to use in production, the amount of each product to produce, and the production techniques to employ.[45]

However, management is far more complex than described by Thomas and Amick. It entails developing an overall perspective of the farm business firm, taking into account the realities of the business environment in which the firm is located. This is followed by the recognition of family and business goals and objectives, then by surveying, gathering, and sorting information, ideas, and facts, and finally by developing judgments and intuition so necessary in the framework of uncertainty in which an Alaskan farm manager operates. Even the *beginning* farm operator needs to combine a knowledge of farming and farm practices with managerial capacity and business judgment and, above all, initiative and ambition.

Capital

Investment capital has become a major factor of production on Alaska farms, and the acquisition, use, and accumulation of farm investment capital is one of the most critical problems facing farm firm management in Alaska. The term "capital" is often equated with the term "credit." Such an equation is misleading. Spitze defines capital as "produced goods and

[45]E. Woods Thomas and R.J. Amick, *Information Needs in Farm Management*, Purdue University, Agricultural Experiment Station, Research Bulletin No. 705, 1960, p. 4.

services saved from consumption (maintenance and direct satisfaction of man) and used by, or as part of, the human agent in further production."[46] Capital, as used here, may be considered the dollar investment in all productive resources. While this tends to approach the definition of assets, it includes investment capital not owned by the operator (credit), the value of the ongoing concern not accounted for by listing of inventory, and the capital invested in developing the management resource, as well as a considerable amount of public capital, i.e., education, research, governmental agricultural services, and technology developed by private industry that cannot be accounted for by inventory, but, nevertheless, is part of the capital stock of the farm firm.

Most economists will agree that the cause of low farm incomes is a lack of adequate productive resources in the individual farm firm. Shortage of capital appears to be one of the critical limitations. In reviewing research reports one finds that research concerning credit and capital has traditionally been oriented to the amount of debt held by farm operators, sources of credit, and evaluation of credit agency programs. Farm adjustment research has created some change in emphasis to include both the adjustments that could be made and the necessary addition of resources and technology to accomplish the transition.

Farm operators, when trying to obtain needed capital to survive in business, also face the problem of acquiring an optimum set of resources for their farm organizations. Baker and Irwin[47] found that financing limitations may deter farmers from attaining an economically optimum organization. Lending agencies may restrict loans to finance ventures profitable for the farmer but unattractive to the lender.

In reviewing problems of capital acquisition, use, and accumulation on Alaska farms, one finds all indications of capital being a critical limiting factor in development and growth of farm firms. Examples of farm firms being too small, due to the limited capital resource, to initiate the growth

[46]R.G.F. Spitz, "Determinants of Capital Formation-Conceptual and Factual Considerations," *Capital and Credit Needs in a Changing Agriculture*, Iowa State University Press: Ames, 1961, pp. 19-35.

[47]C.B. Baker and G.D. Irwin, *Effects of Borrowing From Commercial Lenders on Farm Organization*, University of Illinois Agricultural Experiment Station, Bull. 71. April 1961.

process are common. Examples of external capital rationing causing a malallocation of resources in the farm firm are not uncommon. Lender limits, either statutory or philosophical, contribute to both situations, and availability of farm investment capital in Alaska is very limited for above-average-size farm units.

Equity accumulation in Alaska farm firms is not comparable to equity accumulation in farm firms of mature agricultural areas; consequently, Alaska firms are found wanting when evaluated by traditional loan criteria. Until loans are evaluated in terms of economic profitability to the farm firm rather than suitability to the lender, Alaska firms will continue to be found wanting.

Growth of the Farm Business Firm in Newly Settled Regions

There has been little or no recognition given the farm firm concept in agricultural settlement and development philosophies and policies with regard to Alaska. Emphasis has been on *"farms"* and *"farmers,"* with a typical definition of farm being *"one or more tracts of land held or operated as a unit of production for agricultural products,"* and of a farmer, *"the head of a household who lives on and/or operates a farm."* One must question, however, whether a farmer plus a farm can necessarily be equated with a farm firm. Mosher reminds us that:

> Agriculture is a specialized kind of production based on growth processes of plants and animals. *Farmers* manage and stimulate plant and animal growth on *farms*. The production activities on each farm are a *business* in which costs and returns are important.[48]

It has been recognized that agricultural production entails combining land, labor, capital, and management in a directed effort to produce some product of economic value. However, it must also be realized that land, labor, capital, and managment are the "inputs" of the farm (business) firm, and that the quantity and proportion of these factor inputs used by the "farm firm" will determine the kind and quantity of agricultural production. The economic success of the farm firm will depend on the price relationship of factor

[48]A.T. Moser, *Getting Agriculture Moving*, Published for the Agricultural Development Council by Frederich A. Praeger Publishing Co.: New York, 1966, p. 13.

inputs and product outputs, and on the use of strategies to assure economic survival of the firm in the short run and firm growth in the long run.

One must keep in mind that a firm is made up of a number of physical entities and actions, and is structured by social, economic, and political institutions. The farm firm may exist for only a short period or it may exist for many generations, with a succession of farm families being involved in its operation. Individuals or agencies, other than the farm operator, may provide much of the capital. All those persons and agencies who participate in the decision-making process make up the management resource input. Only a minimal part of the labor input may be provided by the farm operator. Ownership of the land resource may rest within the firm, or its use and control may be obtained through rental or leasing. Consequently, the farm business firm encompasses a far broader spectrum than just a "farmer" and a "farm."

The traditional concept of the farm firm was a static concept of efficiency of the input/output relationship of a "fixed" group of resources.

> Allocation was considered a major problem because the chief resources—land, and, to a lesser degree, machines and labor force—were considered fixed in amount to the farm firm. The fixed resources had to be allocated to the various product enterprises so as to maximize net returns to the firm.[49]

The possibility of increased profit through firm growth was not included. Boulding expressed the traditional concept of the firm as:

> The firm is thought of essentially as an input/output process whereby certain inputs or factors of production—land and labor services, capital services, raw materials, and so on—are transformed into outputs of saleable products.[50]

Breimyer expressed much the same thought:

[49]Warren R. Bailey, "Necessary Conditions for Growth of the Farm Business Firm," in *Farm Management in the West—Problems of Economic Growth: Research into Economic Growth of the Firm*, Conference Proceedings for the Farm Managment Research Committee of the Western Agricultural Economic Research Council, Report No. 6, p. 35.

[50]Kenneth E. Boulding and W. Allen Spivey, *Linear Programming and the Theory of the Firm*, The Macmillan Co.: New York, p. 3.

> A single managerial unit striving for profit, using two or more resources, the supply of at least one of which is variable, and producing product (s) which therefore is (are) variable as to number or quality or both.[51]

The traditional concept viewed the manager, even though a profit maximizer, as a passive reactor to market forces. His major entrepreneurial decision was whether or not to enter into a particular business activity. From there on the factor market dictated how the available production resources would be combined, i.e., methods of production, and product markets determined the quantity of output. The manager, then, was the passive manipulator of resources that reflect factor market and product market forces.

A modified firm concept, the managerial theory, has evolved from studies of industrial firms. This theory has escaped the trap of "a fixed group of resources." Rather, the firm is an organized information system geared to the attainment of both monetary and nonmonetary goals. Decision making is raised to a position of primary importance, and is regarded as both complex and specialized. It is assumed that the use of strategy to manipulate forces from within the firm can affect the external forces of factor and product markets. The managerial theory, unlike the traditional firm theory in which the firm is a passive reactor to these external forces, considers the firm to be active in modifying the external environment.[52]

Farm management economists have traditionally accepted the premises of the traditional firm model; consequently, the behavior of the farm firm continues to be interpreted in terms of product and factor market forces. Farm production economics research has been oriented to resource allocation and efficiency within the firm, and adheres tenaciously to the fixed resource concept of the traditional firm. Neither emphasis is adequate to understand the firm growth process. Growth of firms is a response to managerial strategy and human decision rather than determined only by input/output factors. Past emphasis of the traditional firm concept has been

[51]H.F. Breimyer, *The Farm Firm in the Structure of the Agricultural "System,"* Paper presented at conference on Implication of Structural Changes in the Economy of the Farm Firm, Chicago, Illinois, October 28, 1964.

[52]R.R. Robinson, "Towards a Growth Theory of the Farm Firm," in *Farm Management in the West—Problems of Economic Growth: Research into Economic Growth of the Firm*, Conference Proceedings for the Farm Management Research Committee of the Western Agricultural Economic Council, Report, No. 6, p. 5.

on the simple, small-scale farm unit, and the managerial concept has been oriented to a large-scale, complex economic organization that has considerable control over its own destiny. However, the critical need in the Alaska settlement and development environment is to focus on the growth of the individual farm firm, from the small homestead unit to the larger and more complex commercially competitive farm firm. Until there is, first, some explicit recognition of the farm firm concept in development philosophies and policies, and, second, an even more explicit recognition of the growth aspects, strategies, and evaluative criteria, there will be little hope for farm operators to receive assistance in developing farm firms. Decisions will still be made concerning the development and combination of all inputs as individual facets, with little realization of how that input will affect firm growth. Little does it matter how great the availability of technology, how great the potential market, or how profitable the production might be if there are resource restrictions on management and capital that cannot be overcome by the operator because the particular needs for growth of the farm firm are not recognized.

The Growth Process

Halter, in studying the process of growth in agricultural firms has drawn heavily on the philosophy and techniques of "industrial dynamics."[53] He approaches the problem of firm growth from two standpoints. The first is concerned with an internal process of development. A unique characteristic of the industrial dynamics approach, as seen by Halter, is the absence of an optimizing procedure built into the approach or its tools. It is assumed that social and economic systems are so complex that an optimum for an entire system is difficult, if not impossible, to attain. Thus, in growth situations, the most expedient validity test of recommended improvements in the system is a comparison of present performance with projected results. If projected results are sufficiently greater, it would be the basis for a sound management decision. Industrial dynamics, then, is an approach for studying management and growth by tracing the relationship between projected and actual results through information feedback that links decision to action in an organization.

[53]A.N. Halter, "Simulation as a Means of Studying Growth," in *Farm Management in the West—Problems of Economic Growth: Research into Economic Growth of the Firm*, Conference Proceedings for the Farm Management Research Committee of the Western Agricultural Economic Council, Report No. 6, p. 96.

Bailey projects a somewhat different approach to firm growth in more detail:

> In dynamic analysis of firm growth, no production resources are considered fixed to the firm. From an assumed starting *state* the firm acquires additional resources out of annual income. For growth to occur, the starting state must provide a surplus of cash returns over farm and family living expenses unless the firm is subsidized. The firm actually may include significant non-farm activities, particularly at the start. In fact, non-farm employment of the operator or his wife could be the chief source of new capital in the early stages of firm growth. Returns need not cover depreciation or a return to owned equity in the short-run. In fact, a firm may operate at what would be a long-term net loss, but cover its direct costs and achieve firm growth in the short-run. Rate of growth is maximized when net cash return is maximized in the short-run. Financial strategies are the core of growth problems. Because no resources are fixed, both the starting and growth resources can be allocated to high-return enterprises.[54]

This may well explain why Alaska farmers have not fared well by traditional efficiency measure analysis. They have concentrated on long run firm growth through financial strategy rather than using traditional static firm concepts, and have been "found wanting" by their critics.

In his discussion, Bailey emphasized five conditions necessary for farm growth: (1) excess managerial capacity, (2) business profits, (3) minimum starting size, (4) some unused resources, and (5) added procurable resources. There are two underlying assumptions throughout his discussion: (1) there is a disequilibrium of resources in the farm firm, and (2) growth is a matter of managerial objective and is subject to a range of strategies.

Certain other premises must be recognized. Growth does not demand superiority in management, but does require excess capacity. Growth does not require that the firm be the most efficient firm in the area or group, or even that it be highly efficient. The growth process requires a specific recognition of the growth objective, a high enough net operating profit margin to increase family income and provide additional investment capital for short run growth, and a high probability of meeting long run investment requirements. It is also necessary to use presently unutilized resources advantageously, and to procure additional resources. Finally, positive action must be taken to sustain growth once it is started.

[54]Bailey, *op. cit.*, pp. 36-37.

Summary

Future rural settlement-development programs must recognize the critical distinction between "homestead"—part-time or small commercial ventures, oriented to personal goals with a "quality of life" emphasis—and potentially large commercial agricultural production units. Programs directed to the former must emphasize aspects that will enhance the "social welfare" of that particular group. Programs directed to the latter must emphasize institutions and technology that will lead to rapid growth and transition to a large-scale commercial agricultural industry.

For structured settlement-development programs to be effective, the planning process should specify clearly the purpose of a program, reconcile conflicting objectives, and establish priorities. It is particularly important to recognize that change comes about from within the actual settlement-development process, and it must occur in a form and manner consistent with the values, culture, and aspirations of the people involved before research, education, and service programs can be developed that will attain desired objectives.

However, development is the result of peoples actions in relation to social, political, and economic institutions; the stimulus to develop and to sustain development will come only from the human resource. The most critical factor in settlement-development efforts is the full utilization of the accumulated output of the human resource in the process of organizing all resources for increased production, more efficient distribution, and increased consumption to benefit the peoples in the development regions. There is no simple solution to the problems of accelerated settlement-development in Alaska's rural areas, and no magic mix that will work in all places at all times. However, the combination that can be adapted to environmental conditions and that will succeed in a particular area can be learned.

Particularly, there is need for research to develop policies and knowledge to utilize natural and other resources efficiently and economically. Well-planned research can and should demonstrate the potential for progress in the agricultural sector, and encourage as well as guide increased governmental investment in agricultural development. New technology and development of marketing infrastructures can both demonstrate and stimulate development and growth in the agricultural industry. It is through these factors that capital can be encouraged to flow into development efforts. However, because of the diversity and increased complexity of

problems in transition from traditional to modern agricultural development, there is an acute need for general understanding of production and marketing systems over and above the direct and specific application of research results from individual research projects. Research should isolate the critical gaps in information and technology that would inhibit industry growth and development, and then formulate research programs to suffice such needs. Science (research) today cannot be simply an effort of unbiased description and impartial forecast, but must be used as a tool to achieve goals in the most efficient and economical manner.

The slow and costly "cut and try" procedure for ascertaining and adopting information and technology must give way to studied and guided assessments of potential combinations that will allow efficient and economical development. The more distant and undeveloped the location, the more difficult and costly it is to acquire advanced research information and technology. Thus, in settlement-development areas, the supply of research information and technology must be increased relatively more than in developed areas. Where past research and production experience has been deficient, integrated and multidisciplinary research programs should be undertaken to rapidly and efficiently broaden and deepen understanding of the agricultural production and marketing processes. That which is known must be made available to the public.

Although development theory and the theory of firm growth are pursued with great diligence, it is difficult to focus on a unique situation. Alaska's agricultural firms are growth oriented and will continue to be so. The critical role of decision making in a growth oriented industry should be recognized and all facets of production, processing, and distribution blended with respect to time and stage of development. Capital must be made available when and where economic opportunities occur.

Excess management capacity is critically important for growth in the individual farm firm. Strategems for growth must be conditioned by individual habits, social and economic pressures, and restrictions placed by available institutions. Firm growth does not demand superiority in management, but does require excess capacity. It does not require that the firm be the most efficient, but does require specific recognition of the growth objective. It also requires an adequate net operating margin to provide for an adequate family income, additional investment capital for short run growth, and a high probability for meeting long run investment requirements. Finally, positive action must be taken to maintain the momentum of growth once started. Until aspects of firm growth are

recognized in planning and evaluative criteria for program development, there will be little hope for (potential) farm operators to receive assistance in developing farm firms.

The planning process for unstructured settlement-development efforts is of an indeterminate nature, as the unstructured type may be described as a process of "natural selection." This type of settlement is made up of individual households scattered in spontaneous patterns without structured social and economic institutions. Such individuals are looking for an undisturbed natural environment, where they will be free from social coercion. They only graze at the cafeteria of available public services, institutions, information, and technology. However, isolation often leads to poor subsistence farming, economic hardship, and an impoverished social and cultural life that stagnates because of nonrenewal. Only a limited number of the "fit" succeed. Unstructured settlement is costly in terms of human and capital resources for so little settlement-development accomplishment. Thus, there is need for program planning efforts of a "social welfare" nature to enhance the "quality of life" of such groups, and to salvage human and capital resources for more productive uses. Ideally, the unstructured type of settlement may meet certain personal goals for many individuals for a period of time, but it is an inefficient means of attaining goals associated with an accelerated rate of agricultural industry growth and development and is costly in terms of social capital.

CHAPTER II

GOALS AND OBJECTIVES FOR AGRICULTURAL DEVELOPMENT IN ALASKA

> Here one looks at the goals, implied or stated, of the individuals or society and determines whether or not the individual or society has achieved these goals. If there is a gap between the achievements and the goal, the gap becomes the problem for study.[1]

An understanding and appreciation of events is often enhanced by a careful review of goals and policies that have, in the past, and will, in the future, structure those events. Certain reservations must be recognized, however, when reviewing goals and policies concerned with agricultural settlement and growth in developing areas. Heady identifies one of the problems in this approach as the inability to identify a set of values and goals for American agriculture, which is, in part, a reflection of the characteristics of values themselves.

> Value systems provide internalized guides, invested with a high degree of effect and meaning of participants. . . . of necessity . . . These emotionally laden characteristics of value-goal systems need be kept in mind constantly as agricultural adjustment proposals are made.[2]

Another reservation connected with the review of goals and objectives that must be recognized is that policies and programs as carried out do not necessarily correspond to implied or stated goals. Spengler points out that,

[1]R.J. Hildreth and E.N. Castle, "Identification of Problems," in *Methods of Land Economics Research*, W.L. Gibson, Jr. *et. al*, eds. (Lincoln: University of Nebraska Press), 1966, p. 24.

[2]Earl O. Heady, "The Concern with Goals and Values," in *Some Selected Papers on Goals and Values in Agricultural Policy*, Proceedings of Ames Conference, June 27-29, 1960, p. 13.

"It is possible, of course, that salutary change may be retarded by deliberate action, as when codes continue to prescribe outmoded technology. . . ."[3] Policies once implemented may be considered as final blueprints for present and future development and may not have been modified and reoriented to changing goals and objectives. Consequently, programs as carried out may deter the attainment of intended general goals and objectives for development.

Still another consideration is the "will and commitment to progress" of the individuals implementing various programs and of those affected by the programs in question. For example, the goal of maintaining the status quo may have higher priority than goals of progress and development.

On the positive side, however, are sound reasons for reviewing goals and objectives, as well as the policies for carrying out programs aimed at attaining the goals. By definition, goals should reflect a desired ultimate status towards which purposeful action is continually directed, without specific time limits, representing the summation of objectives. Spengler emphasizes that:

> Today more than ever, social change in general and economic development in particular are the deliberate change-producing actions on the part of men, groups, and agencies situated in a society . . . anticipations of the future, together with action in the present to make possible what men want in the future, is the focus of a great deal of activity; it is therefore a major force in the present giving shape to the future.[4]

Goals, then, are the focus of change and reflect the focus of change over time. Even though they may not always reflect change that has occurred with precision, they do serve as a basis for useful comparison between "desired ultimate status" and development that has actually occurred. Thus, they provide an opportunity for increased understanding and appreciation of events as they relate to agricultural settlement and growth of the agricultural industry.

[3]Joseph Spengler, "Social Evolution and the Theory of Economic Development," in *Social Change in Developing Areas*, Herbert R. Barringer, *et. al.*, eds. (Cambridge, Massachusetts: Schenkman Publishing Company, Inc.), 1965, p. 253.

[4]*Ibid.*

Federal Goals and Objectives for General Economic Development

When one looks at the future of Alaska's agricultural industry, he must search through a number of clouded goals and policy issues regarding economic development in the state.

Before statehood, federal goals for the territory were limited and drifted with the shifting winds of politics and public opinion.[5] An overly cautious attitude toward initiating development may have been projected because of the magnitude of criticisms historically leveled at development policies used in other frontier areas. Although the need for development planning became critical with Alaska statehood, a concerted and continuing federal effort to develop goals and objectives for economic development was not initiated until the early summer of 1964, precipitated by reconstruction planning after Alaska's Good Friday earthquake.

The most recent expression of key federal objectives for economic development in Alaska has been summarized by Jones as: (1) the broadening of the civilian economy with less dependence on the federal government; (2) the achievement of maximum returns from existing expenditures; and, (3) the proposing of new high-yield programs.[6] Jones, as Adjunct Professor of Economics, Alaska Methodist University, and the economist member of the Federal Field Committee for Development Planning in Alaska, reviewed the various segments of the Alaskan economy in terms of federal goals and objectives on numerous occasions.

The background from which current federal goals and objectives have been developed has been summarized by Jones as:

[5]George W. Rogers and Richard A. Cooley, *Alaska's Population and Economy: Regional Growth, Development and Future Outlook*, Institute of Business and Government Research, University of Alaska, 1963, p. 109.

[6]Douglas N. Jones, "Alaska's Economy: The State of the State," *Alaska Review*, Alaska Methodist University, Anchorage, Vol II, No. 3, pp. 1-38.

> Following statehood, the need for long-range development became recognized, and the devastating earthquake of March, 1964, provided the dramatic occasion. In view of the need for large-scale Federal assistance to rebuild the stricken areas of the State, it was appropriate that such efforts be channeled toward the rebuilding of facilities in a manner that would contribute to the long-range development of the State. In modified form and with different emphases direct Federal participation in the development planning continues. . . .
>
> Although the extensive military buildup in Alaska during World War II and during the Korean crisis hastened the development of the civilian economy by providing roads, airport, seaports, and other capital improvements essential to the economic development, as well as a steady infusion of funds on which related service industries could be built, there was, necessarily, a lag in the translation of this development into a relatively sophisticated, balanced, civilian economy producing goods for export to other states or foreign countries. As a result, the State remains too dependent upon the Federal establishment as its major industry, and of equal or greater significance to this context, this type of capital development has added little to the tax base of the state. In short, the State is too dependent upon an import of dollars through the expenditures of the United States Government, without sufficient spin-off into social capital which can broaden the base, and, hence, the self-sufficiency of the civilian economy. But if the State has a high degree of dependency on Federal expenditures, it is also true that the volume of expenditure is great enough, if properly directed, to have a major impact on the course and direction of the economic growth of the State.[7]

One can extrapolate from Jones's reports the following federal goals for economic development: (1) to develop a relatively sophisticated, balanced, civilian economy that will generate the needed social overhead capital, without continuing federal dependence, and that will provide a suitable climate in the private sector for systematic and integrated economic development in those areas where opportunity exists; and (2) to select and plan for the economic development of those areas where there are strong national interests and where strong federal participation is required in order to broaden the development base. The areas of strong national interest include all of the "Native" problems and, as a consequence of federal ownership of a major portion of the land area of the state, natural resource extraction and allocation such as minerals and mineral fuels and forestry products. The federal government is also interested in sources of energy, communications, research and education, and transportation through its financing and regulation activities.

[7] *Ibid.*

Because Alaska emerged from territorial status only 11 years ago and since the federal government still provides more than 40 per cent of all wage and salary disbursements in the state through direct programs, the federal government retains a strong proprietary interest in the economic development goals and objectives formulation for a wide variety of areas and industries in the state.

Federal Goals in Alaska Agriculture

Due to the rather indefinite situation that has existed for the past several years, a brief review of what appears to have been federal policy in the recent past and a brief statement of possible alternative goals for the near future are in order. Federal goals of the recent past appear to have been: (1) to provide and maintain agricultural agencies that are common in other states; (2) to allow each of the agricultural agencies to pursue common agency goals to the extent possible in Alaska—as long as no modification or adaptation to the Alaska environment or situation was suggested or attempted that would in any way upset the status quo; and (3) to dominate policy leadership, a continuation of the situation that existed throughout territorial days and has continued well into the present.

The above-mentioned policies were probably predicated on the belief that agricultural production in Alaska was not yet needed, and, as long as "stateside" production created surplus, increased production in Alaska would not be in the national interest. The unofficial opinion has been expressed that agricultural development in Alaska would be disadvantageous to Northwest Coast distributors who have preempted Alaska markets as an outlet for "stateside" produced surpluses. Apparently there has been an almost sacred belief that at any time Alaska agricultural production is needed, an immediate and direct transferral of knowledge, technology, crops, capital, entrepreneurship, people, and all of the institutions necessary to have a highly productive and successful agricultural industry can immediately be made without modification or adaptation. One is tempted to observe that the cost of transferral is exceedingly high and, predicated on past experience, is highly unlikely.

If one pursues the topic of possible alternative goals for agriculture in the future, four federal goals appear to have priority for consideration at this time (the first two having been explicitly stated in a presidential report by

the Federal Field Committee for Economic Development Planning in Alaska and the other two implied or discussed on numerous occasions):[8]

(1) To continue the present yearly investment of men and money under the present goals of existing agency programs, i.e., product research, loans, statistical compilation, dissemination of information, and other normal government assignments;

(2) To carry out a gradual withdrawal of the existing agency activities to a minimum degree of involvement. This alternative is the recognition that current expenditures could be considered highly questionable. It assumes that limited benefits can be gained from continuing present programs; also, that arising problems can be solved with consultant expertise on overnight trips from "outside" agency locations;

(3) A third alternative would be to institute "a policy of no agricultural policy." This policy would allow almost unlimited flexibility in adjustment of individual agency objectives, with little or no opportunity for coordinating agency programs at all levels of government towards development and growth. The selection of this alternative would indicate a complete reversal from domination of agricultural development policy to abdication of all policy responsibility; and

(4) To develop a comprehensive program with goals oriented toward agricultural settlement and growth in the modern frontier settlement areas of the subarctic. Such a program must consider the availability and suitability of resources, technology, information, research data, agency programs, and institutions that would be necessary and suitable in modern frontier settlement areas in the subarctic. New and radically different systems of production must be explored. Older systems must be critically reviewed to determine restrictions and shortcomings. Commodity-project programs oriented to specific geographic areas must be developed if private entrepreneurs are to be allowed the opportunity to develop production and marketing firms without undue waste of capital and human resources.

[8]U.S. Federal Field Committee for Development Planning in Alaska, "Economic Development in Alaska: A Report to the President," Washington: U.S. Government Printing Office, 1966.

The latter program would be predicated on the belief that agriculture will develop to some degree in the foreseeable future, and that public investment now will reduce the waste of resources used in unstructured agricultural settlement efforts that are occurring now and will occur in the future. One must assume that the "testing with fire" of the results of such a program would have to come from the "pioneer firms" that attempt to develop in Alaska's "modern frontier environment."

Any of the first three alternatives negates the possibility of an increasing positive federal contribution to the development of Alaska's agricultural industry.[9] The fourth alternative would allow concentration on facets of development that should have broad application beyond Alaska's borders. Federal concentration on new and radically different systems of production for the northern latitudes could be eminently beneficial to agricultural development. Development of new and different crops that would enhance export potential for Alaska would surely be helpful to the industry. Concentration on institutions and services that would make new-lands settlement in the northern latitudes more feasible, both in the social and technical fields, would be worthy of serious consideration. Certain food technology and consumer research programs and facilities would provide stimulus to the industry.

Alaska provides a unique climatic location and socio-economic environment for dealing with particular problems of the northland. Advantage should be taken of the opportunity. Such a program would not preclude continuation of agency programs now in Alaska, but would provide new emphasis and new stimulus to adaptation and orientation of federal goals, objectives, policies, and programs that would in turn revitalize the federal contribution to Alaska's agricultural development.

State Goals and Objectives for Agricultural Development

State goals and objectives, as they relate to agricultural development, are difficult to ascertain beyond those stated or implied in the state constitution's establishment of various departments and divisions in the state

[9]The U.S. Department of Agriculture appeared to have selected and instituted policy alternative No. 3 for the period 1967-70, and the Alaska Power Commission, U.S. Department of Interior appeared to partially fulfill the void thus created. However, it now appears the Department of Agriculture may have selected a goal and policy orientation similar to No. 4 and is reorienting policies and programs in that direction.

government. The Department of Natural Resources, with its divisions of agriculture and lands, has the primary responsibility for agriculture. Other departments less directly involved are the Department of Economic Development and Planning, and the Department of Education. The University of Alaska, while not a division of state government, does have research and educational responsibilities relevant to the agricultural industry. General policy responsibility, however, rests with the state.

The Division of Agriculture is primarily a service and regulatory agency, responsible for protection, development,[10] and promotion of agriculture in Alaska.[11] Annual reports of the division state that "increasing and supplying more of our food is a large part of Alaska's objective; however, there lies an important future in producing specific commodities for export."[12] General and particular objectives of the individual sections provide little insight into the state's goals and policies for overall development of the agricultural industry.

The Division of Agriculture encompasses a number of sections: the animal industries section is charged with control, suppression, and eradication of contagious, infectious, and communicable diseases. The diagnostic laboratory acts as the primary diagnostic service for the state and as the basic research facility for animal diseases that are endemic in the area. The plant industries section is responsible for produce inspection, plant quarantine, seed testing, potato and egg regulation work, weed control, marketing assistance, seed certification, and the compilation of acreage and production figures. The soil conservation section promotes land development and use of proper conservation practices.

The division is also required to obtain and diffuse information on agriculture to people of the state, prospective settlers, and others desiring to engage in agriculture. The Agricultural Revolving Loan Fund has the stated purpose, "to meet the particular needs of the Alaska farmers for low cost farm financing essential to the development of agriculture." Under this

[10]Development as used here must be interpreted in a very narrow sense, as providing regulatory services and limited promotion of the industry.

[11]1965-1966 Annual Reports of the Division of Agriculture, Alaska.

[12]*Ibid.*

program priority is given to loans that could not be suitably financed elsewhere. Since programs within the Division of Agriculture vary in the degree to which they have met stated objectives, it is difficult to evaluate its contribution to overall agricultural development.

The Division of Lands' sphere in agricultural development is limited. It has the delegated responsibility of selection, classification, and disposal of agricultural lands through sale, homesteading, or leasing. The purpose of the state's agricultural lands program is to selectively encourage agricultural development when and where it would be most advantageous.

> State land policies unequivocally encourage allocation of land to agricultural use. This is explicitly stated as a goal in the Alaska Statutes. Additional evidence of the State's policies of encouraging agriculture is found in legislation which was passed by the Fifth Legislature. This authorizes the Commissioner of Natural Resources to select areas of state land classified as agricultural and contract for the land to be cleared or drained or both at State expense."[13]

The Division of Lands has pursued its responsibilities as it sees fit; however, the time and opportunity "to selectively encourage agricultural development" has evidently not yet arrived.

Lack of development and expression of comprehensive state goals, objectives, and policies have limited the effectiveness of the programs being carried out by the two divisions discussed. This lack of attention to developing a comprehensive policy has been excused by the belief that agriculture is of such small scale that it has a very low priority among the problems faced by the state administration. Such a belief provides little consolation to those attempting to develop agricultural firms, to settle rural areas, and to consider the marginal cost of providing additional roads, schools, power, transportations, mail service, fire and police protection, and the many other commercial services to scattered settlement areas.

If one pursues the discussion of state goals for development of the agricultural industry, several alternatives are appropriate for discussion: (1) to continue current programs and policies, accepting federal domination in

[13]Robert C. Haring, *et. al, Alaska Agricultural Study: Economic Evaluation of the Potential for Agricultural Development in Alaska,* Unpublished Report, Institute of Social, Economic and Government Research, University of Alaska, College, November 1967.

general policy and program leadership, even though agriculture continues in a state of chronic depression; (2) to accept a policy of no agricultural policy, assuming that for all times and all places the best thing government can do to foster economic growth in an industry is to limit its scope of operation to the possible minimum, and leave economic progress up to the private economy. This position ignores the inadequacy of institutions in the underdeveloped economy of Alaska and the need for planning in overall resource development; and (3) to develop positive state goals, policies, and programs for agricultural development, giving due recognition to timing and emphasis where greatest opportunities can be identified through sound study and discussion with people who would be involved.

If either of the first two alternatives is considered, little can be said except that the criticisms made in territorial days still have validity, i.e., a complete lack of planning precludes a sufficient concentration on problems of agricultural development. The acceptance of either alternative would amount to a continuation of the burden of self-inflicted colonial attitudes caused by the lack of a positive state posture in developing goals, objectives, and policies for the agricultural industry.

The last alternative is predicated on the belief that the state does have a positive responsibility to its rural people, and that state leadership in agricultural development can be more responsive to the individuals involved than can federal leadership in Washington. It further assumes that agricultural development can contribute to overall economic development, and that the increased commerce resulting will contribute to developments in transportation, communications, secondary road building, social and commercial services in rural areas, and an overall increase in tax base. Such development would eventually contribute to the national economy.

If the third alternative is considered, several problems arise. Consequently, a number of suggestions are offered. The first problem would be to clarify general goals regarding agricultural settlement and development of the agricultural industry, and then to further develop and express a comprehensive agricultural development policy. Such a policy would provide a definitive framework from which to plan and direction to all those persons working toward the end of improving and expanding agriculture to its full economic potential.

A second problem in policy and programming is poor coordination between government agencies and other groups working towards solutions of

problems that are directly or indirectly related to development of the agricultural industry. The problem is often caused by a lack of well-defined goals and policies, or by conflicting objectives of the agencies and groups involved. Since much of the confusion and conflict is due to a lack of liaison between individuals and agencies, it could be alleviated by an agricultural program coordinator, supported by an advisory group representing major interests of the agricultural industry.

There have been a number of agency groups (committees) such as the Rural Areas Development Committee, the Federal Field Committee's Agricultural Task Force, the Technical Action Panel, the Rural Civil Defense Committee, the Alaska Rural Development Review Committee (Washington, D.C.), and others of lesser scope, but none of these committees have been charged with the responsibility of developing and coordinating Alaska's agricultural development goals and policies. The above-mentioned groups were primarily oriented to federal and state agencies, and did not include farm and ranch groups, the processing and distribution people, borough governments, or consumers.

A third difficulty is insufficient attention to area commodity-project problems. Geographic separation and environmental differences preclude a general uniform approach throughout the state. The selection of commodity projects by geographic areas, followed by a coordinated development program including all agencies and interested persons, would concentrate resources to enhance the probability of success.

It is necessary to consider all facets of production, market structure and facilities, promotional development, investment capital and credit, and service programs such as research, education, product inspection and control if a commodity production project is to have a chance to succeed.

Commodity projects such as red-meats: (1) beef and mutton on the Kenai Peninsula, Kodiak, the Alaska Peninsula, and the Aleutian Chain, (2) reindeer production on the Seward Peninsula, and (3) pork production in the Tanana Valley, Matanuska-Susitna Valley, or the Kenai Peninsula would certainly benefit from a commodity-project approach. Other commodity projects include milk and vegetable production in the Matanuska-Susitna Valley, vegetable and grain production in the Tanana Valley, small fruit and nursery plant growing on the Kenai Peninsula and in the Susitna Valley areas, and bedding plants and adapted ornamentals to supply local needs and revegetation programs close to each of the population centers. All would

probably benefit as equally as red-meats from a fully coordinated commodity-project approach. Numerous other products, such as cranberries and lingonberries, grass seeds, vegetable and oil seeds, as well as some not yet recognized, await a concerted approach in industry development.

Several other areas of programming that can add much to agricultural development are research, education, and service programs oriented to feasibility studies, followed by development planning and promotion where applicable. There are currently a number of groups inside and outside the state that carry on intermittent research oriented to agriculture. It would enhance the chances of beneficial development if research were more closely coordinated to well-defined and known objectives that could be provided by a comprehensive agricultural development policy for the state. Development of a research coordinating function oriented to state agriculture development should attract active participation from more research units of government agencies, as well as from private industry. The continued fragmentation and dispersal of research efforts adds little to the solution of development problems, as long as they are not recognized in research programs and are not integrated into a well-defined program of development.

The current state of educational programs oriented to expanding agriculture and rural development is inadequate. At present, there is no university degree program oriented to any major phase of agriculture, even though the subarctic environment and a concentration of research and teaching resources provides the opportunity to develop well-rounded programs oriented to northern rural and agricultural development. Agriculture broadly defined should include rural people, agricultural products, agriculturally related business, utilization of the numerous resources in the rural environment, rural recreation, and the socio-economic environment. Using this definition of agriculture, the Cooperative Extension Service at the University of Alaska could expand its programs noticeably to assist in overall rural economic development. The state Division of Vocational Education could develop a variety of educational programs in the related areas of agriculture, i.e., rural development, agriculture business, vocational agriculture, subarctic technical biology and engineering vocations, as well as agricultural related businesses and vocations. Adult vocational agriculture programs are conspicuous by their absence. A very broad program of education could be developed in vocational agriculture, related agriculture businesses, village adult programs, etc. The university's Division of Statewide Services could expand its program of off-campus and short courses to fulfill

a need for education programs oriented to rural development. Programs dealing with small business management, village economic development, rural sociology programs oriented to village cultural and economic changes, etc., would assist in accelerating rural economic development.

Service, development, and planning programs could give more attention to developmental aspects of agriculture product assembly, processing, storage, and distribution. There is an unmet need for a liaison between current and prospective agricultural producers and processors and all of the state and federal agencies that would give due consideration to ideas, opinions, and desires of those actually involved in agriculture as a livelihood. The current feeling of many agricultural producers and rural residents, as well as marketing people and consumers, is that they have no voice in agriculture industry policy and program development.

Summary

Goals, objectives, policies, and programs of all levels of government have not been oriented to the development and growth of Alaska's agricultural industry. More recent emphasis on long-range planning has brought forth some interest in evaluating potential development of the industry. However, there appears to be no policy commitment at any level of government towards agricultural industry growth and development.

Goals should reflect a desired ultimate status towards which purposeful action is continually directed. They also serve as a basis for useful comparisons between desired ultimate status and progress that has occurred, as well as provide for an increased understanding and appreciation of events as they relate to agricultural settlement, and growth of the industry. Policies and programs carried out may not contribute to attainment of primary goals, in fact, they may deter the attainment of general goals and objectives regarding industry development. A secondary objective of maintaining the "status quo" may have a higher priority at the action program level than goals of industry progress and development. Goals should reflect the desired ultimate status of the population as a whole, including both social and economic benefits over time.

It would appear that one alternative federal goal oriented to settlement-development in the potential rural agricultural regions of Alaska would be:

To develop a comprehensive program with goals oriented towards agricultural settlement and growth in the modern frontier regions in the northern latitudes. Such a program would consider the availability and suitability of resources, research data, information, technology, agency programs and institutions that would be necessary for settlement-development progress in the transition from traditional to modern industry development. New and radically different systems of production would be explored and older systems critically reviewed to determine restrictions and shortcomings. Commodity-project programs oriented to specific geographic regions would be emphasized to allow private entrepreneurs the opportunity to develop production and marketing firms without undue waste of capital and human resources.

Lack of development and expression of comprehensive state goals, objectives, and policies with regard to agricultural industry development has limited possible progress in the potential agricultural industry. It would appear that because of the small and undeveloped state of the agricultural industry in Alaska, an initial goal to develop positive state goals, policies, and programs for agricultural development, giving due recognition to timing and emphasis where greatest opportunities for accomplishment can be identified through sound study and discussion with people who would be affected, would certainly be in order.

Rural-agricultural development has both social and economic implications. Alaska has a unique situation where modern and traditional sectors are divided both culturally and economically. It would appear that the combination of social and economic benefits of rural-agricultural development would extend far beyond the increased value of agricultural products. The posed state goals could provide an opportunity to institutionalize a development infrastructure and at the same time contribute to institutionalizing development progress in the rural-agricultural sector.

PART TWO

ALASKA AGRICULTURAL DEVELOPMENT: A CASE STUDY

This part of the study examines agricultural development as it has occurred and explores certain future potentials. Chapter III reviews development progress and problems. Chapter IV provides data regarding selected farm production enterprises. Chapter V explores the availability of resources and production and market potentials.

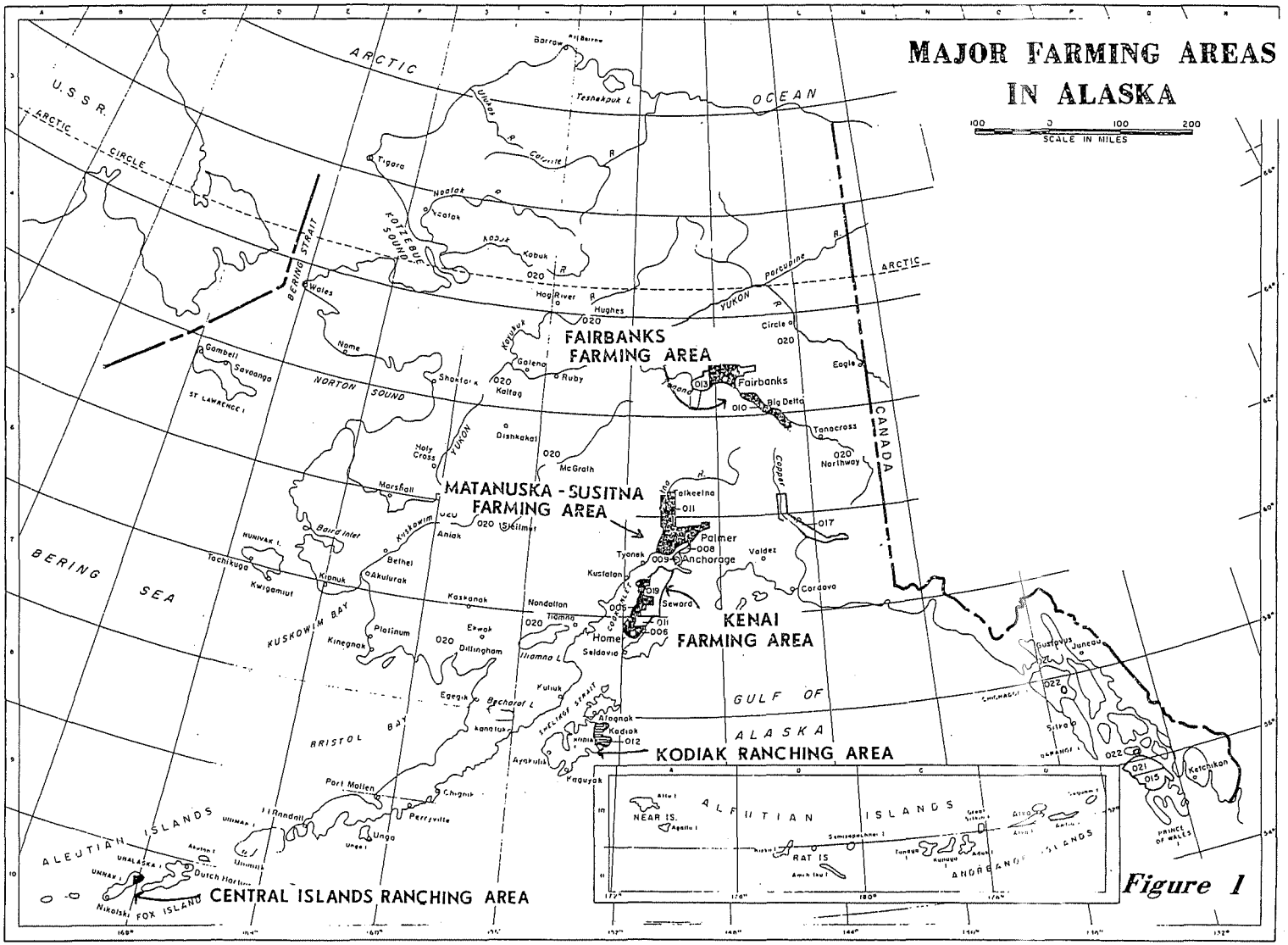

MAJOR FARMING AREAS
IN ALASKA
SCALE IN MILES
FAIRBANKS
FARMING AREA
MATANUSKA - SUSITNA
FARMING AREA
KENAI
FARMING AREA
KODIAK RANCHING AREA
CENTRAL ISLANDS RANCHING AREA
ALEUTIAN ISLANDS
ARCTIC OCEAN
BERING SEA
GULF OF ALASKA
NORTON SOUND
KUSKOKWIM BAY
BRISTOL BAY
U.S.S.R.
CANADA
Barrow
Wales
Kobuk
Hughes
Circle
Eagle
Fairbanks
Big Delta
Tanacross
Northway
Nome
Galena
Ruby
McGrath
Palmer
Anchorage
Valdez
Cordova
Seward
Homer
Seldovia
Kodiak
Dillingham
Bethel
Kotzebue
Unalaska
Dutch Harbor
Nikolski
Port Moller
Perryville
Sitka
Juneau
Ketchikan
NEAR IS.
RAT IS.
ANDREANOF ISLANDS
PRINCE OF WALES I.

Figure 1

Interest in the Matanuska Valley reached its initial peak during the 1915-17 period, with some 400 settlers in the valley. Nearly all land was homesteaded at that time.[4] As in the Tanana Valley, agricultural interest dissipated after construction of the Alaska Railroad, and did not arise again until the Matanuska Colony settlement of 1935. The post-war period brought another sharp increase in interest, which remained, with varying intensity, until the mid-1960's, when the agricultural situation appeared to become static. Agency representatives reported no inquiries about farming opportunities or new agricultural loans during the mid-1960's.

The Kenai Peninsula received an active interest in settlement during the late 1940's and 1950's after the completion of the Sterling Highway, which linked the area with Anchorage. Settlement activity was strong during this period, but agricultural activity declined very rapidly during the 1960's, with very few farms remaining by the end of the decade.

Other areas have had similar spurts of interest, but these died as market systems and facilities did not develop and speculative values of land did not materialize as expected.

Population Growth

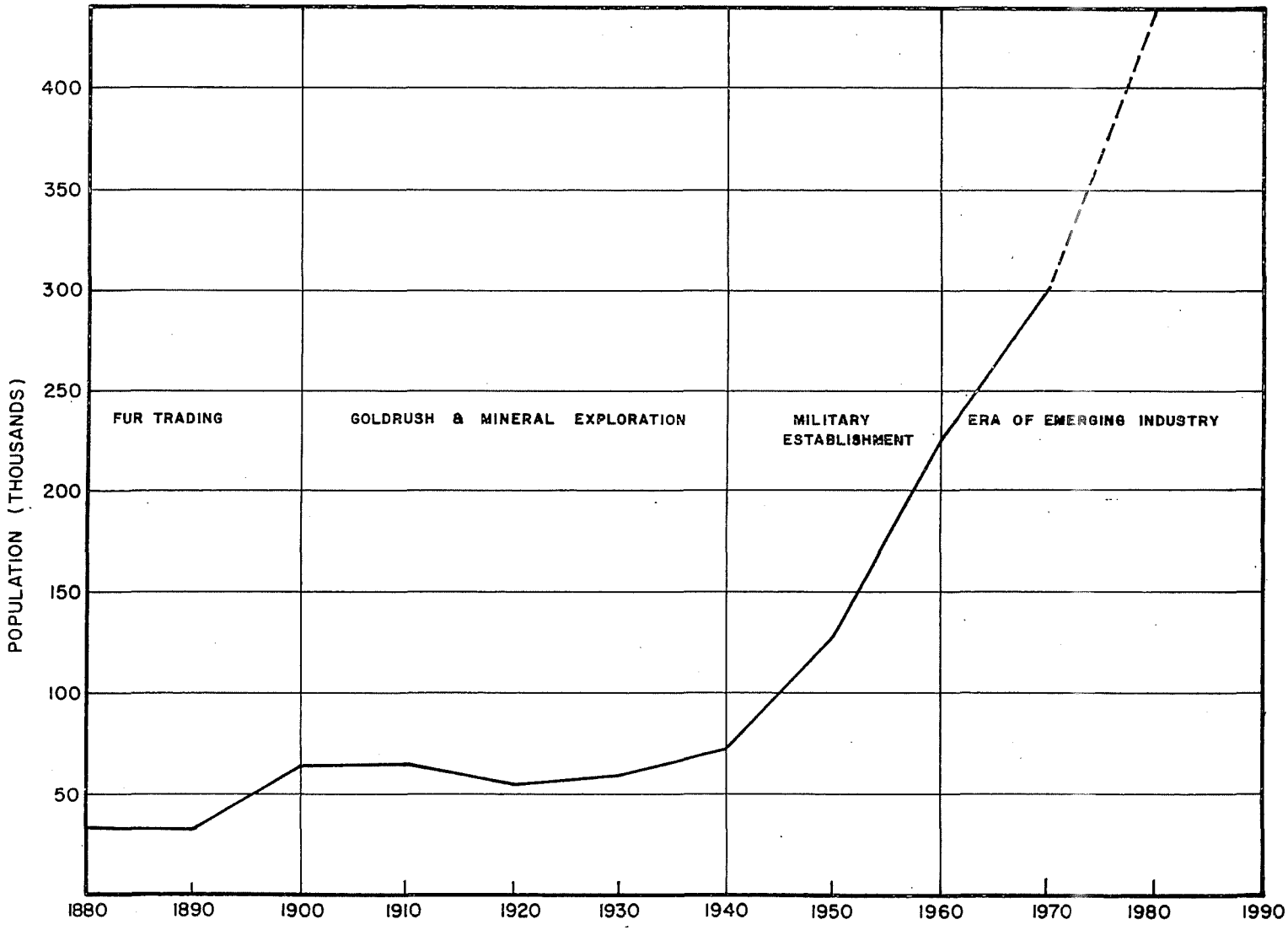
Alaska's population has been relatively small and highly unstable until the last two decades. Population fluctuations during the period 1880-1940 were influenced primarily by an ebb and flow of economic activities following a fairly typical colonial pattern of natural resource exploitation and development.[5] Population growth since 1940 has been marked by the rapid military buildup during World War II and the rapid growth of the civilian economy since the mid-1940's.

The growth of Alaska's population may be divided into four time periods (Figure 2). The first is the fur-trading period, from the initial Russian

[4]Hugh A. Johnson and Keith L. Stanton, *Matanuska Memior: The Story of How One Alaska Community Developed*, A.A.E.S. Bul. 18, pp. 28-29.

[5]G.W. Rogers and R.A. Cooley, *Alaska's Population and Economy: Regional Growth, Development and Future Outlook.* (Vol. I, Analysis, Vol. II, Statistical Handbook, University of Alaska Econ. Series, College of Business, Economics and Government, 1963, p. 21.

Figure 2: Alaska Population Growth



NOTES TO FIGURE II

SOURCES: (1880-1960) G. W. Rogers and R.A. Cooley, *Alaska's Population and Economy: Regional Growth, Development and Future Outlook*, (Vol. I, Analysis, Vol. II, Statistical Handbook), University of Alaska Econ. Series, College of Business, Economics and Government, 1963. 1970 data from preliminary Census releases. Estimates through 2,000 from George W. Rogers, *Alaska Regional Population and Employment*, Institute of Social, Economic and Government Research, University of Alaska, SEG Report No. 15, Dec. 1967, p. 87.

settlement until approximately 1900. The second, from 1900 until about 1940, is the gold rush and mineral exploitation period. Growth during the third period, the 1940's and 1950's, is clearly related to fluctuations in size of military establishments. By the late 1950's, the fourth period of population growth began. This period might be described as the era of emerging industry, and coincides with the period of Alaska statehood.

The official census in 1880 reported 33,426 Alaskans, of which all but 430 were Native people. Population doubled during the gold rush and then declined somewhat until the mid-1930's, when recognition was given to the need for more settlers, military security, and commercial development. The Matanuska Colony project was initiated in 1935, and World War II military buildup began in 1940. The post-war growth in population has occurred predominantly in the civilian sector.

Population growth during the 1960's was stimulated by development of the petroleum, forest products, fisheries, minerals, construction, and service and supply industries and nonmilitary government spending. The agricultural industry has not responded as might have been expected, as population growth has greatly exceeded agricultural development during the past decade.

> . . . when measured against the spectacular expansion of local Alaska markets for agricultural products as indicated by population growth, it is clear that this category of economic activity (commercial agriculture) has fallen far behind the general upward trend of the total economy and population of the State.[6]

[6] *Ibid.*, p. 162.

TABLE I.

Alaska's Population Growth by Regions, 1880-1970

Year	Total	Southeast	Southcentral	Southwest	Interior	Northwest
1880	33,426	7,748	4,352	13,914	2,568	4,844
1890	32,052	8,038	6,112	12,071	2,333	3,498
1900	63,592	14,350	10,000	13,000	5,600	20,642
1910	64,356	15,216	12,900	12,049	13,064	11,127
1920	55,036	17,402	11,173	11,541	7,964	6,956
1930	59,278	19,304	11,880	12,118	8,246	7,730
1940	72,524	25,241	14,881	12,846	10,345	9,211
1950	128,643	28,203	50,093	17,715	23,008	9,624
1960	226,167	35,403	108,851	21,001	49,128	11,784
1970	302,173	42,565	163,758	26,491	56,513	12,846

SOURCE: Figures for 1880 through 1960: Rogers, G.W. and R. Cooley, *Alaska's Population and Economy, Vol. II,* University of Alaska, College, Alaska, 1963. Table P-9. 1970 figures are based on the 1970 Census of Population.

Past Production of Agricultural Crops, Livestock, and Livestock Products

Alaska's history of commercial agricultural production is relatively short, and the time period of regularly collected statistical data regarding production of agricultural products is even shorter. Annual collection of statistical data regarding crop and livestock production and sales did not start until 1953. At that time, the Alaska Agricultural Experiment Station, cooperating with the territorial department of agriculture, initiated the regular collection of statistical data and began publishing a Farm Production Report series. It was not until 1960 that the U.S. Department of Agriculture, Statistical Reporting Service, extended its data collecting services to Alaska. The Alaska Cooperative Crop Reporting Service took over primary responsibility for agricultural data collection and publication in 1960.

A summary report on agricultural production and sales for the period 1953-65 was prepared for the Federal Field Committee's Agricultural Task Force by a subcommittee headed by the statistician-in-charge, Statistical Reporting Service, U.S. Department of Agriculture, Palmer. The following summarization has been abstracted from that report:

> The number of farms in Alaska according to the U.S. Census increased from 12 farms in 1900 to a peak of 623 in 1939 and has declined since then to an estimated 350 farms for 1965. Virtual elimination of commercial fur farming in Alaska since 1939 accounts for much of the decrease in number of farms. . . . Rapid growth of commercial farming occurred right after the close of World War II. The 1950 Census of Agriculture shows value of sales of livestock and livestock and poultry products in Alaska had nearly trebled since the 1940 census. . . . However, dollar-wise, even a greater leap upwards occurred between 1950 and 1960 when sales of all crops, livestock, and livestock and poultry products rose to $3,214,000 from a total of $1,572,000 in 1950. . . . Most of this increase from 1940 through 1960 resulted from a rapid acceleration in the sales of milk from $307,000 in 1940 to . . . $1,643,000 in 1960, according to the U.S. Census of Agriculture for Alaska . . . Accompanying the increase in value of milk production was the acceleration in production of hay and silage to feed the expanded milking herd . . . Production of potatoes also showed a substantial increase in this period. Further expansion in value of agricultural production continued through 1964 which was followed by a sizable decrease in 1965.[7]

Production data were selected from the Task Force report to show production trends (Table II), trends in value of production (Table III), and livestock inventories (Table IV) for the state. Data for 1966 through 1970 were added to the original statistical tables from the Alaska Crop and Livestock Service Annual Reports.

[7] Alaska's Agricultural Production, 1953-1965. (unpublished paper prepared for the Alaska Agricultural Task Force, Palmer, 1966).

TABLE II.

Total Quantity of Agricultural Commodities
Produced in Alaska, 1953-1970*

CROPS	Unit	1953	1954	1955	1956	1957	1958	1959	1960	1961
Oats for Grain	Cwt.	6,620	11,160	7,780	12,880	12,820	17,500	15,900	25,500	14,700
Barley for Grain	Cwt.	3,240	3,600	5,540	11,240	15,840	32,700	28,900	41,800	35,000
Grain Silage	Tons	8,200	8,300	11,300	16,000	18,400	17,300	20,200	18,000	19,000
Grass Silage	Tons	700	1,300	1,700	3,500	2,000	3,400	5,700	5,400	8,000
Grain Hay	Tons	2,400	2,400	2,400	2,700	2,900	1,600	2,300	1,400	1,600
Grass Hay	Tons	2,800	3,000	3,600	3,900	3,400	4,100	6,300	7,200	6,800
Potatoes[a]	Cwt.	147,200	127,600	114,100	173,400	148,300	178,100	107,900	131,400	146,300
Cabbage[a]	Cwt.	5,600	6,000	3,200	3,900	5,600	4,500	4,000	3,600	3,400
Carrots[a]	Cwt.	5,800	4,700	5,400	3,900	5,100	6,200	4,700	7,600	5,200
Head Lettuce[a]	Cwt.	4,500	4,600	5,300	5,800	6,800	4,900	5,300	6,200	6,800
Other Vegetables	Cwt.	na†	na	na	na	na	na	na	2,780	2,100
LIVESTOCK AND LIVESTOCK PRODUCTS										
Milk in Thou	Lbs.	10,200	11,800	12,600	14,800	15,500	16,100	16,900	20,000	23,000
Eggs	Doz.	298,000	346,000	343,000	364,000	402,000	444,000	553,000	529,800	541,700
Poultry Meat	Lbs.	113,000	105,000	126,000	65,000	55,000	100,000	67,800	55,000	61,000
Beef & Veal	Lbs.	225,000	207,000	314,000	294,000	372,000	320,000	359,000	357,000	321,000
Pork	Lbs.	88,000	111,000	112,000	94,000	142,000	180,000	225,000	151,000	175,000
Mutton & Lamb	Lbs.	8,000	6,000	11,000	11,000	23,000	18,000	20,000	12,000	18,000
Wool	Lbs.	75,000	72,000	89,000	92,000	98,000	88,000	113,000	125,000	128,000

TABLE II. (Continued)

CROPS	Unit	1962	1963	1964	1965	1966	1967	1968	1969	1970
Oats for Grain	Cwt.	21,500	14,400	11,500	9,800	10,200	14,800	15,000	3,840	7,200
Barley for Grain	Cwt.	42,200	31,700	28,400	21,100	34,600	36,300	27,400	16,128	26,784
Grain Silage	Tons	22,300	28,800	28,500	18,700	16,000	17,100	16,500	9,200	12,700
Grass Silage	Tons	9,000	7,600	6,100	4,600	4,000	5,600	6,400	5,100	7,000
Grain Hay	Tons	1,300	800	1,500	1,000	2,400	2,000	1,100	1,000	1,600
Grass Hay	Tons	7,700	6,900	7,300	5,900	9,200	12,000	9,600	6,600	8,900
Potatoes[a]	Cwt.	138,700	140,600	140,900	131,000	111,500	138,000	114,700	71,300	105,400
Cabbage[a]	Cwt.	3,600	6,300	2,700	3,000	2,800	2,200	3,800	2,200	4,500
Carrots[a]	Cwt.	5,400	5,800	4,000	2,400	3,900	5,200	5,400	1,500	1,800
Head Lettuce[a]	Cwt.	8,000	8,100	7,200	6,500	6,300	7,500	9,400	5,400	8,100
Other Vegetables	Cwt.	2,020	2,400	3,600	2,100	1,900	2,000	5,000	5,000	2,300
LIVESTOCK AND LIVESTOCK PRODUCTS										
Milk in Thou	Lbs.	23,000	23,000	22,700	20,700	19,000	18,200	17,700	17,800	18,600
Eggs	Doz.	508,300	475,000	416,700	766,700	862,500	750,000	608,000	442,000	417,000
Poultry Meat	Lbs.	47,000	56,000	48,000	89,000	73,000	116,000	86,000	59,000	73,000
Beef & Veal	Lbs.	626,000	623,000	769,000	798,000	1,000,000	893,000	832,000	764,000	837,000
Pork	Lbs.	130,000	70,000	136,000	205,000	152,000	130,000	203,000	155,000	135,000
Mutton & Lamb	Lbs.	20,000	18,000	30,000	28,000	45,000	38,000	30,000	28,000	28,000
Wool	Lbs.	146,000	167,000	184,000	209,000	215,000	246,000	264,000	269,000	239,000

*Alaska Farm Production Reports, A.A.E.S. and State Department of Agriculture through 1959, S.R.S. 1960 through 1970 adjusted.

†Not available.

[a]The data for 1953 through 1957 for Potatoes, Cabbage, Carrots, and Head Lettuce is only the quantity sold and does not include that used at home.

TABLE III.

Value of Agricultural Commodities Produced in Alaska, 1953-1970*

CROPS	1953	1954	1955	1956	1957	1958	1959	1960	1961
				(Thousands of Dollars)					
Oats for Grain	39.8	62.0	43.3	58.7	65.3	79.1	67.8	118.9	71.0
Barley for Grain	16.5	18.2	27.6	56.3	75.4	148.9	125.8	190.0	172.0
Grain Silage	177.2	167.9	234.0	320.2	366.6	355.6	420.1	368.0	399.0
Grass Silage	13.3	26.0	33.7	69.4	39.2	67.2	113.0	108.0	168.0
Grain Hay	131.5	125.9	118.9	135.6	173.6	100.7	149.0	96.0	91.0
Grass Hay	144.0	170.0	214.5	197.2	203.9	249.0	376.0	536.0	463.0
Potatoes	835.8	635.1	520.4	957.8	841.7	694.6	589.0	723.0	783.0
Cabbage	44.5	41.0	22.6	33.5	44.4	34.9	46.1	31.0	29.0
Carrots	53.2	35.0	43.3	34.3	45.6	76.6	55.2	49.0	57.0
Head Lettuce	73.2	60.2	53.8	81.5	81.6	76.1	76.4	78.0	86.0
Other Vegetables	64.0	70.0	52.0	60.0	77.0	60.3	68.6	39.9	29.0
Value of All Crops	1,593.0	1,411.3	1,364.1	2,004.5	2,014.3	1,943.0	2,087.0	2,337.8	2,348.0
LIVESTOCK AND POULTRY PRODUCTS									
Milk	1,086.6	1,286.8	1,374.0	1,583.7	1,687.8	1,694.8	1,877.8	2,162.0	2,392.0
Eggs	300.8	336.3	322.9	347.3	366.0	395.5	469.2	464.0	422.0
Poultry Meat	72.8	66.0	66.8	32.6	23.5	52.4	33.0	26.0	29.0
Beef and Veal	92.8	84.9	127.2	110.7	131.4	126.4	145.0	144.0	148.0
Pork	36.6	37.1	41.8	39.1	60.2	71.4	92.9	62.0	71.0
Mutton & Lamb	4.9	3.2	5.4	5.2	6.2	9.1	10.0	6.2	10.0
Wool	38.5	30.4	43.8	45.9	58.6	48.4	62.1	50.0	51.0
Reindeer Meat	na	na	na	na	na	185.9	175.8	180.0	181.0
Value of Livestock Products	1,633.0	1,844.7	1,981.9	2,164.5	2,333.7	2,583.9	2,865.8	3,094.2	3,304.0
Value of all Commodities Produced	3,226.0	3,256.0	3,346.0	4,169.0	4,348.0	4,526.9	4,952.8	5,432.0	5,652.0

TABLE III. (Continued)

CROPS	1962	1963	1964	1965	1966	1967	1968	1969	1970
					(Thousands of Dollars)				
Oats for Grain	97.0	65.0	50.0	41.0	42.0	62.0	68.0	14.0	29.0
Barley for Grain	185.0	135.0	115.0	86.0	140.0	144.0	117.0	59.0	106.0
Grain Silage	424.0	533.0	527.0	357.0	288.0	274.0	248.0	166.0	229.0
Grass Silage	171.0	140.0	113.0	86.0	72.0	89.0	96.0	91.0	126.0
Grain Hay	69.0	39.0	78.0	54.0	115.0	100.0	54.0	67.0	120.0
Grass Hay	493.0	408.0	432.0	360.0	553.0	670.0	534.0	465.0	668.0
Potatoes	666.0	612.0	1,043.0	799.0	619.0	607.0	654.0	471.0	643.0
Cabbage	33.0	50.0	25.0	37.0	31.0	21.0	41.0	21.0	45.0
Carrots	60.0	52.0	42.0	33.0	51.0	60.0	61.0	20.0	23.0
Head Lettuce	113.0	73.0	97.0	98.0	96.0	103.0	118.0	65.0	104.0
Other Vegetables	31.0	26.0	45.0	29.0	30.0	30.0	63.0	58.0	29.0
Value of All Crops	2,347.0	2,133.0	2,567.0	1,980.0	2,037.0	2,160.0	2,054.0	1,497.0	2,122.0
LIVESTOCK AND POULTRY PRODUCTS									
Milk	2,380.0	2,309.0	2,181.0	2,053.0	1,953.0	1,951.0	1,882.0	1,949.0	2,083.0
Eggs	412.0	383.0	335.0	590.0	667.0	599.0	490.0	341.0	351.0
Poultry Meat	22.0	21.0	16.0	22.0	18.0	28.0	21.0	15.0	19.0
Beef and Veal	293.0	265.0	302.0	294.0	417.0	373.0	351.0	383.0	439.0
Pork	55.0	26.0	54.0	94.0	81.0	68.0	88.0	70.0	82.0
Mutton & Lamb	14.0	10.0	15.0	12.0	19.0	16.0	17.0	14.0	14.0
Wool	72.0	97.0	112.0	111.0	123.0	98.0	92.0	94.0	72.0
Reindeer Meat	182.0	171.0	254.0	230.0	238.0	257.0	324.0	269.9	294.7
Value of Livestock Products	3,430.0	3,282.0	3,269.0	3,406.0	3,516.0	3,370.0	3,265.0	3,135.9	3,354.7
Value of all Commodities Produced	5,777.0	5,415.0	5,836.0	5,386.0	5,553.0	5,530.0	5,319.0	4,635.9	5,476.7

*Alaska Farm Production Reports, A.A.E.S. and State Division of Agriculture through 1959, S.R.S., 1960 through 1970 adjusted.

TABLE IV.

Livestock on Alaskan Farms and Ranches
on January 1, 1954-1971*

	1954[a]	1955	1956	1957	1958	1959	1960	1961	1962
Milk Cows 2-years-old or over	1,400	1,600	1,800	2,100	2,100	2,100	2,200	2,800	3,200
Dairy Heifers 1- to 2-years-old	500	500	600	600	600	700	600	600	600
Dairy Heifers under 1-year-old	500	400	500	500	600	600	700	600	600
Beef Cows 2-years-old or over	500	700	1,100	1,100	1,000	1,100	1,400	1,400	1,400
Beef Heifers 1- to 2-years-old	200	200	500	500	300	300	400	400	500
Other Calves[b] under 1-year-old	100	200	400	300	500	700	700	700	700
Steers 1-year-old or over	100	300	300	400	300	300	400	600	700
Bulls 1-year-old or over	100	100	100	100	100	100	200	200	200
All Cattle	3,400	4,000	5,300	5,600	5,500	5,900	6,600	7,300	7,900
All Hogs	600	1,100	800	1,000	800	900	1,300	1,000	1,000
All Sheep and Lambs	9,200	9,100	9,900	12,400	13,600	10,800	13,600	15,000	15,000
Hens and Pullets	31,000	40,000	33,000	29,000	32,000	34,000	47,000	41,000	34,000

	1963	1964	1965	1966	1967	1968	1969	1970	1971
Milk Cows 2-years-old or over	2,900	2,800	2,600	2,400	2,100	2,000	1,900	1,700	1,700
Dairy Heifers 1- to 2-years-old	600	600	700	500	400	400	400	600	600
Dairy Heifers under 1-year-old	600	700	500	400	400	400	500	600	†
Beef Cows 2-years-old or over	1,600	1,700	1,800	2,000	2,300	2,400	2,500	2,400	2,500
Beef Heifers 1- to 2-years-old	400	600	500	600	600	700	700	700	600
Other Calves[b] under 1-year-old	1,000	1,000	1,000	1,200	1,500	1,600	1,400	1,500	2,100
Steers 1-year-old or over	700	700	700	900	700	700	800	1,000	1,000
Bulls 1-year-old or over	200	200	200	200	300	300	400	500	500
All Cattle	8,000	8,300	8,000	8,200	8,300	8,500	8,600	9,000	9,000
All Hogs	1,000	900	1,400	1,400	1,200	1,200	1,100	1,100	1,100
All Sheep and Lambs	16,000	18,000	20,000	23,000	24,000	27,000	27,000	27,000	27,000
Hens and Pullets	36,000	33,000	38,000	46,000	50,000	36,000	29,000	28,000	23,000

*Alaska Farm Production Reports, A.A.E.S. and State Department of Agriculture through 1959; S.R.S., 1960 through 1971, adjusted.
†Included in Other Calves under 1-year-old.

[a]Not complete for some species and classes.

[b]Includes dairy bull calves as well as all beef-type calves.

The Demand for Agricultural Products That Can Be Grown in Alaska

To establish the first parameter for evaluating Alaska's agricultural industry, demand estimates for agricultural products that can be grown in Alaska were calculated from per capita consumption data (estimated by Alaska Agricultural Experiment Station and the Economic Research Service, U.S. Department of Agriculture personnel) and population data for 1965. Crop production data from the Alaska Crop and Livestock Reporting Service were then compared with demand estimates in order to estimate production deficits at the present time. Data on land availability, from the Alaska Soil Conservation Service, U.S. Department of Agriculture, were used to estimate present potential for additional production. Comparisons were then made, using available data, between estimates of demand, present production, and potential production.

Per capita consumption estimates of selected food products that could be produced in Alaska were made by the Alaska Experiment Station and Economic Research Service economists during the summer of 1967, using Alaska consumption studies, national per capita average consumption data, estimates by commercial food distributors, and the best judgments of other persons (Table V).

State consumption estimates for 1965 were calculated using per capita consumption data and population estimates for Alaska for that year (Table VI). Total consumption estimates were converted to farm level equivalent quantities for comparisons with Alaska production data (Table VII).

Production deficits for those products that could be produced in Alaska were calculated using total consumption estimates and Alaska production data. No attempt was made to determine what portion of the production deficit Alaska producers should supply, but only to determine what additional acreages would be needed at 1965 yields if total deficits were produced in Alaska. Estimated acreage deficits for potatoes and vegetables

TABLE V.

Estimated Per Capita Consumption of Selected Food Products in Alaska By Crop Reporting District, 1967

Item	Unit	Tanana Valley		Matanuska Valley		Kenai Peninsula		Southeast		Southwest	
Milk	lb	260.0		300.0		275.0		300.0		100.0	
Potatoes											
Fresh	lb	150.0		140.0		140.0		115.0		75.0	
Frozen	lb	20.0		20.0		20.0		15.0		10.0	
Chips and shoestrings	lb	12.0		12.0		12.0		12.0		10.0	
Eggs	no	400.0		400.0		400.0		400.0		200.0	
Carrots[a]	lb	7.0	(0.3)	7.0	(0.3)	7.0	(0.3)	7.0	(0.3)	4.0	(0.1)
Cabbage	lb	8.0		8.0		7.0		7.0		4.0	
Cauliflower[a]	lb	1.5	(0.1)	1.5	(0.1)	1.5	(0.1)	1.0	(0.1)	0.5	
Lettuce	lb	15.0		15.0		15.0		10.0		5.0	
Brussel sprouts[a]	lb	0.2	(0.1)	0.2	(0.1)	0.2	(0.1)	0.3	(0.1)	0.1	
Peas[a]	lb	0.3	(1.5)	0.3	(1.5)	0.3	(1.5)	0.2	(1.5)	0.1	
Beets	lb	0.6		0.6		0.6		0.6		0.3	
Celery	lb	3.0		3.0		3.0		4.0		2.0	
Green onions	lb	1.0		1.0		1.0		1.0		1.0	
Rhubarb[a]	lb	0.5	(.03)	0.5	(.03)	0.5	(.03)	0.5	(.03)	0.2	
Broccoli[a]	lb	0.5	(0.5)	0.5	(0.5)	0.5	(0.5)	0.5	(0.5)	0.2	
Cucumbers	lb	1.0		1.0		1.0		1.0		0.5	
Tomatoes	lb	6.0		6.0		6.0		6.0		3.0	
Zucchini	lb	0.1		0.1		0.1		0.1		0.1	
Rutabagas and turnips	lb	0.2		0.2		0.2		0.2		0.1	
Radishes and parsnips	lb	0.2		0.2		0.2		0.2		0.1	
Beef	lb	85.0		85.0		85.0		90.0		50.0	
Pork	lb	35.0		35.0		35.0		45.0		25.0	
Lamb and mutton	lb	0.2		0.2		0.2		0.5		0.5	
Reindeer	lb	0.2		0.2		0.2		0.2		10.0	
Other meats	lb	5.0		5.0		5.0		5.0		25.0	
Wild game	lb	40.0		35.0		35.0		20.0		35.0	

[a]Figures in parentheses are frozen consumption.

SOURCE: Alaska Agricultural Experiment Station, Unpublished report.

TABLE VI.

Estimated Consumption of Selected Products in Alaska By Crop Reporting District, 1965

Item	Unit	Tanana Valley District 1		Matanuska Valley District 2		Kenai Peninsula District 3		Southeast Alaska District 4		Southwest Alaska District 5		Total of all Regions	
Milk	mil lbs	13.94		33.45		3.05		12.63		4.49		67.56	
Potatoes													
Fresh	tons	4,020.0		7,805.0		777.0		2,420.8		1,683.8		16,706.6	
Frozen	tons	536.0		1,115.0		111.0		315.8		224.5		2,302.2	
Chips and shoestrings	tons	321.6		669.0		66.6		252.2		224.5		1,534.3	
Eggs	mil doz	21.44		44.60		4.44		16.84		8.98		96.30	
Carrots[a]	tons	187.6	(8.0)	390.3	(16.7)	38.9	(1.7)	147.4	(6.3)	89.9	(2.2)	854.0	(34.9)
Cabbage	tons	214.4		446.0		38.9		147.4		89.8		936.5	
Cauliflower[a]	tons	40.2	(2.7)	83.6	(5.6)	8.3	(0.6)	21.0	(2.1)	11.2		164.3	(11.0)
Lettuce	tons	402.0		836.3		83.2		210.5		112.3		1,644.3	
Brussel sprouts[a]	tons	5.4	(2.7)	11.2	(5.6)	1.1	(0.6)	6.3	(2.1)	2.2		26.2	(11.0)
Peas[a]	tons	8.0	(40.2)	16.7	(83.6)	1.7	(8.3)	4.2	(31.6)	2.2		32.8	(163.7)
Beets	tons	16.1		33.5		3.3		12.6		6.7		72.2	
Celery	tons	80.4		167.3		16.7		84.2		44.9		393.5	
Green onions	tons	26.8		55.8		5.6		21.1		22.5		131.8	
Rhubarb[a]	tons	13.4	(0.8)	27.9	(1.7)	2.8	(0.2)	10.5	(0.6)	4.5		59.1	(3.3)
Broccoli[a]	tons	13.4	(13.4)	27.9	(27.9)	2.8	(2.8)	10.5	(10.5)	4.5		59.1	(54.6)
Cucumbers	tons	26.8		55.8		5.6		21.1		11.2		120.5	
Tomatoes	tons	160.8		334.5		33.3		12.6		67.4		608.6	
Zucchini	tons	2.7		5.6		0.6		2.1		2.3		13.3	
Rutabagas and turnips	tons	5.4		11.2		1.1		4.2		2.3		24.2	
Beef	mil lbs	4.56		9.48		0.94		3.79		2.25		21.02	
Pork	mil lbs	1.88		3.90		0.39		1.89		1.12		9.18	
Lamb and mutton	mil lbs	0.01		0.02		0.002		0.02		0.20		0.072	
Other meat	mil lbs	0.27		0.56		0.06		0.21		1.12		2.220	
Reindeer	mil lbs	0.01		0.02		0.002		0.008		0.45		0.490	

[a]Figures in parentheses are frozen consumption.

TABLE VII.

Deficit of Alaska Crop Production to Supply Intrastate Demand, 1965

Item	Unit	Demand[a]		Production[b]	Deficit	
Milk	mil lb	72.34[c]		20.70	51.64	
Potatoes						
Fresh	tons	17,488.3[c]		6,550.	10,938.3	
Frozen	tons	5,640.4[c]		None	5,640.4	
Chips and shoestrings	tons	3,759.0[c]		None	3,759.0	
Eggs	mil doz	99.19[c]		0.767	98.423	
Carrots	tons	879.6[c]	(35.9)	120.	759.6	(35.9)
Cabbage	tons	1,011.4[c]		150.	861.4	
Cauliflower	tons	164.3[c]	(11.0)		164.3	(11.0)
Lettuce	tons	3,191.3[c]		325.	2,966.3	
Brussel sprouts	tons	26.2[d]	(11.0)		26.2	(11.0)
Peas	tons	36.7	(183.3)[c]	All	36.7	(183.3)
Beets	tons	72.2[d]		vegetable	72.2	
Celery	tons	425.0[c]		crops not	425.0	
Green onions	tons	131.8[d]		individually	131.8	
Rhubarb	tons	59.1[d]	(3.3)	reported are	59.1	(3.3)
Broccoli	tons	59.1[d]	(54.6)	reported at	59.1	(54.6)
Cucumbers	tons	131.3		105 tons	131.3	
Tomatoes	tons	608.6[d]			608.6	
Zucchini	tons	14.5			14.5	
Rutabagas and turnips	tons	21.7[d]			21.7	
Radishes and parsnips	tons	21.7[d]			21.7	
Beef	mil lbs	28.38[e]		0.798	27.58	
Pork	mil lbs	13.77[e]		0.205	13.565	
Lamb and mutton	mil lbs	0.936[e]		0.028	0.0656	
Other meat	mil lbs	2.22[d]				
Reindeer	mil lbs	0.490[d]		0.563	0.173	

[a]Demand estimates converted to farm level equivalents.

[b]Alaska Crop and Livestock Reporting Service, SRS, U.S.D.A., 1966.

[c]Conversion factor from *Marketing and Transportation Situation*, ERS, U.S.D.A. MTS-164, February 1967. (Table 16, p. 39).

[d]Not converted to farm equivalents.

[e]Dressed weight (carcass).

were: approximately 2,200 acres potatoes, 113 acres carrots, 127 acres cabbage, 420 acres lettuce, and 640 acres other vegetables. Feed acreage deficits for an additional 5,650 dairy cows were 6,400 acres barley, 3,000 acres of oats, and some 11,000 acres of hay and silage. Deficits in hog production would add another 28,000 acres of barley production. Beef deficits would add another 16,000 acres of barley and some 17,000 to 18,000 acres or more of harvested forage for the beef-finishing operations. Neither dairy nor beef estimates include needed feeds for breeding herds. Indicated total acres needed to offset 1965 deficits were some 3,500 acres for vegetables, more than 50,000 acres of barley, 3,000 acres of oats and more than 28,000 acres of harvested forage. Idle land available for immediate cultivation was only 19,000 acres (Table VIII).

Production Status of Present Farming Areas

The area commonly known as the *Matanuska Valley*, in Crop Reporting District No. 2, is currently the major farming area of the state (Figure 3). It is characterized by a predominance of commercial farming operations. All but one of the commercial Grade A dairy farms in the state are located in this area, as are both of the large commercial egg producers. During the 1970 cropping year, 10,518 acres, or 60.3 per cent of the total land cropped within the state, were used for crops in the valley (Table IX). Historically, since the regular collection of statistical data, the valley has, on the average, produced more than 70 per cent of the value of Alaska's agricultural production.

The *Tanana Valley*, in Crop Reporting District No. 1, is the second largest farming area in terms of farm products raised and sold, containing, during 1970, 22.6 per cent (3,940 acres) of the total land cropped within the state. The area is characterized by a mixture of commercial and part-time farmers with potatoes, vegetables, forage, and grain crops predominant. Diary farming has declined until only one commercial Grade A dairy farm remains in the area.

On the *Kenai Peninsula* in Crop Reporting District No. 3, most farms are small and in the beginning stages of development. Much of the food produced is locally consumed. There are diary, beef, swine, and poultry, as well as small crop farms. Most farms are part-time operations. There are no commercial dairy farms. The number of beef ranches has declined, but cattle numbers have remained about the same. A few part-time vegetable-potato farms continue in operation.

TABLE VIII.

Land Availability as Reported by Soil Conservation Subdistrict, 1967 (Major Farming Areas)*

Crop Reporting District	Cropland			Forest Land		
	Tilled Acres	Idle Acres	Total Acres	Commercial Acres	Non-Comm. Acres	Total Acres
District No. 1						
Fairbanks	5,523	2,877	8,400	162,692	76,560	239,252
Salcha-Big D	2,846	1,605	4,451	87,915	213,941	301,856
District No. 2						
Anchorage	100	-----	100	19,960	7,164	27,124
Chugiak	200	-----	200	11,536	8,103	19,639
Kenny Lake	300	200	500	14,585	33,680	48,265
Montana	572	3,071	3,643	172,805	8,976	181,781
Palmer	12,260	228	12,488	66,451	27,072	93,523
Wasilla	2,050	6,463	8,513	277,073	76,747	353,820
District No. 3						
Homer	1,615	292	1,907	52,767	22,295	75,062
Kenai-Kasilof	1,123	2,000	3,123	113,695	31,370	145,065
Ninilchik	277	2,000	2,277	73,963	21,833	95,796
District No. 4 (No Subdistrict Reported)						
District No. 5						
Kodiak	400	-----	400	25,299	-----	25,299
TOTAL	27,266	18,736	46,002	1,078,741	527,741	1,606,482

TABLE VIII. (Continued)

Land Availability as Reported by
Soil Conservation Subdistrict, 1967
(Major Farming Areas)*

Crop Reporting District	Pasture and Range	Other	Inventory Total	Urban
District No. 1				
Fairbanks	250	6,669	254,571	965
Salcha-Big D	250	1,103	307,660	300
District No. 2				
Anchorage	-----	8,776	36,000	15,100
Chugiak	-----	4,561	24,400	4,000
Kenny Lake	-----	4,973	53,738	50
Montana	-----	58,816	244,240	100
Palmer	-----	22,155	128,166	1,300
Wasilla	-----	198,735	561,068	800
District No. 3				
Homer	65,037	39,374	181,380	360
Kenai-Kasilof	691	41,508	190,387	1,250
Ninilchik	1,852	36,566	136,491	40
District No. 4 (No Subdistrict Reported)				
District No. 5				
Kodiak	141,098	139,850	306,647	560
TOTAL	209,178	563,086	2,424,748	24,825

*_Alaska Conservation Needs Inventory_. Soil Conservation Subdistricts, SCS, USDA, Palmer, 1968.

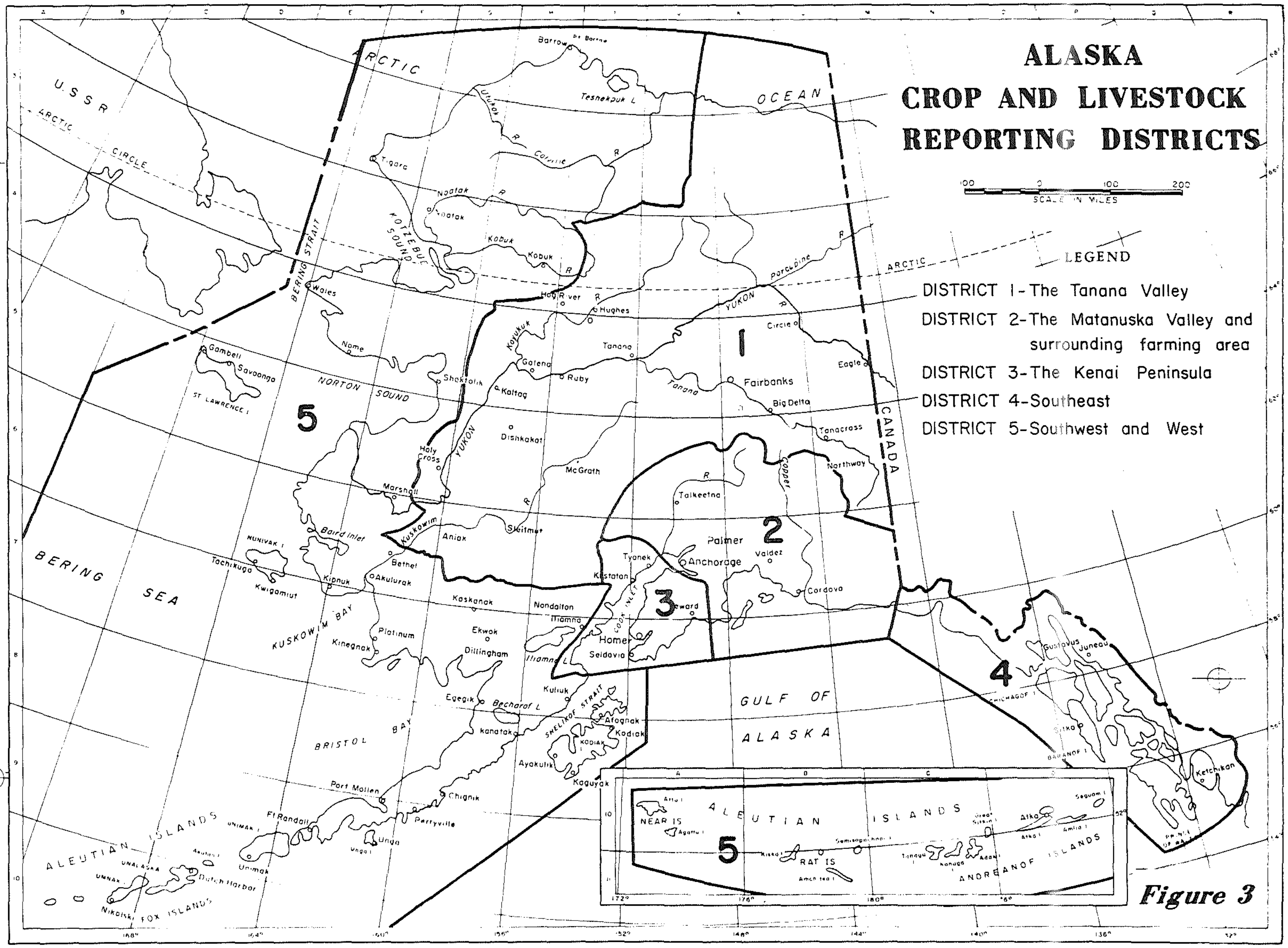

ALASKA
CROP AND LIVESTOCK
REPORTING DISTRICTS
SCALE IN MILES
LEGEND
DISTRICT 1 - The Tanana Valley
DISTRICT 2 - The Matanuska Valley and surrounding farming area
DISTRICT 3 - The Kenai Peninsula
DISTRICT 4 - Southeast
DISTRICT 5 - Southwest and West
ARCTIC OCEAN
BERING SEA
GULF OF ALASKA
NORTON SOUND
BRISTOL BAY
CANADA
U.S.S.R.
BERING STRAIT
ALEUTIAN ISLANDS
Barrow
Fairbanks
Anchorage
Palmer
Valdez
Cordova
Homer
Juneau
Ketchikan
Sitka
Nome
Bethel
Kodiak
Dillingham
McGrath
Talkeetna
Big Delta
Tanacross
Northway
Eagle
Circle
Tanana
Ruby
Hughes
Kaltag
Marshall
Aniak
Seldovia
Gustavus
1
2
3
4
5
Figure 3

TABLE IX.

Cropland Utilization, Tanana Valley*

Crops Planted	1960	1962	1964	1966	1968	1970
			(Acres)			
Commercial Vegetables						
Potatoes	300	310	315	285	226	215
Cabbage	16	12	10	13	7	10
Carrots	5	18	8	9	7	6
Lettuce	4	9	10	9	10	9
Other Vegetables[b]	9	7	9	16	16	20
Feed Crops						
Oats	620	600	430	430	360	380
Barley	780	1,080	920	500	670	1,500
Other Grain	40	10	30	20	a	-----
Grain Mixtures	640	740	1,010	450	260	250
Total Acres Planted	2,414	2,786	2,742	1,732	1,556	2,390
Grasslands Harvested						
Seeded Grass	380	1,370	1,430	1,270	1,100	1,180
Native Grass	130	100	60	210	400	370
Total in Crops	2,924	4,256	4,232	3,212	3,056	3,940
Per cent of State Total	18.8	21.8	23.2	20.2	18.6	22.6

TABLE IX. (Continued)

Cropland Utilization, Matanuska Valley*

Crops Planted	1960	1962	1964	1966	1968	1970
			(Acres)			
Commercial Vegetables						
Potatoes	384	355	406	410	370	450
Cabbage	30	27	22	20	16	25
Carrots	45	30	21	24	36	14
Lettuce	61	55	49	55	69	74
Other Vegetables[b]	45	24	37	21	110	75
Field Crops						
Oats	2,020	1,850	1,100	900	920	940
Barley	1,760	1,360	1,210	1,130	1,350	1,240
Other Grains	20	40	45	30	a	-----
Grain Mixtures	2,480	3,180	3,900	2,750	2,290	2,600
Total Acres Planted	6,845	6,921	6,790	5,340	5,161	5,418
Grasslands Harvested						
Seeded Grass	4,040	5,680	4,980	5,000	4,870	4,750
Native Grass	110	100	60	150	630	350
Total in Crops	10,995	12,701	11,830	10,490	10,661	10,518
Per cent of State Total	70.8	65.2	65.0	66.2	62.6	60.3

TABLE IX. (Continued)

Cropland Utilization, Kenai Peninsula*

Crops Planted	1960	1962	1964	1966	1968	1970
			(Acres)			
Commercial Vegetables						
Potatoes	50	85	27	28	40	20
Cabbage	1	1	2	1	2	a
Carrots	a	2	1	1	2	a
Lettuce	1	1	1	1	1	2
Other Vegetables[b]	3	2	3	2	3	5
Field Crops						
Oats	200	380	440	130	520	330
Barley	60	60	70	70	80	60
Other Grains	-----	-----	-----	-----	-----	-----
Grain Mixtures	100	120	-----	250	350	150
Total Acres Planted	415	651	544	483	998	567
Grassland Harvested						
Seeded Grass	170	350	590	700	880	820
Native Grass	280	700	460	580	1,140	1,260
Total in Crops	865	1,701	1,594	1,763	3,018	2,647
Per cent in State Total	5.57	8.7	8.7	11.1	17.7	15.2

TABLE IX. (Continued)

Cropland Utilization, Southeast*

Crops Planted	1960	1962	1964	1966	1968	1970
			(Acres)			
Commercial Vegetables						
Potatoes	3	4	4	2	2	5
Cabbage	---	a	---	a	a	a
Carrots	---	a	---	1	a	a
Lettuce	a	a	---	a	a	a
Other Vegetables[b]	a	1	---	a	a	a
Field Crops						
Oats	30	50	---	---	---	a
Barley	---	---	---	---	---	---
Other Grains	---	---	---	---	a	---
Grain Mixtures	60	40	90	50	---	---
Total Acres Planted	93	95	94	53	2	5
Grasslands Harvested						
Seeded Grass	110	80	80	90	---	---
Native Grass	330	310	20	90	120	100
Total in Crops	533	485	194	233	122	105
Per cent of State Total	3.43	2.5	1.1	1.5	0.7	0.6

TABLE IX. (Continued)

Cropland Utilization, Southwest*

Crops Planted	1960	1962	1964	1966	1968	1970
			(Acres)			
Commercial Vegetables						
Potatoes	3	6	8	5	2	a
Cabbage	a	a	1	1	a	a
Carrots	---	a	a	a	a	a
Lettuce	a	a	---	a	a	a
Other Vegetables[b]	a	1	1	1	1	a
Field Crops						
Oats	130	120	130	40	a	50
Barley	---	---	---	---	---	---
Other Grains	---	---	---	---	---	---
Grain Mixtures	20	20	---	---	---	---
Total Acres Planted	153	147	140	47	3	50
Grasslands Harvested						
Seeded Grass	---	20	20	40	50	50
Native Grass	50	190	200	70	110	120
Total in Crops	203	357	360	157	163	220
Per cent of State Total	1.31	1.8	2.0	1.0	1.0	1.3

*_Alaska Agricultural Statistics, 1960-1970_, Alaska Crop and Livestock Reporting Service, SRS, Palmer.

[a]Small amount, combined to avoid disclosures of individual operations.

[b]Includes radishes and celery.

In *Southeastern Alaska*, Crop Reporting District No. 4, chief products are fish and timber. Farming would generally be classed as part-time and subsistence agriculture. The greatest shifts in the state's agricultural output between 1953 and 1970 occurred in Southeastern Alaska, where it declined steadily from 10 per cent in 1953 to only 0.6 per cent in 1970. Nearly all commercial egg production in the area came to a close during 1966, as well as all commercial milking herds, causing a sharp reduction in the area's share of farm production.

On *Kodiak and Aleutian Islands*, Crop Reporting District No. 5, stock raising (sheep and cattle) is the leading agricultural enterprise. Natural vegetation and grasses provide seasonal and even year-long grazing, although supplemental feeding is recommended. Wool is shipped and sold "stateside." Some beef is shipped to Anchorage, in addition to that sold for local consumption. Although it has a relatively small portion, Kodiak and other islands of Southwest Alaska have maintained the steadiest level of any one area's share of Alaska's farm production.

General Problems Faced By Agricultural Producers

Alaska farmers and potential farmers are faced by a harsh climate that limits what crops can be grown. Little progress has been made to date in developing products and production methods particularly suited to the Alaskan environment. Farms are found in widely separated geographic locations that have differing production possibilities. Producers located near growing population centers find it difficult to exploit expanding markets because of small volumes of production and inadequate development of some elements of the intermediate marketing structure in Alaska. Producers in more "remote" locations find their problems infinitely more complex. Absence of public facilities such as roads, schools, churches, and hospitals discourages settlement by able, experienced farmers. Lack of access to remote areas provides both economic and psychological barriers. The 160-acre limitation of federal land settlement laws, high costs of purchasing privately owned or state lands, high clearing and development costs, the long waiting period after clearing due to slow drying of the soil and slow bacterial action, and the short and cool growing season, all tend to discourage both current and prospective farmers.

Scattered locations of many small production units and lack of appropriate marketing organizations make it necessary for many producers,

generally untrained in marketing, to sell their own produce, oftentimes in distant markets. Similarly, general absence of cooperatives forces producers to purchase agricultural supplies and equipment in small quantities without the discounts that accompany large-volume buying. The marketing problem is accentuated by extreme seasonality of production of many commodities and the difficulty of breaking into established markets for only a short period each year.

Many of Alaska's operators are part-time farmers, dependent on off-farm incomes to continue their agricultural efforts. The absence of specialization in farm production, marketing, and service operations often results in placing undue managerial burdens on small farm operators. High development, production, processing, and marketing costs require large financial investments to develop operations large enough to be economically feasible. Unavailability of such capital to most existing farmers and ranchers has resulted in a high proportion of small, uneconomic units. Agencies concerned with Alaska agriculture have been unable to furnish much of the needed technical assistance.

Finally, transportation costs involved in delivering Alaska products to "outside" markets, in conjunction with generally high production costs, limit the range of products that can currently compete for outside markets. Also, transportation costs involved in delivering Alaska products to the few major Alaska markets limit the opportunities to successfully compete in the in-state markets, and the shortage of processing facilities limits the markets for Alaska produce even more.

Source of Farmers and Entry into Farming

Problems of entry into farming are numerous and complex. The question often raised, "Where are your replacement farmers coming from?" is not unique to Alaska, but it does focus on two complex and interrelated problems. The first problem is the lack of replacement farmers and the second is the difficulties of entry into the farm production sector of the agricultural industry in Alaska. Surveys have shown practically no second generation Alaskan farmers.

Experienced, mature farmers with investment capital, who come from "outside," are not attracted to farming opportunities in Alaska due to the aforementioned complex problems of production, undeveloped marketing structure, limited loan capital, limited sources of technical information, the limited service and supply industry, and often remote locations of farming

and ranching areas. Inexperienced, potential farmers without investment capital find problems of entry insurmountable and are quickly discouraged. Financial agencies are reluctant to encourage the development of additional or new enterprises. Statutory limitations on agricultural loans limit opportunity to develop large commercial, or even economic-sized farm units in many instances.

It is extremely difficult for interested individuals to "find" farms for sale due to the lack of real estate institutions oriented to farm or farmland sales. This situation is further complicated by the historical pattern of small land holdings. Very limited information regarding possible farm availability, either through purchase or rental, may be found from agency or commercial sources.

Technical production and farm practices information, in suitable package form, is unavailable to prospective farmers, and the time and cost of researching such information by the individual is excessive. In addition, the very limited market organization and market information place heavy burdens on prospective farmers who are attempting to budget probable costs and returns on enterprises they are interested in.

The absence of processing facilities for most agricultural products, and the absence of an intermediate marketing structure necesssitates an integrated firm structure that includes production, processing, and distribution. Such a firm structure is not compatible with the small family farm philosophy generally held by agricultural agencies in the state.

Credit and Loan Capital

The limited availability of credit and investment capital is one of the more serious problems of existing farm operators, and one of the critical deterrents to new entry into farming. Due to this limited availability of agricultural credit and statutory limitations on individual loans, farm operators are forced into complex credit arrangements with a number of credit sources. A unique problem rising out of loan limitations is the tacit approval given to financing through "forgiven delinquencies" that evade the statutory authorizations. This eventually labels the borrower a questionable loan risk and often results in a negotiated foreclosure.

Unlike other areas of the U.S., private capital is available only in small quantities and only for short-term use. Only one commercial bank makes

agricultural loans with any degree of frequency. Agency credit is often loaned for shorter periods than in other states. Federal land bank credit is available to Alaska borrowers on a 20-year basis, but on a 33-year basis in most other states. Overall agency appraisals, other than federal land bank appraisals, have been exceedingly liberal on capital assets, until quite recently, causing overconfidence among borrowers.

A final limiting factor is evident when management control is relinquished to credit agency loan supervisors who do not accept the responsibility to use that control in planning, evaluating, and making the decisions that go with such managerial control. The arrangement is comparable to joint ownership, with one of the owners jealously guarding his "rights" of management, but not willing to assume the managerial responsibility of decision making.

Management and Consultant Services

Farm record and accounting services provided by Cooperative Extension Service, Farm Bureau, commercial banks, and other institutions in many states do not exist in Alaska. Farm management specialists and consultants, and association field men are not available. Fertilizer, feed, and agricultural engineering consultants, elsewhere supplied by commercial companies and processors, are not available. Farm publications, both commercial and institutional, are very limited and do not adequately cover information needs of Alaska farmers. The burden of supplying such information falls on the Cooperative Extension Service, the Agriculture Experiment Station, and the Division of Agriculture, which have limited available information and specialized staff, and are not equipped to meet the range of informational needs.

Ranch Problems

Since most ranchers operate on leased government land, with consequent uncertainty of tenure, they are reluctant to make desirable improvements. Furthermore, state agricultural land disposal prices, when combined with costs of surveying, access roads, and transportation to and from market and service centers, discourage ranch development. Access is a critical problem in most ranching and farming areas not served by commercial carriers. Many agricultural areas that have road access do not have adequate commercial transport service or are faced with high intrastate freight rates. Nearly all farm supplies must come from "outside;" consequently time in transit can further complicate the situation.

Other Problems

Vagaries of military procurement of agricultural produce in Alaska provide a critical element of uncertainty, particularly because military markets, in the absence of other marketing structures, have been the focus for Alaska producers.

CHAPTER IV.

A PROFILE OF SELECTED FARM PRODUCTION ENTERPRISES IN ALASKA†

An unmet need for additional information on Alaska agriculture was recognized when Congress passed the fiscal 1947 Department of Agriculture Appropriations Act, which provided for an investigation by the Agricultural Research Administration, U.S. Department of Agriculture, of basic problems underlying potential agricultural development in appropriate areas of Alaska. The initial exploratory investigation was carried out by a task group of eight technical employees of the department during the summer of 1946.[1] A study of farming activities in the Matanuska Valley and other farming areas in the state was conducted in 1948 by the Bureau of Agricultural Economics, U.S. Department of Agriculture, cooperating with the Alaska Agricultural Experiment Station.[2] Since then, there have been numerous studies and reports dealing with selected aspects of the production sector of the industry. Rapid change and adjustment in the nation's agricultural industry and rapidly changing conditions in Alaska have led to renewed interest in the economic aspects of farm production.

Production costs for agricultural products have been subject to more question and controversy than have any other data used to analyze current situations or to project future potentials. Little consensus can be arrived at regarding suitable cost data. The situation is further complicated by the very small number of farms of any given type or specialization. Representative cost data are not available for some enterprises even in the more populated

†Mid-1960's data has been used due to the unavailability of 1969 Census of Agriculture data at time of printing.

[1]Agricultural Research Administration, *Report on Exploratory Investigations of Agricultural Problems of Alaska,* U.S. Department of Agriculture, Miscellaneous Publication No. 700, December, 1949.

[2]O.L. Mimms, J.L. Paschal, and W.U. Fuhriman, *Some Economic Aspects of Farming in Alaska, with Chief Attention to the Matanuska Valley*, Bureau of Agricultural Economics, U.S.D.A. cooperating with Alaska Agricultural Experiment Station, FM-74, January, 1950.

areas. Emphasis in the following discussion will be oriented to costs of farming as they exist, based on the premise that one starts from the status quo to evaluate and project for the future.

In computing costs of production and expected net returns, cost data are specifically applicable to a given situation at a given time. Soils differ from farm to farm, and weather conditions vary between years. Prices paid for resource inputs vary between producers, and cultural practices carried out are not always comparable. Management decisions regarding allocation of fixed costs vary widely, and time is a particularly crucial factor as all costs change over time. Consequently, any set of data dealing with costs of production must be used with care.

Several farm management studies have been carried out in recent years to determine costs of production for various types of farm enterprises in different regions of Alaska. Survey data have been used in most instances to provide critical insight into the recent cost situation of agricultural producers under existing farm organization and technology. The underdeveloped state of Alaska's agricultural production sector has not come about by chance. It has been the result of individual decisions made within the industry, as well as many decisions made by agencies and individuals that are not an immediate part of the industry. Reasoning behind the decisions has been quite varied. This lack of overall planning and coordination of development efforts has made the industry today a tyranny of many small decisions. Nevertheless, the structure of the present industry provides the base from which changes must occur. Consequently, a detailed review of the recent cost and income situation should allow more accurate predictions to be made about the industry of the future.

For many years, major study emphasis was the dairy industry, due to its economic importance in terms of numbers of farmers and value of total product. Annual business summaries were collected from dairy farmers for several years. During the summer of 1965, a survey was carried out to determine characteristics of the industry as it then existed. Enterprise studies were made the following year to gain further insight into the cost structure of dairy farms in the Matanuska Valley. Other enterprise studies were carried out to provide cost data on hog production, potato and vegetable production, and one study, which included cost data, was carried out by the Bureau of Reclamation regarding potential for beef production.

Characteristics of the Alaska Grade A Dairy Industry, 1965

Location of Supply

In 1965, 20.7 million pounds of milk were produced in Alaska, of which 95 per cent was sold in the commercial Grade A market.[3] The four major areas of production were: The Matanuska Valley-Anchorage area—16.825 million pounds; the Tanana Valley area—2.2 million pounds; Southeast Alaska—0.90 million pounds; and the Kenai Peninsula—0.78 million. By late 1966, the Matanuska Valley was the only community in the state with more than one commercial Grade A producer, and milk production had declined by 2.0 million pounds from the previous years' totals.

Producer Characteristics

The "average producer," calculated by averaging survey data[4] from 41 farms in the valley, was a farm unit consisting of 200 acres of farmland, 46 cows two-years-old or over, 1.4 full-time workers (including the operator), family help when available, and 35 days of seasonal labor. He produced 70 acres of silage, 55 acres of grain, 20 acres of hay, and 55 acres of pasture of varying quality on 145 acres of owned land and 55 acres of rented land. He also produced 379,000 pounds of milk for sale at an estimated cash cost of production of $8.37 per hundredweight. In doing so, he fed approximately 93 tons of grain ration, 94 tons of hay, and 390 tons of silage. It was quite probable that he fed by hand, milked in a walk-through parlor of some type, used a pipeline milker and bulk tank, and was cautiously considering expanding his milking herd by six or seven cows in the next year.

Farm Organization

Farms ranged in acreage from less than 100 to over 400 acres. As mentioned, the average number of acres farmed was 200, with 35 per cent of

[3] *Alaska Agricultural Statistics, 1965* Alaska Crop and Livestock Reporting Service, Statistical Reporting Service, U.S. Department of Agriculture cooperating with Alaska Division of Agriculture and Alaska Experiment Station.

[4] Survey of all commercial Grade A dairy farms in the Matanuska Valley, made during first half of June, 1965.

the land area in silage, 27.5 per cent in grain, 10 per cent in hay, and 27.5 classed as pasture.

The main crops produced were silage and grain, with 34 farms producing silage and 31 producing grain crops. Hay was produced on 20 farms; however, only 10 produced as much as 40 acres. Development of pasture land ranged from intensely farmed areas to timber and wasteland.

Size of Herd

When classed by herd size, Matanuska Valley Grade A dairy farms ranged from less than 20 cows to more than 100 cows two-years-old and over. Approximately 20 per cent of the herds included 25 cows or less, and an almost equal percentage had 75 cows or more. Fifty per cent of the herds had 26 to 50 cows. The average number of cows per herd was approximately 46, with 74 per cent in the milking line and 26 per cent dry when the survey was made. There were approximately 9.5 heifers one- to two-years-old per herd. This indicates a four- to five-year replacement cycle.

TABLE X.

Distribution of Herd Size by Class, As Reported by 41 Matanuska Valley Grade A Milk Producers, June, 1965.

Size of herd	Number of herds in class	Per cent of all cows
Under 25	8	9.4
26 to 50	21	40.6
51 to 75	5	15.5
76 and over	7	34.5
Total	41	100.0

Volume of Production

In volume of production, farms ranged from a small farm producing just over 100 thousand pounds of milk for sale, to a large farm producing over one million pounds in 1964. Seven per cent of the farms sold less than 150 thousand pounds of milk and an equal number sold over 750 thousand pounds of milk (Table XI). The ten smallest producers sold just over one and three quarter million pounds of milk, while the ten largest sold over seven million pounds.

TABLE XI.

Distribution of Producers and Production by Size Group, 41 Grade A Milk Producers, For Calendar Year 1964*

Farm size group production per year (1,000 lbs.)	Number of producers	Per cent of producers	Per cent of total milk produced by group
Under 150	3	7.32	2.39
150 to 300	14	34.16	20.43
300 to 450	14	34.16	31.94
450 to 600	4	9.76	13.93
600 to 750	3	7.32	12.72
750 and over	3	7.32	18.59
Total	41	100.0	100.0

*Data collected during June, 1965.

Other Characteristics

Information regarding dairy farm labor requirements also was obtained in the survey of the Matanuska Valley. Seventy per cent of the farms were operated by one full-time worker (the operator) with available family help, 22 per cent used two full-time workers, and 8 per cent used more than two full-time workers. Farms operated by one full-time worker that had seasonal help averaged using more than 100 days of seasonal labor.

Forty-six per cent of the producers reported sources of income other than dairying. Fifty-four per cent indicated that they received all income from

dairying. Less than 13 per cent indicated less than one-half of their income from dairying.

Slightly over 34 per cent of the Grade A milk producers owned all the land they farmed. Thirty-nine per cent rented as much as half of their land, and less than 5 per cent rented as much as three-fourths. No farm operators indicated the rental of all their land. There were noticeable variations in use of rented land between farm size groups.

TABLE XII.

Distribution of Rented Land by Farm Size Group, 41 Dairy Farms, 1964

Farm size group (acres)	Farms (no.)	Land rented (per cent)	Average size of farm (acres)
Under 120	8	9.85	107
120 to 159	11	48.65	141
160 to 199	5	15.53	173
200 to 239	4	47.80	216
240 to 279	4	24.31	254
280 to 319	3	25.42	298
320 and up	6	33.35	364

Sources of Replacement Cattle. Slightly over 63 per cent of the producers planned to raise all of their replacement stock. Twelve per cent planned to buy one-fourth, 15 per cent planned to buy one-half, approximately 5 per cent planned to buy three-fourths, and a like number planned on buying all of their replacements. Recent adjustments in the dairy industry would indicate, however, the expansion and, to some degree, replacements have come from diary herds that were being dispersed in the area.

Feed Inputs and Sources of Feed. During the calendar year 1964, producers fed 3,800 tons of grain ration, 3,680 tons of hay, and 16,000 tons of silage, in addition to green chop and pasture. Seventy per cent purchased all the grain ration fed, 12 per cent purchased all their hay, none purchased all silage fed. However, 15 per cent reported feeding no silage and 5 per cent reported feeding no hay. Eighty-eight per cent produced all silage fed and 60 per cent produced all hay fed.

Mechanization of Milking and Feeding Systems. Seven producers reported automated feeding systems, 12 partly automated systems, and 22 fed by hand. Thirty-two reported pipeline milking systems, and nine reported bucket-type milkers. All reported bulk tank cooling and storage systems for milk handling. Fifteen producers reported using stanchions, ten with walk-through parlors, nine with side-opening stall parlors, and seven reported using herring-bone-type milking parlors.

Operational Plans. Twenty-four producers indicated that they felt that their facilities were currently being used to capacity. Thirteen had expanded their milking herds during 1964, and ten planned some expansion during 1965. Planned expansion ranged from one cow to 20 head with an average of 7.5 cows per herd. Most common reasons given for expansion in 1964 were: the need for more income, more efficient use of equipment, greater market availability, new building space, and more efficient use of land. Unavailability of capital was the most frequently mentioned reason for not expanding in 1964; however, it was mentioned by less than 43 per cent of those who did not expand. Other reasons mentioned were: low price of milk, limited building space, shortage of labor, and equipment used to capacity. Those who expanded herds during 1964 were mostly those with larger herds. The final question on operation plans regarded future expectations of cash costs of producing milk. Eleven producers expected cash costs to go down. Nineteen expected them to stay the same, and 11 expected cash costs to go up. Respondents who indicated plans for some herd expansion during 1965 were predominantly those with herds ranging from 30 to 50 cows at the time the survey was taken.

Size of One- and Two-Man Units. The final survey question, one quite critical to the goal structure of future planning, was, "How many cows do you consider it takes to make a full-time one-man dairy unit; a full-time two-man dairy unit?" Responses ranged from 15 to 70 cows for a one-man unit, and averaged just over 35. Twelve thought that one man with occasional family help and seasonal cropping labor should milk 25 or less cows. Twelve thought that such a unit should have 30 to 40 cows. Eight producers indicated a belief that such a unit should have 40 to 50 cows, and eight thought it would be 50 or more.

Responses regarding size of herd for a two-man unit ranged from 34 to 100 cows, with an average figure of approximately 68 cows. Nine respondents thought 50 cows or under were adequate for a two-man unit,

while thirteen indicated 60 to 75, thirteen indicated 75 to 90, and six indicated 90 to 100.

Investment, Costs, and Receipts

Data were collected from a purposefully selected sample of 15 valley dairymen at the end of the 1965 calendar year. The sample was selected to include dairies ranging from small to large, yet provide an average size comparable to the average from the earlier survey of all commercial Grade A dairy farms in the valley.

Size of herds surveyed ranged from 30 to 100 cows. Milk produced per farm ranged from 120,000 pounds to almost 1,200,000 pounds. Milk production per cow in the milking herd ranged from approximately 5,000 to over 13,000 pounds among herds surveyed. Percentage of time cows were in the milking line ranged from 72 per cent to 86 per cent.

Investment Per Farm. Survey data were collected on capital investment in physical resources as of December 31, 1965. Investment per farm ranged from $43,500 to almost $300,000. Investment in physical resources included current depreciated values of land and buildings, farm machinery and equipment, all livestock, stored crops and feed, and miscellaneous supplies. Average investment for the 15-farm sample was approximately $122,000. Borrowed capital made up 53 per cent of inventory value.

Annual Costs of Production. Annual costs of production include cash operating expenses of the dairy, depreciated values on buildings, machinery and equipment, as well as difference between interest paid and 5 per cent interest on average borrowed capital. Cash operating expenses amounted to $32,754, and unpaid annual operating expenses were $4,147.

Gross Cash Receipts. Gross cash receipts ranged from $11,000 to $118,000. Milk sales averaged $41,117 on the farms surveyed. Sales of other farm products and miscellaneous farm incomes averaged $2,537. Total farm income averaged $43,654. Farm family incomes were undoubtedly somewhat higher due to nonfarm incomes.

Net Income. Business operating margin for the group of 15 dairies averaged $6,753. Opportunity cost of operators' equity averaged $2,876, when calculated at 5 per cent. Income available to labor and management averaged $3,877.

TABLE XIII.

Average Investment, Cost and Receipts,
15 Matanuska Valley Dairy Farms, 1965

		Survey Average
Production		
Total milk per farm	pounds	428,352
Cows	number	45.27
Production per cow 2-years-old and over	pounds	9,642
Investment Per Farm		
Total investment (including dwelling)	dollars	122,134
Total borrowed capital, Dec. 31, 1965	dollars	64,610
Owner's equity	dollars	57,524
Gross Cash Income Received		
Milk Sales	dollars	41,117
Other Sales	dollars	2,537
Total Sales	dollars	43,654
Cash Cost of Production		
Cash expenses paid	dollars	32,754
Unpaid yearly operating expenses[a]	dollars	4,417
Total yearly operating expenses[b]	dollars	36,901
Net Income		
Business operating margin	dollars	6,753
Opportunity cost of equity investment (5%)	dollars	2,876
Income available to labor and management	dollars	3,877

[a]Depreciation and unpaid interest.

[b]Does not include operator's labor and management, family labor, or return to operator's equity.

Farm Costs Per Hundredweight of Milk Produced

Farm operating expenses for 1965 are shown in Table XIV. All cash farm operating expenses are included. All farms in the sample included feed enterprises contributing to the dairy enterprise, consequently, all costs and incomes are attributed to the dairy.

TABLE XIV.

Farm Costs Per Hundredweight of Milk Produced on 15 Matanuska Valley Dairy Farms, 1965

	Survey Average	
	Total	Per cwt.
Hired labor	$ 1,999.31	$0.467
Feed purchased	13,524.77	3.157
Seed and fertilizer	5,263.81	1.229
Machine hire and haul	1,617.84	0.378
Supplies	568.17	0.133
Repairs, auto, equipment improvement	1,376.18	0.368
Veterinary and breeding	523.42	0.126
Gas, oil, fuel	1,299.19	0.303
Taxes	359.87	0.201
Insurance	779.75	0.182
Interest	1,840.59	0.430
Electricity and telephone	1,026.50	0.240
Rent	831.20	0.194
Miscellaneous	1,029.17	0.240
Cash farm operating	32,753.76	7.65
Depreciation and unpaid interest[a]	4,147.00	0.97
Annual farm operating	36,900.76	8.62

[a]Estimated at 5 per cent.

The Contributing Enterprises

On concluding the 1965 surveys, it was deemed necessary to pursue in depth the costs involved in contributing enterprises on dairy farms in the valley. Subsequent surveys were carried out regarding costs of producing dairy herd replacements, oat-pea silage, barley or oats for grain, and brome or timothy for silage, hay, green-chop or pasture.

The evaluation of individual contributing enterprises on dairy farms presented in this section of the report may lead to erroneous conclusions unless consideration is given to how each enterprise fits into the farming system as a whole. Each of the cropping enterprises should be considered in terms of typical use of all resources available to the farm firm, as well as how each enterprise contributes to the success of the main income enterprise. It is assumed that most, if not all, feed crops were marketed through the dairy enterprise. It must be noted, however, that each of the crops is produced on farms raising other types of livestock or producing other primary income crops, rather than on single enterprise farms.

Farms surveyed were scattered throughout the valley to account for variation in topography, depth of soil, and rainfall. Seven to ten farms were surveyed in each enterprise study to account for differences in location as well as size of enterprise.

Survey data were collected regarding acres of crop, yield per acre, land and materials used, costs of raising crops, costs of harvesting crops, machinery used, production practices, and capital invested in various resources used. Survey data were compared with statistical data, other research data, and research reports where available.

Emphasis in developing budgets was directed to average total costs per acre and per unit of product. All costs were estimated to be full costs for resources used as allocated by the farm operator in his business organizational decisions. All costs reflected current prices, levels of management, technology being used, and enterprise organization on farms included in the various surveys. Costs reported were based on cooperators' farm records and operators' best estimates of time and value if records were not available on particular cost items. Return-to-capital was calculated using

present value of resources allocated to each enterprise at a 5 per cent rate. Storage costs were not included in the contributing enterprise budgets.

Costs of Producing Dairy Herd Replacements[5]

A purposefully selected sample of eight dairy farms was surveyed during the fall of 1966 to determine total costs of raising dairy herd replacements. Data were collected to determine numbers of heifers raised, feeding practices, resource inputs used, and factor costs. Costs were divided into three time periods corresponding to age-related feeding systems.

The following budget (Table XV) reports results of the study to determine representative costs and resources used in the herd replacement enterprise.

Most dairymen surveyed selected heifers at birth and did little culling until after production was known in the milking line. The replacement cycle for dairy herds in the valley is just over four years, based on survey data. Estimated income received from cull heifers was credited against total costs incurred.

Oat-Pea Crop for Silage

Survey data were obtained from eight dairymen whose farms were selected for spatial distribution throughout the Matanuska Valley and included the full range of herd sizes. Acres of oat-pea crop per farm in the survey ranged from 30 acres to 85 acres, and reported yields ranged from 3 tons to 8 tons of silage per acre. Data were collected regarding seeding rates, fertilizer use, crop yields, machinery used, and production practices, as well as costs for factor inputs used.

Seeding rates differed between farms as influenced by soils and microclimate of field locations and the judgements of individual farm

[5]Wayne E. Burton, *Costs of Producing Dairy Herd Replacements in the Matanuska Valley, Alaska, 1966.* University of Alaska Agricultural Experiment Station, Unpublished Manuscript.

TABLE XV.

Average Cost Per Heifer Raised and Placed in Milking Herds, On Eight Matanuska Valley Dairy Farms, 1966.

	Low cost group	High cost group	Weighted ave. all calves in sample
Feed Costs			
First 2 Months			
Milk replacer	$ 12.07	$ 16.67	$ 12.12
Whole milk	-----	-----	4.68
16% dairy ration	2.36	1.40	1.85
Calf starter and manna	2.48	7.16	4.73
Hay	3.18	2.25	2.50
Sub-total	$ 20.29	$ 27.48	$ 25.88
2 Months-6 Months			
Calf starter	$ 4.50	$ 4.75	$ 3.31
16% dairy ration	15.60	28.63	22.68
Hay	16.97	19.57	18.42
Sub-total	$ 37.07	$ 52.95	$ 44.41
6 Months-Freshening			
16% diary ration	$ 54.75	$ 80.20	$ 82.20
Hay	73.68	117.63	108.55
Silage	104.74	91.57	68.70
Pasture	17.00	34.87	24.90
Sub-total	$250.17	$324.26	$284.35
Total Feed Costs	$307.83	$404.69	$354.64
Other Costs			
Labor	$148.66	$154.96	$156.16
Buildings	17.14	23.04	20.58
Bedding	22.50	15.39	16.71
Vet. and medicine	1.50	.78	1.04
Breeding	9.00	10.00	9.10
Insurance	3.05	1.17	2.59
Interest	24.25	27.66	26.27
Misc. cost	4.14	3.09	3.92
Sub-total	$230.25	$236.18	$236.37
Adjustment for culled heifers	-----	$ 11.74	$ 5.19
Total Costs Per Heifer	$537.78	$629.13	$585.82

operators. Some operators included vetch in the seed mixture. Co-operators averaged planting 129 pounds of the seed mixture: 86 pounds of oats, 33.5 pounds of peas, and 9.5 pounds of vetch. (Table XVI.)

TABLE XVI.

Estimated Seeding Rates for Oat-Pea Crop on Eight Selected Matanuska Valley Dairy Farms, 1966

Farm	Component Rates			Total
	Oats	Peas	Vetch	
	(pounds/acre)			
1	100	33	10	143
2	60	50	---	110
3	90	40	---	130
4	100	20	---	120
5	60	---	50	110
6	100	50	---	150
7	120	35	---	155
8	60	40	15	115
Av.	86	33.5	9.5	129

Reported seeding rate differed somewhat from Cooperative Extension Service and Agricultural Experiment Station recommendations of 40 to 50 pounds of oats and 50 to 60 pounds of peas.

Klebesadel recommended that "to prevent excess lodging of the crop, at least 40 to 50 pounds of oats and no more than 60 to 70 pounds of peas should be planted per acre."[6] Farmers in the sample appear to have used more oats and less peas than recommended to overcome problems of excess moisture in silage.

There were marked differences among farms, both in application rates and analysis of fertilizers used. Average application rates in pounds per acre for major fertilizer nutrients were 47 pounds of N, 67 pounds of P_2O_5 and 38 pounds of K_2O. Recommended rates of application were 300 pounds of

[6]L.J. Klebesadel, *Planting Rate of Oats and Peas: Some Yield, Quality, and Cost Considerations*, Alaska Agricultural Experiment Station, Forage Research Report No. 4, p. 5.

10-20-10 per acre, or 30 pounds of N, 60 pounds of P_2O_5 and 30 pounds of K_2O. Rates of fertilizer nutrients applied deviated from those recommended, but this may have been due to variability of soils or to type of silage desired by the farm operator.

TABLE XVII.

Rates of Application of Major Fertilizer Nutrients for Oat-Pea Production on Eight Matanuska Valley Dairy Farms

Farm	Component Rates		
	N	P_2O_5	K_2O
1	73	48	23
2	36	90	36
3	12	48	24
4	48	102	48
5	57	64	64
6	52	40	20
7	45	96	45
8	51	48	48
Av.	47	67	38

Yield in tons per acre ranged from 3 to 8 tons, averaging 5.95. Average yield per acre, as reported by the Alaska Crop and Livestock Reporting Service (preliminary estimates) was 5.7 tons per acre for grain silage for the Matanuska Valley in 1965 and 1966.

Costs

Charge per acre of land, including land tax, ranged from $7.65 to $13.60, the average charge being approximately $12.09.

Plowing cost per acre ranged from $3.69 to $7.63 because of differences in size and type of equipment used, size of farm unit, and allocation of fixed costs to the oat-pea silage enterprise by farm operator. Plowing costs included gasoline or diesel fuel, oil and grease, depreciation and maintenance on tractor and plow, and labor to carry out the plowing operation. The average cost reported for plowing was $3.93 per acre; one operator disced instead of plowed.

Discing and harrowing costs were consolidated because the two tillage practices were performed together by some operators. Reported costs per acre ranged from $1.26 to $5.80. The average charge for discing and harrowing was $2.81 per acre.

Cultipacking, drilling and fertilizing costs were consolidated into a single cost due to the nature of equipment used and the combining of the three cultural practices into a single field operation by some. Cost per acre for these operations ranged from $3.25 to $7.62, averaging $5.03 for all acres reported. Costs varied somewhat according to size and value of equipment used, and number of times over the field.

Chopping cost per acre ranged from $5.43 to $13.24, averaging $8.95 for all acres reported. Direct field cutting of the standing crop was the most common method of harvesting, although some acreage was cut with a windrower, then chopped from the windrow. Cost differences were chiefly due to depreciation and size of equipment, as well as total acres farmed.

Hauling cost varied widely due to differences in equipment used and allocation of fixed costs. Trucks, wagons, and combinations were used. Cost ranged from $3.61 to $12.15 per acre. Some equipment was used extensively in the overall farming operation and, consequently, fixed costs assigned to hauling the oat-pea crop were very small. Labor cost per acre varied with efficiency of operation, opportunity cost of operator's and family labor, and price of hired labor. It is assumed, however, that the average cost per acre of $7.04 is typical of oat-pea silage enterprises on dairy farms in the valley area.

Return to capital was calculated on investment for the full year, because of the time pattern of acquisition of inputs and sale or use of product. Charge for capital per acre ranged from $4.31 to $7.28, averaging $5.94 on all acres reported. Certain farm business overhead capital may not be included because the primary income enterprise was dairy and it is difficult to allocate overhead costs in a multiple enterprise unit.

Total cost of oat-pea production per acre apparently was more dependent on cultural practices, rate of fertilizer application, and allocation of fixed costs between enterprises than on economies of scale for the enterprise. Total cost per acre ranged from $65.89 to $91.12. Average total cost per acre on all acres reported was $75.03, based on weighted average cost per acre.

TABLE XVIII.

Average Costs Per Acre for Producing Oat-Pea Crop on Eight Matanuska Valley Dairy Farms

	Ave.
Oat-Pea acres per farm	54
Production per acre[a] (tons)	5.95
Land and Materials	
Seed-Oats 86.0 lbs.	$ 5.90
Peas 33.5 lbs.	3.74
Vetch 9.5 lbs.	.84
Fertilizer 47 lbs. N, 67 lbs. P_2O_5, 39 lbs. K_2O	19.01
Charge for land (per acre)	12.09
Subtotal	$41.58
Raising Crop	
Plow	$ 3.93
Tractor	
Disc	
Tractor	2.81
Drill	
Cultipacker	
Fertilizer	5.03
Subtotal	$11.77
Harvesting Crop	
Chopper	$ 8.95
Tractor	7.04
Hauling trucks or tractor and wagons	
Subtotal	$15.99
Return to Capital[b] (non-land)	5.94
Total Cost of Production	$75.28
Cost Per Ton	$12.66

[a]Silage equivalent.

[b]Interest on investment is calculated for a full year due to pattern of acquisition of inputs and sale or use of product.

Cost per ton of oats and peas ranged from $8.74 to $25.38, and averaged $12.66 on total production in the survey. Using areawide per-acreage production of 5.7 tons per acre, cost per ton would be $13.16, assuming per-acre costs developed in the study to be representative of all oat-pea silage produced.

Due to the limited sale of oat-pea silage, market prices for silage are not readily available; however, the Alaska Crop and Livestock Reporting Service reported grain silage at $18.00 per ton for the 1966 calendar year.

Costs of Producing Barley for Grain

Data were obtained from nine farm operators who had either raised barley during the 1966 cropping season or had raised barley during several recent years. The barley enterprise differs from other feed crops in that the crop is generally harvested and delivered to the commercial dryer and storage facility for final disposition. The barley crop provides an important component of the feed supply through the commercially mixed ration. Due to having established marketing facilities, barley is grown on farms with livestock enterprises other than on dairy and crop farms where no livestock is kept. The nine units surveyed ranged from one farm with only 15 acres of barley to farms with approximately 80 acres.

Seedings rates for barley ranged from 100 pounds to 150 pounds per acre, and averaged 116 pounds per acre for all acres included in the survey. Recommended seeding rate, by the Experiment Station, was 100 pounds per acre.

Application rates of major fertilizer nutrients varied between producers because of different locations, soil types, and operator judgements with regard to need and price. Recommended rates of application by the Experiment Station were 20 pounds/acre N, 40 pounds/acre P_2O_5, and 20 pounds/acre K_2O.

Raising Crop

Land preparation practices were not directly comparable in all instances, so costs were divided between plowing and disc-harrowing. Plowing costs averaged $4.49 per acre and disc-harrowing averaged $2.46 per acre for all

TABLE XIX.

Estimated Seeding Rates and Rates of Application of Major Fertilizer Nutrients on Barley Crop on Nine Matanuska Valley Farms

Farm	Seed	Component Rates N	P_2O_5	K_2O
			(pounds/acre)	
1	100	24	96	48
2	125	24	96	48
3	150	36	77	36
4	100	38	77	38
5	110	50	32	44
6	120	24	48	48
7	120	36	77	36
8	125	37	74	74
9	150	20	80	40
Wtd. ave. all acres	116	28	85	45

acres in the survey. The operations of culti-packing, drilling seed, and fertilizing were grouped because of the number of operators that combined the three operations into a single field operation. The average cost per acre reported was $3.49 per acre. Spraying for weeds was a common practice. Most operators found it necessary to spray with premerge and occasionally with 2-4-D in the spray mixture. Average cost per acre was reported to be $1.25.

Harvesting costs for barley were most often reported as the custom charge. The typical charge reported for combining was approximately $15.00; however, the range, which included some binding and threshing, was from $7.65 per acre to $22.56 per acre. The average reported cost for all acres harvested was $14.27. Hauling costs varied as part was a custom charge, and part was hauled by the farm operator. Operator's assigned charge varied according to value and size of hauling equipment and portion of truck costs assigned to the barley enterprise. Drying costs were estimated from farm records and the drying cost schedule of the one commercial dryer in the community.

The *charge for capital* was calculated on that capital allocated to the enterprise by the farm operator, and included capital invested in machinery and equipment and annual operating costs. It did not include investment in land as it is included in the charge for land. Certain farm business overhead costs are not included due to the difficulty of allocation on a multiple enterprise unit.

Total Costs of Production

Total costs of production ranged from $70.30 per acre to $115.08 per acre, averaging $82.50 for all acres surveyed. Due to the differing yields per acre, total costs per ton varied considerably more than costs per acre. Costs per ton ranged from $52.70 to $80.26 per ton, and the average cost on all tons produced was $61.78. Value per ton of barley, as reported by the Alaska Crop and Livestock Reporting Service, was $80.00 during 1966.

Costs of Producing Bromegrass-Timothy for Green Chop, Pasture, Hay, and Silage

The seeded grass crop is the most flexible of all crops in terms of harvesting. Most operators will harvest in the form appropriate to the time and situation. Grass is most often hayed from the first crop, weather permitting, and used for silage on the second crop. Some portion of the crop will often be pastured, and, in many instances, on dairy farms, will be chopped for green feed during the appropriate summer season. The Alaska Crop and Livestock Reporting Service reported some 7,100 acres of seeded grass being harvested in the state during 1966, 5,000 acres of which were harvested in the Matanuska Valley area.

Survey data were obtained from eight farm operators who had harvested seeded grass during the 1966 cropping season. Not all farm operators had harvested seeded grass in all forms reported, but estimates were obtained with regard to the particular forms of harvest the operator was most familiar with. Cost estimates were made as if the crop were used for a single harvest purpose for the complete season in each case.

Acreage per farm ranged from 36 to 425 acres and averaged 112 acres per farm surveyed. Most seeded grass in the survey was bromegrass.

TABLE XX.

Estimated Average Costs Per Acre for Producing Barley on Nine Selected Matanuska Valley Farms

	Ave.
Acres per farm	70.28
Production per acre (tons)	1.328
	Ave. cost per acre
Land and Materials	
Seed 116 lbs. @ $7.09 per cwt.	$ 8.22
Fertilizer 28 lbs. N, 85 lbs. P_2O_5, 45 lbs. K_2O	19.75
Spray materials (2 qts. premerge)	2.51
Land (acre)	11.89
Subtotal	$42.37
Raising Crop	
Plowing	$ 4.49
Disc-harrow	2.46
Cultipack, drill and fertilizer	3.49
Spraying	1.25
Subtotal	$11.69
Harvesting Crop	
Combine or bind and thresh	$14.27
Hauling	2.71
Drying	6.14
Subtotal	$23.12
Cost of Capital	$ 4.87
Total Costs of Production	$82.05
Total Costs Per Ton	$61.78

TABLE XX-a.

Estimated Costs Per Acre For Producing Barley in the Tanana Valley*

	Ave.
Acres per farm	320
Production per acre (tons)	1.0
	Ave. cost per acre
Land and Materials	
Seed 125 lbs. @ $6.00 per cwt.	$ 7.50
Fertilizer 20 N, 40 P_2O_5, 40 K_2O	15.00
Spray materials	3.00
Land (acre)	4.00
Interest on investment @ 6%	1.94
Subtotal	$41.44
Raising Crop	
Tractor	$ 3.83
Plow	.35
Disc	.44
Harrow	.06
Drill	.66
Spray	.09
Combine	4.40
Hauling	2.00
Drying	5.00
Storage	4.00
Operator's labor 3 hr. @ $2.50/hr.	7.50
Subtotal	$28.33
Total	$69.77

*Data included in budget from the synthesized costs of production in A. Dale Saunders, *Grain Production Costs for the Tanana Valley*, A.A.E.S., mimeo., January 1968, pp. 1-5.

Establishing the Stand

The seeded grass crop, generally bromegrass, a perennial, is seeded only at infrequent intervals. Consequently, costs of establishing a stand are separated out as a single budget and are prorated over the number of years suggested by the farm operators. Frequent winter kill and intensive harvesting practices limited the duration of stands on farms surveyed to about five years. Seeding rates and rates of application of major fertilizer nutrients varied according to operator's experience and location within the valley.

Recommended rates of major fertilizer nutrient applications, by the Experiment Station, were 60 pounds/acre N, 60 pounds/acre P_2O_5, and 60 pounds/acre K_2O for establishing a stand of bromegrass-timothy.

TABLE XXI.

Estimated Seeding Rates and Rates of Application of Major Fertilizer Nutrients for Establishing a Bromegrass Stand on Eight Matanuska Valley Farms

Farm	Seed	Component Rates N	P_2O_5	K_2O
			(pounds/acre)	
1	12.5	58	64	32
2	6	30	60	30
3	15	20	40	40
4	20	80	115	58
5	15	73	48	23
6	10	70	32	32
7	25	42	90	42
8	25	86	64	64
Ave.	16.3	62	58	34

Costs

No production was included in the first-year budget as expected yields were limited and assumed to be equivalent in value to costs of cleaning up the field during the late summer of the seeding year.

Green chop (Budget B) is a harvest form used by a considerable number of dairymen to offset disadvantages of pasturing during the summer season.

BUDGET A.

Cost of Establishing Stand of Bromegrass

	Ave.
Bromegrass Acres Per Farm	112
Production Per Acre (tons)	-----
	Ave. cost per acre
Land and Materials	
Seed	$ 5.97
Fertilizer	22.24
Spray	.38
Charge for land	12.55
Subtotal	$41.14
Raising Crop	
Plow	$ 3.23
Disc-harrow	3.95
Cultipack-drill-fertilizer	4.29
Spraying	.12
Subtotal	$11.59
Return to Capital Investment	3.06
Total Cost of Establishing Stand	$55.79
Average Life of Stand (years)	4.94

BUDGET B.

Costs of Producing Bromegrass-Green Chop

	Ave.
Bromegrass Acres Per Farm	112
Production Per Acre (tons)	10.88
	Ave. cost per acre
Land and Materials	
Seed	$10.38
Fertilizer	45.15
Fence	1.00
Spray	-----
Charge for land	12.70
Subtotal	$69.23
Raising Crop	
Fertilizing	2.32
Subtotal	$2.32
Harvesting Crop	
Chopping	7.23
Subtotal	$7.23
Return to Capital Investment	4.17
Total Cost of Production	$82.95
Average Cost Per Ton	$ 7.63

Fertilizer was generally applied in the spring with additional nitrogen fertilizer applied after harvest of the first crop during late June or early July. Harvesting of the crop in various forms varied from year to year on most farms because of weather, seasonal growth, and summer feed requirements.

Bromegrass production budgets for hay and silage have been separated as to best estimates of costs for each harvest form. Weather conditions often preclude successful harvest of the first crop for hay and generally preclude haying of the second crop. However, haying of the seeded grass crops is a common practice and thus necessitated a budget inclusion. Yield of hay per acre was calculated for two crops harvested in that form. Yield of silage or hay per acre reported is quite low when compared with experimental results.

BUDGET C.

Costs of Producing Permanent Bromegrass Pasture

	Ave.
Bromegrass Acres Per Farm	112
Production Per Acre	-----
	Ave. cost per acre
Land and Materials	
Seed	$11.50
Fertilizer	34.34
Fence	3.10
Spray	-----
Charge for land	12.25
Subtotal	$61.19
Raising Crop	
Clipping	$ 1.07
Fertilizing	1.80
Subtotal	$ 2.87
Return to Capital Investment	$ 2.91
Total Cost of Production	$66.97

BUDGET D.

Costs of Producing Bromegrass Hay

	Ave.
Bromegrass Acres Per Farm	112
Production Per Acre (tons)	3.255
	Ave. cost per acre
Land and Materials	
Seed	$ 7.88
Fertilizer	25.23
Charge for land	8.37
Subtotal	$41.48
Raising Crop	
Fertilizing	$ 1.68
Subtotal	$ 1.68
Harvesting Costs	
Mowing-Conditioning	$ 3.65
Raking	1.84
Baling	15.90
Hauling	8.33
Subtotal	$29.72
Return to Capital Investment	$ 4.19
Total Cost of Production	$77.07
Average Cost Per Ton	$34.17

This indicates a possible doubling of yield with cultural and harvesting practice changes.

Costs-of-establishing-stand used in budgets for different harvest forms varied due to size of farm units and particularly due to length of expected time span before reseeding.

BUDGET E.

Costs of Producing Bromegrass Silage

	Ave.
Bromegrass Acres Per Farm	112
Production Per Acre (tons)	3.67
	Ave. cost per acre
Land and Materials	
Seed	$ 8.25
Fertilizer	25.54
Charge for land	8.94
Subtotal	$42.73
Raising Crop	
Fertilizing	$ 1.58
Subtotal	$ 1.58
Harvesting Costs	
Mowing and chopping	$ 5.92
Windrowing	2.04
Hauling	6.70
Subtotal	$14.66
Return to Capital Investment	$ 4.10
Total Cost of Production	$63.07
Average Cost Per Ton	$17.18

Total Costs of Production

Total costs of production were estimated for each harvest form to include all estimated costs, with the exception of possible business overhead costs that posed a problem of allocation between enterprises. Total costs per acre were estimated at $82.95 for green chop, $66.97 for pasture, $77.07 for hay, and $63.07 for silage.

No sale prices are reported for green chop or pasture. Tame grass hay was reported at $58.79 per ton and tame grass silage at $17.88 per ton by the Alaska Crop and Livestock Reporting Service.

Costs of Producing Hogs in Alaska[7]

Interest in hog production in Alaska occurs at frequent intervals. Very little information is readily available as few hogs have been produced, and most of these have been produced on garbage from military bases. Slaughter facilities have been scarce and inadequate until recently. Marketing channels for local pork are relatively undeveloped. Costs of raising hogs in Alaska are difficult to determine because of the small numbers of producers and the difficulty of obtaining data. Observations of Anchorage and Fairbanks trade channels lead to the belief that typical one- and two-litter production systems common to many hog producing areas would face serious marketing difficulties in Alaska, as wholesale and retail outlets cannot readily handle "one-shot" marketings of any sizable quantity. Controlled-environment confinement systems of hog production would give Alaska producers the opportunity for monthly farrowing and marketing that would in turn help foster the development of marketing channels for local pork.

Sources of Data

Data for costs of production budgets for hogs were collected from case studies, published research reports from other geographic areas, discussions with members of the engineering section at the Alaska Agricultural Experiment Station, local prices for materials and supplies, and discussions with other agricultural specialists. Data from all sources were synthesized into estimates of resource requirements, production practices, and possible investment and production costs.

[7]Wayne E. Burton, *Hog Production in Alaska: Some Economic Aspects*, Alaska Agricultural Experiment Station cooperating with U.S. Department of Agriculture, Miscellaneous Circular, June, 1964.

Physical Production Requirements

Capital Requirements for commercial farrow-to-finish controlled environment pork enterprises are quite extensive. Estimates included housing, equipment, breeding stock, and the necessary operating capital to cover out-of-pocket costs throughout the year. Land may run $200 or more per acre. Cash housing costs may approach or exceed (1) insulated confinement housing (with full slotted floors) @ $10 per gross square foot of floor space, (2) insulated confinement housing (with partially slotted floors) @$9.50 per square foot, (3) insulated confinement with concrete floors @ $9.00 per square foot. Estimates do not include the operator's labor during the building period. Breeding stock may run $100 or more for sow stock and $150 or more for boar stock. Feed and other out-of-pocket costs may require $400 or more per litter to slaughter age. Capital requirements for an 800-head per year capacity enterprise may thus approach $55,000.

Cost of Production

Cost of production data for hogs were developed from case study data for 1962-64 production years and planning projections for two different systems of production in a controlled environment housing facility. Housing for both options was a 36' by 72' insulated barn with slotted dunging alleys, supplemental heat, and forced air ventilation.[8] Option A (Table XXII) was a farrow-to-finish system with eight sows farrowed each month. Sows were brought into the barn to farrow and moved from the barn as soon as pigs were weaned. Pigs were sorted by size at weaning, and re-sorted monthly until slaughtered.

Option B (Table XXIII) was a production system modification of Option A. The major differences were that only six sows were farrowed each month, and litters were left in the farrowing pen until slaughter, with no consolidation or sorting.

Average price received for pork in carcass form in 1966 was reported at 53.29 cents per pound by the Alaska Crop and Livestock Reporting Service.

[8]Housing estimates developed in cooperation with producers and personnel of the engineering section, Alaska Agricultural Experiment Station.

TABLE XXII.

Costs of Producing Hogs, Option A, 1964*

Investment	Estimate
Land (5 acres @ $200 per acre)	$ 1,000
Swine (50 sows @ $100, 3 boars @ $150)	5,450
Buildings and equipment	
36' x 72' insulated barn with slotted dunging alley and equipment	24,000
20' x 80' pole barn and grain storage	3,000
Pens and miscellaneous equipment	1,000
Operating capital (½-year's feed cost plus 25%)	19,000
Total Continuing Investment	$53,450
Estimated Expenses	
Feed (575,000 pounds plus pasture)	$31,625
Other out-of-pocket costs (25% feed cost)	7,900
Interest on 50% of investment (borrowed capital) @ 6%	1,604
Depreciation	2,155
Slaughter and delivery cost @ 3.5 cents/lb. dressed carcass	4,200
Total estimated annual cash cost	$47,484
Return to family labor (4,800 hr. @ $2)	9,600
Return to 50% equity @ 6%	1,604
Total Annual Cost	$58,688
Total cost of carcass pork, 48.9 cents/pound	

*Assuming 96 to 100 litters of nine or more pigs farrowed and eight or more pigs marketed at 200 pounds, an overall feed conversion ratio of 3.5 to 1, labor requirements of 1.9 man hours per 100 pounds live weight of pork produced.

TABLE XXIII.

Costs of Producing Hogs, Option B, 1964*

Investment	Estimate
Land (5 acres @ $200 per acre)	$ 1,000
Swine (36 sows @ $100, 2 boars @ $150)	3,900
Buildings and equipment	
36' x 72' barn, etc.	24,000
20' x 80' barn	3,000
Miscellaneous pens, etc.	1,000
Operating capital	$15,000
Total Continuing Investment	$47,900
Estimated Expenses	
Feed (431,298 lbs. plus pasture)	$23,721
Other out-of-pocket costs (25% of feed cost)	5,930
Interest on 50% of investment (borrowed capital) @ 6%	1,437
Depreciation	2,155
Slaughter and delivery cost @ 3.5 cents/lb. dressed carcass	3,024
Total estimated annual cash costs	$36,267
Return to family labor (3,456 hr. @ $2)	6,912
Return to 50% equity @ 6%	1,437
Total Annual Cost	$44,616
Total cost of carcass pork, 51.64 cents per pound	

*Assuming 75 to 78 litters with eight pigs per litter raised, 3.5 to 1 feed ratio, and 75 per cent dress out, using "farrow to finish in the pen" system. Other standards comparable to Option A.

Costs of Production on Potato-Vegetable Farms

Potatoes have historically been the second largest income farm commodity produced in Alaska, reaching a peak of 26 per cent of the value of all farm commodities, with total sales above one million dollars during 1964. During the mid-1950's, potato acreages totalled around 1,500. In recent years, acres harvested have ranged from 700 to 800. Marketings have ranged from 5,400 tons to 5,700 tons since 1960. Alaska potatoes have marketed as "fresh table stock," with occasional sales for livestock feed; the primary market has been the military contract market.

During the homesteading periods in most communities, potatoes were considered to be the fastest and easiest cash income enterprise to develop. Consequently, chaotic marketing conditions frequently occurred. More recently, potatoes have been raised by experienced and highly competent commercial farmers. Acreages are small by "stateside" standards, often ranging from 10 to 60 acres in the Matanuska Valley and infrequently to larger acreages in the Tanana Valley. Yields in the Tanana Valley tend to run about two tons per acre lower than those in the Matanuska Valley. (Yields in the Matanuska Valley are frequently 10 to 12 tons per acre, with occasional yields of 15 tons of number one's and two's.)

From time to time, concern has been expressed by potato producers in the Matanuska Valley regarding possible increased marketings and their competitive position in the overall Alaska potato market. During recent years, considerable interest has been expressed in possible development of potato processing facilities of some type within the state. Projected trends of increased processed potato marketings have stimulated much interest, and, at the same time, have caused considerable alarm. Increased interest in cost-of-production data was generated as a result of studies to determine the feasibility of some type of potato processing in Alaska.

Characteristics of Potato Production Firms in the Matanuska Valley

Surveys were carried out during the 1965 and 1966 production seasons to determine production costs, firm investments, and some general characteristics of firms producing potatoes or potatoes and vegetables. Group interviews and discussions were held to further pursue topics regarding possible production expansion. Survey schedules were completed for seven commercial potato farms which, in some instances, also produced

other vegetable crops. Four farm operators reported only potatoes. Three reported head lettuce, two reported cabbage and carrots, and one reported several other vegetable crops. A total of 58 acres of vegetables other than potatoes was reported, or 8.3 acres per farm.

Farm operators in the survey had lived in the community for an average of slightly over 21 years, approximately 20 years of which were on the farm, and 17 years in which they raised potatoes. The average owned acreage per farm operator was 217 acres, with an additional 24 acres being rented in and 16 acres being rented out. Average cropland reported was 58 acres, unused land 13 acres, and 146 acres woodland. Average cleared land per farm was approximately 60 acres. Average acreage of potatoes for the sample group during the 1966 cropping season was just over 35 acres and ranged from 17 acres to 60 acres, with an average reported yield of just over 11 tons per acre. Yields were generally reported as tons of saleable Grade one's and two's.

Cost of Production

Captial investment per farm was calculated from detailed inventory and investment data obtained from the farm operators. Acquisition costs and depreciated values were reviewed to determine present depreciated investment values.

Annual operating costs were obtained from farm records, and delivery costs of potatoes to fulfill contracts were estimated from past costs and 1966 crop yields. Return-to-capital was calculated at 5 per cent. Operator's labor was calculated at $2.50 per hour.

TABLE XXIV.

Costs of Producing Potatoes on Seven
Matanuska Valley Farms, 1966

Production Per Farm:	
Acres in farm	217
Acres potatoes	35
Acres other vegetables	8.3
Yield per acre (potatoes)—tons	11
Investment Per Farm:	
Land (cleared $250.000/acre, uncleared $70.00)	$ 25,990
Buildings[a] (including house and family garage @ $24,000)	51,171
Machinery and equipment	24,789
Annual operating capital	23,504
Total Investment	$125,454
Annual Operating Expense:	
Cash operating	$ 23,504
Depreciation	4,438
Total Annual Operating Expense	$ 27,942
Return to capital	$ 6,273
Operator's unpaid labor	$ 5,200
Full cost recovery for all resources used on potato-vegetable farms (other than management return)	$ 39,415
(Per acre costs)	$910.28
Full cost per cwt. of potatoes[b]	4.12

[a]Potato storage facilities were found on all farms surveyed, and made up a major portion of capital investment in buildings.

[b]Other vegetable costs were considered as being comparable per acre with potatoes regardless of difference in storage costs, length of time of planting to final sale and a number of other factors; therefore, costs per cwt. are estimated potato equivalents.

It is assumed that the full cost recovery is approximately the cost basis on which Alaska producers have been making decisions. However, if only costs and investment directly related to the potato-vegetable enterprise are considered, a somewhat lower figure will be derived.

TABLE XXV.

Enterprise Costs of Producing Potatoes on Seven Matanuska Valley Farms, 1966

Annual Operating Expense:	
Cash operating expense	$23,504
Depreciation	3,838+
Total Annual Operating	$27,342
Return to capital	3,523
Operator's unpaid labor	5,200
Total	$36,065
Per Acre Costs	$835.38
Full cost per cwt. (except management return)	$ 3.78

From discussions with potato producers and other interested professional agriculturalists, a consensus was reached that unit costs might drop as much as 12 per cent with expansion on present farm units. Other conclusions were that rent for potato land would go up and labor costs would increase, causing operators to substitute machinery for labor. Major problems of expansion might be availability of loan capital and potato storage.

Average price received, per hundredweight, by Alaska producers was reported to be $4.80 during the 1966 calendar year.

"The Kenai Peninsula and Kodiak Island, along with the other islands in the Southwest, were the homes of 94 per cent of the cattle and calves in Alaska on January 1, 1966."[9] Stock raising is the leading agricultural enterprise throughout the southwest region of the state, and it is the leading agricultural enterprise on the Kenai Peninsula at the present time. Island ranges provide year-long grazing in some instances, even though supplemental feed is generally recommended. Many other areas in the state provide ample seasonal grazing, but require prolonged periods of heavy winter feeding. Varying estimates have been made regarding range carrying capacity. The Bureau of Land Management, U.S. Department of the Interior, maximums for leases in the islands, exclusive of Chirikof Island, were estimated to be approximately 13,500 animal units. Estimates of ranchers in the area have been noticeably higher.[10] However, due to the very limited range management research regarding sustained carrying capacity, it is quite possible that future estimates by agency people may be much higher than at present.

Most of the islands are hilly or mountainous, with irregular coastlines, and are characterized by prominent headlands and sea cliffs, many narrow steep-walled bays, few suitable harbor areas, and extremely difficult waters for moving in supplies and moving out livestock. Other than Kodiak, most of the islands are treeless and are covered with grass and forbs. Most of the islands have a maritime climate, with temperature variations that fall within quite narrow limits, and considerable wind. Precipitation is abundant throughout the year. Winter precipitation tends to be rain or snow, and snow tends to persist at higher elevations well into the spring.[11]

[9]Alaska Crop and Livestock Reporting Service, *Alaska Agricultural Statistics—1965*, U.S. Department of Agriculture Statistical Reporting Service, cooperating with Alaska Division of Agriculture and Alaska Experiment Station.

[10]Bureau of Reclamation, *Livestock Industry in Alaska: Possibilities for An Integrated Livestock Industry on Kenai Peninsula, Kodiak and Adjoining Islands*, Juneau, Alaska: U.S. Department of the Interior, March, 1967, pp. 30-31.

[11]*Soil Survey and Vegetation, Northeastern Kodiak Island Area, Alaska*, U.S. Department of Agriculture Soil Conservation Service and U.S. Department of Interior Bureau of Land Management, in cooperation with Alaska Agricultural Experiment Station, Soil Survey Series 1956, No. 17, October, 1960.

Ranches throughout the Kenai Peninsula-Islands area are in varying stages of development. As herds have generally been built up through natural increase, they are of mixed ages and numbers of cows, heifers, calves, and steers. Steers up to four- and five-years-old were reported on ranches during the summer of 1966. Winter feed production has been very limited wherever year-round grazing could be practiced. Due to longer winters and heavy snow on most areas of the Kenai Peninsula, considerable emphasis has been placed on winter feed production and harvest. Leases throughout the islands tend to be stocked at much less than lease capacity, and at only fractional stocking with regard to rancher estimates of carrying capacity. Interest in expansion of cattle numbers continues.

Beef cattle numbers have increased almost every year since statistical data collection was initiated in 1953, reaching a total of 6,700 head by January, 1971. Beef cow numbers have increased annually since records started in 1954. Steer numbers have tended to remain stable in the last several years.

Considerable interest has been expressed by producers and agency people in possible efforts to establish central cooperative slaughter facilities that would be suitable for federal slaughter and meat inspection and of sufficient size to facilitate the establishment of marketing channels for Alaskan beef. Progress has been made in increasing slaughter capacity in the ranching areas, but an integrated cooperative livestock feeding, slaughter, and distribution system does not appear imminent.

The Bureau of Reclamation examined prospects for a project-type integrated livestock industry on the Kenai Peninsula during 1966-67 and concluded that prospects were marginal for growing, feeding, and slaughtering beef in the Kenai-Kodiak area. The underlying premise of the study was that an integrated cooperative project, particularly in the feeding and slaughter phases, was a necessary condition for growth of the industry. It was assumed that all feed would be grown in the Kenai-Soldotna area, and that all cattle would be produced on the Kenai Peninsula or in the Kodiak area, with an alternate feeder cattle source in Canada. Potential feeder cattle production in the Aleutian Islands did not appear to be considered in the study, even though feeder lambs from that area were considered.

Costs of Production

Data with regard to investments, costs, and incomes on ranches were sketchy and incomplete. Due to the nature and stages of ranch development, and the remote locations of many ranches, representative data of the present situation were not available. Saunders estimated feed and probable investment and cost data for the Kenai Peninsula in 1962 for a 100-cow unit. Annual costs were estimated at $23,055 and annual sales were estimated at $14,860.[12]

Several sizes and types of ranch organizations, for both Kodiak and adjacent islands and the Kenai Peninsula, were studied for the Bureau of Reclamation report:

> An economic-size ranching unit on Kodiak and adjacent islands is considered to be about 560 head, where a herd of 300 cows is kept and long yearlings sold . . . At a reasonable 85 per cent calf drop, 300 cows should drop 255 calves . . . Of course, the number of cows would vary considerably with the operation. Where calves were sold, a cow herd of 472 head would be necessary; with yearling sales, it would take 300 cows; with 2-year-olds, 226 cows; and with 3-year-olds, 193 cows.[13]

A ranch unit with a cow herd which sold two-year-olds appeared to be the most usual type of ranch operation presently found on Kodiak and the adjacent islands. Investment, costs, and revenues discussions will be focused on a unit of that type.

Capital requirements for the ranch operation, as projected by the Bureau of Reclamation, add up to some $202,436. Estimates. were based on new acquisition costs for buildings, machinery and equipment, clearing and original land preparation costs, and local prices for cattle and horses.

Table XXVI estimates that ranch income to be $1,960 less than a full return to all resources committed. However, interest on ranch capital is calculated on full acquisition value of all resources. Return to operators for

[12] A. Dale Saunders, *Producing Beef for Alaska's Railbelt, A Summary of Expected Costs and Possible Returns*, University of Alaska Agricultural Experiment Station, Palmer, Miscellaneous Mimeo., March, 1962.

[13] Bureau of Reclamation, *op. cit.*

TABLE XXVI.

Investments, Costs and Revenues for Cattle Ranches With Mixed Herds, Selling Two-Year-Olds*

	Estimated Value
Investment:	
Land (clearing costs @ $200 per acre)	$ 20,000
Buildings and improvements	56,114
Machinery and Equipment	17,572
Livestock (565 mixed cattle and 6 horses)	108,000
Total Capital Inventory	$201,686
Estimated Revenues:	
Steers (88-950 lbs. @ 22.5 cents)	$ 18,810
Heifers (51-870 lbs. @ 21 cents)	9,318
Cows (31-1,000 lbs. @ 16 cents)	4,960
Bulls (3-1,400 lbs. @ 18 cents)	756
Subtotal	$ 33,844
Value of ranch perquisite	3,600
Total Income	$ 37,444
Cash Operating Costs:	
Grazing Fees (565 head x 10 mo. x .05)	$ 282
Feed, Salt, and Minerals	2,425
Fertilizer	2,970
Seed	81
Hired Labor	6,000
Fuel, Oil, Grease	1,012
Insurance	500
Veterinary and Vaccine, etc.	500
Repairs	2,282
Taxes (total ranch investment @ 10 mills)	2,024
Interest on operating capital	450
Miscellaneous ranch business expense	750
Total Cash Costs	$ 19,276
Depreciation	3,635
Interest on ranch capital ($201,686 @ 5 per cent)	10,084.30
Wages and management fee allowed operator	6,372
Total Annual Costs	$39,367.30

*Budget data drawn from Bureau of Reclamation Report, assuming cattle sold on Kodiak Island so excluded barge and truck expense to Soldotna.

living costs and other expenditures would be $14,533. Cattle sales are assumed to be made at Kodiak as slaughter facilities are available there to handle available beef at present.

Prices received by Alaska producers in the beef-raising areas were reported to be 44.2 cents per pound and 41 cents per pound dressed weight when all reporting areas are considered. Price differential can be explained by dairy beef slaughter in other farming areas.

CHAPTER V.

POTENTIAL FOR AGRICULTURAL DEVELOPMENT

Any assessment of potential for agricultural development in Alaska entails broad areas of conjecture because of the very limited agriculture development and wide diversity of opinion regarding the scope and direction of possible future potential development. The situation is further complicated by the paucity of information and technology particularly suited to the climatic, social, and political environment existing at this time. (Resources committed to the generation of information and technology directed to new and different crops, or new and different production systems for presently grown crops are practically nil.) Thus, it behooves one to review certain resource availability, and then estimate possible or probable development potentials in some manner, predicated on predictions or projections of future events with regard to population, industrial growth, and general economic development. It is also necessary to include predictions or projections regarding new information, technological transition, new and different production systems and market infrastructures, and future resource inputs.

Recent appraisals of potential for agricultural development have included consideration of present national posture on environmental pollution through pesticides, nitrates and phosphates in water sources, agricultural wastes, noise, odors, and numerous other pollutants from the present agricultural industry. It appears that public regulation, costs of pollution abatement, and competition for particular land resources may well cause major changes in the nature and location of various facets of present-day stateside agriculture, and consequent changes in production technology, costs, and product availability. Such changes have been considered in the assessments made regarding future potential for Alaska agriculture.

Land Suitable For Farming

Alaska's great size has caused many misimpressions with regard to economic agricultural lands, availability of usable water, and areas of usable

grazing lands. With present crops and technology, only a small part of Alaska, less than 1 per cent of the land area, is suitable for commercial farming. An additional 2 per cent is considered suitable for grazing by sheep or cattle. Most of the presently accessible potential farmland is concentrated in three major areas: (1) the central Tanana Valley of Interior Alaska, (2) the Matanuska-Susitna Valley of Southcentral Alaska, and (3) the western Kenai-Lowland area of Southcentral Alaska. Smaller areas in other locations may be suitable, but they are inaccessible and their production potential is relatively unknown. The main grazing areas, exclusive of reindeer, are northeastern Kodiak Island, islands adjacent to Kodiak and along the Aleutian chain, and the southern part of the Kenai Peninsula.

Standard soil surveys have been completed or are in process of completion for all areas shown in Figure 4. Surveys are expected to continue until a soils map suitable for long-range general planning for the whole state is completed. Remote area surveys have been completed in 24 locations and are planned for about ten additional locations. Each remote area survey consists of a 15- to 25-square-mile sample area. These sample surveys will provide the basis for a reconnaissance survey of the entire state. In the soil surveys, soils are identified and named, and areas characterized by each soil are shown on aerial photographs. In addition, each soil is further classified according to its agricultural value and is assigned to one of six capability classes. (Classes I and V are not used in Alaska.) Soils in Classes II and III have limitations, which reduce the choice of crops or require special conservation practices, but are suitable for most crops commonly grown in Alaska. Soils in Class IV have severe limitations (steepness, shallowness, or wetness) for cropping. Soils in Classes VI and VII are suitable primarily for pasture, range, or woodland. Soils in Class VIII cannot be used for commercial plant production.

Acreages assigned to each of the land capability classes in each of the survey areas are given in Table XXVII, and total acreage summaries of Classes II, III, and IV are given in Table XXVIII. Major soil associations, each of which is made up of a characteristic pattern of a few major soils and several minor soils, are shown for the major farming areas in Figures 5, 6, and 7. Table XXIX gives the approximate proportion of soils, by land capability, in each of these associations.

Other areas of potential farmland in Alaska include the Kenny Lake region (south of Copper Center), portions of the Chitna Valley, and narrow

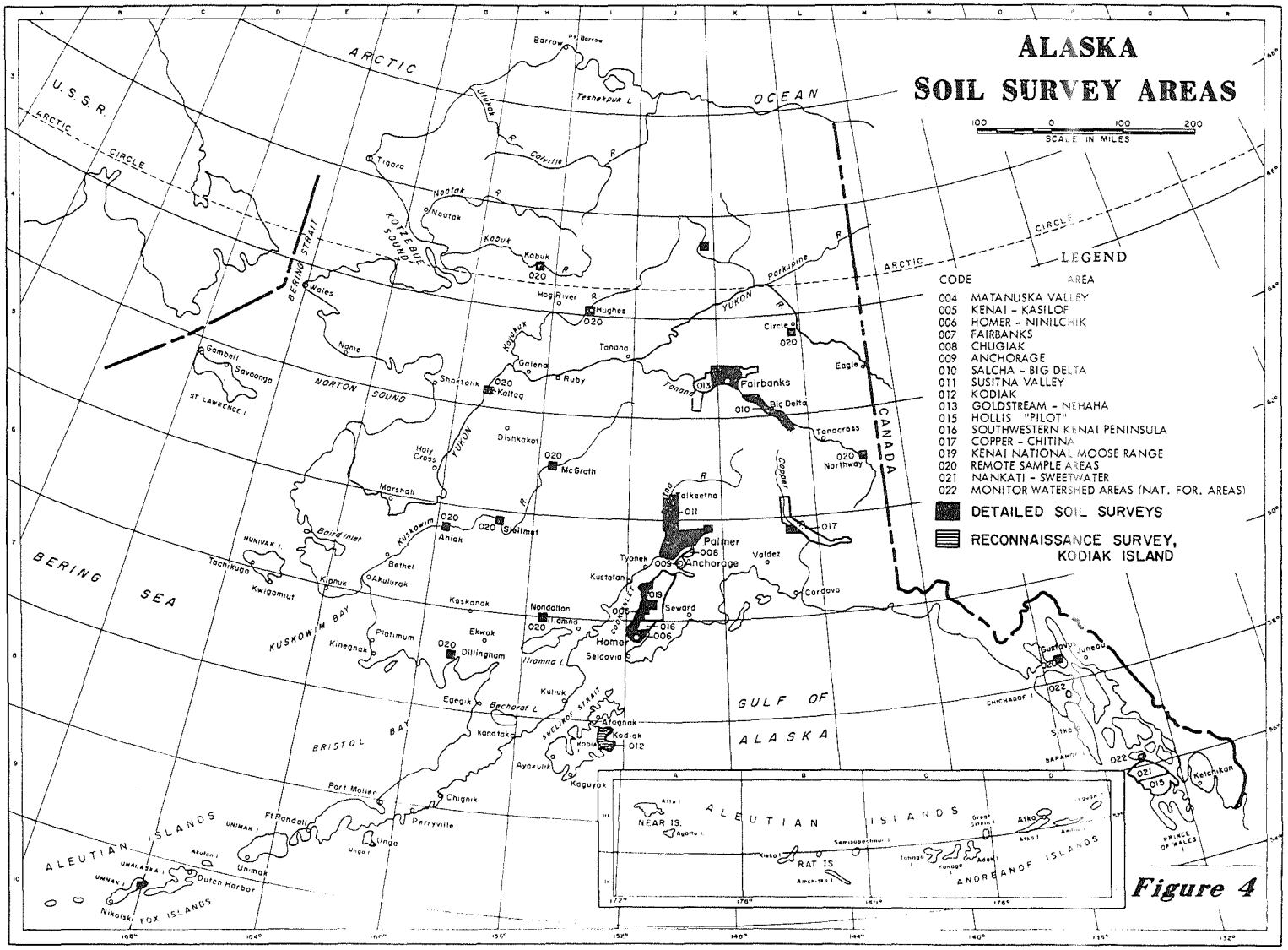

ALASKA
SOIL SURVEY AREAS
SCALE IN MILES
100 0 100 200
LEGEND
CODE AREA
004 MATANUSKA VALLEY
005 KENAI - KASILOF
006 HOMER - NINILCHIK
007 FAIRBANKS
008 CHUGIAK
009 ANCHORAGE
010 SALCHA - BIG DELTA
011 SUSITNA VALLEY
012 KODIAK
013 GOLDSTREAM - NEHAHA
015 HOLLIS "PILOT"
016 SOUTHWESTERN KENAI PENINSULA
017 COPPER - CHITINA
019 KENAI NATIONAL MOOSE RANGE
020 REMOTE SAMPLE AREAS
021 NANKATI - SWEETWATER
022 MONITOR WATERSHED AREAS (NAT. FOR. AREAS)
DETAILED SOIL SURVEYS
RECONNAISSANCE SURVEY, KODIAK ISLAND
ARCTIC OCEAN
U.S.S.R.
ARCTIC CIRCLE
BERING STRAIT
KOTZEBUE SOUND
NORTON SOUND
BERING SEA
KUSKOKWIM BAY
BRISTOL BAY
GULF OF ALASKA
ALEUTIAN ISLANDS
CANADA
YUKON R.
Barrow
Wales
Hughes
Circle
Fairbanks
Big Delta
Eagle
Tanacross
Northway
McGrath
Aniak
Bethel
Palmer
Anchorage
Valdez
Cordova
Seward
Homer
Seldovia
Kodiak
Dillingham
Dutch Harbor
Juneau
Ketchikan
Sitka
NEAR IS.
RAT IS
ANDREANOF ISLANDS
PRINCE OF WALES I.

Figure 4

TABLE XXVII.

Extent, in Acres, of Capability Classes and Subclasses in Standard Soil Survey Areas

Class and Subclass	Soil Survey Area (Standard Surveys)					
	Kenai-Kasilof	Homer-Ninilchik	Matanuska Valley	Susitna Valley	NE Kodiak Island	Fairbanks
IIc	55,643	18,880	20,420	125,630		44,196
IIe	20,435	20,230	11,860	51,270		18,170
IIs						13,352
IIw		4,040		16,120		
II (total)	76,078	43,150	32,280	193,020		75,713
IIIc					859	
IIIe	23,145	39,210	49,080	35,060	2,253	13,915
IIIs	3,530	1,200	40,060	63,060		2,646
IIIw	17,910	7,830	3,520	2,670	5,072	16,525
III (total)	44,585	48,240	92,660	101,590	8,189	33,086
IVe	19,055	32,230	16,570	21,740	2,027	14,602
IVs	5,876		56,710	5,130	10,103	1,646
IVw	6,462	27,520	13,280	27,090		54,350
IV (total)	31,393	59,750	86,560	53,960	12,130	70,598
VIc		1,210				
VIe	11,638	19,810	12,060	23,900	68,075	8,926
VIs			26,200	1,100	1,685	1,225
VIw	3,625	4,850	47,790	33,860	2,521	1,745
VI (total)	15,263	24,870	86,050	58,950	72,281	11,896
VIIe	4,897	19,850	24,290	5,630	86,711	10,529
VIIs	3,092	3,600	17,430	7,020		
VIIw	46,166	53,180	92,240	271,520	5,703	10,859
VII (total)	54,155	76,630	133,960	284,170	92,414	21,388
VIIIs	808	7,320	5,600	800	119,528	2,429
VIIIw	15,707	10,540	11,880	9,010	2,665	1,356
VIII (total)	16,515	17,860	17,480	9,810	122,193	3,785

TABLE XXVII. (Continued)

Extent, in Acres, of Capability Classes and Subclasses in Standard Soil Survey Areas

Class and Subclass	Soil Survey Area (Standard Surveys)					
	Salcha-Big Delta	Copper-Chitna[2]	Goldstream-Nenana[2]	Kenai Moose Range[1]	SW Kenai Peninsula[1]	Total Survey Areas
IIc	39,160		3,000			
IIe	13,730		12,700			
IIs	8,490		2,000			
IIw						
II (total)	61,380		17,700	107,500	54,000	660,826
IIIc						
IIIe	36,110		11,400			
IIIs	62,550		1,500			
IIIw	25,470		2,500			
III (total)	124,130	60,000	15,400	101,900	52,000	681,780
IVe	17,860		16,000			
IVs	11,630		6,000			
IVw	49,480		9,000			
IV (total)	78,970	40,000	31,000	255,900	130,000	850,261
VIc						
VIe	12,480		34,000			
VIs	380		1,000			
VIw	1,890		3,000			
VI (total)	14,750	30,000	38,000	194,100	110,000	656,160
VIIe	15,330		25,000			
VIIs						
VIIw	10,460		18,000			
VII (total)	25,790	36,000	43,000	380,300	190,000	1,337,807
VIIIs	110		5,000			
VIIIw	3,830		3,800			
VIII (total)	3,940	2,000	8,800	5,800	13,000	221,183
						4,408,017

[1]Estimates of acreages.

[2]Estimates of acreages in portions of area covered by soil surveys.

TABLE XXVIII.

Summary in Acres of Capability Class
of Land Suitable for Cultivation

Class	Standard Survey	Other Areas[a]	Total
II	580,000	100,000	680,000
III	700,000	200,000	900,000
IV	890,000	150,000	1,040,000
Totals	2,170,000	450,000	2,620,000

[a]Conservatively estimated.

SOURCE: Tables were developed with cooperation of the Alaska Soil Conservation Service, U.S. Department of Agriculture, Palmer.

strips of land bordering the Kuskokwim, Yukon, and other major rivers of Interior Alaska.[1]

Land Suitable for Livestock Grazing

The figures shown in Table XXX as estimated acreages include potential range areas from the standpoint of suitable vegetation for livestock. Much of the land included might be difficult to use because of the topography and location of the grazing areas. Some areas may have conflicting uses because of current populations of wildlife. Most range areas have an abundance of summer feed; however, range capacity is usually governed by available winter feed, and most areas are currently deficient in winter feed. Most ranch operations in the Aleutian and adjacent islands, and the islands near Kodiak, depend on year-round grazing with little supplemental feeding. All of the mainland range areas require extensive winter feeding.

Reindeer range is generally located along the western coast of Alaska; however, reindeer herds have been kept on several of the islands and at one

[1]Above discussion was developed with cooperation of the Alaska Soil Conservation Service, U.S. Department of Agriculture, Palmer.

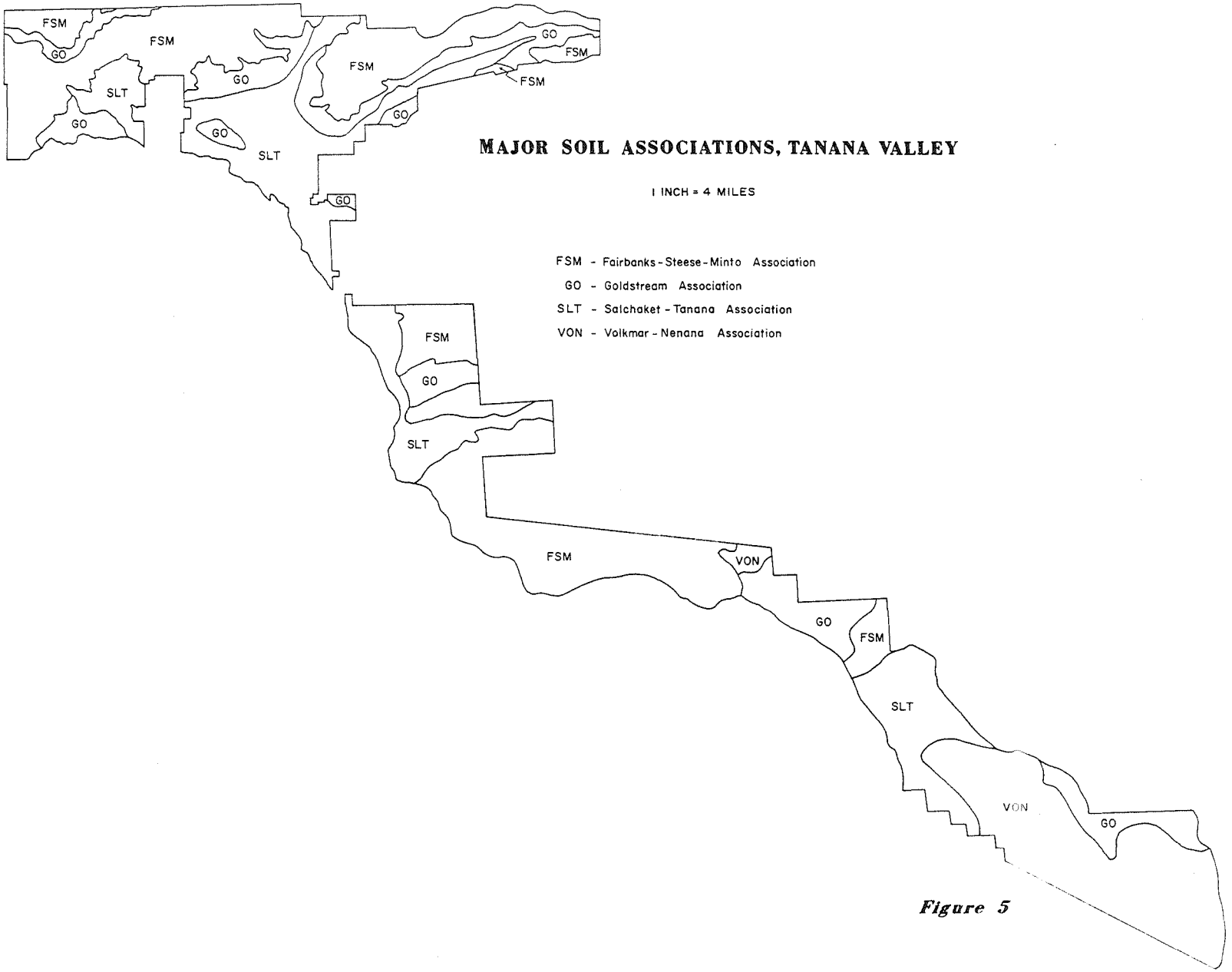
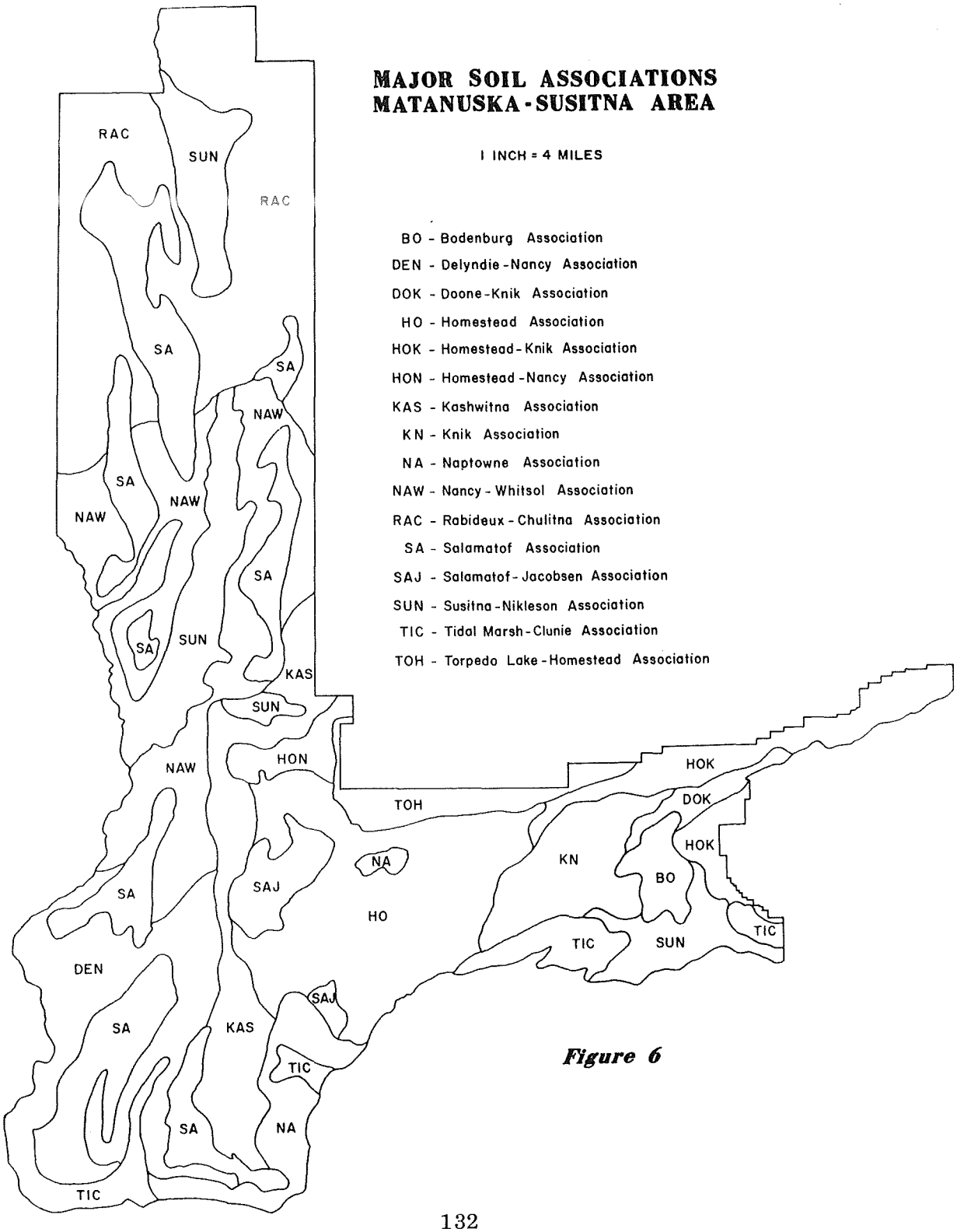

MAJOR SOIL ASSOCIATIONS, TANANA VALLEY
1 INCH = 4 MILES
FSM - Fairbanks - Steese - Minto Association
GO - Goldstream Association
SLT - Salchaket - Tanana Association
VON - Volkmar - Nenana Association
FSM
GO
SLT
VON

Figure 5


MAJOR SOIL ASSOCIATIONS
MATANUSKA-SUSITNA AREA
1 INCH = 4 MILES
BO - Bodenburg Association
DEN - Delyndie-Nancy Association
DOK - Doone-Knik Association
HO - Homestead Association
HOK - Homestead-Knik Association
HON - Homestead-Nancy Association
KAS - Kashwitna Association
KN - Knik Association
NA - Naptowne Association
NAW - Nancy-Whitsol Association
RAC - Rabideux-Chulitna Association
SA - Salamatof Association
SAJ - Salamatof-Jacobsen Association
SUN - Susitna-Nikleson Association
TIC - Tidal Marsh-Clunie Association
TOH - Torpedo Lake-Homestead Association
RAC
SUN
RAC
SA
SA
NAW
SA
NAW
NAW
SA
SUN
SA
KAS
SUN
NAW
HON
HOK
TOH
DOK
HOK
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BO
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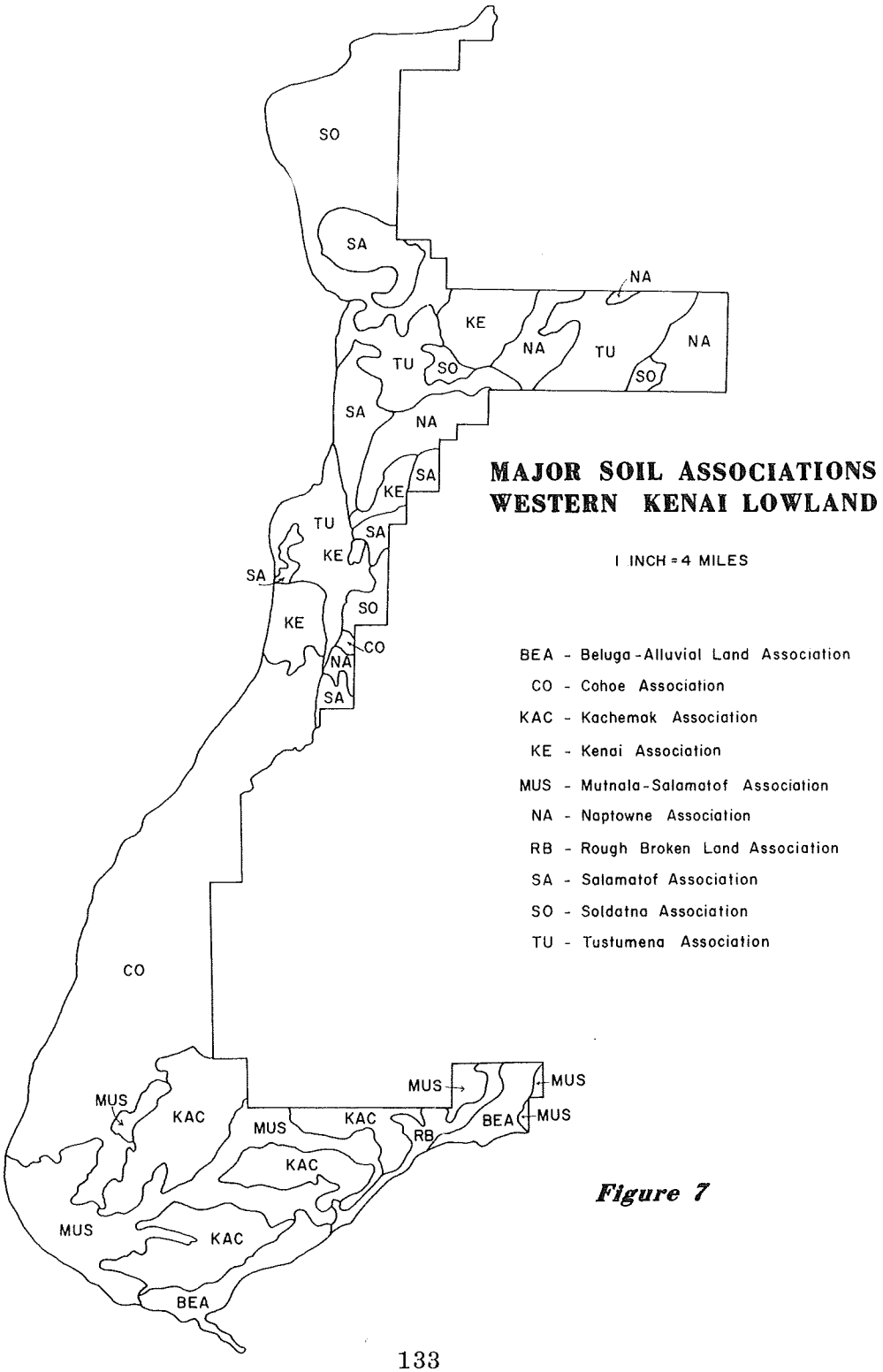
TIC

Figure 6


SO
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CO
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KAC
MUS
KAC
MUS
MUS
BEA
MUS
RB
KAC
MUS
KAC
BEA
MAJOR SOIL ASSOCIATIONS
WESTERN KENAI LOWLAND
1 INCH = 4 MILES
BEA - Beluga-Alluvial Land Association
CO - Cohoe Association
KAC - Kachemak Association
KE - Kenai Association
MUS - Mutnala-Salamatof Association
NA - Naptowne Association
RB - Rough Broken Land Association
SA - Salamatof Association
SO - Soldatna Association
TU - Tustumena Association

Figure 7

TABLE XXIX.

Approximate Proportionate Extent, By Land Classes, of Soils in Major Soil Associations

Map Symbol	Major Soil Associations[a]	Land Classes II %	III %	IV %	VI %	VII %	VIII %
	Tanana Valley Area						
FSM	Fairbanks-Steese-Minto Assn.	10	15	20	25	30	
GO	Goldstream Assn.	5	10	75		10	
SLT	Salchaket-Tanana Assn.	40	20	25		10	5
VON	Volkmar-Nenana Assn.	5	75	10	5	5	
	Matanuska-Susitna Area						
BO	Bodenburg Assn.	50	30	10	5	5	
DEN	Delyndia-Nancy Assn.	20	50	5	5	20	
DOK	Doone-Knik Assn.	30	30	15	10	15	
HO	Homestead Assn.	5	25	25	25	20	
HOK	Homestead-Knik Assn.		20	25	25	30	
HON	Homestead-Nancy Assn.	10	30	25	20	15	
KAS	Kashwitna Assn.	5	60	15	5	20	
KN	Knik Assn.		60	20	10	10	
NA	Naptowne Assn.	15	20	30	20	15	
NAW	Nancy-Whitsol Assn.	40	35	10	10	5	
RAC	Rabideux-Chulitna Assn.	10	45	25	5	15	
SA	Salmatof Assn.		10	10	5	75	

TABLE XXIX. (Continued)

Approximate Proportionate Extent, By Land Classes, of Soils in Major Soil Associations

Map Symbol	Major Soil Associations[a]	Land Classes II %	III %	IV %	VI %	VII %	VIII %
SAJ	Salmatof-Jacobsen Assn.		10	10	5	75	
SUN	Susitna-Niklason Assn.	50	25	5	5	5	10
TIC	Tidal Marsh-Clunie Assn.		5		50	25	20
TON	Torpedo Lake-Homestead Assn.		10	20	50	20	
	Western Kenai Lowland Area						
BEA	Beluga-Alluvial Land Assn.	5	5	5	10	5	70
CO	Cohoe Assn.	40	15	10	5	30	
KAC	Kachemak Assn.		35	15	15	35	
KE	Kenai Assn.	5	40	20	20	15	
MUS	Mutnala-Salamatof Assn.		20	25	20	35	
NA	Naptowne Assn.	15	20	30	20	15	
RB	Rough Broken Land Assn.				5	5	90
SA	Salamatof Assn.		10	10	5	75	
SO	Soldotna Assn.	45	20	15	10	10	
TU	Tustumena Assn.	40	20	20	5	15	

[a]Descriptions in Appendix A.

SOURCE: Alaska Soil Conservation Service, U.S.D.A., Palmer.

TABLE XXX.

Summary of Range Areas
Suitable for Livestock Grazing

Location	Estimated Acreage
Domestic Livestock	
Aleutian and adjacent islands	1,5000,000[a]
Alaska Peninsula	3,000,000[a]
Kodiak Island	250,000[a]
Nearby Kodiak Islands	225,000[a]
Matanuska-Susitna Valley	350,000
Copper River Valley	100,000
Kenai Peninsula	150,000
Interior	5,000,000[b]
Total	10,575,000
Reindeer	
Western Coastal Alaska	30,000,000

[a]Grazing periods of more than 9 months per year.

[b]Much of Interior Alaska may produce suitable range forage. The estimate is held to the acreage reasonably accessible by road or rail.

SOURCE: H.S. Cooper, "Inventory of Natural Resources," paper prepared for the Alaska Agricultural Task Force, Mimeograph, 1966.

time were kept in large areas of the Interior. Carrying capacities are usually determined by the availability of lichens, the preferred winter feed of reindeer.

Water Suitable for Agricultural Purposes

The general abundance of water in Alaska may be somewhat misleading. The quantity and quality of available water are subject to considerable variation. Groundwater conditions are highly variable, and surface water may be seasonally unavailable for agricultural use. Availability of ground water over much of Interior, western, and northern Alaska, and along the Alaska Range, may generally be associated with the occurrence of permafrost.

Recent experience with limited irrigation tests and a few small farm sprinkler systems has brought forth considerable interest in possibilities of irrigation in a number of areas. Many of the known farming areas of the state are subject to dry periods in the early summer. Irrigation at planting time may be quite critical to vegetable crops, and continued irrigation may be quite important in the Tanana Valley during summer droughts. Limited research in the Matanuska Valley indicates beneficial results from irrigation on some field crops during particularly dry periods. The very limited research and experience, however, indicate that responses vary widely with microclimate locations.

Surface Water. "Despite an abundance of water generally, there are periods each year when surface waters may not be available. The time and causes for temporary shortages vary with location."[2] Heavy runoff and glacial sediment in many streams determine availability of suitable irrigation water. Other than in glacial streams, surface waters in the state are generally of good quality and usually meet irrigation standards, Cooper reported that waters were generally of the calcium-magnesium type with low concentrations of chlorides. However, a few streams on the Kenai Peninsula and in the Tanana Valley carry significant quantities of iron.

Groundwater. Groundwater conditions are highly variable, both in quantity and in quality throughout the state. Moderate to large supplies of groundwater can be found in the Palmer area for irrigation use, but, even in the Palmer area, considerable variation is reported. Groundwater is used for irrigation in the Tanana Valley also. Much of the Interior, western, and northern Alaska areas are troubled with permafrost. However, in any given area, permafrost may be absent in the immediate vicinity of lakes and streams or where the ground has thawed to some depth because of the removal of the insulating ground cover.

> On the Arctic Slope, even potentially permeable materials in the overburden and the bedrock are generally frozen to great depth in most places, and there is a likelihood that the unfrozen bedrock strata below will be found to contain saline water in many, if not most, areas.[3]

[2]H. S. Cooper, State Conservationist, S.C.S., U.S.D.A., Mimeo Report, *Inventory of Natural Resources*, prepared for Agricultural Task Force, Federal Field Committee for Economic Development Planning in Alaska, 1966.

[3]*Ibid.*

Iron is the most troublesome chemical in groundwater supplies. It is often quite objectionable for domestic and industrial use, but generally does not hinder water's use for irrigation. Most developed groundwater supplies in the Homer, Kenai, and Fairbanks areas have iron and manganese present. Shallow wells in the Anchorage area have a high iron content. The central part of the Copper River Basin is troubled with groundwater of a high salinity content. Coastal communities such as Barrow, Craig, Homer, Kenai, Kotzebue, and Nome have been troubled with the same salinity problem.

Low water temperature, both from wells and streams, can be a serious problem for irrigating most crops. Alaska streams are often cold enough to "shock" plants when the water is used for irrigation in the spring and early summer. Groundwater temperature is less of a problem.

Present and Potential Yield Capabilities

A second factor in determining potential for agricultural development is that of determining crop production potential, or yield capabilities, of various land classes by geographic region. Comprehensive yield data were assembled for those crops and regions where available. Additional yield data were obtained from Alaska Crop and Livestock Reporting Service annual reports. Consensus estimates for other crops and regions were obtained in a joint meeting of agricultural agency personnel, and other knowledgeable persons, during the summer of 1967. The resulting yield potential estimates for different crops are reported in tables XXXI, XXXII, XXXIII, and XXXIV for the four farming areas in the state, as identified in this study.

Estimated yields are not necessarily comparable to "average" yields being obtained by all producers at this time. First, emphasis was placed on "potential yields," and second, some yield changes have come about in the interim. Yield estimates were developed for two levels of management. Estimates under Management Level I were based on estimates of current "very good" management. Yields under Management Level II were estimated using the assumption that adaptations of latest information, technology, and institutional services would be incorporated into the production process. Estimates for Crop Reporting District No. 2 are undoubtedly more precise than for other districts, because of the concentration of research and other institutional services in that district.

TABLE XXXI.

Estimated Yield Potential by Land Capability Class for Two Levels of Management: Tanana Valley Area of Alaska, 1967. (Crop Reporting District No. 1)*

Land Class	Barley		Oats		Perennial Forage[b]		Barley (High Moisture)	
	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]
	(tons/a)		(tons/a)		(tons/a—dry)		(tons/a—dry)	
IIc	.85-1.0	1.3-1.35	.95-1.0	1.4-1.6	2-3	3-4	1.9-2.0	
IIe	.85-1.0	1.3-1.35	.95-1.0	1.4-1.6	2-3	3-4	1.9-2.0	
IIs	.85-1.0	1.3-1.35	.95-1.0	1.4-1.6	2-3	3-4	1.9-2.0	
IIIe	.75-.90	1.15-1.25	.85-.95	1.4-1.6	2-2.5	3-3.5	1.6-1.7	
IIIs	.75-.90	1.15-1.25	.80-.85	1.4-1.5	2-2.3	2.5-3.0	1.6-1.7	
IIIw					2-2.5	2.5-3.0		
IVe	.65-.80	1.0-1.1	.75-.85	1.2-1.3	1.5-2	2.0-2.5	1.4-1.5	
IVs	.55-.65	.75-.85	.65-.80	.80-1.2	.7-1.5	2.0-2.5	1.0-1.1	
IVw					.7-1.5	2.0-2.5		
VI								
VII								
VIII								

TABLE XXXI. (Continued)

Estimated Yield Potential By Land Capability Class for Two Levels of Management: Tanana Valley Area of Alaska, 1967. (Crop Reporting District No. 1)*

Land Class	Oat-Pea Forage		Rye Grass Forage		Potatoes-Fresh		Potatoes-Processed	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a—dry)		(tons/a—dry)		(tons/a)		(tons/a)	
IIc	1-2	3.2-4.0		3.2-4.0	10.5	17.0	8.75	14.0
IIe	1-2	3.2-4.0		3.2-4.0	10.5	17.0	8.75	14.0
IIs	1-2	3.2-4.0		3.2-4.0	10.5	17.0	8.75	14.0
IIIe	1-2	3.2-4.0		3.2-4.0	6.3	9.0	5.5	8.5
IIIs	.7-1.5	2.5-3.5		2.5-3.5	5.5	6.0	3.5	4.5
IIIw	.7-1.5	2.5-3.5		2.5-3.5	3.5	3.5	2.25	2.25
IVe	.7-1.5	2.0-3.0		2.0-3.0				
IVs	.5-1.0	1.5-2.5		1.5-2.5				
IVw								
VI								
VII								
VIII								

TABLE XXXI. (Continued)

Estimated Yield Potential by Land Capability Class for Two Levels of Management: Tanana Valley Area of Alaska, 1967. (Crop Reporting District No. 1)*

Land Class	Carrots		Lettuce		Cabbage-Fresh		Cabbage-Processed	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a)		(tons/a)		(tons/a)		(tons/a)	
IIc	8.0	13.5	11.0	15.5	17.0	25.5	21.25	34.0
IIe	6.75	12.5	8.5	10.75	17.0	21.25	19.0	25.5
IIs	6.75	12.5	8.5	15.5	17.0	21.25	19.0	25.5
IIIe			6.25	7.5	15.5	18.0	15.5	18.0
IIIs			2.25	4.25	10.75	14.75	10.75	14.0
IIIw								
IVe								
IVs								
IVw								
VI								
VII								
VIII								

TABLE XXXI. (Continued)

Estimated Yield Potential by Land Capability Class for Two Levels of Management: Tanana Valley Area of Alaska, 1967. (Crop Reporting District No. 1)*

Land Class	Green Peas—Processed		Spinach		Summer Squash		Rhubarb	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a)		(tons/a)		(tons/a)		(tons/a)	
IIc	1.6	2.4	5.0	7.0	11.0	22.0	21.25	29.75
IIe	1.6	2.4	4.0	6.0	11.0	22.0	17.0	25.5
IIs	1.6	2.4			11.0	22.0	17.0	25.5
IIIe	1.4	1.6			10.0	16.5	19.0	25.5
IIIs	1.0	1.2			10.0	16.5	6.5	12.75
IIIw							4.25	8.5
IVe	.80	1.2			8.25	13.75	4.25	8.5
IVs							2.1	4.25
IVw							4.25	8.5
VI[c]								

*Yield estimates were developed through a cooperative effort of the Alaska State Conservationist, S.C.S., an Economic Research Service representative, and the author cooperating with A.A.E.S. scientists, S.C.S. scientists, and other agency agriculturists.

[a]Management Level I is comparable to current levels of attainment while Management Level II assumes utilization of currently available technology and cultural practices.

[b]Yield estimates for forage crops are stated on a dry matter basis and can be converted as follows: Hay - DM x 1.22, Silage - DM x 4.0, and haylage - DM x 2.0

[c]Since there was no response to Land Classes VI, VII, and VIII, they have been deleted from this table.

TABLE XXXII.

Estimated Yield Potential by Land Capability Class
For Two Levels of Management: Matanuska-Sustina Area
of Alaska, 1967. (Crop Reporting District No. 2)*

Land Class	Barley		Oats		Perennial Forage[b]		Barley (High Moisture)	
	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]
	(tons/a)		(tons/a)		(tons/a—dry)		(tons/a—dry)	
IIc	.95-1.1	1.45-1.50	1.05-1.1	1.45-1.6	2-3	3.5-4.5		1.8-2.0
IIe	.95-1.1	1.45-1.50	1.05-1.1	1.45-1.6	2-3	3.5-4.5		1.8-2.0
	(No Class IIs land in the area)							
IIIe	.85-.95	1.3-1.4	.95-1.05	1.4-1.6	2.0-2.5	3.5-4.0		1.6-1.7
IIIs	.85-.95	1.3-1.4	.90-.95	1.3-1.5	2.0-2.3	3.0-3.3		1.6-1.7
IIIw					2.0-2.5	3.0-3.5		
IVe	.70-.85	1.0-1.1	.85-.95	1.2-1.3	1.5-2.0	2.5-3.0		1.4-1.5
IVs	.60-.70	.80-.90	.70-.85	.80-1.0	.7-1.5	2.5-3.0		1.0-1.1
IVw					.7-1.5	2.5-3.0		
VI								
VII								
VIII								

TABLE XXXII. (Continued)

Estimated Yield Potential by Land Capability Class
For Two Levels of Management: Matanuaka-Susitna Area
Of Alaska, 1967. (Crop Reporting District No. 2)*

Land Class	Oat-Pea Forage		Rye Grass Forage		Potatoes-Fresh		Potatoes-Process	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a—dry)		(tons/a—dry)		(tons/a)		(tons/a)	
IIc	1-2	4-5		4-5	15	24	12.5	20.0
IIe	1-2	4-5		4-5	15	24	12.5	20.0
IIs								
IIIe	1-2	4-5		4-5	9	13	8.0	12.0
IIIs	.7-1.5	3-4		3-4	7.5	8.5	5.0	6.5
IIIw	.7-1.5	3-4		3-4	5.0	5.0	3.0	3.0
IVe	.7-1.5	2.5-3.5		2.5-3.5				
IVs	.5-1.0	2.0-3		2-3				
IVw								
VI								
VII								
VIII								

TABLE XXXII. (Continued)

Estimated Yield Potential by Land Capability Class
For Two Levels of Management: Matanuska-Susitna Area
Of Alaska, 1967. (Crop Reporting District No. 2)*

Land Class	Carrots		Lettuce		Cabbage-Fresh		Cabbage-Process	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a)		(tons/a)		(tons/a)		(tons/a)	
IIc	9.0	15.0	13.5	18.0	20.0	30.0	25.0	40.0
IIe	7.5	14.0	10.0	12.5	20.0	30.0	22.5	30.0
IIs								
IIIe			7.5	8.75	18.0	21.0	18.0	21.0
IIIs			2.5	5.0	12.5	16.5	12.5	16.5
IIIw								
IVe								
IVs								
IVw								
VI								
VII								
VIII								

TABLE XXXII. (Continued)

Estimated Yield Potential by Land Capability Class
For Two Levels of Managment: Matanuska-Susitna Area
Of Alaska, 1967. (Crop Reporting District No. 2)*

Land Class	Green Peas-Process		Spinach		Summer Squash		Rhubarb	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a)		(tons/a)		(tons/a)		(tons/a)	
IIc	2.0	3.0	5.0	7.0	10	20	25.0	35.0
IIe	2.0	3.0	4.0	6.0	10	20	20.0	30.0
IIs								
IIIe	1.75	2.0			9	15	22.5	30.0
IIIs	1.25	1.5			9	15	7.5	15.0
IIIw							5.0	10.0
IVe	1.0	1.5			7.5	12.5	5.0	10.0
IVs							2.5	5.0
IVw							5.0	10.0
VI[c]								

*Yield estimates were developed through a cooperative effort of the Alaska State Conservationist, S.C.S., an Economic Research Service representative, and the author cooperating with A.A.E.S. scientists, S.C.S. scientists, and other agency agriculturists.

[a]Management Level I is comparable to current levels of attainment while Management Level II assumes utilization of currently available technology and cultural practices.

[b]Yield estimates for forage crops are stated on a dry matter basis and can be converted as follows: Hay - DM x 1.22, Silage - DM x 4.0, and Haylage - DM x 2.0.

[c]Since there was no response to Land Classes VI, VII, and VIII, they have been deleted from this table.

TABLE XXXIII.

Estimated Yield Potential By Land Capability Class For Two Levels of Management: Western Kenai Lowlands, Alaska, 1967. (Crop Reporting District No. 3)*

Land Class	Barley (High Moisture)		Oat Forage		Timothy Forage		Oat-Pea Forage	
	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]
	(tons/a)		(tons/a—dry)		(tons/a—dry)		(tons/a—dry)	
IIc	.75	1.5	.5-1.5	2-3	1-2	2-4		4-6
IIe	.75	1.5	.5-1.5	2-3	1-2	2-4		4-6
				(No IIs in this area)				
IIIe	.75	1.5	.5-1.5	2-3	1-2	2-4		4-6
IIIs	.75	1.5	.5-1.5	2-3	.75-1.5	1.5-3.0		3-5
IIIw	.5	1.0				1.5-3.0		3-5
IVe	.75	1.5	.5-1.0	1.5-2.5	.75-1.5	2.0-3.0		2.5-3.5
IVs					.5-1.0	1.0-2.0		2.0-3.0
IVw	.50	1.0						
VI								
VII								
VIII								

TABLE XXXIII. (Continued)

Estimated Yield Potential By Land Capability Class
For Two Levels of Management: Western Kenai Lowlands,
Alaska, 1967. (Crop Reporting District No. 3)*

Land Class	Grass Forage		Potatoes—Fresh		Native Potatoes—Processing		Lettuce	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a—dry)		(tons/a)		(tons/a)		(tons/a)	
IIc	.75-1.5	1.5-2.5	7.5	15.0	5.5	12.5	13.5	18.0
IIe	.75-1.5	1.4-2.5	7.5	15.0	5.5	12.5	10.0	12.5
			(No IIs in this area)					
IIIe	.75-1.5	1.5-2.5	10.0	12.5	7.5	9.0		
IIIs	.75-1.5	1.5-2.5	10.0	11.5	7.5	9.0		
IIIw								
IVe	.75-1.5	1.5-2.5						
IVs	.75-1.5	1.5-2.5						
IVw								
VI								
VII								
VIII								

TABLE XXXIII. (Continued)

Estimated Yield Potential By Land Capability Class
For Two Levels of Management: Western Kenai Lowlands,
Alaska, 1967. (Crop Reporting District No. 3)*

Land Class	Carrots		Cabbage—Fresh		Cabbage—Processing		Green Peas—Processing	
	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II	Mgt. I	Mgt. II
	(tons/a)		(tons/a)		(tons/a)		(tons/a)	
IIc	5.0	10.0	20.0	30.0	25	40	1.0	2.5
IIe	3.75	9.0	20.0	25.0	22.5	30	1.0	2.5
			(No IIs in this area)					
IIIe			18.0	21.0	18.0	21.0	.75	1.0
IIIs			12.5	16.5	12.5	16.5		
IIIw								
IVe								
IVs								
IVw								
VI								
VII								
VIII								

*Yield estimates were developed through a cooperative effort of the Alaska State Conservationist, S.C.S., an Economic Research Service representative, and the author cooperating with A.A.E.S. scientists, S.C.S. scientists, and other agency agriculturists.

[a]Management Level I is comparable to current levels of attainment while Management Level II assumes utilization of currently available technology and cultural practices.

TABLE XXXIV.

Estimated Yield Potential By Land Capability Class For Two Levels of Management: N.E. Kodiak Island Area of Alaska, 1967. (Crop Reporting District No. 5)*

Land Class	Barley (High Moisture)		Perennial Forage		Native Grass Forage			Potatoes	
	Mgt. I	Mgt. II[a]	Mgt. I	Mgt. II[a]	Mgt. I		Mgt. II[a]	Mgt. I	Mgt. II[a]
	(tons/a—dry)		(tons/a—dry)		(tons/a—dry)			(tons/a)	
II	(No class II land in the area)								
IIIe	1.0-1.2	1.5-2.0	1.5-2.5		.5-1.0		1-2	5.0	10.0
IIIs	(No IIIs in the area)								
IIIw			1.0-2.0		.5-1.0		1-2		
IVe	1.0-1.2	1.5-2.0	1.5-2.0		.5-1.0		1-2		
IVs	1.0-1.2	1.5-2.0	1.0-2.0		.5-1.0		1-2		
IVw	(No IVw in the area)								
VI									
VII									
VIII									

*Yield estimates were developed through a cooperative effort of the Alaska State Conservationist, S.C.S., an Economic Research Service representative, and the author cooperating with A.A.E.S. scientists, S.C.S. scientists, and other agency agriculturists.

[a]Management Level I is comparable to current levels of attainment while Management Level II assumes utilization of currently available technology and cultural practices.

No attempt was made to predict future estimated yields resulting from anticipated research results and technological transitions, even though:

> It is generally held that (1) there is a direct relationship between the growth of a firm or industry and the level of investment in research and development; and (2) rapid growth regions include concentrations of technology-intensive industries; concentrations of scientists, engineers, and technicians; and relatively high research and development expenditures. . . . Two aspects of this role are the *location* of scientific and technological activity itself and the usefulness of the *results* of that activity in application. Both of these aspects have relevance to Alaska's (agricultural industry) growth and development.[4]

Projections of new crop and livestock possibilities for the future will be treated in a later section.

Projected Demand for Agricultural Products That Can Be Grown in Alaska

A major portion of the agricultural products presently consumed within Alaska is produced in "stateside" production areas, and is distributed through long-standing food distribution channels. Haring[5] reported food store sales of $64.3 million exclusive of military commissary food sales during 1964. Only a limited portion of food sales is made up of those products that can be produced in Alaska, but the potential market appears to be of a magnitude that elicits considerable interest and attention, particularly in view of the declining portion of the market being supplied by Alaska producers in recent years.

Demands for the agricultural products that can presently be produced in Alaska for in-state markets were considered initial parameters for potential production. Maximum demand estimates were calculated, using "best estimates" of per capita consumption and projected population estimates for 1970, 1980, 1990, and 2000.

[4]Douglas N. Jones, Federal Field Committee for Development Planning in Alaska, *A Subregional Economic Analysis of Alaska*, Anchorage, August 1968, p. 353.

[5]Robert C. Haring, *et. al.*, "Alaska Agricultural Study, Economic Evaluation of the Potential for Agricultural Development in Alaska," Institute of Social, Economic and Government Research, University of Alaska, unpublished report.

Population Projections

Any approach to estimating possible or probable growth and development of the agricultural industry is in some manner predicated on predictions or projections of future growth or change in population. Rogers[6] evaluates predictions as being informed, inspired, or simply wild-eyed, and sophisticated projections as being mechanical and somewhat lacking in intuition and imagination. According to Rogers, predictions tend to be subjective and in varying degrees irrational. He believes also that projections are enshrouded in assumptions calculated to protect the scientist from the future responsibility of inaccuracy and finds the main body of contemporary studies dealing with the future lying somewhere between instinctive prediction and mechanical projection.

Rogers expresses the thesis that science today is not simply an effort of unbiased description and impartial forecasting, but may be used as a tool to achieve a goal in the most economical way. Accordingly, one must recognize that, generally, the projection of increased consumer demand, and the necessary planning to service such demand, is dependent on projections of population growth, along with projections of potential economic development.

The low estimate used (Figure 8) is an extension to the year 2000 of the low range of population projections for Alaska made by the Bureau of the Census from 1970 to 1985. It is simple mechanical projection of past trends. This estimate would forecast a relatively stagnant future for Alaska. The high estimate, with minor adjustment made by Rogers, was based on population estimates made by the Department of the Interior of future employment and economic growth. The underlying approach was of the prospective type. The intermediate estimate, used in this study (Table XXXV), was also developed by the Department of the Interior. This projection indicates a bit over 53 per cent increase in numbers of people from 1970 to 1975 within the state and approximately a 100 per cent increase in 1990 over 1970. Population projections through the year 2000 provide additional prospective as to future market growth and an indication of potential for growth of the agricultural industry.

[6]George W. Rogers, *Alaska Regional Population and Employment*, Institute of Social, Economic and Government Research, University of Alaska, SEG Report No. 15, December 1967, pp. 81-86.

Figure 8: Projections of Future Population

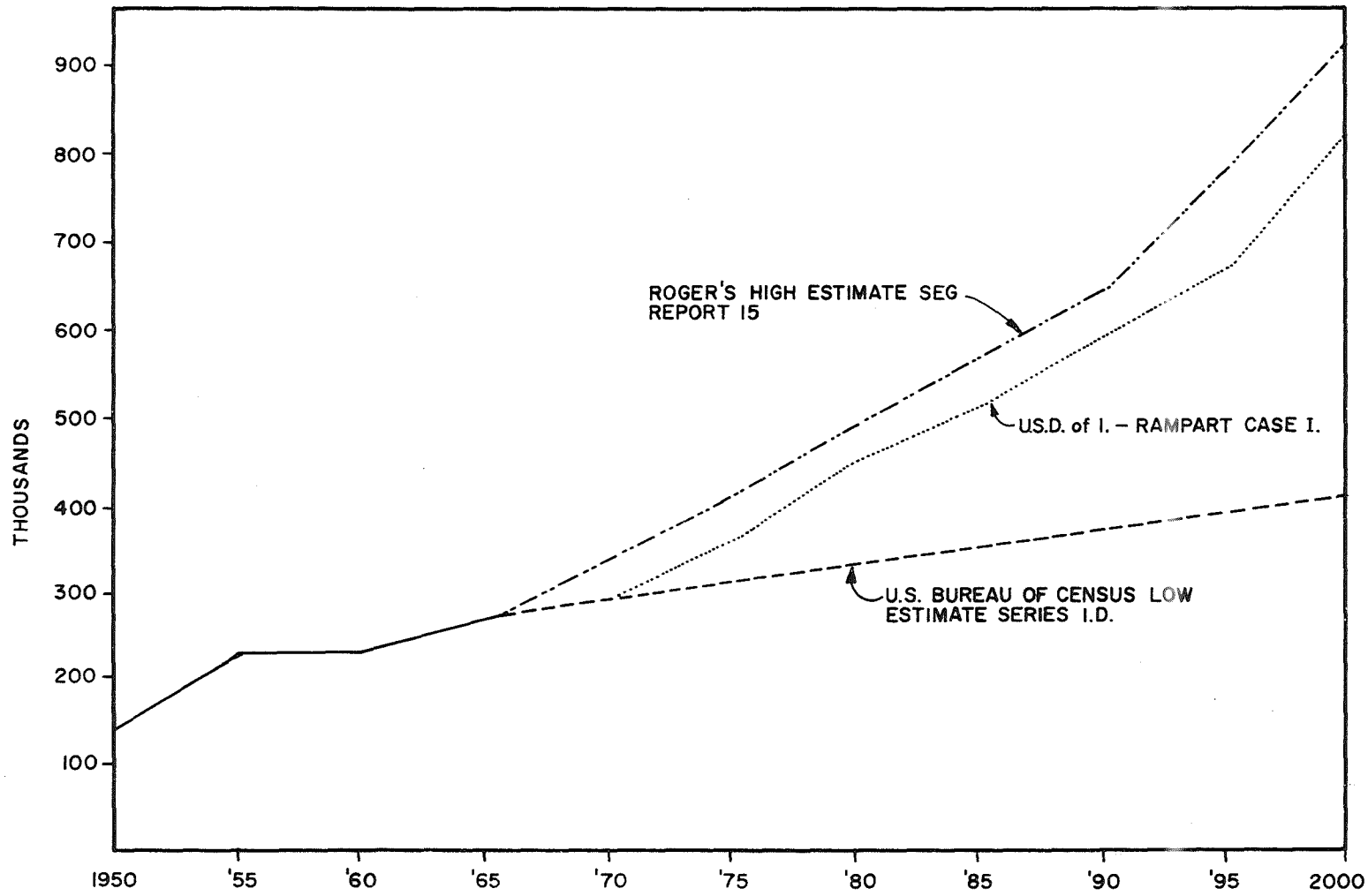

TABLE XXXV.

Estimates of Total Resident Population, By Regions, 1970-2000

Region	1970*	1980	1990	2000
		(Thousands)		
Interior	52	130	138	188
Northwest	17	31	51	77
Southcentral	164	153	209	263
Southeast	43	107	151	226
Southwest	27	31	41	66
Total	302	452	590	820

*Preliminary 1970 census data.

SOURCE: George W. Rogers, *Alaska Regional Population and Employment*, Institute of Social, Economic and Government Research, University of Alaska, SEG Report No. 15, December 1967. p. 97.

Consumption Projections

Estimates of potential annual consumption of selected agricultural products were calculated, by regions, to provide some perspective regarding future potential markets for agricultural products that could be produced in Alaska. National per capita consumption data for 1960-68 were used to project both typical consumption and trends in consumption of individual products. It is not anticipated that all data are representative of all regions in Alaska at this time, but is that present and future population will progressively take on consumption characteristics of the rest of the nation as the economy develops and comparable goods and services become available.

The list of food products, projected for 1970-2000, includes those crops grown commercially in some quantity and others that have some known potential, either in field or greenhouse production. An extensive list of horticulture and floriculture crops, which appear to have future potential, has been deleted from consideration because of the indeterminate time expectation of their becoming commercial crops. Only intrastate consumption estimates have been projected in estimating market parameters,

as export markets are not sufficiently developed to provide a basis for estimation.

Export markets for agricultural products may well become a reality within the time period of demand estimate projection. Reindeer meat has been shipped "stateside" from time to time. Sample shipments of both reindeer meat and mutton have been made to Japan. Reindeer antlers have been shipped to Korea in some quantity. Seed potatoes, grass seed, frozen vegetables, and berries have all been shipped in very limited quantities to explore possible out-of-state markets. While such markets have not yet become a reality to Alaska farmers, and market infrastructures have not yet been conceived, such markets may well provide a second parameter for a goodly number of products within the time span of the study.

Japanese trading companies have repeatedly expressed interest in the purchase of mutton, beef, and reindeer from Alaska sources. Their increasing demand for red meat is reflected as,

> Import needs are expected approximately to double between 1965 and 1970, to double again by 1975, and by 1980 to stand at about six times the 1966 figure. (Imports of beef were about 13 thousand tons and those of mutton were about 93 thousand tons in 1966 . . .). Production in Australia and New Zealand is not expected to be able to supply this need, and Japanese meat packers are looking to other areas, Mexico, Brazil, and even Alaska, for meat sources to be developed in the next few years.[7]

The initiation of a state/federal meat inspection program has overcome certain export hurdles for beef, mutton, and reindeer. Such meats can now be shipped with inspection certification.

Consumption estimates (b), tables XXXVI through XXXIX, have been transposed to farm equivalent quantities for a selected group of products in Table XL. Needed acres of grain and harvested forages to produce projected quantities of milk, meat, and eggs were calculated using enterprise research data, various feeding standards, and yield estimates for each time period. Range-pasture acreage estimates were deleted as no adequate range yield data were presently available. Yield estimates reflect research, technology, irrigation, and institutional program inputs similar to national trends over

[7] Arlon R. Tussing, *et. al.*, *Alaska-Japan Economic Relations*, Institute of Social, Economic and Government Research, University of Alaska, SEG Report No. 17, 1968, pp. 74-75 and 203-15.

TABLE XXXVI.

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 1970

Item	Unit	Total	Total	Southcentral		Interior		Southwest		Northwest		Southeast	
		a	b	a	b	a	b	a	b	a	b	a	b
Fluid milk whole	mil lb	81.194	74.788	44.011	40.538	13.899	12.802	7.343	6.764	4.504	4.149	11.438	10.535
Fluid milk low fat	mil lb	10.419	15.109	5.648	8.190	1.783	2.586	0.942	1.366	0.578	0.838	1.468	2.128
Nonfat dry milk	mil lb	1.777	1.692	0.963	0.918	0.304	0.289	0.161	0.153	0.099	0.094	0.250	0.239
Total retail milk prod	mil lb	112.640	110.595	61.057	59.949	19.282	18.932	10.186	10.001	6.249	6.135	15.866	15.578
Potatoes fresh	tons	14,555.7	13,522.4	7,889.9	7,329.7	2,491.7	2,314.8	1,316.3	1,222.9	807.4	750.2	2,050.4	1,904.8
Potatoes frozen	tons	2,014.1	3,263.4	1,091.7	1,768.9	344.8	558.7	182.1	295.1	111.7	181.0	283.8	459.7
Potatoes fresh equiv	tons	16,634.7	17,163.3	9,016.7	9,303.3	2,847.6	2,938.1	1,504.4	1,552.1	922.8	952.1	2,343.2	2,417.7
Eggs	mil doz	8.093	7.857	4.386	4.259	1.386	1.345	0.732	0.710	0.449	0.436	1.140	1.107
Carrots fresh	tons	1,050.2	1,038.0	569.2	562.6	179.8	177.7	95.0	93.9	58.2	57.6	148.0	146.2
Carrots frozen	tons	71.0	117.9	38.4	63.9	12.2	20.2	6.4	10.7	4.0	6.5	10.0	16.6
Cabbage	tons	1,444.2	1,344.8	782.9	728.9	247.2	230.2	130.6	121.7	80.1	74.6	203.4	189.4
Cauliflower fresh	tons	160.1	143.7	86.8	77.9	27.4	24.6	14.5	13.0	8.9	7.9	22.5	20.3
Cauliflower frozen	tons	33.4	39.2	18.0	21.2	5.7	6.7	3.1	3.6	1.9	2.2	4.7	5.5
Lettuce	tons	3,086.8	3,308.9	1,673.2	1,793.5	528.4	566.4	279.2	299.3	171.2	183.6	434.8	466.1
Brussels sprouts fresh	tons	13.6		7.4		2.3		1.2		0.8		1.9	
Brussels sprouts frozen	tons	30.3		16.4		5.2		2.7		1.7		4.3	
Peas-fresh	tons	40.7	36.3	22.0	19.7	7.0	6.2	3.7	3.3	2.3	2.0	5.7	5.1
Peas-frozen	tons	281.1	309.9	152.3	168.0	48.1	53.0	25.5	28.0	15.6	17.2	39.6	43.7
Beets	tons	77.1	63.5	41.8	34.4	13.2	10.8	7.0	5.8	4.2	3.5	10.9	9.0
Celery	tons	1,069.7	997.2	579.8	540.5	183.1	170.7	96.7	90.2	59.4	55.3	150.7	140.5
Onions and shallots	tons	1,775.4		962.3		303.9		160.6		98.5		250.1	

TABLE XXXVI. (Continued)

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 1970

Item	Unit	Total a	Total b	Southcentral a	Southcentral b	Interior a	Interior b	Southwest a	Southwest b	Northwest a	Northwest b	Southeast a	Southeast b
Rhubarb frozen	tons	4.7		2.5		0.8		0.4		0.3		0.7	
Broccoli fresh	tons	51.5		27.9		8.8		4.7		2.8		7.3	
Broccoli frozen	tons	101.2	119.3	54.8	64.7	17.3	20.4	9.2	10.8	5.7	6.6	14.2	16.8
Cucumbers	tons	448.7	463.9	243.2	251.4	76.8	79.4	40.6	42.0	24.9	25.8	63.2	65.3
Tomatoes	tons	1,861.3	1,838.7	1,009.0	996.6	318.6	314.8	168.3	166.3	103.2	102.0	262.2	259.0
Corn-fresh	tons	1,201.1	1,102.9	651.1	597.8	205.6	188.8	108.6	99.8	66.6	61.2	169.2	155.3
Corn-frozen	tons	161.7	287.1	87.6	155.6	27.7	49.1	14.6	26.0	9.0	16.0	22.8	40.4
Pumpkin-squash frozen	tons	13.6	18.2	7.4	9.9	2.3	3.1	1.2	1.6	0.8	1.0	1.9	2.6
Radishes and parsnips*	tons	30.3		16.4		5.2		2.7		1.7		4.3	
Rutabagas and turnips*	tons	30.3		16.4		5.2		2.7		1.7		4.3	
Zucchini*	tons	15.2		8.2		2.6		1.4		0.9		2.1	
Blueberries frozen	tons	27.2	35.9	14.7	19.4	4.7	6.2	2.5	3.3	1.5	2.0	3.8	5.0
Raspberries frozen	tons	26.0	24.0	14.0	13.0	4.5	4.1	2.4	2.2	1.4	1.3	3.7	3.4
Strawberries fresh	tons	226.6	250.7	122.8	135.9	38.8	42.9	20.5	22.7	12.6	13.9	31.9	35.3
Strawberries frozen	tons	211.5	216.9	114.7	117.6	36.2	37.1	19.1	19.7	11.7	12.0	29.8	30.5
Cranberries	tons	30.3		16.4		5.2		2.7		1.7		4.3	
Beef	mil lb	29.351	35.204	15.909	19.082	5.025	6.026	2.654	3.184	1.628	1.953	4.135	4.959
Pork	mil lb	19.050		10.326		3.261		1.723		1.057		2.683	
Lamb-Mutton	mil lb	1.320	1.208	0.716	0.655	0.226	0.207	0.119	0.109	0.073	0.067	0.186	0.170
Veal	mil lb	1.490	1.208	0.808	0.655	0.255	0.207	0.134	0.109	0.083	0.067	0.210	0.170
Turkey	mil lb	2.227	2.479	1.208	1.344	0.381	0.424	0.201	0.224	0.124	0.138	0.313	0.349
Chicken	mil lb	9.839	11.393	5.333	6.175	1.684	1.950	0.890	1.031	0.546	0.632	1.386	1.605

[a]Per capita consumption based on 1960-68 average U.S. consumption.

[b]Per capita consumption based on projected trends from 1960-68 trends.

*Per capita consumption taken from: Wayne E. Burton, Alaska's Agricultural Production Potential: An Economic Analysis, Unpublished Dissertation, Montana State University, Bozeman, Montana, 1968.

TABLE XXXVII.

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 1980

Item	Unit	Total	Total	Southcentral		Interior		Southwest		Northwest		Southeast	
		a	b	a	b	a	b	a	b	a	b	a	b
Fluid milk whole	mil lb	121.452	96.050	41.111	32.513	34.931	27.625	8.330	6.588	8.330	6.588	28.751	22.738
Fluid milk low fat	mil lb	15.585	33.222	5.275	11.246	4.482	9.555	1.069	2.279	1.069	2.279	3.689	7.865
Non fat dry milk	mil lb	2.658	2.305	.900	.780	.764	.663	.182	.158	.182	.158	.629	.546
Total retail milk prod	mil lb	168.492	159.556	57.034	54.009	48.460	45.890	11.556	10.943	11.556	10.943	39.886	37.771
Potatoes	tons	21,772.8	17,808.8	7,370.0	6,028.2	6,262.1	5,122.0	1,493.3	1,221.4	1,493.3	1,221.4	5,154.2	4,215.8
frozen	tons	3,012.6	8,475.0	1,019.7	2,868.8	866.5	2,437.5	206.6	581.3	206.6	581.3	713.3	2,006.3
fresh equiv	tons	24,882.6	26,894.0	8,422.7	9,103.5	7,156.5	7,735.0	1,706.6	1,844.5	1,706.6	1,844.5	5,890.4	6,366.5
Eggs	mil doz	12.106	11.131	4.098	3.768	3.482	3.201	.830	.763	.830	.763	2.866	2.635
Carrots fresh	tons	1,570.7	1,518.7	531.7	514.1	451.8	436.8	107.7	104.2	107.7	104.2	371.8	359.5
Carrots frozen	tons	106.2	287.0	36.0	97.2	30.6	82.6	7.3	19.7	7.3	19.7	25.1	67.9
Cabbage	tons	2,160.6	1,733.4	731.3	586.8	621.4	498.6	148.2	118.9	148.2	118.9	511.5	410.3
Cauliflower fresh	tons	239.6	153.7	81.1	52.0	68.9	44.2	16.4	10.5	16.4	10.5	56.7	36.4
Cauliflower frozen	tons	49.7	74.6	16.8	25.4	14.3	21.5	3.4	5.1	3.4	5.1	11.8	17.7
Lettuce	tons	4,617.2	5,480.5	1,562.9	1,855.1	1,328.0	1,576.3	316.7	375.9	316.7	375.9	1,093.0	1,297.4
Brussel sprouts fresh	tons	20.3		6.9		5.9		1.4		1.4		4.8	
Brussel sprouts frozen	tons	45.2		15.3		13.0		3.1		3.1		10.7	
Peas-fresh	tons	61.0	43.0	20.7	14.5	17.6	12.4	4.2	2.9	4.2	2.9	14.4	10.2
Peas-frozen	tons	420.4	533.4	142.3	180.5	120.9	153.4	28.8	36.6	28.8	36.6	99.5	126.3
Beets	tons	115.6	79.1	39.0	26.8	33.2	22.8	7.9	5.4	7.9	5.4	27.3	18.7
Celery	tons	1,600.1	1,265.6	541.6	428.4	460.2	364.0	109.7	86.8	109.7	86.8	378.8	299.6
Onions and shallots	tons	2,655.5		898.9		763.8		182.1		182.1		628.6	

TABLE XXVII. (Continued)

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 1980

Item	Unit	Total	Total	Southcentral		Interior		Southwest		Northwest		Southeast	
		a	b	a	b	a	b	a	b	a	b	a	b
Rhubarb frozen	tons	6.8		2.3		2.0		.5		.5		1.6	
Broccoli fresh	tons	76.8		26.0		22.1		5.3		5.3		18.2	
Broccoli frozen	tons	151.4	223.7	51.3	75.7	43.6	64.4	10.4	15.3	10.4	15.3	35.8	53.0
Cucumbers	tons	671.2	716.4	227.2	242.5	193.1	206.1	46.0	49.1	46.0	49.1	158.9	169.6
Tomatoes	tons	2,784.3	2,703.0	942.5	914.9	800.8	777.4	191.0	185.4	191.0	185.4	659.1	639.9
Corn-fresh	tons	1,796.7	1,389.9	608.2	470.5	516.8	399.8	123.2	95.3	123.2	95.3	425.3	328.8
Corn-frozen	tons	241.8	727.7	81.9	246.3	69.6	209.3	16.6	49.9	16.6	49.9	57.2	172.3
Pumpkin-squash frozen	tons	20.3	33.0	6.9	11.2	5.9	9.5	1.4	2.3	1.4	2.3	4.8	7.8
Radishes and parsnips*	tons	45.2		15.3		13.0		3.1		3.1		10.7	
Rutabagas and turnips*	tons	45.2		15.3		13.0		3.1		3.1		10.7	
Zucchini*	tons	22.6		7.7		6.5		1.6		1.6		5.4	
Blueberries frozen	tons	40.7	76.8	13.8	26.0	11.7	22.1	2.8	5.3	2.8	5.3	9.6	18.2
Raspberries frozen	tons	38.9	29.8	13.2	10.1	11.2	8.6	2.7	2.0	2.7	2.0	9.2	7.1
Strawberries fresh	tons	339.0	413.6	114.8	140.0	97.5	119.0	23.3	28.4	23.3	28.4	80.3	97.9
Strawberries frozen	tons	316.4	344.4	107.1	116.6	91.0	99.1	21.7	23.6	21.7	23.6	74.9	81.5
Cranberries	tons	45.2		15.3		13.0		3.1		3.1		10.7	
Beef	mil lb	43.903	66.670	14.861	22.568	12.627	19.175	3.011	4.573	3.011	4.573	10.393	15.783
Pork	mil lb	28.494		9.645		8.195		1.954		1.954		6.745	
Lamb-Mutton	mil lb	1.975	1.356	.669	.459	.568	.390	.135	.093	.135	.093	.468	.321
Veal	mil lb	2.228	1.356	.754	.459	.641	.390	.153.	.093	.153	.093	.528	.321
Turkey	mil lb	3.331	4.294	1.128	1.454	.958	1.235	.228	.295	.228	.295	.789	1.017
Chicken	mil lb	14.717	21.425	4.982	7.252	4.233	6.162	1.009	1.469	1.009	1.469	3.484	5.071

[a]Per capita consumption based on 1960-68 average U.S. consumption.

[b]Per capita consumption based on projected trends from 1960-68 trends.

*Per capita consumption taken from: Wayne E. Burton, Alaska's Agricultural Production Potential: An Economic Analysis, Unpublished Dissertation, Montana State University, Bozeman, Montana, 1968.

TABLE XXXVIII.

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 1990

Item	Unit	Total	Total	Southcentral		Interior		Southwest		Northwest		Southeast	
		a	b	a	b	a	b	a	b	a	b	a	b
Fluid milk whole	mil lb	158.533	104.725	56.158	37.098	37.081	24.495	11.017	7.278	13.704	9.053	40.574	26.803
Fluid milk low fat	mil lb	20.343	57.230	7.206	20.273	4.758	13.386	1.414	3.977	1.758	4.947	5.206	14.647
Non fat dry milk	mil lb	3.469	2.655	1.229	.941	.811	.621	.241	.185	.300	.230	.888	.680
Total retail milk prod	mil lb	219.934	201.190	77.909	71.269	51.442	47.058	15.284	13.981	19.011	17.391	56.288	51.491
Potatoes	tons	28,420.3	19,912.5	10,067.5	7,053.8	6,647.5	4,657.5	1,975.0	1,383.8	2,456.7	1,721.3	7,273.7	5,096.3
frozen	tons	3,932.4	15,723.5	1,393.0	5,569.9	919.8	3,677.7	273.3	1,092.7	339.9	1,359.2	1,006.4	4,024.2
fresh equiv	tons	32,479.5	36,668.5	11,505.5	12,989.5	7,596.9	8,576.7	2,257.1	2,548.2	2,807.6	3,169.7	8,312.6	9,384.7
Eggs	mil doz	15.802	13.718	5.598	4.859	3.696	3.209	1.098	.953	1.366	1.186	4.044	3.511
Carrots-fresh	tons	2,050.3	1,926.4	726.3	682.4	479.6	450.6	142.5	133.9	177.2	166.4	524.7	493.0
Carrots-frozen	tons	138.7	516.3	49.1	182.9	32.4	120.8	9.6	35.9	12.0	44.6	35.5	132.1
Cabbage	tons	2,820.2	1,905.7	999.0	657.1	659.6	445.7	196.0	132.4	243.8	164.7	721.8	487.7
Cauliflower	tons	312.7	123.9	110.8	43.9	73.1	29.0	21.7	8.6	27.0	10.7	80.0	31.7
frozen	tons	64.9	118.0	23.0	41.8	15.2	27.6	4.5	8.2	5.6	10.2	16.1	30.2
Lettuce	tons	6,026.9	7,832.3	2,134.9	2,774.9	1,409.7	1,832.0	418.8	544.3	521.0	677.0	1,542.5	2,004.6
Brussel sprouts fresh	tons	26.6		9.4		6.2		1.8		2.3		6.8	
Brussel sprouts frozen	tons	59.0		20.9		13.8		4.1		5.1		15.1	
Peas-fresh	tons	79.7	41.3	28.2	14.6	18.6	9.7	5.5	2.9	6.9	3.6	20.4	10.6
Peas-frozen	tons	548.7	784.7	194.4	278.0	128.3	183.5	38.1	54.5	47.4	67.8	140.4	200.8
Beets	tons	150.5	79.7	53.3	28.2	35.2	18.6	10.5	5.5	13.0	6.9	38.5	20.4
Celery	tons	2,088.6	1,371.8	739.9	485.9	488.5	320.9	145.1	95.3	180.5	118.6	534.5	351.1
Onions and shallots	tons	3,466.3		1,227.9		810.8		240.9		299.6		887.1	
Rhubarb frozen	tons	8.9		3.1		2.1		.6		.8		2.3	

TABLE XXXVIII. (Continued)

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 1990

Item	Unit	Total	Total	Southcentral		Interior		Southwest		Northwest		Southeast	
		a	b	a	b	a	b	a	b	a	b	a	b
Broccoli fresh	tons	100.3		35.5		23.5		7.0		8.7		25.7	
Broccoli frozen	tons	197.7	351.1	70.0	124.4	46.2	82.1	13.7	24.4	17.1	30.3	50.6	89.8
Cucumbers	tons	876.2	964.7	310.4	341.7	204.9	225.6	60.9	67.0	75.7	83.4	224.2	246.9
Tomatoes	tons	3,634.4	3,463.3	1,287.4	1,226.8	850.1	810.1	252.6	240.7	314.2	299.4	930.2	886.4
Corn-fresh	tons	2,345.3	1,475.0	830.8	522.5	548.6	345.0	163.0	102.5	202.7	127.5	600.2	377.5
Corn-frozen	tons	315.7	1,348.2	111.8	477.6	73.8	315.3	21.9	93.7	27.3	116.5	80.8	345.0
Pumpkin-squash frozen	tons	26.6	51.6	9.4	18.3	6.2	12.1	1.8	3.6	2.3	4.5	6.8	13.2
Radishes and parsnips*	tons	59.0		20.9		13.8		4.1		5.1		15.1	
Rutabagas and turnips*	tons	59.0		20.9		13.8		4.1		5.1		15.1	
Zucchini*	tons	29.5		10.5		6.9		2.1		2.6		7.6	
Blueberries frozen	tons	53.1	133.6	18.8	47.3	12.4	31.3	3.7	9.3	4.6	11.6	13.6	34.2
Raspberries frozen	tons	50.7	30.7	17.8	10.9	11.9	7.2	3.5	2.1	4.4	2.7	13.0	7.9
Strawberries fresh	tons	442.5	584.1	156.8	206.9	103.5	136.6	30.8	40.6	38.3	50.5	113.3	149.5
Strawberries frozen	tons	413.0	475.5	146.3	168.5	96.6	111.2	28.7	33.0	35.7	41.1	105.7	121.7
Cranberries	tons	59.0		20.9		13.8		4.1		5.1		15.1	
Beef	mil lb	57.307	105.610	20.300	37.411	13.404	24.702	3.982	7.339	4.954	9.129	14.667	27.029
Pork	mil lb	37.194		13.175		8.700		2.585		3.215		9.519	
Lamb-Mutton	mil lb	2.578	1.180	.913	.418	.603	.276	.179	.082	.223	.102	.660	.302
Veal	mil lb	2.909	1.180	1.030	.418	.680	.276	.202	.082	.251	.102	.744	.302
Chicken	mil lb	19.210	33.630	6.805	11.913	4.493	7.866	1.335	2.337	1.661	2.907	4.917	8.607

[a]Per capita consumption based on 1960-68 average U.S. consumption.

[b]Per capita consumption based on projected trends from 1960-68 trends.

*Per capita consumption taken from: Wayne E. Burton, Alaska's Agricultural Production Potential: An Economic Analysis, Unpublished Dissertation, Montana State University, Bozeman, Montana, 1968.

TABLE XXXIX.

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 2000

Item	Unit	Total	Total	Southcentral		Interior		Southwest		Northwest		Southeast	
		a	b	a	b	a	b	a	b	a	b	a	b
Fluid milk whole	mil lb	220.334	120.950	70.668	38.793	50.516	27.730	17.734	9.735	20.691	11.358	60.726	33.335
Fluid milk low fat	mil lb	28.274	98.400	9.068	31.560	6.482	22.560	2.276	7.920	2.655	9.240	7.792	27.120
Low fat dry milk	mil lb	4.821	3.280	1.546	1.052	1.105	.752	.388	.264	.453	.308	1.329	.904
Total retail milk prod	mil lb	305.671	270.600	98.039	86.790	70.081	62.040	24.603	21.780	28.703	25.410	84.246	74.580
Potatoes	tons	39,499.4	23,288.0	12,668.7	7,469.2	9,055.0	5,339.2	3,179.2	1,874.4	3,709.1	2,186.6	10,886.4	6,418.4
frozen	tons	5,465.3	28,331.0	1,752.9	9,086.7	1,253.0	6,495.4	439.9	2,280.3	513.2	2,660.4	1,506.3	7,808.3
fresh equiv	tons	45,141.0	53,177.0	14,478.2	17,055.6	10,349.4	12,191.8	3,633.3	4,280.1	4,238.9	4,993.5	12,441.3	14,656.1
Eggs	mil doz	21.962	17.972	7.044	5.764	5.035	4.120	1.768	1.447	2.062	1,688	6.053	4.953
Carrots-fresh	tons	2,849.5	2,599.4	913.9	833.7	653.3	596.0	229.4	209.2	267.6	244.1	785.4	716.4
Carrots-frozen	tons	192.7	922.5	61.8	295.9	44.2	211.5	15.5	74.3	18.1	86.6	53.1	254.3
Cabbage	tons	3,919.6	2,160.7	1,257.1	693.0	898.6	495.4	315.5	173.9	368.1	202.9	1,080.3	595.5
Cauliflower	tons	434.6	61.5	139.4	19.7	99.6	14.1	35.0	5.0	40.8	5.8	119.8	17.0
frozen	tons	90.2	192.7	28.9	61.8	20.7	44.2	7.3	15.5	8.5	18.1	24.9	53.1
Lettuce	tons	8,376.3	11,832.6	2,686.5	3,795.1	1,920.4	2,712.8	674.2	952.4	786.6	1,111.1	2,308.6	3,261.2
Brussel sprouts fresh	tons	36.9		11.8		8.5		3.0		3.5		10.2	
Brussel sprouts frozen	tons	82.0		26.3		18.8		6.6		7.7		22.6	
Peas-fresh	tons	110.7	36.9	35.5	11.8	25.4	8.5	8.9	3.0	10.4	3.5	30.5	10.2
Peas-frozen	tons	762.6	1,221.8	244.6	391.9	174.8	280.1	61.4	98.3	71.6	114.7	210.2	336.7
Beets	tons	209.1	82.0	67.1	26.3	47.9	18.8	16.8	6.6	19.6	7.7	57.6	22.6
Celery	tons	2,902.8	1,496.5	931.0	480.0	665.2	343.1	233.6	120.5	272.6	140.5	800.0	412.5
Onions and shallots	tons	4,817.5		1,545.1		1,104.5		387.8		452.4		1,327.8	
Rhubarb frozen	tons	12.3		3.9		2.8		1.0		1.2		3.4	

TABLE XXXIX. (Continued)

Estimated Annual Consumption of Selected Agricultural Products in Alaska by Regions, 2000

Item	Unit	Total	Total	Southcentral		Interior		Southwest		Northwest		Southeast	
		a	b	a	b	a	b	a	b	a	b	a	b
Broccoli													
fresh	tons	139.4		44.7		32.0		11.2		13.1		38.4	
frozen	tons	274.7	569.9	88.1	182.8	63.0	130.7	22.1	45.9	25.8	53.5	75.7	157.1
Cucumbers	tons	1,217.7	1,381.7	390.6	443.2	297.2	316.8	98.0	111.2	114.3	129.7	335.6	380.8
Tomatoes	tons	5,051.2	4,510.0	1,620.1	1,446.5	1,158.1	1,034.0	406.6	363.0	474.3	423.5	1,392.2	1,243.0
Corn-fresh	tons	3,259.5	1,988.5	1,045.4	637.8	747.3	455.9	262.4	160.1	306.1	186.7	898.4	548.1
Corn-frozen	tons	438.7	2,439.5	140.7	782.4	100.8	559.3	35.3	196.4	41.2	229.1	120.9	672.4
Pumpkin-squash													
frozen	tons	36.9	84.1	11.8	27.0	8.5	19.3	3.0	6.8	3.5	7.9	10.2	23.2
Radishes and													
parsnips*	tons	82.0		26.3		18.8		6.6		7.7		22.6	
Rutabagas and													
turnips*	tons	82.0		26.3		18.8		6.6		7.7		22.6	
Zucchini*	tons	41.0		13.2		9.4		3.3		3.9		11.3	
Blueberries													
frozen	tons	73.8	230.0	23.7	73.8	16.9	52.7	5.9	18.5	6.9	21.6	20.3	63.4
Raspberries													
frozen	tons	70.5	31.6	22.6	10.1	16.2	7.2	5.7	12.5	6.6	3.0	19.4	8.7
Strawberries													
fresh	tons	615.0	869.2	197.3	278.8	141.0	199.3	49.5	70.0	57.8	81.6	169.5	239.6
Strawberries													
frozen	tons	574.0	698.6	184.1	224.1	131.6	160.2	46.2	56.2	53.9	65.6	158.2	192.6
Cranberries	tons	82.0		26.3		18.8		6.6		7.7		22.6	
Beef	mil lb	79.647	173.890	25.545	55.756	18.260	39.856	6.411	13.992	7.479	16.324	21.951	47.912
Pork	mil lb	51.693		16.580		11.852		4.161		4.854		14.247	
Lamb-Mutton	mil lb	3.583	.820	1.149	.263	.822	.188	.288	.066	.336	.077	.988	.226
Veal	mil lb	4.013	.820	1.297	.263	.927	.188	.325	.066	.380	.077	1.114	.226
Turkey	mil lb	6.043	9.840	1.938	3.156	1.386	2.256	.486	.792	.567	.924	1.666	2.712
Chicken	mil lb	26.699	54.612	8.563	17.516	6.121	12.521	2.149	4.396	2.507	5.128	7.359	15.052

[a]Per capita consumption based on 1960-68 average U.S. consumption.

[b]Per capita consumption based on projected trends from 1960-68 trends.

*Per capita consumption taken from: Wayne E. Burton, Alaska's Agricultural Production Potential: An Economic Analysis, Unpublished Dissertation, Montana State University, Bozeman, Montana, 1968.

recent decades. Other crop estimates were developed in a similar manner. No geographic designation was made for various potential crop acreages because of the undeveloped state of the present industry. Although some yield estimates, tables XXXI through XXXIV, seem in most instances to favor Crop Reporting District No. 2, it must be kept in mind that research efforts have been concentrated in the Matanuska Valley for an extended period of time; therefore, estimates of production potential may be more precise, or more optimistic, than for other production areas. Farm equivalent quantities of selected products, estimated crop yields, and needed acreages have been incorporated into tables XL through XLIII to provide some perspective on potential market size and crop acres needed to supply such markets if production were to occur in Alaska. Southeast (Crop Reporting District No. 4) has been deleted from these tables because of distance from production areas, and the assumption that most food products will be shipped to Southeast from stateside distributors.

Production Expansion

If Alaska producers are to capture a larger part of the expanding demand for agricultural products that can be grown in Alaska, both farm size and farm numbers must be increased along with the concurrent development of marketing systems and facilities. For farm firm development to occur, increased concentrations of research and development inputs will necessarily have to be directed to that end. Both private and institutional inputs must be developed in an effective and meaningful way to legitimize various types of enterprises and allow costs of production to be sufficiently competitive to induce present producers to expand and to attract new producers into the industry.

Estimates of present and expected investments, costs, and possible revenues for individual farm firms were explored for a number of crops. Different production levels and sizes of units were explored to indicate additional alternatives for production expansion in the very short run. Long-run estimates of large-scale commercial farming operations have not been attempted even though a very few are in the initial development stage. Each of the large-scale commercial units will have to organize within the constraints of available entrepreneurial competency and physical, economic, and political resources that can be staged at the relevant time. New crop and livestock possibilities have been treated in a conceptual manner only,

TABLE XL.

Production Potential for Crop Reporting Districts 1,2,3, and 5, 1970

Item	Est. Consumption[a] Farm Equivalents	Required Crop Acres Present Yield[c]	Acres
Milk:	(77.234 mil. lbs.)[b]		
Barley	13,112 tons	@ 40 bu./acre	13,658
Oats	4,768 tons	@ 68 bu./acre	4,382
Hay	20,606 tons	@ 2 ton/acre	10,303
Oat-Pea Silage	60,228 tons	@ 5.75 ton/acre	10,474
Beef:	(68.959 mil. lbs. liveweight)[b]		
Barley	30,155 tons	@ 40 bu./acre	31,421
Hay	94,296 tons	@ 2 ton/acre	47,148
Oat—Pea Silage	309,168 tons	@ 5.75 ton/acre	53,768
Range-Pasture	118,475 A.U.	@ 8 month/year	-----
Pork:	(32.243 mil lbs. liveweight)[b]		
Barley	30,155 tons	@ 40 bu./acre	31,421
Pasture-Forage	-----	-----	----
Lamb and Mutton:	(2.543 mil lbs. liveweight)[b]		
Barley	1,926 tons	@ 40 bu./acre	2,008
Hay	5,821 tons	@ 2 ton/acre	2,910
Range-Pasture	11,883 A.U.	@ 8 month/year	-----
Eggs:	(6.953 mil doz.)[b]		
Barley	5,393 tons	@ 40 bu./acre	5,620
Potatoes:			
Fresh	12,106 tons[b]	@ 9 ton/acre	1,345
Process	3,869 tons[b]	@ 9 ton/acre	430
Cabbage	1,248 tons[b]	@ 7.5 ton/acre	166
Carrots	919 (104) tons[b]	@ 6.5 ton/acre	141 (16)
Celery	925 tons[b]	@ 6.5 ton/acre[d]	142
Lettuce	5,345 tons[b]	@ 6.8 ton/acre[d]	786
Peas	35 (298) tons[b]	@ 2.0 ton/acre	18 (149)
Tomatoes	1,864 tons[b]	@ 6-7 lbs. sq. ft.[d]	(greenhouse)
Other Vegetables	3,667 tons	@ 6.5 ton/acre[d]	538 (26)
Strawberries	215 (186) tons	@ 3.0 ton/acre[d]	72 (62)
Other Berries	26 (52) tons	@ 2.0 ton/acre	13 (26)

[a]Note: Resident population.

[b]*Marketing and Transportation Situation*, E.R.S., U.S.D.A., MST-181, May 1971, (Table 13, p. 25).

[c]Alaska Crop and Livestock Reporting Service, S.R.S., U.S.D.A. and estimates by agency agriculturalists.

[d]Includes greenhouse production.

( ) Frozen products.

TABLE XLI.

Production Potential for Crop Reporting Districts 1, 2, 3, and 5, 1980

Item	Est. Consumption[a] Farm Equivalents	Required Crop Acres Projected Yield[c]	Acres
Milk:	(98.669 mil. lbs.)[b]		
Barley	16,751 tons	@ 50 bu./acre	13,959
Oats	6,091 tons	@ 70 bu./acre	5,439
Hay	26,325 tons	@ 2.5 ton/acre	10,530
Oat-Pea Silage	76,944 tons	@ 6.5 ton/acre	11,836
Beef:	(116.023 mil. lbs. liveweight)[b]		
Barley	50,736 tons	@ 50 bu./acre	42,280
Hay	158,652 tons	@ 2.5 ton/acre	63,461
Oat-Pea Silage	520,173 tons	@ 6.5 ton/acre	80,027
Range—Pasture	199,334 A.U.	@ 8 month/year	-----
Pork:	(42.846 mil. lbs. liveweight)[b]		
Barley	37,667 tons	@ 50 bu./acre	31,389
Pasture—Forage	-----	-----	-----
Lamb and Mutton:	(2.536 mil. lbs. liveweight)[b]		
Barley	1,921 tons	@ 50 bu./acre	1,601
Hay	13,426 tons	@ 2.5 ton/acre	5,370
Range—Pasture	11,850 A.U.	@ 8 month/year	-----
Eggs:	(8.750 mil. doz.)[b]		
Barley	6,787	@ 50 bu./acre	5,656
Potatoes:			
Fresh	14,164 tons[b]	@ 13.5 ton/acre	1,049
Process	8,927 tons[b]	@ 12.5 ton/acre	714
Cabbage	1,429 tons[b]	@ 15.0 ton/acre	95
Carrots	1,194 (226) tons[b]	@ 12.0 ton/acre	100 (19)
Celery	1,043 tons[b]	@ 10.0 ton/acre[d]	104
Lettuce	7,864 tons[b]	@ 12.0 ton/acre[d]	655
Peas	456 (37) tons[b]	@ 2.0 ton/acre	19 (228)
Tomatoes	2,434 tons[b]	@ 8-10 lbs. sq. ft.[d]	(greenhouse)
Other Vegetables	4,541 tons	@ 6.5 tons/acre[d]	665 (34)
Strawberries	316 (263) tons	@ 3.5 ton/acre[d]	90 (75)
Other Berries	35 (81) tons	@ 3.0 ton/acre	12 (27)

[a]Note: Resident population.

[b]*Marketing and Transportation Situation*, E.R.S., U.S.D.A., MST-181, May 1971, (Table 13, p. 25).

[c]Alaska Crop and Livestock Reporting Service, S.R.S., U.S.D.A. and estimates by agency agriculturists.

[d]Includes greenhouse production.

( )Frozen products.

TABLE XLII.

Production Potential for Crop Reporting Districts 1, 2, 3, and 5, 1990

Item	Est. Consumption[a] Farm Equivalents	Required Crop Area Projected Yield	Acres
Milk:	(124 mil. lbs.)[b]		
Barley	21,072 tons	@ 67.5 bu./acre	13,074
Oats	7,662 tons	@ 80.0 bu./acre	5,986
Hay	33,114 tons	@ 3.0 ton/acre	11,038
Oat-Pea Silage	96,790 tons	@ 9.0 ton/acre	10,754
Beef:	(179.164 mil. lbs. liveweight)[b]		
Barley	78,347 tons	@ 67.5 bu./acre	48,362
Hay	244,992 tons	@ 3.0 ton/acre	81,664
Oat-Pea Silage	803,257 tons	@ 9.0 ton/acre	89,251
Range—Pasture	307,814 A.U.	@ 8 month/year	-----
Pork:	(54.520 mil. lbs. liveweight)[b]		
Barley	47,930 tons	@ 67.5 bu./acre	29,586
Pasture—Forage	-----	-----	-----
Lamb and Mutton:	(2.151 mil. lbs. liveweight)[b]		
Barley	1,629 tons	@ 67.5 bu./acre	1,006
Hay	11,387 tons	@ 3.0 ton/acre	3,796
Range—Pasture	10,051 A.U.	@ 8 month/year	-----
Eggs:	(10.513 mil. doz)[b]		
Barley	8,155 tons	@ 67.5 bu./acre	5,034
Potatoes:			
Fresh	14,688 tons[b]	@ 15.0 ton/acre	979
Process	12,191 tons[b]	@ 13.5 ton/acre	903
Cabbage	1,532 tons[b]	@ 20.0 ton/acre	77
Carrots	1,476 (396) tons[b]	@ 13.5 ton/acre	110 (29)
Celery	1,102 tons[b]	@ 10.0 ton/acre[d]	110
Lettuce	10,956 tons[b]	@ 13.5 ton/acre[d]	812
Peas	34 (654) tons[b]	@ 2.0 ton/acre	17 (327)
Tomatoes	3,041 tons[b]	@ 10-12 lbs. sq. ft.[d]	(greenhouse)
Other Vegetables	4,750 (433)	@ 6.5 ton/acre[d]	731 (67)
Strawberries	435 (354) tons	@ 4.0 tons/acre[d]	109 (86)
Other Berries	44 (122) tons	@ 3.5 ton/acre	13 (35)

[a]Note: Resident population.

[b]*Marketing and Transportation Situation*, E.R.S., U.S.D.A., MST-181, May 1971, (Table 13, p. 25).

[c]Alaska Crop and Livestock Reporting Service, S.R.S., U.S.D.A. and estimates by agency agriculturists.

[d]Includes greenhouse production.

( )Frozen products.

TABLE XLIII.

Production Potential for Crop Reporting Districts 1, 2, 3, and 5, 2,000

Item	Est. Consumption[a] Farm Equivalents	Required Crop Area Projected Yield	Acres
Milk:	(165.877 mil. lbs.)[b]		
Barley	28,161 tons	@ 75.0 bu./acre	15,645
Oats	10,240 tons	@ 90.0 bu./acre	7,111
Hay	44,256 tons	@ 4.0 ton/acre	11,064
Oat-Pea Silage	129,353 tons	@ 11.3 ton/acre	11,498
Beef:	(287.230 mil. lbs. liveweight)[b]		
Barley	125,603 tons	@ 75.0 bu./acre	69,799
Hay	392,764 tons	@ 4.0 ton/acre	98.191
Oat-Pea Silage	1,287,755 tons	@ 11.3 ton/acre	114.467
Range—Pasture	493,478 A.U.	@ 8 month/year	-----
Pork:	(73,769 mil. lbs. liveweight)[b]		
Barley	64,851 tons	@ 75.0 bu./acre	36.028
Pasture—Forage	-----	-----	-----
Lamb and Mutton:	(1.445 mil. lbs. liveweight)[b]		
Barley	1,102 tons	@ 75.0 bu./acre	612
Hay	7,703 tons	@ 4.0 ton/acre	1.926
Range—Pasture	6,799 A.U.	@ 8 month/year	-----
Eggs:	(13.410 mil doz.)[b]		
Barley	10,401 tons	@ 75.0 bu./acre	5,778
Potatoes:			
Fresh	17,578 tons[b]	@ 18.0 ton/acre	977
Process	28,321 tons[b]	@ 15.0 ton/acre	1,888
Cabbage	1,690 tons[b]	@ 24.0 ton/acre	70
Carrots	1,940 (585) tons[b]	@ 15.0 tons/acre	129 (39)
Celery	1,170 tons[b]	@ 10.0 tons/acre[d]	117
Lettuce	16,114 tons[b]	@ 16.0 ton/acre[d]	1.007
Peas	30 (991) tons[b]	@ 2.5 ton/acre	12 (396)
Tomatoes	3,855 tons[b]	@ 15.0 lbs./sq. ft.[d]	(greenhouse)
Other Vegetables	6,311 (682) tons	@ 6.5 ton/acre	97 (105)
Strawberries	630 (506) tons	@ 4.0 ton/acre	157 (127)
Other Berries	59 (190) tons	@ 3.5 ton/acre	17 (54)

[a]Note: Resident population.

[b]*Marketing and Transportation Situation*, E.R.S., U.S.D.A., MST-181, May 1971, (Table 13, p. 25).

[c]Alaska Crop and Livestock Reporting Service, S.R.S., U.S.D.A. and estimates by agency agriculturists.

[d]Includes greenhouse production.

( )Frozen Products.

TABLE XLIV.

Investments, Receipts, and Costs on Above-Average
Sized Dairy Farms in the Matanuska Valley, 1966*

	Mean
Production:	
Total milk sold per farm (pounds)	873,869
Cows 2-years-old and over (number)	86
Production per cow 2-years-old and over (pounds)	10,161
Investment Per Farm (January 1, 1967):	
Total investment	$187,882
Borrowed capital	79,559
Machinery investment	22,444
Investment per cow 2-years-old and over	2,185
Investment per cwt. milk sold	21.50
Gross Farm Receipts:	
Milk sales	$ 87,678
Other sales	4,463
Total sales	92,141
Price received per cwt.	10.05
Annual Costs of Production:	
Cash expenses paid (not including interest)	$ 64,234
Depreciation	4,463
Total annual expenses (not including interest)	$ 68,697
Incomes:	
Net operating margin	$ 23,444
Return to operators labor (2,920 hours @ $2.50)	7,300
Return to management (at 5% of gross sales)	4,607
Residual return to capital	$ 11,537
Rate of return on invested capital was approximately 6.15 per cent	

*Farms included in the very limited sample are operated by knowledgeable and experienced farmers operating what has been previously described as two-man units. Production per cow kept was above average for the valley and investment per unit of production was below average for the valley.

reflecting the "best professional judgement" of various scientists regarding available knowledge and technology, and possibilities for new and different products, production systems, and marketing infrastructures.

Expansion of Dairy Production

Milk production in Alaska has provided the largest single source of farm income every year since statistical records have been collected. Consumption estimates for 1970-2000 indicate possibilities for considerable expansion. Potential fresh milk consumption estimates would indicate the need for some 7,480 dairy cows in 1970, 8,580 in 1980, 9,930 in 1990 and 11,850 in 2000. While present production of milk is limited, even with store prices that seem to preclude per capita consumption at the national level, efficiently organized and operated dairies should be able to produce a major portion of the fresh milk and fresh milk products consumed within the state in the future. Dairy is the one agricultural industry that presently has a developed marketing infrastructure to service both civilian and military markets, consequently it should have the most immediate opportunity for expansion.

Cost studies in recent years have indicated that larger, more efficiently organized dairy farms can produce milk profitably. Case studies of smaller units have indicated that with reorganization and expansion of production, they, too, can become profitable. Recent farm surveys (Table XLIV) show the larger farms with a full return to all factor inputs and thus indicate the opportunity for profitable milk production in excess of what is presently being produced. Market prices for milk are reflective of delivered costs of "stateside" milk for processing in Alaska, and production costs are reflective of present factor input costs in the Alaska production area.

One case farm, assumed to be somewhat representative of the smaller dairy farms in the Matanuska Valley, was selected to study effects of reorganization and expansion of production.

The expansion alternative was explored by using available resources and estimating additional capital needed for an 80-cow herd. Assumptions were: (1) total farm acreage would be held at current level; (2) crops raised would be limited to barley, oats, and peas for silage, and grass for green chop and pasture; (3) field machinery cost and investment would be held at current level; (4) dairy ration and hay would be purchased; and (5) dairy herd would

be expanded within limits dictated by capital restriction. Restrictions posed were: (1) oat-pea silage crop would not exceed 100 acres and barley would not exceed 40 acres; (2) herd size would not exceed 80 cows, two-years-old and over, with necessary replacement stock under two-years-old; and (3) borrowed capital from all sources would not exceed $150,000.

An estimate was made of facilities and livestock needed to expand the dairy herd to 80 cows. This was transposed into an estimate of additional capital needed, along with expected expenses and income (Table XLV).

The case study indicated economically beneficial results from expansion of the unit and further benefits from increased production technology and increased input of the management factor (Table XLVI).

Cost estimates for dairy farms averaging 85 cows would indicate the opportunity for up to 100 herds in 1980, 115 herds in 1990, and 140 herds in 2000. Larger herds would undoubtedly be prevalent, but were not estimated because of the expectation that economies of scale would be realized with the herds averaging approximately 85 cows. Average production per cow was projected at 11,500 pounds in 1980, 12,500 in 1990, and 14,000 pounds in 2000.

Expansion of dairy herds towards the number needed to supply estimated quantities of milk needed in 1980, 1990, and 2000 would generate the opportunity for increasing barley, oat, and forage crop production towards acreage estimates in tables XL through XLIII (13,959 acres barley, 5,439 acres oats, and approximately 22,360 acres forage in 1980; 13,074 acres barley, 5,986 acres oats, and 21,792 acres forage in 1990; and 15,645 acres barley, 7,111 acres oats, and 22,562 acres forage in 2000). Production estimates throughout have been predicated on increasing yields and improving input/output ratios, thus more competitive store prices for milk.

The dairy industry in Alaska should have a promising future. The potential fresh milk market will increase several fold during the next 30 years. Relative cost reductions will occur with increasing size and efficiency of production units. Increasing numbers of dairies and grain farms will help stimulate a larger and more mature service and supply industry. However, public and private resources will have to be committed to that end. "Present research being devoted to dairy production is grossly inadequate. . . . Even if the research level were tripled, experts connected with the dairy industry would consider the program a minimum for adequate study of all aspects of

TABLE XLV.

Projected Changes in Investment, Costs, and Income for Case Farm

Current Total Capital Investment in Farm:

Current Capital Investment	$149,909
Proposed Additions:	
Cattle Shed, 60' x 100'	7,000
Barnyard, manure storage, feeders, etc.	12,000
Added grain handling equipment	2,800
Machine storage shed	3,000
Addition to house	9,000
40 cows @ $500	20,000
Additional equipment for milking facilities, etc.	5,200
Proposed Added Capital Investment	$ 59,000

Proposed Total Capital Investment:

Current Capital Plus Proposed Additions	$208,909

Projected Operating Expense

	Expense	Projection 1	Projection 2
Feed	$11,791	$24,187	$26,848
Seed and plants	1,132	2,264	2,284
Fertilizer	4,223	4,223	4,223
Gas, oil, and fuel	3,077	3,116	3,116
Repairs and maintenance machinery and equipment	1,035	1,436	1,436
Machine hire	86		
Labor hired	2,653	8,008	8,008
Vet. and livestock	896	1,792	1,792
Auto upkeep	560	560	560
Repairs and maintenance plus improvements	862	2,108	2,108
Taxes	560	779	779
Interest	4,214	7,164	7,164
Rent on farm	840	840	840
Insurance	1,014	2,028	2,028
Electricity and telephone	973	1,216	1,216
Truck hauling	20	200	200
Bookkeeping	45	600	600
Miscellaneous	102	308	308
Depreciation	3,282	7,090	7,090
Total Yearly Operating Expense	$36,366	$67,919	$70,584

TABLE XLV. (Continued)

Projected Changes in Investment, Costs, and Income for Case Farm

Projected Cash Farm Income	Current Sales	Projection 1 Sales	Projection 2 Sales
Total Cash Income	$39,299	$82,239	$90,834

Projection 1 was developed using current average production per cow in the dairy herd and current price received for milk. Production costs were adjusted, using unit costs, where increased use of resources was expected. Projection 2 was developed using trend increase in production per cow and current prices of inputs and output in all enterprises.

The summary of current and projected investments, costs, and income indicates that the projected adjustment and expansion of Case Farm would allow the unit to be moved from an "uneconomic" context to an "economic" context (Table XLVI). Projection 1 would cover total yearly operating costs, return to equity, and a nominal return to operator's labor and management. Projection 2 would indicate the opportunity to pay a higher rate for resources used in the farm firm throughout, particularly on borrowed and equity capital.

dairy science."[8] Institutional programs will also have to incorporate the kind of organizational flexibility that will enhance the effectiveness of research and related service programs on increasingly varied types of problems. The rate at which technological transition and change in the structure of agriculture is taking place stateside necessitates immediate action here. There is an immediate need for a general understanding of production and marketing systems over and above specific research results from individual projects or the services from individual programs. The formation of general research and service programs directed to identifying immediate and critical needs of the industry, and guiding research and services into those relevant gaps to increase the functional and economic efficiency of public and private investment, must occur in the immediate future if the industry is to make significant progress towards its future potential.

[8]University of Alaska Agricultural Experiment Station, "Dairy Production: Major Enterprise Within The State With A Good Potential Future," *Agroborealis*, Vol. 1, No. 2, Sept. 1969, pp. 4-9.

TABLE XLVI.

Summary of 1965 and Projected Investment,
Expenses, and Income for Case Farm

	1965	Projection 1	Projection 2[a]
Production:			
Total milk per farm (pounds)	378,500	776,200	858,900
Cows 2-year-old and over	39	80	80
Production per cow (pounds)	9,700	9,700	10,740
Average, herd milked (%)	72.3	80	80
Investment Per Farm:			
Total investment (includes dwelling)	149,909	208,909	208,909
Total borrowed capital	84,277	143,277	143,277
Owner's equity	65,632	65,632	65,632
Gross Cash Income Received:			
Total for milk sold	37,126	80,310	88,914
Other sales	2,173	1,920	1,920
Total sales	39,299	82,239	90,834
Cash Cost of Production:			
Cash expenses paid	29,433	60,829	63,494
Unpaid yearly operating expenses	6,933	7,090	7,090
Total yearly operating costs	36,366	67,919	70,584
Net Income:			
Business operating margin	2,933	14,320	20,250
Return to equity @ 5 per cent	3,282	3,282	3,282
Net income to labor and management	− 349	11,038	16,968

[a]Calculated with production increase due to improved practice and technology.

Expansion of Beef Production

The scope of Alaska's beef animal production potential is somewhat indeterminate because of the present small and undeveloped state of the industry, a dearth of technical information and experience regarding sustained grazing of the extensive range resource, a continuing lack of new and adapted research information and technology suited to the various geographic regions of the state, and the undeveloped state of beef and feed production systems needed for any modern livestock industry development. Persons who have pursued dreams of developing ranches, and a range livestock industry, have found Alaska's climate and economic environment harsh deterrents to "blood, sweat, and tears" types of development efforts. In most instances, the results were less than satisfactory. However, beef cattle numbers have continued to increase in most years since agricultural statistics have been regularly collected.

During 1970, Alaska producers supplied only a very small portion of potential instate consumption of beef and veal. The four crop and livestock reporting districts (1, 2, 3, and 5) produced less than 2 per cent of potential consumption. The estimated deficit would account for some 64,000 beef carcasses. Looking ahead some 20 years, the potential market may be equivalent to 158,000 choice beef carcasses. Potential acres of barley to produce such a quantity of beef would be 48,000, hay and silage 170,000, and range-pasture 308,000 A.U.[9] The potential number of beef carcasses needed needed in 1990, using 1970 instate carcass beef prices, would indicate farm revenues of some $55 million, and feed production valued at some $25 million to $30 million.

In reviewing the present situation, and the potential for growth and development of a beef cattle industry, certain factors of a general nature gave indications of expansion possibilities: (1) an abundant feed supply; (2) strong consumer demand for meat; (3) adequate marketing and processing facilities; and (4) desire, interest, and enthusiasm. Alaska appears to have the potential for an abundant feed supply of some types in certain areas. Soil survey data, as soil surveys are expanded, indicate increasing amounts of land suitable for crop production and grazing use. Consumption projections for beef and veal would indicate a rapidly expanding market over an extended period of time. Recent developments in the slaughter industry, such as the

[9]Animal units: 1 cow and calf = 1.0; 1-400 lb. calf or short yearling = 0.54; 1-680 lb. yearling or short two-year-old = 0.77; and bulls and horses = 1.2 each.

state-federal meat inspection program and new slaughter house construction, would indicate adequate opportunity for time-staging slaughter and marketing facilities to meet the needs of a rapidly growing beef industry. Finally, desire, interest, and enthusiasm for development and growth of a beef industry have been demonstrated for a number of years by individuals and more recently by some agencies.

When conclusions were positive regarding indications of expansion possibilities, other factors of a more specific nature were considered. They were: (1) geographic location of potential beef production; (2) availability of an adequate body of knowledge, technology, and experience related to development problems that must be solved; (3) availability of institutions and agency programs critical to industry development; and (4) public priority given to development of an Alaska beef cattle industry. Nowhere in discussions of agricultural development within the state does there appear to be more controversy than about the probable growth and development of a beef cattle industry. Positions vary from unlimited potential to practically no opportunity. Most conclusions drawn regarding geographic location of potential beef production are strongly influenced by geographic provincialism. Summaries of land capability classes suitable for grazing and crop use do provide some direction in defining probable areas of beef production, and historical ranching areas provide validation for some areas. The state of knowledge, technology, and experience related to development problems may best be described:

> The extent of applicable results in beef, sheep, swine, and reindeer research is severely limited by a paucity of research efforts directed to all aspects of production, marketing, and distribution in Alaska's peculiar sub-arctic "frontier-development" environment. The minor exploratory research in progress has resulted primarily in revealing the inadequacy of information regarding all aspects of the functional process of a livestock and meat industry development. Research is needed to ascertain and evaluate the basic inventory of available physical resources that might be used in developing the industry. Basic research is needed in all aspects of range evaluation and management; environmental engineering of farm structures and specialized equipment for handling and/or storage of grain, forages, manure, and for various land clearing and soil conserving problems; various aspects of animal husbandry, including genetic evaluations and combinations oriented to hardiness and suitability for specific climatic and geographic locations, polygastric nutritional research specific to the area, health problems peculiar to the sub-arctic, adaptive husbandry problems, and carcass evaluation and utilization; grain and forage production and storage systems; and development of range resources, production management, marketing, slaughter, transportation, distribution, consumer attitudes and acceptance of

"Alaska" meat, capital and credit, and industry development policy. Results of such studies would provide the basis for sound industry development and for additional basic and applied research on each type of livestock.[10]

Institutions and agency programs critical to industry development are beginning to emerge, but may be inadequate to meet the timing needs of industry development. Meat inspection and quality control programs have been initiated, an animal disease laboratory is functional, research facilities and programs have been funded but have not yet emerged, other agency programs have been slow in reorienting to the needs of a developing beef industry. Public priority has not yet been given to beef industry development even though limited appropriations have been made for public research facilities and service programs.

As indicated earlier, the paucity of research directed to beef industry development leaves much room for conjecture in determining the potential for beef industry development. Present production provides only a limited basis for projecting future development. Present grazing leases and estimates of production capacity (Table XLVII) lend little optimism to projections of industry growth and development. However, consumption projections for the future do indicate a rapidly expanding market for beef and veal. Continuing development of soil survey and land use capability studies provide knowledge regarding additional areas suitable for beef production. Emerging public interest in agricultural industry development lends limited optimism regarding staging and development of research, service, and education institutions, which are critical to such development. Recent interest and innovations in some areas of controlled environment technology provide additional optimism regarding potential beef production in the Interior. Beef production can have a bright future if resources are committed to industry development.

Expansion in Hog Production

Pork production has received little attention in past years because of limited feed supply, no marketing infrastructure for Alaska-grown pork, and limited knowledge about growing hogs in Alaska's farming areas. The few hogs raised were generally located near military bases, where dependable

[10]Wayne E. Burton, "Report of Research and Goals Committee on Red-Meats Research," I.A.S., University of Alaska, 1970, Unpublished report, pp. 23-24.

TABLE XLVII.

Current Alaska Ranching Area, Potential Cattle Production Excluding the Mainland

Animal Units of Grazing — 15,536[a]

Number of Cattle Under 12 Month Grazing System for Cow Herd, Selling Two-Year-Olds[b]

	Kodiak	Islands Off Kodiak	Shumagin Group And Others	Aleutians	Total
Acres	229,940	182,951	231,978	966,062	1,610,931
Animal Units	2,478	3,263	2,770	7,025	15,536
Classes of Cattle					
Cows	1,061	1,398	1,186	3,007	6,652
2's (Replacements)	215	282	239	607	1,343
2's (Mixed)	810	1,067	907	2,303	5,087
1's (Mixed)	1,051	1,381	1,174	2,972	6,578
Bulls	50	68	57	145	320
Total Cattle	3,187	4,196	3,563	9,034	19,980
Expected Yearly Slaughter					
2's (Steers)	498	655	556	1,407	3,115
2's (Heifers)	288	379	323	813	1,803
Cows	174	230	194	496	1,094
Bulls	18	19	18	49	104
Total Number	978	1,283	1,091	2,765	6,116
Expected Yearly Slaughter (lb.)[c]					
2's (Steers)	331,923	436,564	370,507	946,326	2,085,321
2's (Heifers)	162,459	213,953	182,042	458,367	1,016,821
Cows	86,453	114,630	96,699	247,192	544,975
Bulls	12,638	13,541	12,638	34,303	73,121
Total Pounds	593,473	778,688	661,886	1,686,189	3,720,237

[a]Bureau of Land Management, U.S. Department of Interior, "Summary of Current Grazing Leases and Reported Use," Maximum A.U. Used.

[b]Bureau of Reclamation, "Livestock Industry in Alaska: Possibilities for an Integrated Livestock Industry on Kenai Peninsula, Kodiak, and Adjoining Islands," Juneau, Alaska: U.S. Department of Interior, March 1967.

[c]Average dressed weights from U.S. Average, Livestock & Meat Statistics, 1967. Supplement to Stat. Bulletin No 333.

supplies of garbage were available. Much of the pork was used for sausage. Recent interest in large-scale commercial barley production in the Tanana Valley has stimulated active interest in commercial pork production. As with other red-meat products, the paucity of adapted research information and technology suited to climatic conditions and particular geographic locations places a heavy burden on both the potential grain and hog producer. However, projected consumption estimates do lend credibility to optimism regarding potential commercial pork production in Alaska.

Consumption estimates projected over the next 30 years would indicate the need for 143,000 hog carcasses in 1970 increasing to 328,000 by 2000, if national per capita consumption were to be attained in Alaska. Barley production needed to produce such hog numbers would range from 31,400 acres in 1970 to 36,000 acres in 2000, even with projected increases in barley yields. The expansion opportunity for hog production appears to be very good.

Controlled environment housing and year-round production would be expected because of climatic conditions. Cost estimates have been calculated using two levels of management based on feed conversion ratios of 3.5 to 1 and 3.0 to 1. Two barley prices have also been used, one being the recent price of $80.00 per ton and the second being $62.00 per ton from cost estimates in Chapter IV. Labor requirements were estimated at 1.9 hours per 100 pounds liveweight of hogs produced, which could be greatly decreased with larger-scale operations.

Research information and adapted technology are lagging far behind the present stage of hog and barley production development. Adapted grain varieties, fertilizer response data, production systems, suitable machinery for newly cleared land, and numerous other gaps in information and technology are rapidly being identified as deterrents to immediate production success. Some of these problems are being partially overcome through cooperation with commerical companies and very limited research efforts. Institutionsal and agency inputs from the public sector will have to be increased manyfold if pork production in Alaska is to reach its potential.

Budgets were estimated for an enterprise producing some 800 hogs per year. It would be expected that larger units would develop if the hog enterprise were the primary income enterprise of a farm. Costs per pound liveweight would be quite similar if more than one hog house or larger hog

houses were used. Acres of barley required would be 250 to 174 for Management Level I hog budgets and approximately 215 to 150 for Management Level II, using average production possibility estimates for barley.

Production costs per pound liveweight for hogs were calculated at 24.57 cents with barley at $80.00 per ton and 21.81 cents with barley at $62.00 per ton when Management Level I production costs were used. When Management Level II costs were used, overall costs were calculated at 21.93 cents and 18.76 cents per pound liveweight (Table XLVIII). To make comparisons with reported prices, liveweight costs per pound were converted to dressed weight costs per pound, which included 3.5 cents per pound added for farm slaughter and delivery. Calculated costs were 36.25 cents and 33.43 cents per pound under Management Level I, and 32.74 cents and 28.66 cents per pound under Management Level II. Reported prices for the 1960-67 period averaged 41.94 cents, with 53.10 cents in 1966 and 52.80 cents in 1967. Carcass pork prices are reported at approximately 60 cents per pound in 1970.

Projected differences between production costs and recent instate prices for carcass pork further indicate an opportunity for considerable expansion in hog production. Efficient hog producers should be able to supply a considerable part of the pork for Alaska markets at 18.76 cents to 21.93 cents per pound liveweight. Thus, hog producers should be very competitive in bidding for development capital.

The hog industry should have a promising future, especially when considered in conjunction with barley production in the Tanana Valley. Private resources are being committed to that end at this time. One developing large-scale commercial barley-hog farm provides a focus of interest for such development. It expects to produce some 6,000 acres of barley within five years and some 14,000 hogs per year within ten years. The present rate of development indicates that such time goals will be met. It has recently been reported that at least three more hog producers will have at least 100 sow herds within the year.

Expansion of Sheep Production

Sheep ranches are presently located on Umnak and Unalaska islands and on the Kenai Peninsula, with very small flocks in various other locations.

TABLE XLVIII.

Estimated Investment and Production Costs
For the Hog Enterprise

	Management Level I		Management Level II	
Investment:				
Land (5 acres)	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Breeding stock (50 sows and 3 boars)	5,450	5,450	5,450	5,450
Buildings & equipment	28,000	28,000	28,000	28,000
Operating capital	14,555	11,645	12,476	9,981
Total Continuing Investment	$49,005	$46,095	$46,926	$44,431
	(Barley $80/ton)	(Barley $62/ton)	(Barley $80/ton)	(Barley $62/ton)
Estimated Expenses:[a]				
Feed	$23,288	$18,631	$19,961	$15,969
Other-out-of-pocket costs	5,822	4,658	4,990	3,992
Interest on 50 per cent of investment	1,470	1,388	1,408	1,333
Depreciation	2,155	2,155	2,155	2,155
Total Cash Costs	$32,735	$27,327	$28,514	$23,449
Return to operator and family labor	$ 5,100	$ 5,100	$ 5,100	$ 5,100
Return to equity investment	1,470	1,470	1,470	1,470
Total Annual Cost	$39,305	$34,897	$35,084	$30,019
Total cost (in cents) per pound (liveweight)	24.57	21.81	21.93	18.76
Total cost (in cents) per pound (dressed weight)	36.25	33.43	32.74	28.66

[a]Expenses were calculated for 800 butcher hogs of approximately 200 pounds liveweight. Labor costs were calculated for 2,040 hours at $2.50 per hour.

Ranches in island locations have concentrated on wool production because of unavailability of transportation to move lamb and mutton into a red-meats market. Herd composition emphasizes wethers, and minimizes ewe flocks to that necessary for replacements and planned growth in total flock numbers. Lamb crop percentages have historically been quite low. Shorn fleeces tend to be heavier than national averages and of better than average quality.

Interest has arisen from time to time regarding slaughter and marketing of mature sheep from island locations. Possibilities of exporting mutton to Japan have been explored in some detail. The absence of slaughter facilities in the past that would meet federal inspection standards precluded export shipment. It has recently been reported that a slaughter facility is near completion on Umnak Island that will meet state-federal standards under the wholesome meat act. This plant will provide an opportunity to ship frozen mutton and beef, and thus a potential market outlet for island mutton and beef. Interest has been expressed in distributing mutton to village markets, particularly where reindeer meat is insufficient to meet present demand.

Alaska consumption of lamb and mutton has historically been low. Potential consumption, if we were to attain national per capital averages, would indicate a possible market for the equivalent of some 24,000 lamb carcasses by 1980 and a slightly smaller number in 1990. It might be expected that the numbers would be somewhat less because a larger number of mutton carcasses are being used. Because of the location of present sheep flocks, and limited grain requirements for fattening lambs, needed acres of barley and hay would be limited. Estimated barley acres ranged from 2,008 in 1970 to 612 in 2000, and 2,190 acres of hay in 1970 to 1,926 acres in 2000. Export possibilities for mutton do appear quite good, thus adding to the optimism of possible development of the sheep industry. Here again, research and institutional services have been negligible because of the location of present flocks and lack of general interest in sheep production.

Reindeer

The Stanford Research Institute report to the governor summarizes one perspective of potential industry development:

> The economic potential of reindeer in Alaska is clearly great enough that the subject deserves serious study. Assuming that Hanson's 1950 estimate of Alaska's long term carrying capacity of 320,000 reindeer is acceptable . . . a slaughter yield of 100 pounds per reindeer carcass and an annual slaughter of 118,000 head for Alaska (on a sustained basis) implies production of 11.8 million pounds of hung reindeer carcasses . . . with reindeer carcass prices of 40 to 50 cents a pound in Nome, the Alaska reindeer industry conceivably could produce an income to herders and slaughters of something between $4.7 and $5.9 million annually.[11]

Such a perspective would warrant considerable effort and investment in developing additional information, and in pursuing solutions to recognized and unrecognized problems of industry development. A recent study provides some perspective of the recent past:

> . . . those government agencies concerned with reindeer have agreed upon a division of labor. State personnel are charged with processing and marketing, Bureau of Indian Affairs personnel will continue to supervise and develop deer production methods, and the Bureau of Land Management has assumed complete responsibility for range land utilization. Such functional separation is not paralleled in the world of the Eskimo owner. . . . That some people specialize in an area of range control or marketing appears impractical to the herder in that one thus learns only a part of the job. . . . For him, there is no distinction to be drawn. The herding, marking, processing, and marketing of reindeer form a single package of activities that cannot be discussed at length separately or apart from himself or his village. . . . The inundation of government specialists, each bearing the fruits of isolated inquiry and imbued with the certainty that his expertise will remove *the obstacle* to industrial expansion, has produced little more than confusion and uncertainty among Eskimo herders.[12]

[11]"Planning Guidelines for the State of Alaska," prepared for the Office of the Governor, State of Alaska, Stanford Research Institute, Project 8183, December 1969, Chapter IV, "Agriculture."

[12]Dean Francis Olson, *Alaska Reindeer Herdsmen: A Study of Native Management in Transition*, Institute of Social, Economic and Government Research, University of Alaska, College, S.E.G. Report No. 22, December 1969, pp. 134-37.

Additional comments perhaps may reflect another side of the problem:

> The precise role of Native ownership of reindeer in western Alaska has been the subject of almost continual evaluation since 1892. Originally conceived as a subsistence industry, this policy view has been brushed aside each time the possibility of a supportive, semi-commercial ownership role has presented itself. . . . All herd owners, to the extent that their resource base permits, respond to both subsistence and commercial ownership criteria, and federal government programs have also reflected this same ambiguity with regard to ownership objectives. . . . The measurement of "progress" is, of course, obscured by the absence of a single objective or policy orientation.[13]

It would appear that the initial step in reindeer industry development would be selection of a single general goal and policy orientation, and the organization of a single coordinated multidisciplinary task-force group that would seek an understanding of production and marketing systems over and above individual research projects or agency programs. Experience dictates this to be inordinately difficult to accomplish. However, the socio-economic goal structure must be determined in some manner, for a point in time, if research and service programs are to be carried out that will serve to identify immediate and critical needs of the industry and guide research and service programs into those relevant gaps.

A single administrative authority for such a multidisciplinary group would go far to alleviate the apparent fragmentation and confusion of past development efforts. It would also provide the opportunity for liaison and coordination with reindeer producers in a manner not heretofore attained, and one that would be compatible with the social decision process involved.

Scientific and technological activity would have to be close to the production area, and the results of such activity must be demonstrably useful to the individual producer. The direct relationship between the growth of a firm or an industry and the level of investment in research development must be reiterated, particularly because of the remote location and the unique character of the reindeer enterprise in American agriculture.

[13] *Ibid.*

Expansion of Potato Acreage

Alaska's potato industry has been oriented to the fresh table-stock market, and primarily to the military contract market for an extended period of time. Average harvest during the 1960-65 period was 754 acres, and has declined to some 620 acres in 1969-70. Drouth in production areas has affected acreages in recent years. Average costs of production, including storage and distribution, in a survey sample were $4.12 per hundredweight in the Matanuska Valley during the 1965-67 period. Other farming areas undoubtedly had higher production costs because of transportation costs on factor input items and lower yields, but, elsewhere, prices per hundredweight were higher than in the Matanuska Valley.

Projected consumption estimates for the period 1970 through 2000 indicate the need for potato acreages ranging from 1,345 acres of fresh table stock and 430 acres of processing potatoes in 1970 to 977 acres of fresh table stock and 1,888 acres of processing potatoes in 2000. National per capita consumption averages may somewhat underestimate potato consumption at present, but it is anticipated that Alaska consumers will tend to move toward national trends as time goes on. Cost estimates for farms averaging 43.3 acres of potatoes could be competitive until prices dropped to $3.31 per hundredweight (Table XLVIX) and farms with 80 acres of potatoes could be competitive until prices dropped to $2.83 per hundredweight (Table L). The 15-ton yield projected in Management Level I is being attained by some producers at present. The 24-ton yield projected in Management Level II is not yet being attained, but is expected with new and different information and technology by later projection dates. When this higher yield is attained, expected costs on 80-acre units would go down to $2.34 per hundredweight, using reported factor input prices. Further cost reductions would be expected on larger production units.

If Alaska's potato producers are to have the opportunity to capture a major portion of the instate market in future years, several changes must come about. Potato varieties that will directly compete with those being shipped in from "outside" must come into common usage by Alaska producers. Many Alaska consumers are recently from other states and retain their "outside" consumption preferences. Sales promotional efforts must be intensified to change new consumers' attitudes with regard to Alaska potatoes. Advertising of "local new potatoes" in midwinter does little to improve the image of Alaska potatoes, especially when the potatoes are neither local nor new. In the future, some portion of the processing potato

TABLE XLVIX.

Costs of Producing Potatoes With Different Yield Levels, Matanuska Valley (43.3 Acres Potatoes)*

Acres in Farm			217
Acres in Potatoes			43.3
		Mgt. Level I	Mgt. Level II
Production Per Farm:			
Production (tons)	476.3	649.5	1,039.2
Yield (tons per acre)	11[a]	15	24
Investment Per Farm:			
Land	$ 25,900	$ 25,900	$ 25,900
Buildings	51,171	51,171	80,215
Machinery & equipment	24,789	24,789	24,789
Annual operating capital	23,504	26,797	36,462
Total Investment	$125,454	$128,657	$167,366
Annual Operating Expenses:			
Cash operating	$ 23,504	$ 26,797	$ 36,462
Depreciation	4,438	4,438	5,890
Total Annual Operating	$ 27,942	$ 31,235	$ 42,352
Return to capital	6,273	6,433	8,368
Operators unpaid labor	5,200	5,200	5,200
Total Costs (except management return)	$ 39,415	$ 42,958	$ 55,920
Cost per acre	$910.28	$992.10	$1,291.00
Cost per cwt.	$ 4.12	$ 3.31	$ 2.69

*Estimates made on proportionate increased storage, harvest storage, and selling costs. It was assumed that a major portion of yield increases would come from improved genetic stock, improved production systems, timing, and knowledge.

TABLE L.

Cost of Producing Potatoes with Different Yield Levels, Matanuska Valley (80 Acres Potatoes)

Acres in Farm			217
Acres in Potatoes			80
Production Per Farm:		Mgt. Level I	Mgt. Level II
Production (tons)	880	1,200	1,920
Yield (tons per acre)	11	15	24
Investment Per Farm:[a]			
Land	$ 33,950	$ 33,950	$ 33,950
Buildings	80,215	80,215	113,944
Machinery & equipment	37,183	37,183	37,183
Annual operating capital	37,606	45,542	63,398
Total Investment	$188,954	$196,890	$248,475
Annual Operating Expenses:			
Cash operating	$ 37,606	$ 45,542	$ 63,398
Depreciation	7,129	7,129	8,815
Total Annual Operating	$ 44,735	$ 52,671	$ 72,213
Return to capital	9,448	9,845	12,424
Operators unpaid labor	5,200	5,200	5,200
Total Costs (except management return)	$ 59,383	$ 67,716	$ 89,837
Cost per acre	$742.25	$846.45	$1,128.00
Cost per cwt.	$ 3.38	$ 2.83	$ 2.34

[a]Cleared land increased proportionately to increased potato acres. Buildings increased proportionately to increased storage needs. Proportionate increase in Machinery Investment and proportionate increase in Operating Expenses minus 12 per cent as indicated by committee of potato growers.

market may be opened up through development of processing facilities. Food technology laboratory facilities will undoubtedly be necessary to overcome some of the current problems of processing Alaska potatoes.

Yield increases, particularly outside the Matanuska Valley, will necessarily have to be effected at a very early date if expansion of potato acreage is to occur. Much of the necessary information and technology is presently available to accomplish this task. Irrigation would offset present seasonal moisture problems. Fertilizer practices and amounts used could be adjusted to noticeably improve yields. Timing of tillage and harvesting operations are critical in most localities, and must be more critically observed. Technology must be updated to the level of the best stateside products. Even with these changes, research attention to new and advanced information and production systems will have to be increased several fold, both in quantity and effectiveness.

At best, Alaska's potato industry will remain small. Even if Alaska producers were to capture a major portion of both fresh table stock and processing potato markets, using the most optimistic demand estimates, it is not anticipated that potato acreage would reach 2,500 acres. If potato production were to take on the characteristics of commercial stateside production, one could only project a decreasing number of potato farmers.

Expansion of Vegetable Production[14]

The image of Alaska vegetable production is often tied to 50 pound cabbages and oversized turnips. Tourist and resident consumer access to many Alaska vegetables is often limited to fair displays, roadside stands, or someone's home garden. Retail distributor handling has not always presented Alaska produced vegetables at their best, and vegetable producers have not always provided retail stores with the best quality of product. Consequently, Alaska consumers have not used Alaska produce in quantities that would nearly approach production potential. Wide differences between consumption and production potential have stimulated considerable discussion regarding potential expansion of the vegetable industry. Results of preliminary discussions indicate a considerable number of potential commercial vegetable crops:

[14]Much of the discussion of potential expansion of vegetable production has been gleaned from many hours of discussion with Dr. Donald H. Dinkel, Head, Dept. of Horticulture, I.A.S., University of Alaska.

> The vegetables which can easily be grown in Alaska include potatoes, carrots, cabbage, cauliflower, lettuce, brussels sprouts, peas, beets, celery, green onions, rhubarb, broccoli, cucumbers, tomatoes, zucchini, rutabagas, turnips, radishes, and parsnips. Other vegetables that could be grown in Alaska are: beans (green and broad), chives, corn, eggplant (greenhouse only), fiddlehead fern, greens (beet, mustard and turnip), horseradish, kale, kohrabi, mushrooms, parsley, peppers (greenhouse only), spinach, squash, swiss chard, and summer squash.[15]

It should be recognized that only a limited number of the vegetables listed are being grown commercially. Others have been grown in home gardens, greenhouses, and research plots for many years. The list is not exhaustive, and not all vegetables are suited to field production. New and different research information, technology, and production systems would undoubtedly increase and refine the list mentioned. Historical patterns of commercial vegetable production have been determined by grower familiarity and preference, with the selective support of research and service inputs. Research and service priorities have been determined in the following manner.

> To derive the greatest impact from limited research and development resources, agricultural researchers approach the problem by evolvement of a choice of priorities from the present state of knowledge of individual crops, available land and microclimate, knowledgeable and interested producers, available storage, processing and marketing facilities, and that which provides the greatest assurances of success in terms of financial returns to the producer.[16]

One might translate the above statement, "To help our selected cooperators with their previously recognized problems." This might help explain much of the present product composition, size, and geographic location of commercial vegetable production. However, the continuation of this philosophy will certainly retard expansion potential of commercial vegetable production.

Recent perusals of available research information and technology provide substantial insights into potential industry development and expansion. Many limiting factors in present vegetable production could be alleviated

[15]University of Alaska Agricultural Experiment Station, "Vegetables in Alaska: Current Demand Indicates Market for $3 Million Farming Industry," *Agroborealis*, Vol. 1, No. 2, September 1969, pp. 7-10.

[16]*Ibid.*

through expanded and intensified multidisciplinary research and service efforts directed to varietal screenings and plant breeding, adapted tillage systems, production technology and equipment, irrigation practice and equipment, fertilizer responses for various soils and crops for specific areas, harvest technology and equipment, storage systems and facilities, product quality and grading standards, product packaging, and marketing systems.

Production of some types of vegetables (cabbage, cauliflower, broccoli, brussels sprouts, summer squash, winter squash) could be noticeably increased if direct field planting were practiced. To accomplish this transition, it would be necessary to utilize precision planting equipment, irrigation, different tillage practices, and mechanization comparable to the most advanced stateside growers. Acreages could be rapidly increased, particularly if new and different harvesting technology were also incorporated into the production system.

A clear polyethylene mulch has been used for several years to enhance yields of sweet corn, cucumbers, summer squash, winter squash, and snap beans in research and garden plots. Field production, using the clear polyethylene mulch, has been limited by the absence of field machinery suited to economic application of the mulch and field planting of adapted crops. Clear polyethylene row covers also appear to offer considerable promise for field production of tomatoes, peppers, green onions, early radishes, cucumbers, leaf and romaine lettuce, strawberries, melons of various types, and perhaps a number of other crops. Row covers would give crops the advantage of early season sunlight, particularly if portable heaters were used to offset risk of occasional light frosts. The clear polyethylene mulch and row covers, if used commercially, would allow quite rapid expansion in a number of vegetables and melons that are not presently in commercial production, or that are produced in very limited quantity.

Proper fertilization and supplemental water use have been persistent problems for the commerical vegetable producer. It has been estimated that vegetable production possibilities will increase as much as threefold from improved varieties and cultural practices, irrigation, and increased knowledge of fertilizer use. Comparable production increases could be anticipated if problems of vegetable storage were solved. Greenhouse production of vegetables has equivalent or greater possibilities because of advances in lighting sources and other technological innovations.

Research and grower experience indicate considerable promise for greenhouse growing of a number of vegetables on a commercial scale.

Research and development effort will need to be expended to gain additional knowledge and adapt present techniques and technology to enhance probabilities of enterprise success. A recent survey of greenhouse producers in the Fairbanks and Anchorage communities indicates a mounting need for research and service inputs. Extended discussions on "growth-factory" type greenhouses, to be used for year-round production of vegetables and ornamentals, substantiate both the promise for greenhouse production of vegetables, and the need for greatly increased research and service inputs.

Green peas have provided the stimulus to visions of a frozen-food-products industry within the state. The "pilot-project" for freezing green peas at Palmer, in 1968, was expanded to include test runs of fiddlehead ferns during the summer of 1969. Test runs were also made on carrots, broccoli, cauliflower, and brussels sprouts in 1968 and 1969. The enthusiasm with which the project has been promoted by the individuals involved, the press, and other supporters of the project could be considered indicative of growth opportunities for a frozen vegetable industry; however, other food processing studies and consumption projections for Alaska would indicate only a modest multiproduct processing facility sometime in the future.

Particular emphasis on controlled environment storage, storage techniques, and storage materials for most vegetables will have a major impact on expanding Alaska's vegetable industry. Such efforts should materially extend the marketing season beyond the limited growing season. It would also allow development of a marketing infrastructure with which Alaska producers could gain entry into, and service, the food distribution industry.

Because of present limited acreages of vegetables and widely varying production and marketing situations for instate producers, projected cost estimates have been omitted; however, brief comments have been included on a selected list of vegetables.

Lettuce appears to be one of the more promising field vegetables for production expansion, with historical experience of successful field production and excellent consumer acceptance of the Alaska grown product. "Research that has been done indicates that lettuce may be stored in Alaska long enough to market local lettuce through January 1, without too much difficulty."[17] Recent appraisals of potential greenhouse lettuce production

[17] *Ibid.*

indicate an economic probability for year-round production. Greenhouse production may be limited to leaf and bib types, with present technology. Projected potential lettuce consumption for the four districts, excluding Southeast, ranges from some 5,300 tons in 1970 to some 16,000 tons in 2000. Combined field and greenhouse production could provide a major portion of the lettuce consumed in Alaska.

Cabbage also appears to have considerable potential for commercial production expansion. Certain Alaska-developed varieties can be harvested over a long period of time without splitting, and can be stored well into the following year with proper storage techniques and facilities. Alaska produced cabbage has met with excellent consumer acceptance over time. Projected potential consumption of cabbage ranges from 1,250 tons in 1970 to 1,690 tons in 2000. Field production of cabbage could provide a major portion of the anticipated consumption in the foreseeable future.

Carrots have been produced commercially over an extended period of time. Alaska produced carrots have the advantages of excellent flavor and texture, and can be stored for several months. Historically, market quality and packaging of Alaska produced carrots has not always attracted consumers. Production practices, technology, and mechanization will have to be improved if Alaska producers are to capture a major portion of expanding markets. Research and service programs will have to concentrate on "packaged" production systems.

Tomatoes are at present considered a greenhouse crop. More research information is now available on tomatoes than for any other greenhouse crop in Alaska. However, there is need for a production "package" including management techniques, lighting, fertilizers, watering, production practices, temperature requirements, grade requirements, and market requirements. The variety, "Early Tanana," will produce good yields of fruit under field conditions in the Tanana Valley. Use of row covers would allow increased field production, perhaps using additional varieties. Tomatoes appear to have an excellent potential for production expansion, both in greenhouse and field production.

Radishes grown under cool conditions are large and have a mild flavor. They can be stored for a period of time if tops are removed. Production has been quite limited in most years. There appears to be an excellent

probability of production expansion if precise production systems are developed for field production, field production using row covers, and greenhouse production. With the development of such production systems, and the necessary "packaged information and technology," production could be extended throughout a major portion of the year. As with other vegetables, an extended production season would enhance market entry and the probability of supplying Alaska markets.

Celery is one of the salad crops that appears to offer considerable market opportunity. It grows well and is of excellent flavor and texture. Celery has been grown for the commercial market from time to time, and is commonly grown in gardens. The potential market is some 925 tons in 1970 and 1,085 tons in 2000.

Broccoli appears to have a definite advantage in flavor and texture when grown in the cool Alaska climate; however, the commercial market appears small for the fresh product and only 400 tons of frozen broccoli are projected by 2000. There appears to be only a limited commercial market until a multiproduct freezing facility becomes a reality.

Corn (fresh) appears to be one of the more opportune crops for commercial expansion. Research and garden plot growth, using a clear polyethylene mulch, has demonstrated excellent production. Commercial production has been limited by the lack of mechanization. While the national per capita consumption for fresh corn shows a downward trend, the potential Alaska market appears to be some 950 tons at present and increasing to some 1,440 by 2000. The frozen corn market does not appear to be in the offing with present states of knowledge.

Cucumbers have been one of the standard greenhouse crops, and will continue to be of importance for greenhouse production. "Growth-factory" type greenhouse production would extend the production season throughout the year. Row covers would allow summer field production of some varieties. Present potential market is for some 400 tons and this potential market will increase threefold by 2000. There appears to be an excellent opportunity for commercial production expansion.

Other Vegetables, including green onions and shallots, peas, beets, spinach and chard, cauliflower, brussels sprouts, rutabagas and turnips, and various other greens, will undoubtedly offer some opportunity for expansion in multiproduct commercial truck gardens. At such time as there is some

freezing capacity, some of these vegetables may offer promise for commercial field production. Summer and winter squash, when clear polyethylene mulch is used, produce excellent yields.

Commercial vegetable production, when assessing agricultural development potential, often labors under the burden of relatively small acreages when compared to grains, forages, and grazing. The dollar volume of vegetable crop potential is often overlooked and development needs are minimized. If the vegetable industry is to have the opportunity to grow, in relationship to expanding markets, major concentration will have to be given to channeling public and private resources into the industry.

Small Fruits, Bedding Plants, and Nursery Products[18]

The general groupings of small fruits, bedding plants, and nursery products are not recognized as agricultural products in Alaska. Producers are not recognized as part of the agricultural industry. Institution and agency programs and personnel have excluded such products, and enterprises, from the definition of "agriculture." Potential development of this sector of the agricultural industry has suffered from the resulting neglect. However, with the ever increasing interest in improving the environment in which we live and the quality of food products which we consume, agricultural industry emphasis will change from "feed base" to "quality of life," and the definition of "agriculture" will be expanded to include a far broader range of products. Growth in population and increasing standards of living in Alaska have shifted many interests from "gleaning from the wild" to acquiring the accouterments of urbanization. Particular emphasis will be directed to production of vegetables and fruit of superior freshness and more delicate flavor; indoor plants and the technology with which to grow them, to offset winter doldrums generated by long winters and short days; and high quality-low maintenance plant materials, which meet specific indoor and outdoor needs and can withstand environmental stresses and, at the same time, be ecologically compatible in most locations.

[18]The discussion of small fruits, bedding plants, and nursery products was developed in cooperation with Dr. Donald H. Dinkel, Head, Dept. of Horticulture, I.A.S., University of Alaska.

Small fruits attracted considerable attention in early settlements and research units, but interest generally declined over the years. "Wild berries of some kind are found from one end of the state to the other under extremely varied conditions of climate and soil." This probably explains much of the general apathy towards development of commercial small fruit production. With increasing urbanization, the wild berry will diminish in importance in the typical household, and an increasing concern will be directed towards garden and commercial production of a number of small fruits. The initial emphasis will undoubtedly be directed to producing planting materials rather than commercial fruit production. Initial concern will focus on certain plants:

> The kinds of small fruits of particular concern to Alaskans are the strawberry, raspberry, cranberry, lingonberry, blueberry, currant, gooseberry, elderberry, cloudberry and bearberry, most of which have some species that are indigenous to Alaska.[19]

Alaska-developed strawberries are in the offing, from College, which appear to offer promise for commercial and home garden production. The variety *Alaska Pioneer* was released in 1968, and other selections appear nearly ready for release. The new varieties have been produced by hybridizing the native species with domesticated kinds. They are particularly hardy, and appear to be of excellent flavor, texture, and color. Initial commercial production will necessarily be directed to plant sales. One production and marketing system that offers promise in maximizing distribution of these new varieties is to harvest plants in the fall, hold them in controlled environment storage through the winter, and ship them to distributors or individual customers in the early spring. It is possible that plants may be started in greenhouses for field transplanting either in the open or under row covers, or plants may be grown in the greenhouse to extend the production season. The potential market for fresh strawberries appeared to be some 215 tons in 1970 and will increase to more than 600 tons by 2000. Frozen strawberries offer an almost equivalent market. The market for strawberry plants is of undetermined size, but appears to offer promise for development both for instate and export markets.

[19]University of Alaska Agricultural Experiment Station, "Small Fruit Development: Air Freight Business May Open New Outside Market For Alaska," *Agroborealis*, Vol. 1, No. 2, September 1969, pp. 15-17.

The cranberry, lingonberry, blueberry group appears to offer promise for commercial production in Alaska. "Low insect and disease occurrences within the Alaska environment, coupled with mechanization and Alaska's favorable soil and climate conditions could provide a favorable competitive situation for rather large export markets."[20] A considerable research and development effort will have to be made to bring this about. While many areas are similar in climate and soils to areas where cranberries are commercially grown, and lingonberries and blueberries are found in abundance in the wild, no information is available about the suitability of these for commercial production at this time. Problems of propagation and culture of the indigenous berries will have to be solved if they are to attain commercial status. Both home garden and commercial interests repeatedly express interest in cultivating cranberries, lingonberries, and blueberries. Research and technological developments will have to wait. Potential markets have been indicated by expressions of interest in the lingonberry for juice blends; previous market reconnaissance studies had shown an interest in fresh berries for jams and jellies, ice cream flavoring, and toppings.

The raspberry has had an extended history of interest. Occasional limited research has been carried out over a 70 year time span. However, wild raspberries have been plentiful in many areas of the state, and few tame berries have been raised. Potential production development will undoubtedly be directed to production of plants for sale to home gardeners, with limited commercial production of fruit for fresh market sale or freezing.

A number of other berries offer possibilities for home gardens, and thus opportunities for the nurseryman in producing and selling plants.

> Large commercial acreages of small fruits such as currant, gooseberry, and indigenous kinds such as elderberry, cloudberry, bearberry, and service berry will never exist in Alaska even though they thrive and produce abundantly. Nevertheless, improved varieties and cultural information is demanded by the public.[21]

[20] *Ibid.*
[21] *Ibid.*

Perhaps an even greater opportunity exists in producing plants for export:

> The indigenous small fruits represent a genetic pool providing new sources of earliness, hardiness and other characteristics which are in demand by small fruit breeders of Alaska and the world. . . . Production of nursery plants for the stateside small fruit industry is possible through the utilization of Alaska's unique and "clean" environment to supply disease and insect free planting stock to growers in southern latitudes.[22]

Small fruits will provide an opportunity for commercial development and industry growth in the years ahead, if they are recognized as agricultural products. Greenhouses and nurseries must be accepted as agricultural enterprises. Institutions and agencies must provide research information, technology, and services without discrimination. Recognition must be given that plants and fruit are just as much agricultural products as hay, grain, and vegetables, and home gardeners are just as legitimate a market as other farmers and vegetable distributors. The potential dollar volume of berry plants and fruit will compete favorably with many "traditional" agricultural products. If small fruits remain in the "nonagricultural—noncommercial" category of past years, little development will be expected.

Bedding plants and nursery products fall in the general classification of ornamentals, along with turf grasses, and will be treated as a single grouping. Alaska has a wide use for ornamentals in landscaping homes, commercial and public building, parks and public areas, highway rights-of-way, and airfields. Most Alaskans are interested in the aesthetics of well landscaped homes and public areas, as well as the functional aspects of revegetating disturbed sites resulting from all types of construction, and respond readily to any availability of ornamental planting materials. However, very little of the potential Alaska market is being supplied with Alaska grown materials, and an even smaller portion is being served with hardy plants which will stand environmental stresses and are ecologically compatible in most locations. Bedding plants used for outdoor flower beds and planters, and those used for pot plants, hanging baskets, and indoor planters are used quite extensively in urban areas, although not all are well adapted to the Alaska environment. The cost and frustration of using and maintaining perennial exotics in landscaping both public and private areas has been experienced by most people who have tried. Most housewives have experienced the frustrations of

[22] *Ibid.*

trying to maintain indoor plants during the winter. There appears to be a noticeable opportunity to develop and provide both plant materials and technology to alleviate many of these problems, and an opportunity for increased commercial development of some considerable magnitude. However,

> Ironically, though there is a tremendous market for good, Alaska-oriented ornamentals, very little direct research is being done in this field. In fact, most of the work is being accomplished on a somewhat casual and incidental basis.[23]

Bedding plants and other floriculture products presently make up a major portion of greenhouse product sales. Supermarkets, garden supply stores, home and garden sections of other stores, nurserys, and florists add to the total volume of bedding plants, pot plants, bulbs and root stocks, seeds, and supplies that go to make up the annual bedding plant and related floriculture product market. The active and expanding market for such products has stimulated half of the growers, in a recent greenhouse survey, to plans for facility expansion. Present bedding and pot plant varieties serve a wide range of needs, but the most often expressed research need was for new varieties or selections adapted to Alaska conditions for both indoor and outdoor use. Alaska grown bedding plants are generally well adapted to geographic locations; however, imported plants, bulbs and root stocks, and available seed supplies are not always well adapted to the Alaska environment. Pot plants are generally ordered from outside growers and are finished in Alaska, or are ordered as finished plants for direct sale to the customer. Alaska grown plants would provide more precise timing and selection of plants for finishers, and would alleviate much of the danger of introducing disease and insects that are not presently here. Bedding and pot plant growers would benefit from constant screening and selection from present varieties, and testing of new releases for suitability to the Alaska environment by geographic location. Even more critical to the growth and development of this industry is information, technology, and cultural practices for year-round greenhouse production of floriculture products. For any major expansion of production, such information must be forthcoming.

[23]University of Alaska Agricultural Experiment Station, "A Look At Ornamentals: Alaskans Have A Wide Use For Grass, Flowers, Bedding Plants," *Agroborealis*, Vol. 1, No. 2, September 1969, pp. 11-13.

Perennial ornamentals of both herbacious and woody types, to be used in landscaping both home and public areas, offer one of the larger development opportunities in Alaska at this time. Wherever subdivisions, public buildings and facilities, industrial developments, roads, and airfields are constructed, perennial ornamentals become a major concern for landscaping or restoring vegetative cover to the disturbed lands. An increasing concern has been developing with indigenous plants that are ecologically compatible in the particular location. Very little hardy plant material is available and almost no indigenous plant materials are commercially available. Introduced herbacious perennials such as tulips, lilies, iris, peonies, delphinium, bleeding hearts, day lilies, and a number of others have been used in the past and offer an opportunity for further screening and selection of hardy adapted materials, and also offer opportunities for intensive breeding programs in the future. Indigenous plants such as several species of wild orchids, shooting star, wild iris, squaw lily, anemone, wild geranium, and a number of ferns are a few of those that offer promise for collection and screening as possible ornamentals. However, this would necessitate intensive research efforts directed to propagation and culture of such materials. Such indigenous species would provide hardy types that were well suited to landscaping and revegetation needs, and genetic stock for developing truly Alaskan ornamentals. A number of additional herbacious perennials could be selected and propagated for roadside plantings to be used in revegetation and beautification of such areas.

Introduced woody perennials (shrubs) such as lilac, roses, mockorange, flowering cranberry, honey suckle, and juniper are a few of many that offer additional possibilities for landscaping purposes. Many of these would materially benefit from intensive research efforts on selection of most suited materials, and on culture and maintenance of such materials in the Alaska environment. Indigenous woody perennials such as dwarf birch, willow, dogwood, service berry, juniper, and a host of others offer opportunities almost without limit for development of hardy adapted ornamentals for all areas of Alaska. Observers are impressed with the possibilities of Alaska flora for developing a very wide range of badly needed ornamentals. This area of ornamentals research and development can only be assessed as having been ignored and neglected by public institutional and service units.

Introduced trees such as Siberian stone pine, Swiss stone pine, Siberian spruce, and others of similar types offer additional possibilities for

permanent landscaping. Alaska landscapers are constantly in need of such products. Indigenous trees such as selections of birch and alder would extend both landscaping possibilities and geographic locations where trees could be planted. Efforts by Alaska nurserymen to provide the needed woody perennials and trees have been severely hampered by not having adequate research and development support, nor an adequate available reservoir of commercially available hardy and adapted plants. It is sad indeed that we have the capability of providing the information, technology, and planting materials for an indoor tropical garden in the arctic, but are unable to provide the same for fully landscaping a private home or public building in urban or rural Alaska.

Turf development has received considerable research attention with limited results. Two Alaska-developed grasses, *nugget* bluegrass and *arctared* red fescue, have had limited use in lawns and revegetating public areas. Restricted seed availability has precluded general usage of both. Restricted release of foundation and certified seed has kept commercial seed production to a minimum. Perusals of potential grass seed markets indicate an excellent possibility for considerable expansion and growth in grass seed production for lawn and revegetation purposes. Export possibilities have been expounded at some length. Development possibilities appear dim until rigid controls are relaxed on Alaska-developed seed supplies. Commercial sod growing for transplanting into lawns has been initiated on a very limited scale and offers promise for limited expansion, particularly as an added product for the nurseryman.

It would take several years and great expense to develop information, technology, and planting materials that would allow Alaska to develop any significant part of its potential ornamentals industry. However, the aesthetic rewards would be significant to almost every household, and the economic rewards would be of considerable magnitude to the greenhouse operator and nurseryman. One knowledgeable individual estimated the present potential dollar market for such products far in excess of the leading present reported agricultural enterprise sales (milk).

Summary

Predicting new crop and livestock possibilities for the future is hazardous at best. One must start with the present national posture on improving the

environment in which we live, improving the quality of food products we consume, and the concern for stimulating development that will assist in integrating the traditional and modern sectors of Alaska's economy. Our future needs and competitive posture in producing foods and "quality of life" products must be assessed in terms of anticipated changes in stateside agriculture. It would appear that public regulation, costs of pollution abatement, and competition for particular land resources may well cause major changes in he nature and location of various facets of stateside agriculture. Thus, it may behoove us to not only expand agricultural production of traditional types, but to concentrate on new and different types of products and production systems. Emphasis on environment-controlled production systems for crops and livestock may well provide Alaska with an enhanced opportunity for agricultural development. Additional emphasis on new and different information technology, and products will certainly expand possibilities for product types presently grown.

Livestock production has long held a focused interest for many people in Alaska. An increased flow of information, technology, and resources directed to development of environment-controlled production systems could result in development of sheep production in the Interior. If most of the new developments in sheep research were combined with the most advanced technology in environment-controlled housing, it would not be unreasonable to expect year-round production of some 250 to 400 pounds of marketable lamb per 100 pounds of brood animal per year. Such production has a possibility for the future.

When a breakthrough is made on multiple births in cattle, a system similar to that described for sheep could become a reality. Sufficient knowledge and technology are now available to accomplish such a system, except for the multiple birth problem. Development of such a system will, of course, be dependent on suitable environment-controlled housing, adequate waste disposal systems, yield improvements in forage and grain production, and public acceptance of radically different production systems.

Swine production in environment-controlled production facilities is not new, but future possibilities include the "growth-factory" concept, where swine are produced on the lower floor of a complete environment-controlled facility and horticulture-floriculture products are produced on a second

floor. Pollution control would be maximized through an atmosphere exchange system between floors, a highly sophisticated waste disposal system that would produce a high protein feed supplement, and carbon dioxide enrichment of the upper growing area. High intensity and cyclic lighting systems will enhance yield possibilities several fold for horticulture-floriculture production.

Grain production in Alaska certainly is not new, but the possibilities of hybrids such as triticale developed from dwarf varieties of wheat and rye, which would readily respond to high rates of fertilization and irrigation, do offer new possibilities. New and different production systems and large-scale farm development would also enhance possibilities of such development. One might anticipate doubling or tripling of present yields.

As previously discussed, horticulture and floriculture crops appear to have future possibilities limited only by human perspective. Present known technology, such as "growth factory" type greenhouses using high-intensity lighting systems, advanced cultural techniques, and a broad selection of plant materials available, provide opportunities for noticeable advances in producing exotics as well as native materials. It is now possible to use completely controlled conditions in producing woody perennials and accomplish the equivalent of three-year growth in a single calendar year. The possibility of propagating some plant materials on laboratory media seems a bit far out, but we may accept it as routine in the future.

Future livestock possibilities may be the result of new information and technology incorporated into environment-controlled production systems that will allow economic production of present livestock and livestock products in greatly increased quantities. Future crop and horticultural production will be much more dependent on new developments and availability of genetic stock, along with very different production systems from those now used.

PART THREE

AGRICULTURAL DEVELOPMENT IN TRANSITION

Chapter VI describes a planned, large-scale, commercial farm that began operation in the Big Delta area of the Tanana Valley in 1969. Although the case study results *per se* must be considered preliminary, the examination of the scope and complexity of development problems during the period of technological transition from "traditional" to "modern" agricultural practices provides insights into future needs of modern agricultural industry in Alaska.

CHAPTER VI.

A CASE STUDY OF LARGE-SCALE FARM DEVELOPMENT

> The current technological revolution is shaking the structure of agriculture to its very foundations. The end is not in sight. Many structural changes are only beginning to emerge. Others have been proceeding for some time. The full impact of technology on the structure of agriculture and on agricultural institutions is only now beginning to be felt. The decade of the 1970's may see more changes and adjustments in the organization and structure of agricultural production and of agricultural institutions than all previous decades of the century.[1]

The case study of large-scale farm development has been included in this report because it typifies the structural changes that are emerging in the nation's agricultural industry as a result of technological transition. The case-study farm exemplified the change of organization and structure of agricultural production, and the need for change in agricultural instititions to facilitate the technological transition that is emerging in Alaska's developing agricultural areas. Two separate but interrelated activities make up the body of this case study, one the evolving of a large-scale commercial farm firm, and the other the attempted development of research and service programs that would suffice the needs of a modern large-scale commercial agricultural development in Interior Alaska.

During the late fall of 1969, a small local corporation entered into discussions with the University of Alaska regarding a proposed cooperative research-development project on large-scale grain and hog production in the Tanana Valley of Interior Alaska. Discussions were directed to the state of programs dealing with problems of agricultural development in the region, particularly those of large-scale agriculture. Case-study farm personnel had

[1]John W. Brake, ed., "Foreword," *Emerging and Projected Trends Likely to Influence the Structure of Midwest Agriculture, 1970-1985*, Agriculture Law Center, College of Law, University of Iowa: Iowa City, Monograph 11, June 1970, p. iii.

surveyed the availability of suitable information and service programs earlier, and finding them inadequate, had carried out an extended search of stateside and Canadian sources for information, technology, grain varieties, and machinery suited to their anticipated needs. Several farm supply corporations had expressed willingness to cooperate in a research-development project if the university were a participant. Dialogue between university and case-study farm personnel was focused on what the university might contribute to the project, and in what form the contribution could be made. The initial consensus was, "that due to the lateness in the university's operational year, only consultant expertise, if and when available, could be allocated to the project," but the university would facilitate specific commercial grants to the project. The case-study farm entrepreneurs were assured, however, that the university would do everything in its power to provide research support required in the cooperative project. A Memorandum of Understanding was negotiated, establishing a cooperative research-development project to ascertain the feasibility of large-scale commercial agriculture in the Tanana Valley. The university's responsibility was delegated to the Institute of Agricultural Sciences' College Research Center, and the responsibility of university coordinator was delegated to the author.

The Case-Study Farm

The case-study farm is located some 100 miles southeast of Fairbanks, a few miles off the Alaska Highway. The location was selected because of available land, a previous history of successful barley production in the community, adequate road access to the area and an anticipated opportunity to develop a large-scale commercial farming operation. Firm entrepreneurs had lived in Alaska for a number of years before starting the farm development venture and were well acquainted with Interior Alaska. However, neither brought an agriculture production background to the farm development effort.

Two primary goals of the development effort were:

(1) to demonstrate the feasibility of large-scale commercial farming in the Tanana Valley, and

(2) to attain individual goals of economic success.

Initial farm development efforts were quite modest. Three half-sections of uncleared brush and timberland were purchased from the state early in 1969, and a typical homestead operation was started with the purchase of a used bulldozer to clear land. In September of that year, a family with farm production experience was recruited from stateside to join the working organization. Land clearing was accelerated. Local spring barley was roughed-in just before freeze-up to evaluate dormancy planting, a cultural practice now used in some areas of Canada. Test plots of triticale were also dormancy planted. An extensive search for information and technology applicable to Interior Alaska was carried out to obtain both perspective and needed inputs for the developing farm unit. The search was of limited success. Many people were actively interested in potential agricultural development in Alaska, but available information was incomplete and adapted technology often appeared to be inadequate.

During the winter of 1969-70, development of the case-study farm was reoriented to large-scale commercial farming. First year plans for some 350 acres of barley and no hogs were rapidly abandoned. Land clearing was speeded up by hiring a second dozer. Additional land was acquired through term-lease and purchase, until some 6,000 acres were obtained. A "package" of farm machinery was purchased after extended consultation with company fieldmen and engineers. The Memorandum of Understanding was consummated with the university to initiate the cooperative research-development project. Dialogue was carried on with institute personnel regarding barley varieties, fertilizer use and rates of application, minimum tillage farming systems, alternative land clearing methods, irrigation possibilities, possible crops other than barley, buildings and facilities needed, selection of foundation stock for the swine enterprise, environment-controlled swine housing, swine production systems, pork marketing potentials, slaughterhouse plans, various firm-development strategems, and many other topics. Focus of the dialogue was: "What is available, what will suffice at present, and what is needed to fill the gaps in information and technology?"

While the primary goals of economic success and demonstration of feasibility of modern commercial large-scale farming in Alaska were maintained, intermediate development objectives began to take specific form. Plans were made for an integrated production and processing unit to include some 6,000 acres of grain crops, a grain storage facility that would handle all grain produced, hog houses to handle an annual output of 14,000 marketable hogs, a feedmill adequate to meet farm production needs, a slaughter plant including curing ovens and a sausage kitchen, a first stage

irrigation system to water 640 acres, and a swine herd. Many intermediate development objectives were time dated for accomplishment. Others were recognized as dependent on exogenous factors.

Farming operations for the 1970 cropping year were characterized by accomplishments greater than anticipated and weather conditions less favorable than desired. By late May, almost 1,000 acres of barley had been seeded, all but 140 acres on newly cleared land. Initial tillage had been accomplished with a large offset disk and packer. Small brush left by dozer clearing had been removed with a gyro-mower prior to seeding. Fertilizer was spread with a broadcast spreader. Much of the seeding was done with the same broadcast spreader because of the nonarrival of hydraulic cylinders needed to use grain drills included in the machinery "package." Drought was the byword of the 1970 growing season. Much of the barley was top-dressed with urea fertilizer to offset drought stresses. Results were unexpectedly good. An atypical early winter started with 10 inches of snow on September 6. Much of the grain was still in the field.

Other completed steps in farm development, during 1970, were a 6-inch domestic water well and two 10-inch irrigation wells, a "package" of irrigation components to complete the irrigation system for the first 640 acres, a "Bacon Bin" hog house 48 feet in diameter with a rated annual capacity of some 850 marketable hogs, a 40-foot by 80-foot shop and storage building with second floor temporary labor quarters, four 10,000-bushel grain bins with drying equipment, and an airlifted swine breeding herd of some 50 sows and gilts, and 6 boars. Additional land clearing was started in the late fall along with earth fill and concrete work for the slaughterhouse. Electric power lines were completed to the farmstead.

During October, the "pork palace-growth factory" concept emerged as a result of exploring alternative uses for second floor space in quonset-type buildings being considered as swine housing. Possibilities of producing horticulture and floriculture crops in a "growth-factory" type environment were explored extensively. New and different information and technology were needed to initiate such an enterprise, and the information and technology did not appear to be forthcoming. Anticipations of a biological reduction system to convert animal waste to a high protein feed supplement did not materialize either. Both were necessary to initiate the growth factory enterprise.

The winter of 1970-71 was long and cold, with deep snow and considerable wind. Construction and land clearing proceeded more slowly than anticipated. One activity that proceeded with dispatch throughout the winter was the hog enterprise. The environment-controlled hog house performed better than expected in -60 degree F. temperatures. The cooperative research-development project with the university came to a standstill, necessitating deletion of "growth factory" plans from buildings scheduled for the 1971 construction season. Two-story hog houses were substituted. Additional farming equipment was purchased to facilitate grain planting on some 2,500 acres.

Farming operations for the 1971 cropping year started slowly with heavy-wet soil conditions resulting from snow melt, delays in seed grain delivery because of break-up conditions on the Alaska Highway, field machinery down time caused by field conditions and the need for reinforcing and adapting new planting equipment, and operators inexperienced with the type of equipment being used. Forest fires in the general area caused additional stresses and delays during the planting season. However, some 2,500 acres were seeded and final results were quite satisfactory.

By mid-summer 1971, more than 2,300 acres of barley were showing the full effect of a good growing season. Smaller acreages of triticale were somewhat late but growing vigorously. Delivery of additional grain bins was being delayed by a shipping strike but alternate storage space was confirmed. Construction was proceeding on the first rectangular hog house. The slaughterhouse was being insulated with polyurethane foam. Additional grain harvesting equipment was being sought. Dwellings were in the process of construction. The development process was moving forward.

Observations on the Case-Study Farm Development Process

Development of a modern commercial large-scale farm firm in Alaska has been a new experience. Development, particularly when different from previous experience, results from people's actions and reactions in relation to social, political, and economic institutions, or lack of such institutions. One of the critical functions in developing the case-study farm firm has been the legitimatizing of large-scale commercial farming as an acceptable commercial business endeavor. Time, energy, and resources have, of necessity, been committed in appreciable volume to that end. The "well planned research

that can and should demonstrate the potential for progress in the agricultural sector and encourage, as well as guide, increased public investment in agricultural development" did not appear to have offset the apparent lack of public awareness of the potential for commercial agricultural development.

Management of the case-study farm has been characterized by recognition of the growth and development objective, the ability to procure needed resources, capacity to initiate and carry out a wide range of activities, and positive action to sustain growth of the firm once it was started. Management has appeared to exhibit the philosophy and techniques of "industrial dynamics." It has recognized that development problems are so complex and of such magnitude that optimizing for the complete effort would be acutely difficult, if not impossible, and that the time and cost involved in doing so would probably preclude initiating the development project. One might say the byword of management has been "suffice," to determine what was adequate to accomplish a job at a given level of performance, and to go ahead while working on obtaining the additional level of inputs or sophistication of information and technology needed to enhance physical and economic output at a later date. The evaluation approach is to trace the relationship between projected and actual results through information feedback that links decision to action. Dynamics are structured into the sufficing approach by a "programmed" infusion of information and technology into the ongoing production process, and into the expected results.

Capital, as in any large-scale commercial production enterprise, was needed in large amounts. Capital has been acquired and developed by individual investment, land clearing and development, state agricultural-land development credits, Agricultural Stabilization and Conservation Service practice payments, state small grain program incentive payments, commercial bank and industry credit, State agricultural loan fund credit, and industry development grants. Additional land-capital was acquired through long-term lease of partially developed agricultural lands. The success of acquiring and developing capital to structure a farm firm of this size is unique in Alaska's agricultural history.

Location of the case-study farm indicated a thorough assessment of farm development potential. Land in the Delta-Clearwater area is generally of a topography suited to use of large farm machinery and equipment. Potential water supply was indicative of possibilities for irrigation. Road access into the community was adequate. Other farmers in the community were

interested in barley production, and a number had successful barley production experience, though on a small scale. Land was available for purchase in quantity sufficient to provide the opportunity for large-scale farm development. Community services, while somewhat limited, were adequate to meet many needs. Labor was available. Consequently, the location had many of the attributes for commercial large-scale farm development in Alaska.

Long range planning evidenced flexibility, division of management functions, sufficient scale in each stage of production and processing to utilize modern and efficient organization and facilities, and overall size large enough to incur economies of scale throughout. Long range planning was of a general nature in most instances, and only became finalized when an activity was completed and functioning. Long range planning has been used to structure quests for information, technology, and resources needed. In some instances, such as the growth factory, when information, technology, and institutional service support were not forthcoming, plans have been delayed or abandoned.

Production development strategems to offset limitations of knowledge about the production sector and problems of staging of major resource inputs have focused on "packages" of information, technology, and resources. The initial package was farm machinery and equipment to carry out grain farming operations. Company engineers and fieldmen surveyed the situation and put together a package of machinery and equipment which in their judgment would effectively accomplish the task. The second "package" was the "Bacon Bin" hog production system and facility. Again, the facility, technology, and production system was packaged in a manner that allowed initiation of a production enterprise without delay. The "packaged" irrigation system was another illustration of company engineers and fieldmen providing judgment and expertise in assembling machinery, equipment, and a production system to accomplish a designated task. Buildings have been precut packages, designed with the cooperation of company people to meet a particular need. The cooperative research-development project agreement was an attempt to "package" the needed research-service input. In each instance, the "packaging" strategy was an effort to reduce the time, cost, and other outlays of going and fetching the knowledge, adapted technology, and resource inputs needed for a particular production sector. The strategy has been quite successful in offsetting the relative cost differential caused by being in a distant and undeveloped location rather than in an area of advanced or mature agriculture. The inability to "package" the growth factory project has resulted in the delay or possible abandonment of that

production effort. The significance of the packaging strategy rests with the absolute distance from modern large-scale commercial agriculture, and from the public and private institutional services infrastructure.

The information and adapted technology input has been a limiting factor in development of the case-study farm unit. Even with the "packaging" strategy used, the cost, time delay, and unavailability of knowledge and adapted technology suited to the Interior Alaska environment, and to the needs of modern large-scale commercial agricultural development, have been deterrents in the development process. Basic knowledge regarding land clearing, tillage systems, fertilizer requirements of various crops, fertilizer response, and crop varieties to meet specific timing and use needs have been only partially available, if at all. The unavailability of information and adapted technology for new and different production enterprises is exemplified by the proposed growth factory project. This aspect of the firm's development process certainly illustrates the impact of technological transition on development in new development areas.

Research and Service Needs for Large-Scale Agricultural Development[2]

The Memorandum of Understanding between the University of Alaska and the case-study farm corporation has provided an opportunity to observe and study the process of large-scale farm development, while identifying information and institutional service needs for various enterprises. Historically, agricultural research and service programs have been oriented to "homestead" development and small commercial or part-time farms. Large-scale commercial farming had been slow in coming to Alaska and had not been legitimatized as an acceptable commercial business endeavor; consequently, little previous experience was brought to focus on the case-study problem.

[2]Some information in this section has been drawn from Wayne E. Burton, Donald H. Dinkel, and Frank J. Wooding, "So Many Questions—So Few Answers," *Agroborealis*, University of Alaska, Institute of Agricultural Sciences, College, Vol. 3, No. 1, April 1971, pp. 21-24.

After initial appraisal of the cooperative research-development project, it became apparent that the university's primary goals for the project should be:

(1) To determine critical information and technology required for an evolving large-scale farming industry in a new-lands settlement-development area, and provide such information and technology to the case-study farm during its development period.

(2) To determine a functional and economic research and delivery system for such information and technology.

During early months of university participation in the cooperative project, the university input may be characterized as interested curiosity and limited "consultant expertise." Resource and management studies were initiated by the project coordinator to generate and record scientific and economic data from successive development phases of the case-study farm. Some climatological instrumentation was installed. Regular liaison and planning dialogue were carried on between the project coordinator for the university and the president of the corporation.

By mid-year, focus and tempo of the university-institute program had begun to change and gain momentum. Program needs mushroomed because of the rate at which the case-study farm was developing. Research information unique to the Delta-Clearwater area was conspicuously absent. Need for a multidisciplinary research program was being demonstrated almost daily. Drought-induced problems accentuated agronomic and soil fertility questions. The drought also accentuated differences in tillage systems and the need for irrigation research information. An agronomist joined the institute research staff at College in July, and was immediately involved in the cereal grains-soil fertility program. The advancing scope of problems involved the institute's horticulturist at College in mid-October when the "pork palace-growth factory" concept emerged. The addition of a swine herd at the case-study farm in November again multiplied information needs. A Pandora's box of questions had been opened, and the full impact of the scope and magnitude of research and service program needed to serve a fast-growing, large-scale commercial farming industry in a new-lands settlement-development area finally exploded within the university institute. The task of developing research and service programs adequate to serve

recognized needs was beyond the means of the institute as then constituted. The research effort on commercial large-scale farm development was postponed.

Observations on Research Needs of the Case-Study Farm

Land clearing was by the traditional dozer method. A preliminary appraisal of alternative clearing methods did not indicate an immediate opportunity for change. However, research is needed on problems of land clearing to determine comparative costs and functional efficiency of alternative clearing methods in minimizing environmental disruption.

Tillage practices compared during the 1970 growing season indicated marked differences in plant growth responses during drought years. The stand on fall-plowed land was stunted and irregular until after late summer showers and top-dressing with urea. Grain maturity was late and yields were low. Tillage with a large off-set disk and packer left vegetative materials near the surface and provided a suitable seed bed. Some fields farmed under this system appeared to yield more than twice that of the plowed fields, suggesting that moisture was used more efficiently. Differences in production were sufficient to indicate need for comparisons of several tillage practices and systems. The case-study farm changed to a one-way disk, with seeding attachment and packer, for the 1971 cropping year in an attempt to offset some of the shortcomings of previously used tillage equipment. Research emphasis should be directed to those systems which minimize erosion and increase humus content of the very immature soil. Research needs on functional and economic efficiency of various types of field machines are evidenced by the amount of welding that has been done at the case-study farm.

Fertilizer application and response problems continue to be of significance on the case-study farm. Fertility problems associated with newly cleared land can be immense, and those encountered on the case-study farm were no exception. Fertilizer responses from recommended rates of application, based on soil tests, were certainly less than satisfactory. Responses to top-dressing with urea in mid-summer were far better than anticipated. An extensive research program is needed on plant nutrition in newly cleared

Tanana Valley soils. Differences in fertilizer responses on old mature agricultural soils and on newly cleared lands indicate need for initiating long-term studies, on individual site locations, of the soil maturing process and the changing response of fertilizers over time. Of immediate concern is macronutrient requirements for various crops. A careful vigilance should also be maintained for appearances of micronutrient deficiencies. This research should include both laboratory analysis and field experiments. Of long standing is the need for correlating laboratory soils tests and field growth response tests, for various soil types from different geographic locations, to make the often recommended "soils test" meaningful to the individual farmer.

Spring cereals production and yield statistics for the past two decades give particular emphasis to the need for cereals research to increase yields. Stateside yields have increased at an annual rate of several percentage points while Alaska yields have remained relatively constant. The limited availability of seed from the one recommended variety of barley, which was introduced from Sweden some 20 years ago, lends additional emphasis to the need for cereals variety research in the Tanana Valley. The case-study farm was forced to import untested barley varieties from Canada to meet its 1970 seed requirements. Fortunately, both imported varieties, Galt and Conquest, out-yielded Edda at the case-study farm during the 1970 cropping season, and neither was affected by barley stripe. The favorable response by the two Canadian varieties suggests that even better varieties of barley might be available for Interior Alaska from Canada and other sources. The initial test results with triticale at the case-study farm were sufficiently promising to justify continued research. Triticale varieties being grown at College during the 1971 growing season show even more promise. First year tests with some wheats are particularly promising. Emphasis must be directed to various crops and growth characteristics which lend increased probabilities to seasonal distribution of labor and machinery use and decrease weather and other risks. Concern must also be directed to varieties exhibiting superior qualities, such as feed for hogs.

Swine housing suited to large-scale commercial hog production in the Interior Alaska climate has long been a topic of discussion and conjecture,

but not a subject of experience. The initial facility at the case-study farm was a two-floored, circular-shaped building insulated with polyurethane foam, having a modified heating-circulating fan ventilation system. Feeding and waste removel equipment were an integral part of the facility. The second house, now being constructed, is a two-story house of more traditional design and interior organization. Case-study farm management drew on industry and private consultant expertise in designing the second facility. Research is needed on heating and ventilation systems to attain more economic performance levels, on production equipment to further reduce labor requirements, and on production systems particularly suited to various types of facilities.

Waste disposal remains one of the major unsolved problems for all types of livestock enterprises in Interior Alaska. Waste disposal for the first hog house was initially via a covered log-crib type cesspool; however, while this method proved satisfactory during the winter of 1970-71, it did fail during spring break-up because logs shattered from external hydrostatic pressure. An open lagoon is now being constructed. Review of information on waste disposal systems suggested a number of potential alternatives, but research was needed to adapt present known technology into functional systems for Interior Alaska, or to design entirely new and different systems tailored to specific needs. A careful vigilance should be maintained on sanitation and possible appearances of parasites and disease. Research and service programs should be directed to this need at an early date. Both laboratory analysis and research facility experiments may be needed. While disease has not been a limiting problem at the case-study farm as yet, it often is a major problem in intensive environment-controlled swine production systems.

Swine feeding programs at the case-study farm are intended to maximize use of farm produced feeds. The initial emphasis has been on barley, but the possible use of triticale, wheat, rye, rape and other plant protein sources, and animal proteins generated from waste disposal systems lend considerable urgency to certain types of nutrition research. Present problems with oversized litters create an immediate need for rations and systems of handling new-born pigs. Nutrition programs for growing and maintaining production stock at a high level of performance over an extended period are of concern to case-study farm operators. Limited local availability, and costs of importing breeding stock, lends support to their concern. Consultant

expertise, and possibly service research, may well be needed to assist in maintaining strict production schedules critical to this fully integrated unit.

Hog slaughter and pork processing facilities at the case-study farm are in the process of construction, so operational problems are as yet undetermined. Facility plans were completed by the corporation president with the cooperation of architectual expertise and other professional assistance; consequently, facility research needs are not anticipated. Future processing and marketing activities may generate needs for food technology research assistance.

The "pork palace-growth factory" concept aroused a broad spectrum of interest from a wide variety of sources. Commercial business firms from many areas of the lower 48 as well as numerous inquiries from members of the scientific community lent an aura of excitement to the pursuit of information and technology needed to ascertain functional and economic possiblities of such an endeavor.

Growth factory production of horticulture and floriculture crops has been the quest of commercial and home growers for many years. Case-study farm personnel carried out an extensive exploration of development possibilities, culminating their quest with a prototype test facility at the farm. Recent research application in lighting, use of carbon dioxide enrichment of growing environments, hydroponic culture, and selected varieties adapted to environment-controlled production suggested the possible feasibility of commercial "growth factories" in Alaska. Questions regarding availability of high intensity discharge lamps providing desired light spectrum distribution for a wide range of crops posed initial research questions. Specific light requirements for individual varieties and various crop types posed an additional range of questions. Potential yield levels of desired crop types and varieties under "growth factory" conditions posed an even greater range of questions. A great number of these questions needed answering before refined production systems could be finalized. In addition, the growth factory concept stimulated a whole new area of possible indigenous ornamentals for Alaska, and generated a whole new area of research questions.

Conclusions

The structural changes that are now taking place in the nation's agriculture, and those that are only beginning to emerge, pose a certain urgency to the assessment of possible philosophical and technological transition in developing Alaska's potential agricultural industry. The rate at which the transition is taking place lends an additional urgency for assessment of ways and means of facilitating the transition in Alaska. The philosophy of "normal growth" is no longer adequate to cope with the rate and magnitude of changes and adjustments taking place, and even less adequate to cope with those which are anticipated. The case-study farm's development typifies the structural changes that are emerging in Alaska's agricultural industry as a result of technological transition, and exemplifies the need for change of organization and structure of agricultural institutions in Alaska to facilitate technological transition in the future.

The cooperative research-development project provided a brief opportunity to study, and gain insight into, the scope and nature of information and technology needed by modern commercial agricultural firms in a new-lands development area. The case-study firm's development efforts gave evidence that, as stated in Chapter 1 above:

> The slow and costly "cut and try" procedure for ascertaining and adopting information and technology must give way to studied and guided assessments of potential combinations that will allow efficient and economic development. The more distant and undeveloped the location, the more difficult and costly it is to acquire advanced research information and technology. Thus, in settlement-development areas, the supply of research information and technology must be increased relatively more than in developed areas. Where past research and production experience has been deficient, integrated and multidisciplinary research programs should be undertaken to rapidly and efficiently broaden and deepen understanding of the agricultural production and marketing processes. That which is known must be made available to the public.

Nationally, there is a major search in progress for ways in which research institutions can provide the kind of organizational flexibility to enhance the effectiveness of research on increasingly varied types of problems which are being encountered. Traditional approaches have produced good work in the past, but, looking ahead, it is generally believed that improvements could be made that would reduce delay, lower administrative efforts, and provide greater incentives to researchers in coordinating research efforts. Within Alaska, the immediacy of need for research information and adapted

technology, and the limitation of research resources, does not allow the luxury of following traditional approaches. The flow and timing of research information and technology into agricultural and rural development is particularly critical, and this critical timing element necessitates a general understanding of production and marketing systems over and above the direct and specific application of research results from individual narrow based "problem" research projects. The formulation of general multi-disciplinary research programs is of increasing value in identifying information and technology gaps and in guiding research and service programs into relevant gaps. The diversity and complexity of problems faced on the case-study farm illustrated many times the need for multidisciplinary research to effectively and efficiently generate the flow and timing of information and technology critical to the growth and development of the enterprise.

The cooperative research-development project served to bring forth an awareness of the inadequacy of information and service programs to meet the needs of modern commercial agricultural development in Alaska, and the appreciation that agriculture is more than "a cow, a sow, and a plow." The project validated the opportunity to develop an effective approach for identifying information gaps as they occur, so that immediate and efficient concentrations of expertise and research resources could be committed to sufficing such needs in the most timely and economic manner. The project also demonstrated the possibility of generating "packages" of new and advanced information and technology, adaptable to a wide range of farm sizes and geographic locations, if the will to do so is present and priorities are assigned to that end.

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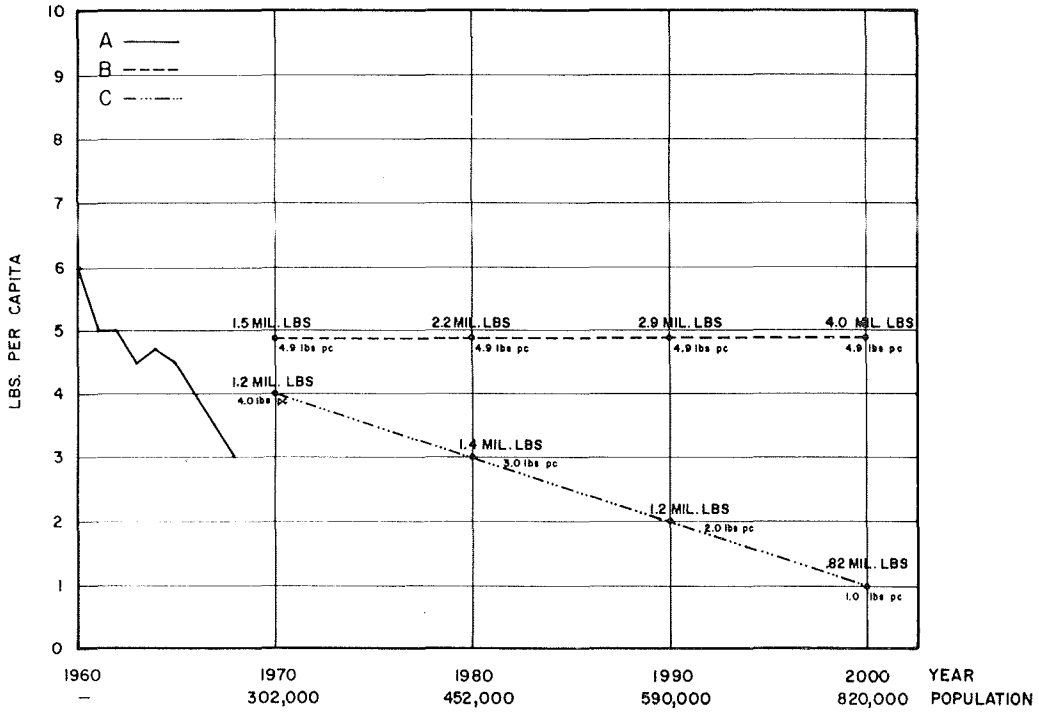
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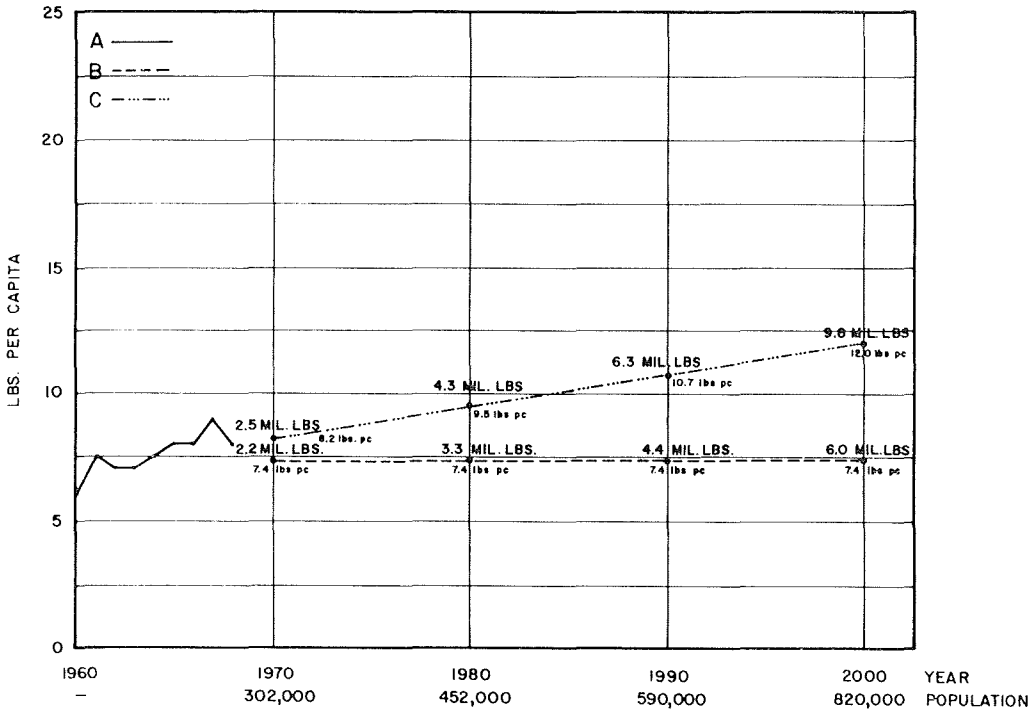
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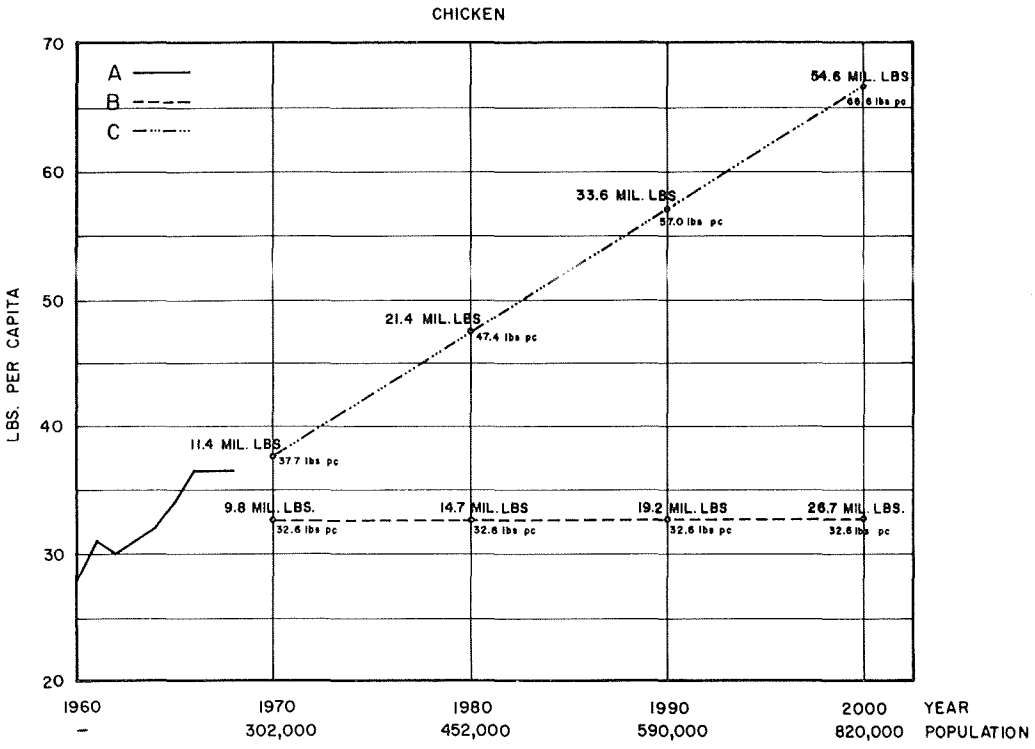
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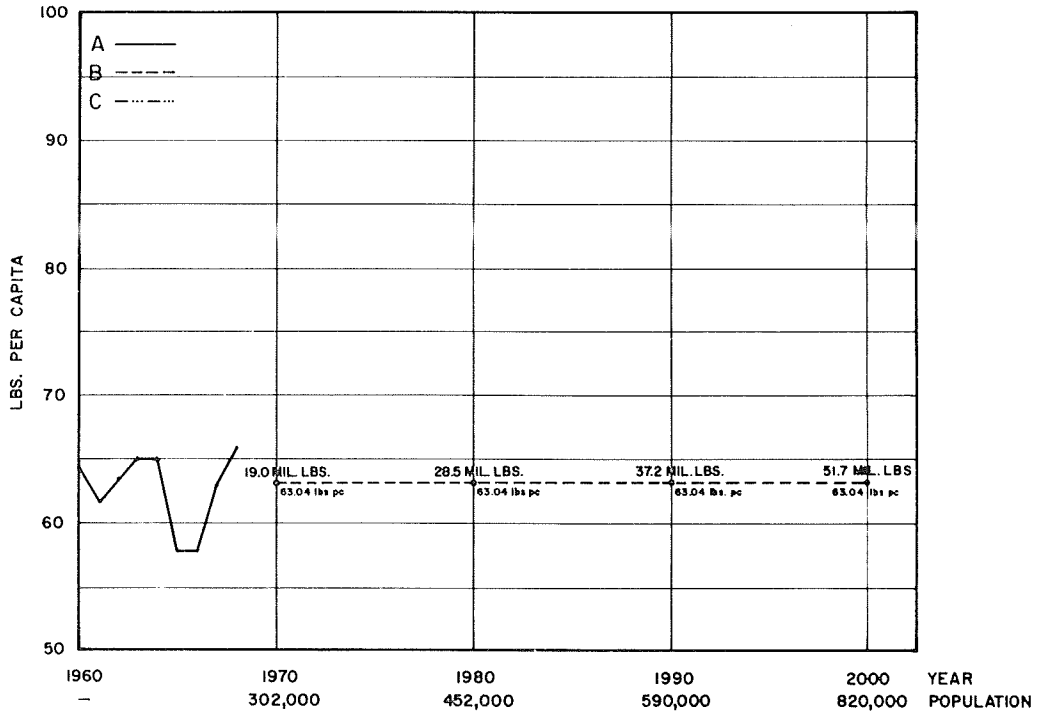
PORK



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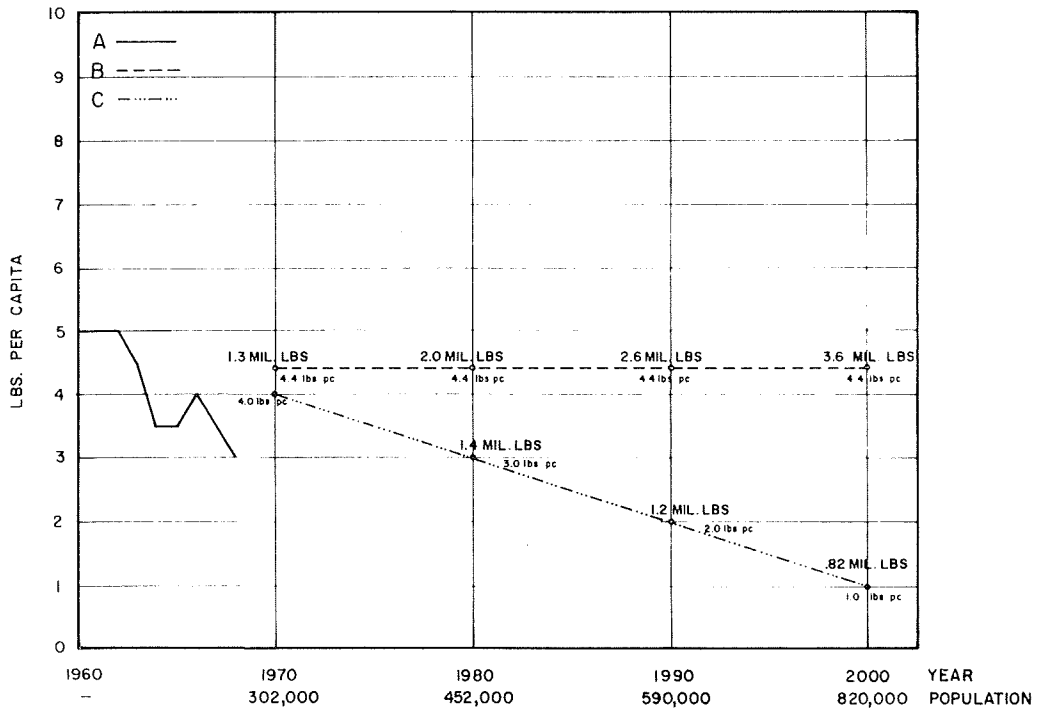

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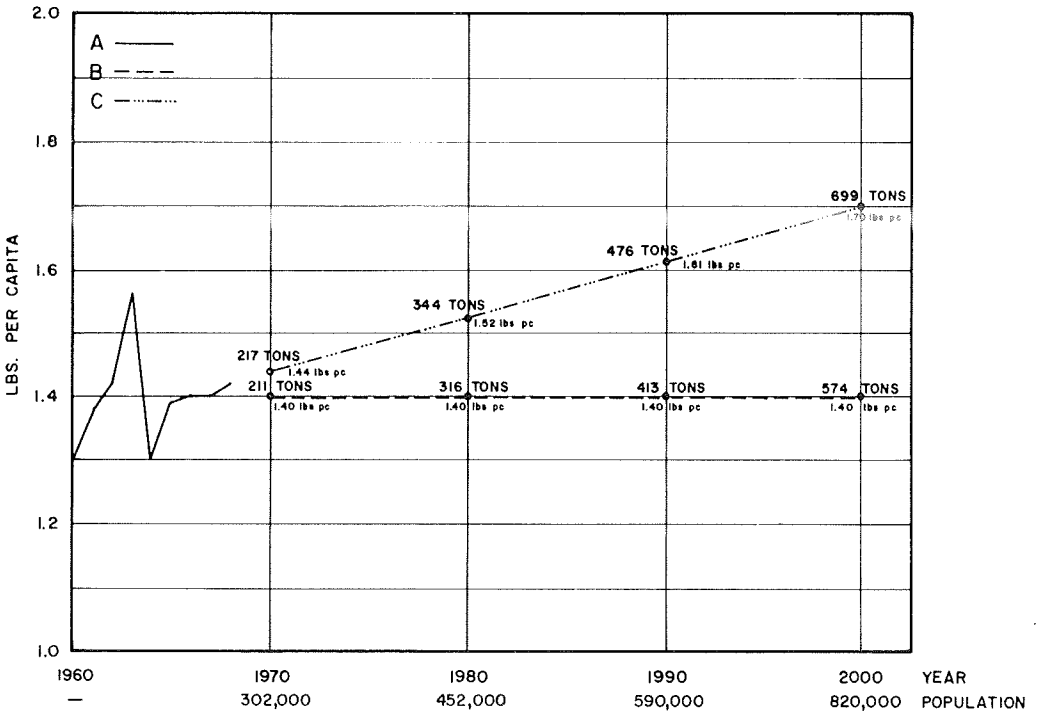
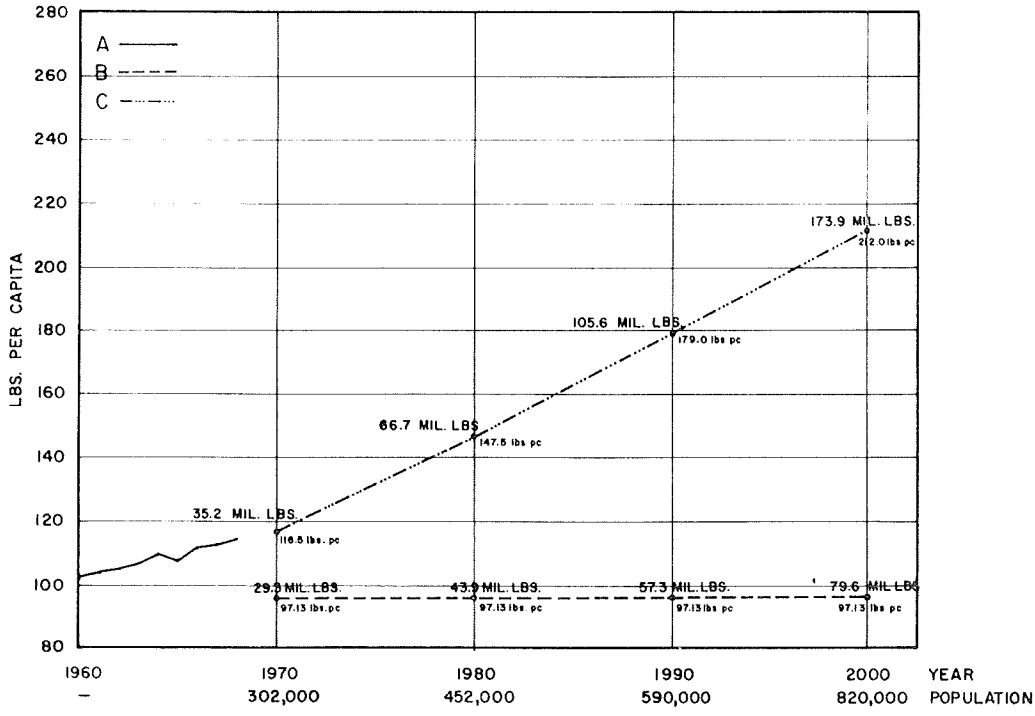


BEEF



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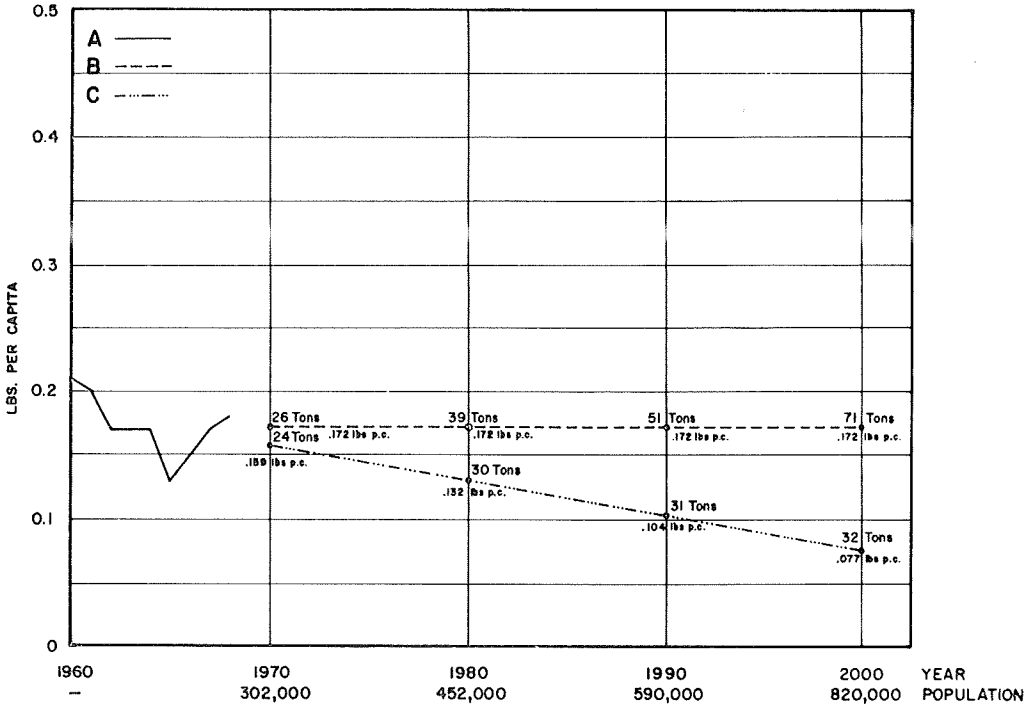

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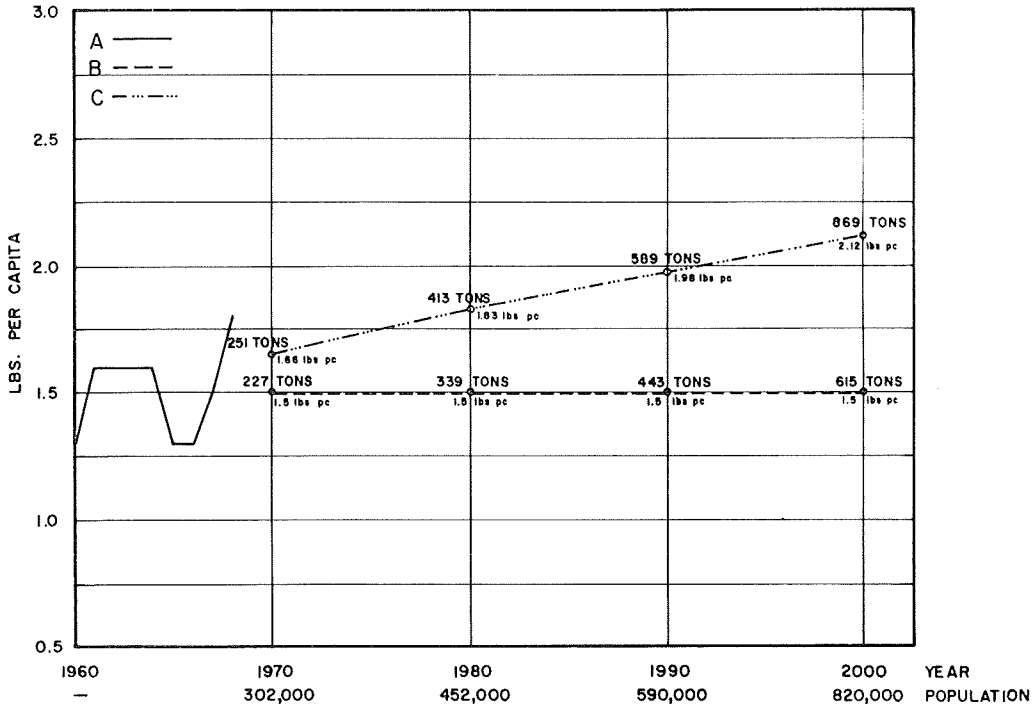

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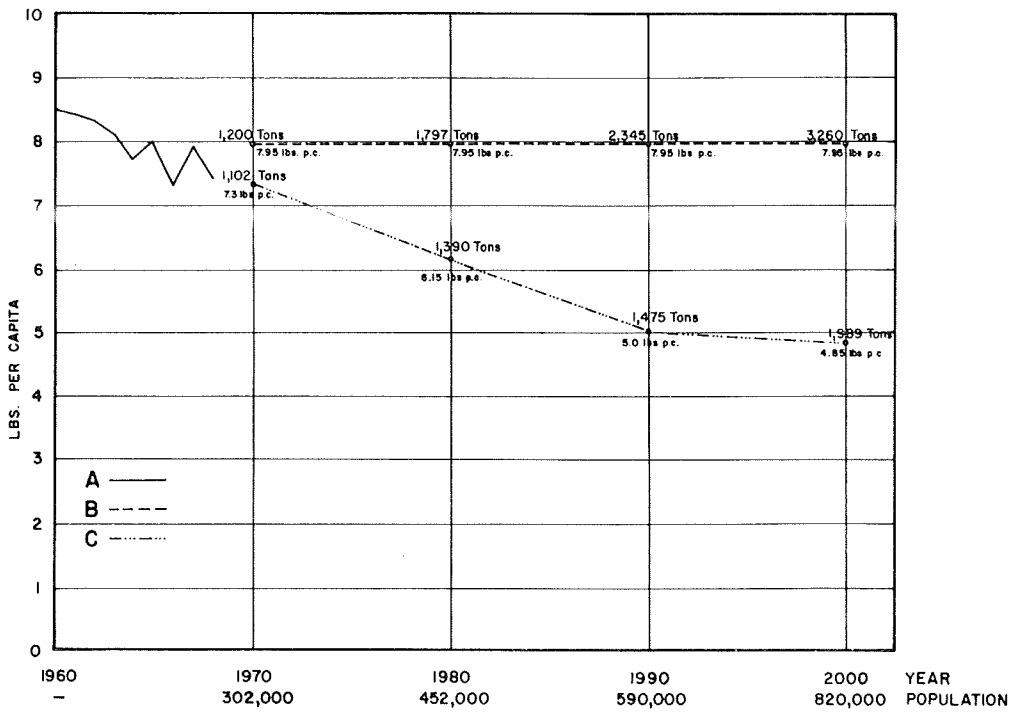

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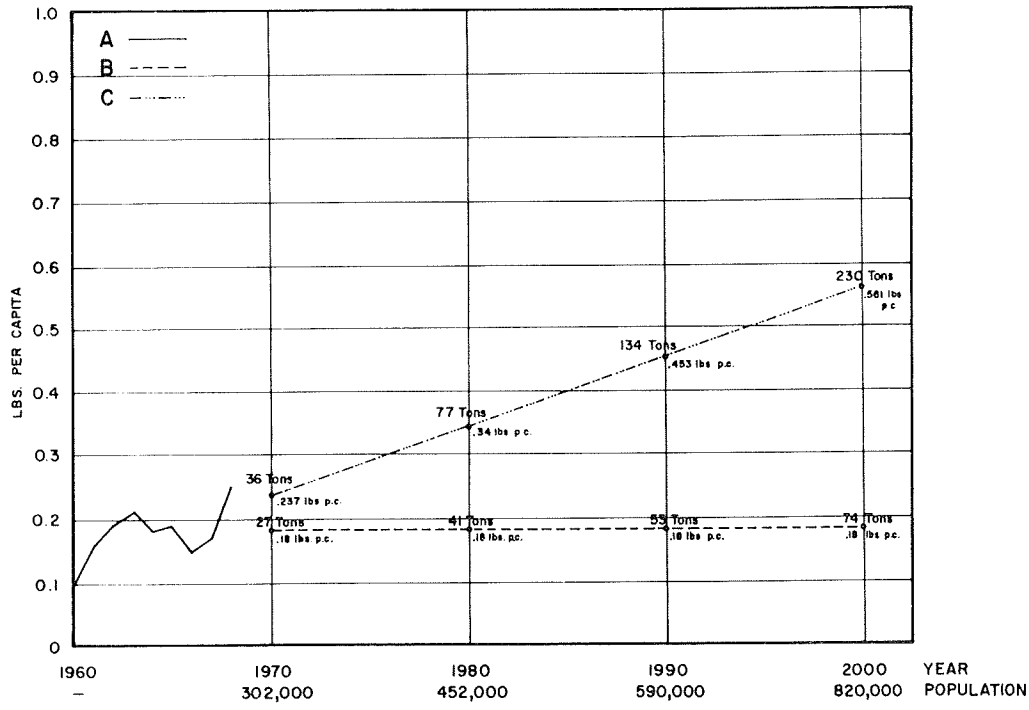

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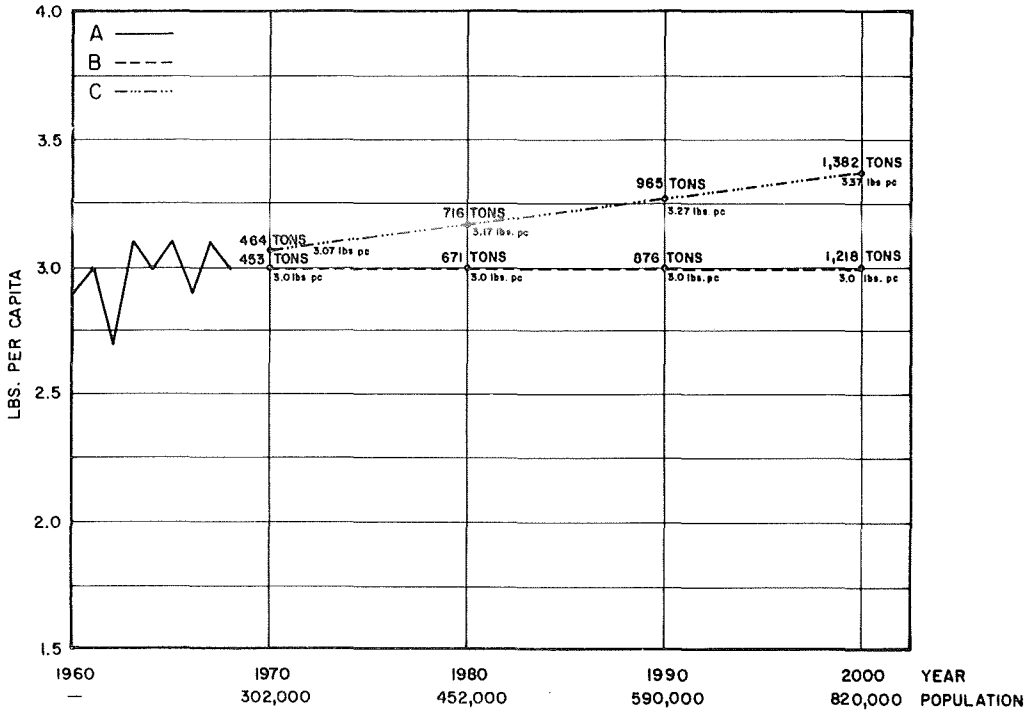

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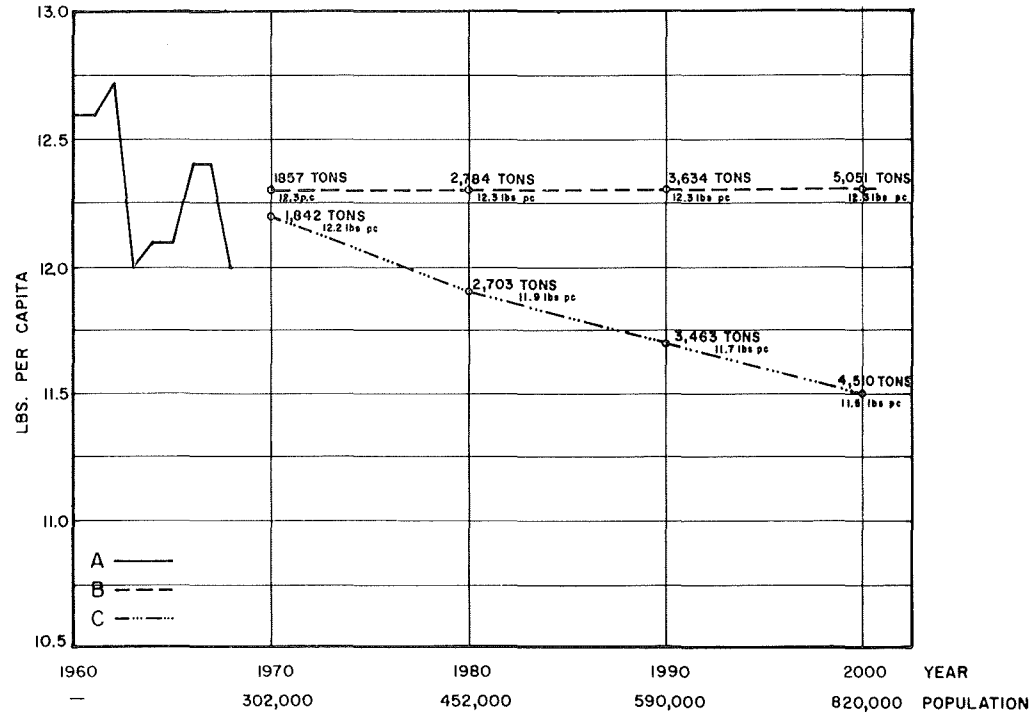

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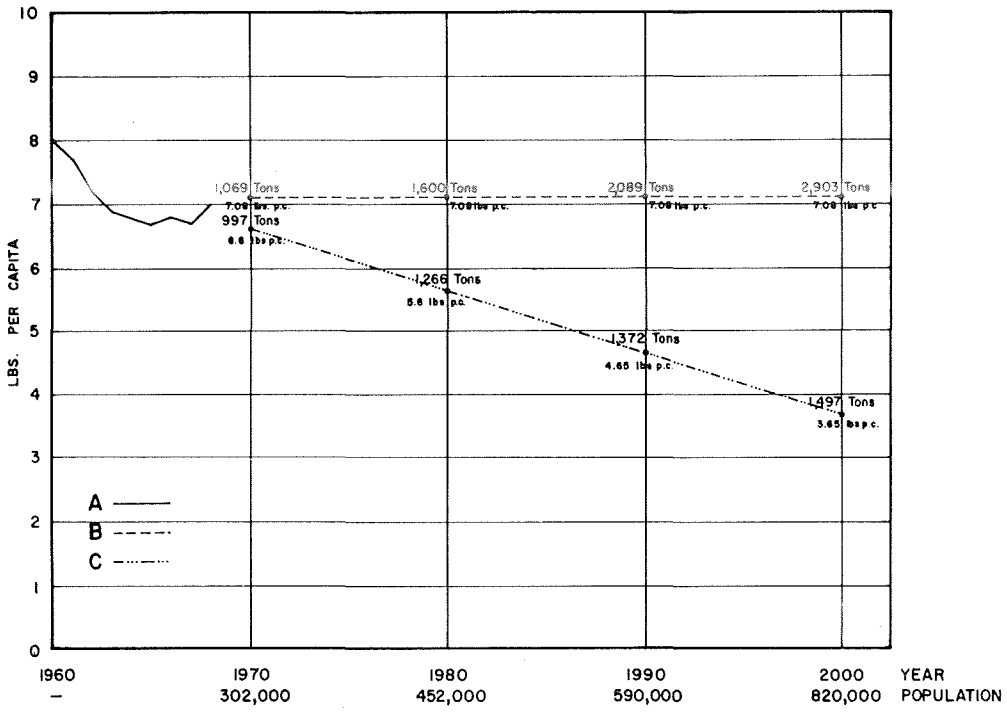
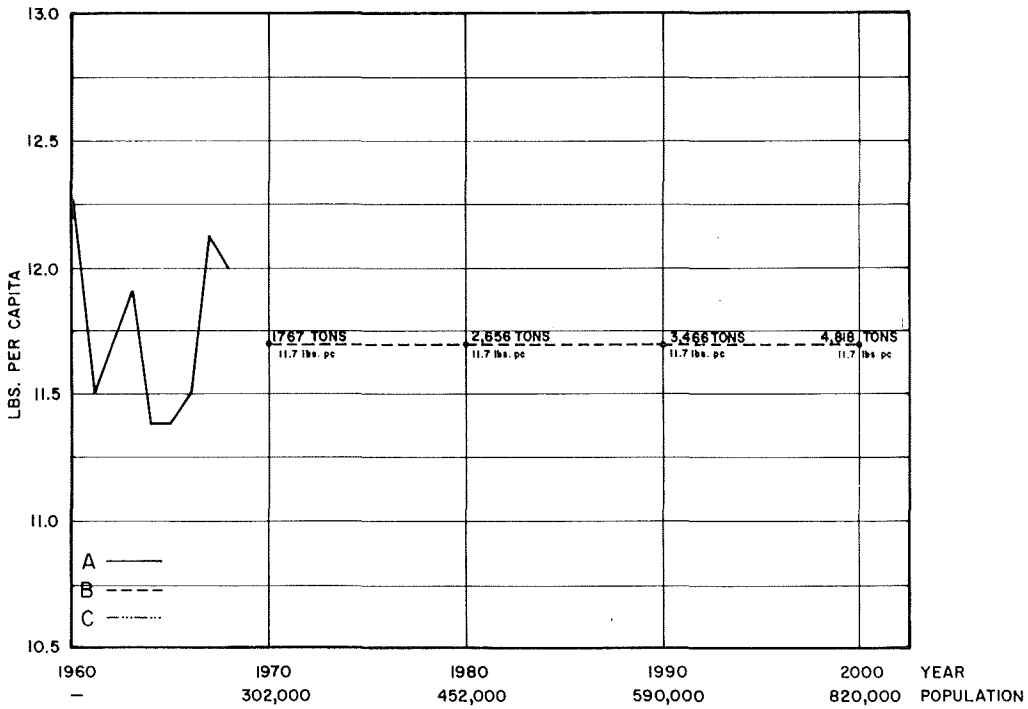


ONIONS AND SHALLOTS



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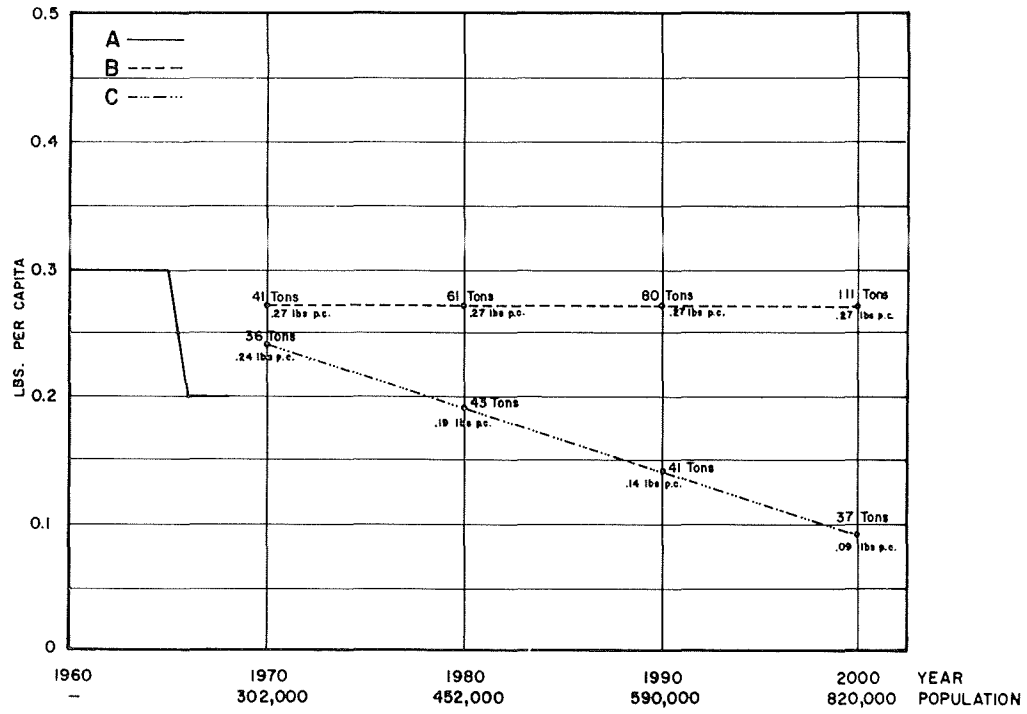

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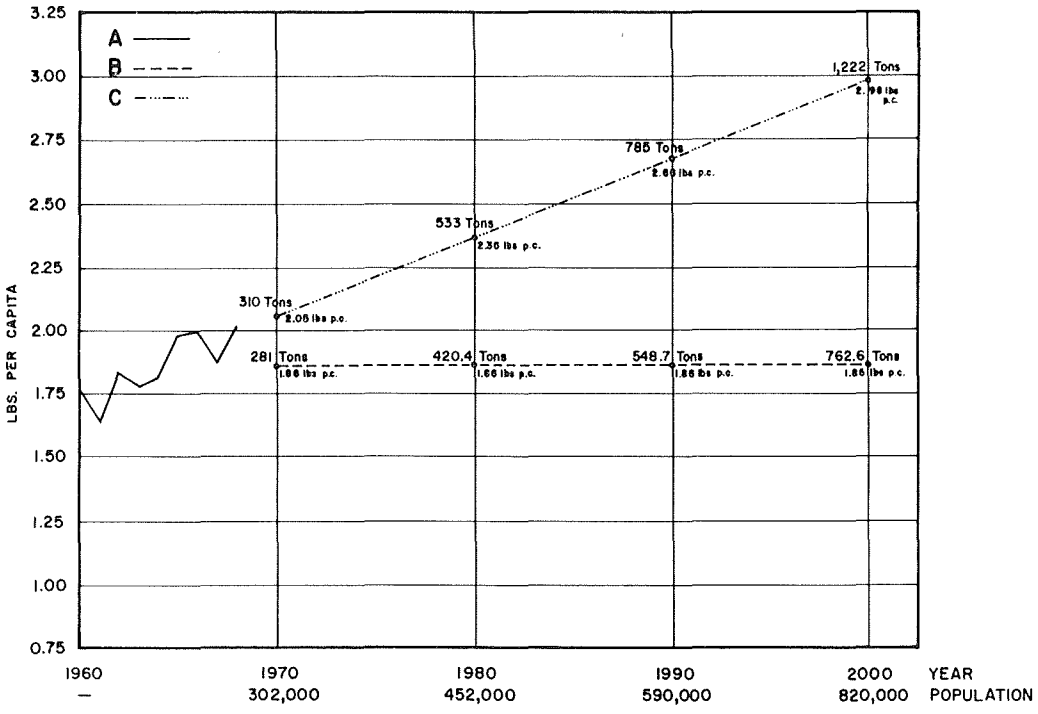

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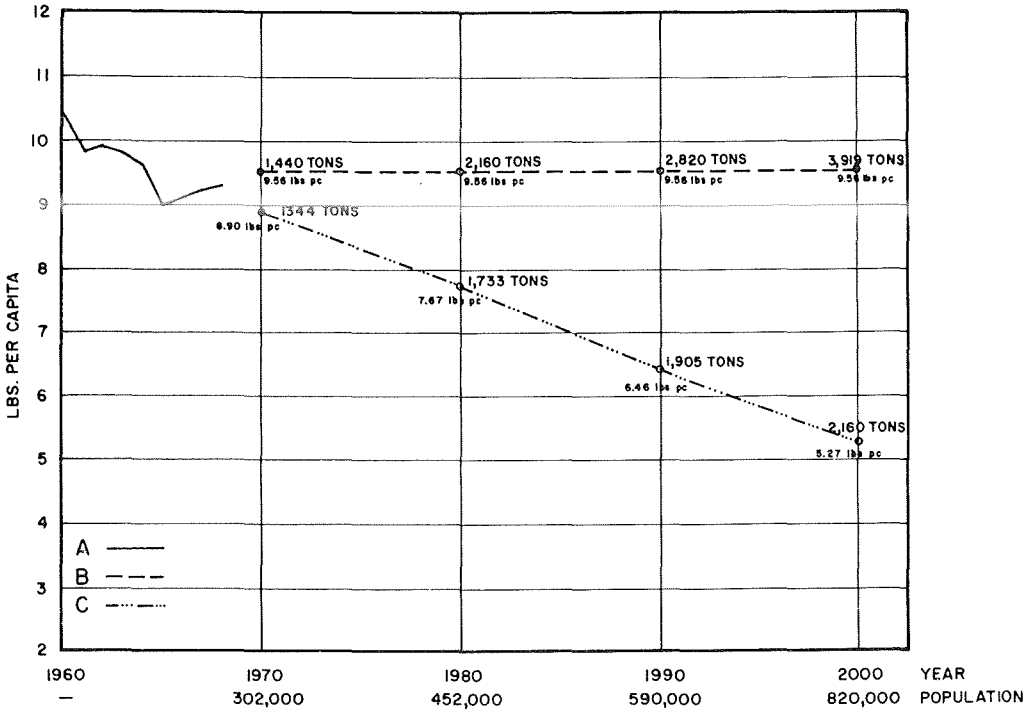

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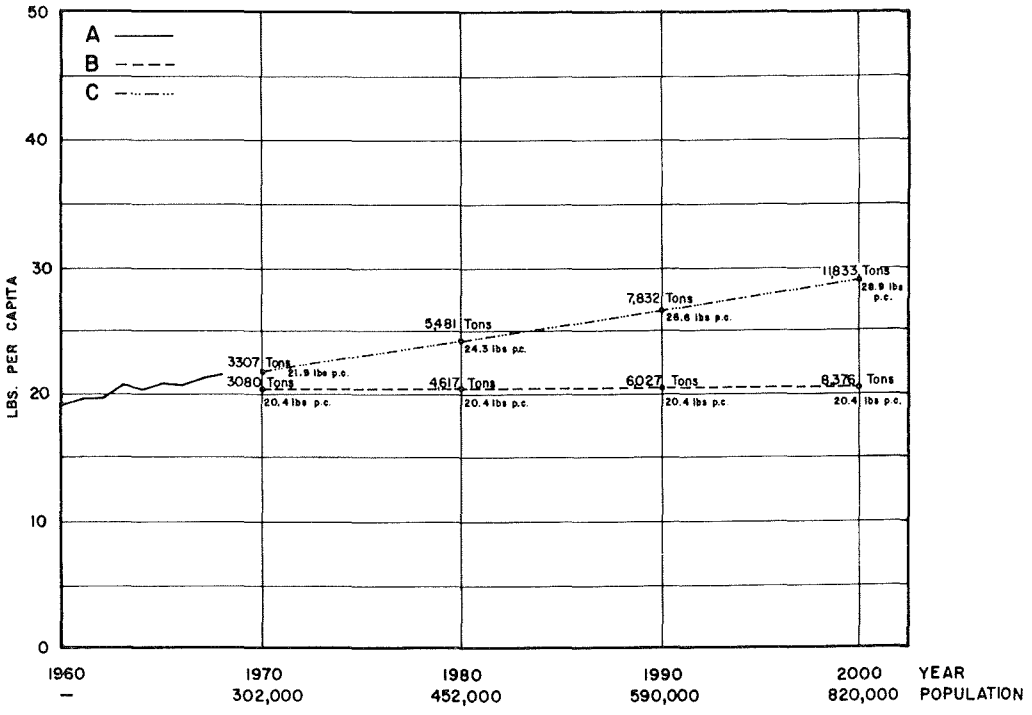

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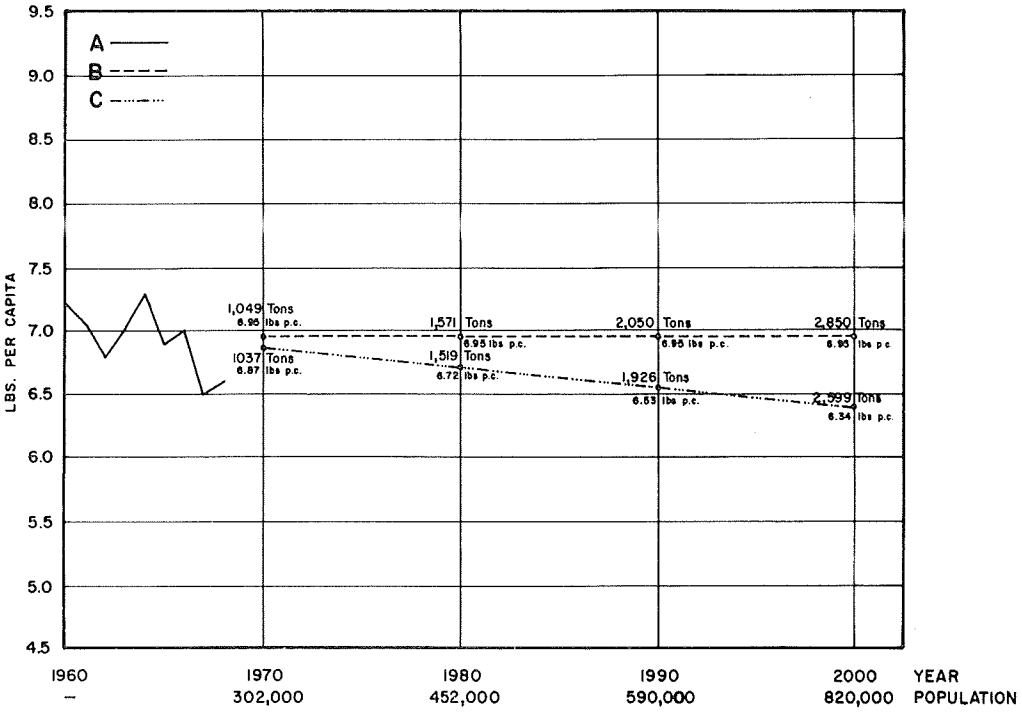

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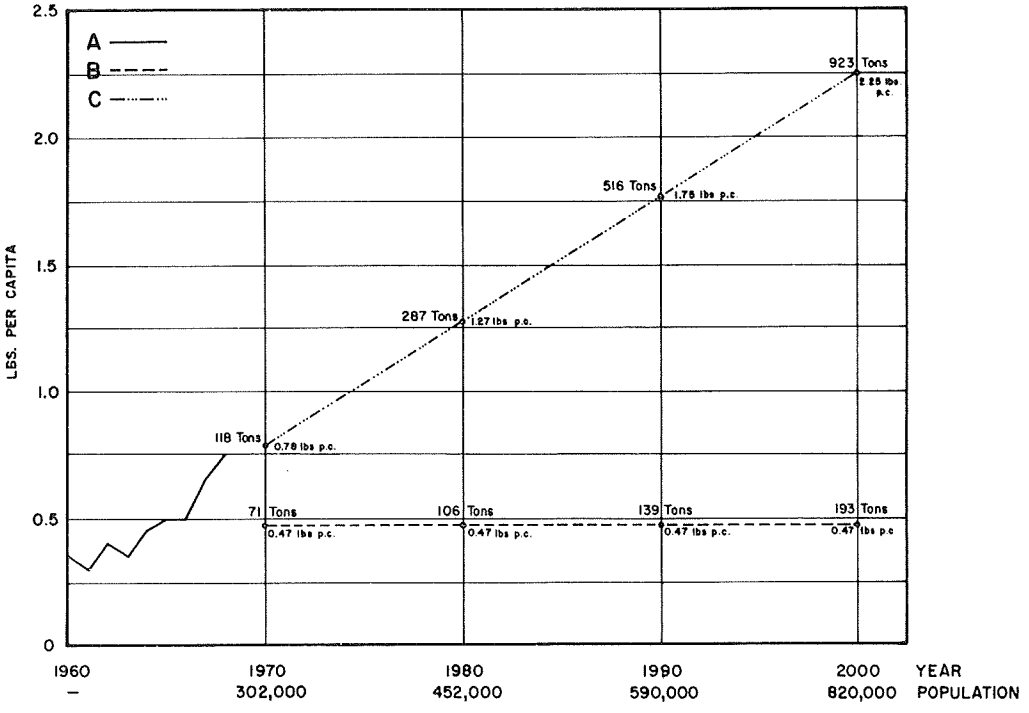
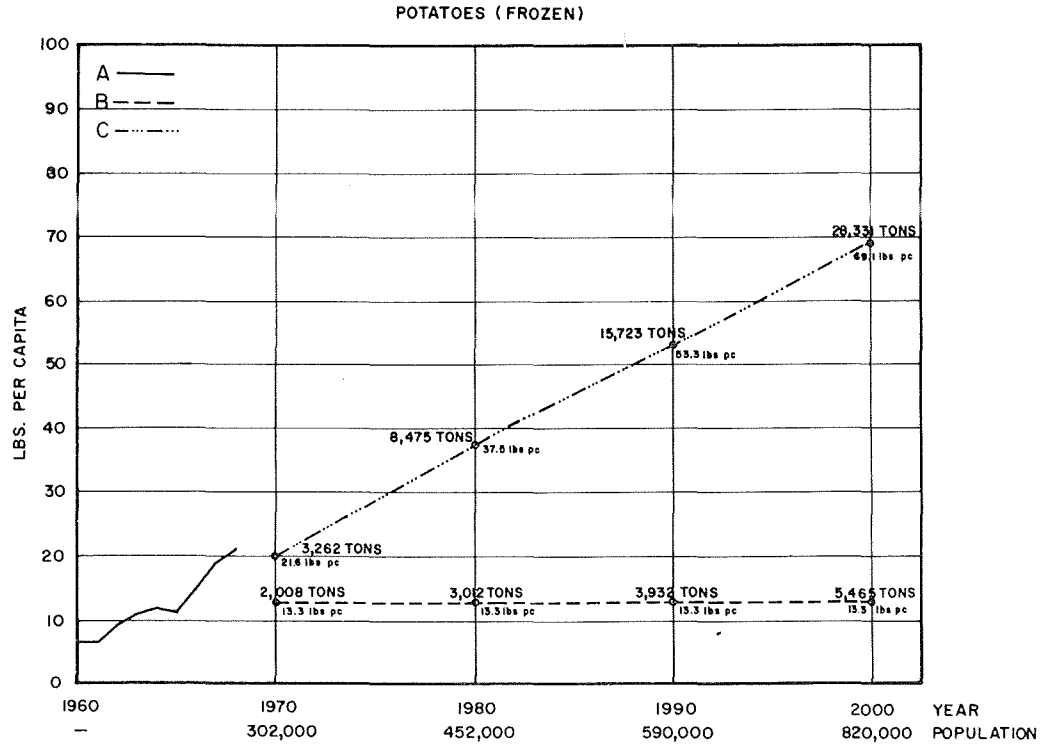
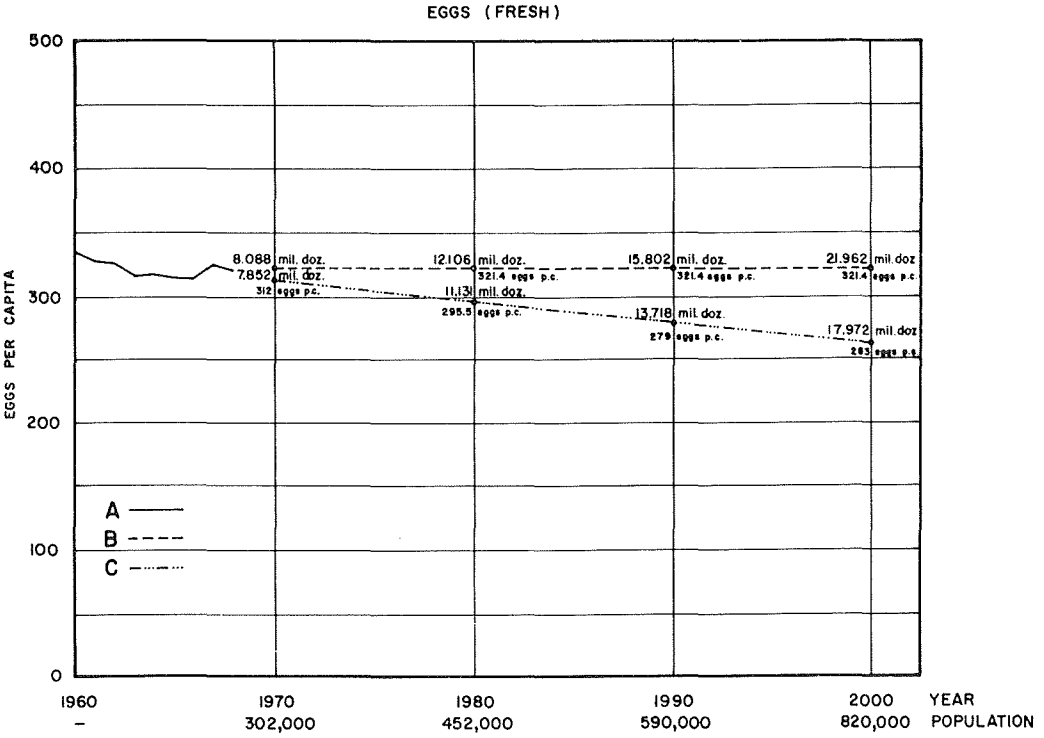
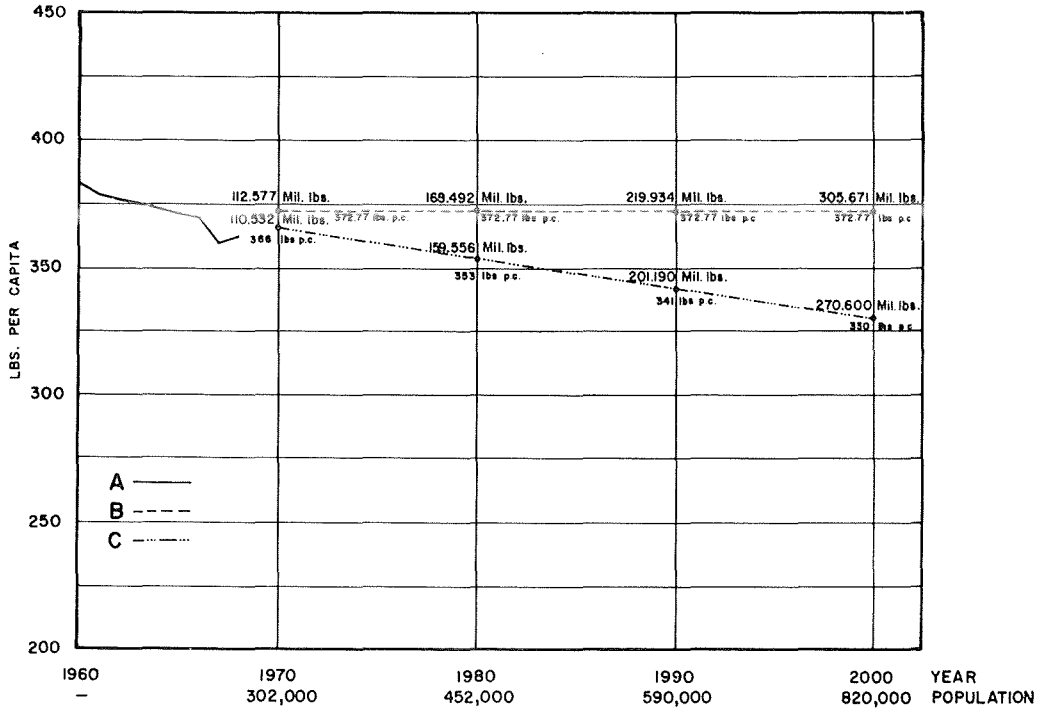


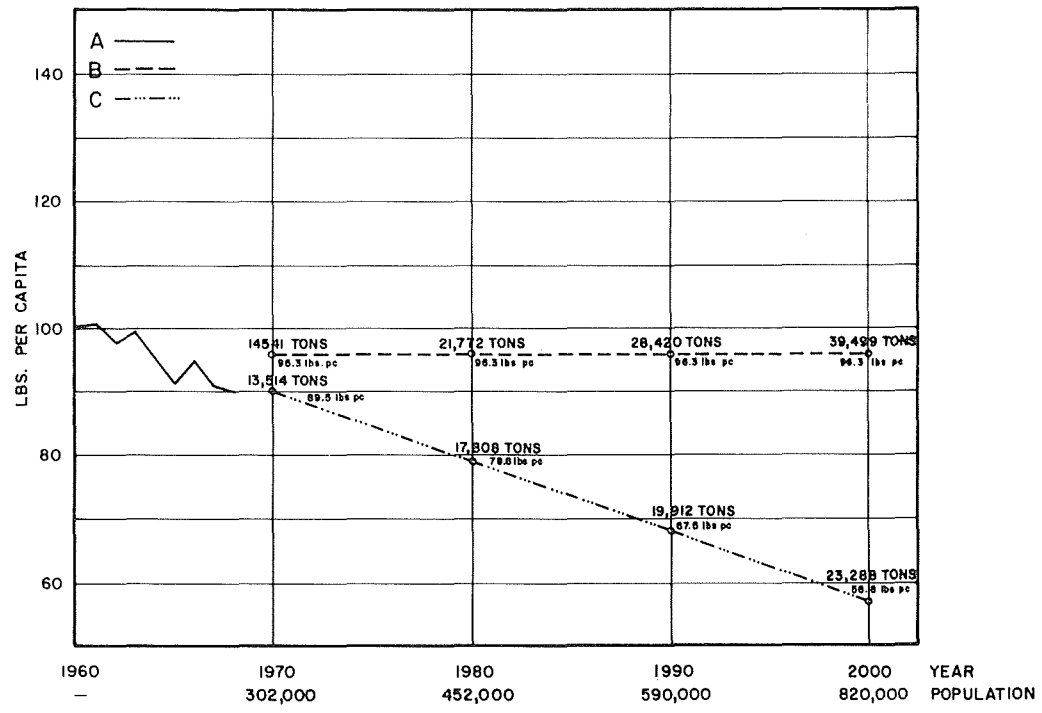

POTATOES (FROZEN)
LBS. PER CAPITA
A
B
C
3,262 TONS
21.6 lbs pc
8,475 TONS
37.6 lbs pc
15,723 TONS
55.3 lbs pc
2,008 TONS
13.3 lbs pc
3,012 TONS
13.3 lbs pc
3,933 TONS
13.3 lbs pc
5,465 TONS
13.3 lbs pc
1960
1970
1980
1990
2000
YEAR
–
302,000
452,000
590,000
820,000
POPULATION


EGGS (FRESH)
EGGS PER CAPITA
A
B
C
8.088 mil. doz.
7.852 mil. doz.
312 eggs p.c.
12.106 mil. doz.
321.4 eggs p.c.
11.131 mil. doz.
295.5 eggs p.c.
15.802 mil. doz.
321.4 eggs p.c.
13.718 mil. doz.
279 eggs p.c.
21.962 mil. doz
321.4 eggs p.c.
17.972 mil. doz
283 eggs p.c.
1960
1970
1980
1990
2000
YEAR
–
302,000
452,000
590,000
820,000
POPULATION

MILK - TOTAL RETAIL



POTATOES (FRESH)



APPENDIX B

Estimated annual consumption of selected agricultural products in Alaska are presented in graph form on the following pages. The graphs include (1) estimated low and high *annual* consumption for 1970, 1980, 1990, and 2000; (2) estimated low and high *per capita* consumption for 1970, 1980, 1990, and 2000; and (3) 1960 to 1968 *per capita* consumption.

Per capita and total annual consumption have been estimated at two levels: (1) average U.S. per capita consumption for the period 1960-1968; and (2) continuation of trends during the 1960-1968 period. Annual consumption has been estimated from projected per capita consumption and population for 1970, 1980, 1990, and 2000.

In the graphs, line A is annual per capita consumption, 1960-1968; line B is projected consumption based on U.S. average, 1960-1968; and line C is projected consumption trends based on author's computations.

silt loams over glacial till or sedimentary strata. They are covered by Sitka spruce and birch. The peat support low growing shrubs or, in places, a black spruce forest.

Naptowne Association (NA). This association occurs in areas of glacial till in the northern part of the Kenai Lowland. The association is described in the Matanuska-Susitna Area.

Rough Broken Land Association (RB). Areas of rough broken land occur on escarpments bordering the Caribou Hills, on canyon walls of streams that flow into Kachemak Bay, and on sea cliffs. All of these areas are steep with eroding, scaling sides. They are either barren or covered with alder thickets. These escarpments have no agricultural value.

Salamatof Association (SA). This association occurs in large muskegs in the northern part of the Kenai Lowland. It is described in the Matanuska-Susitna Area.

Soldatna Association (SO). This association occurs on broad outwash plains and terraces, and on coarse-textured moraines in the northern part of the lowland. The principal soils are shallow to moderately deep silt loams over loose gravelly substrata. Most of the area is covered by forests of white spruce and birch. Many places, especially north of Kenai, have been cleared for farms, industrial sites, and homesites.

Tustumena Association (TU). This association occupies broad terraces bordering the Kenai and Kasilof rivers. The principal soils are shallow to moderately deep silt loams over loose gravelly substrata. The area is covered by a rather spindly forest of young white spruce, aspen, and birch. Sizable areas have been cleared.

Western Kenai Lowland Area

Beluga-Alluvial Land Association (BEA). This association occurs in two areas—the slopes between Kachemak Bay and the Caribou Hills, and the Fox River Valley at the head of Kachemak Bay. On the slopes north of Kachemak Bay, most soils consist of poorly drained stratified materials affected by seep water, but are fairly easily drained to produce good farmland. These soils also occur in the Fox River Valley, but there most soils are frequently flooded alluvial deposits. This land can be used only for grazing.

Cohoe Association (CO). This association occupies much of the area west of the Caribou Hills. The land is generally nearly level to moderately sloping, though steep slopes also occur. The area is dissected by broad deeply incised valleys. The upland soils are mostly well drained moderately deep to deep silt loams over layered substrata. The soils in the valley bottoms, as in some depressions in the uplands, are poorly drained. Many are peats. The well drained soils support a forest dominated by white spruce and birch. The wet soils support grasses, sedges, shrubs, and black spruce. Only a relatively few areas have been cleared for farming.

Kachemak Association (KAC). This association occurs on the rolling to steep Caribou Hills in the southern part of the area. The soils are well drained shallow silt loams over sandy and silty sediments. The native vegetations are tall grass and associated plants, with scattered groves of Sitka spruce. A few farms exist at lower elevations in the hills and several areas are being grazed, but the area is mostly in its native condition. It appears to have good potential as range land.

Kenai Association (KE). This association occurs on hilly moraines in the northern part of the Kenai Lowland. Most of the area has an irregular, choppy topography. The principal soils are well drained shallow silt loams over firm glacial till. The area is covered by forests of white spruce, birch, and aspen. Only a few places have been cleared for farming.

Mutnala-Salamatof Association (MUS). This association occurs in areas of glacial till bordering Kachemak Bay and in valleys in the Caribou Hills. It consists for the most part of a complex pattern of well drained knolls and very poorly drained peats, but along drainageways in the Caribou Hills the well drained soils occur on side slopes and the peats and poorly drained mineral soils on the valley bottoms. The well drained soils consist of shallow

Salamatof Association (SA). This association occupies large muskegs in various parts of the area. The soils are predominantly very poorly drained peats. Poorly drained mineral soils occur at the edges of the muskegs. Mosses and shrubs are the principal vegetation, but black spruce covers many areas. For the most part, soils in this association are not siuted for farming.

Salamatof-Jacobsen Association (SAJ). Soils in this association are similar to those in the Salamatof Association, but many of the very poorly drained areas have stony mineral soils rather than peats. They are equally unsuitable for farming.

Susitna-Niklason Association (SUN). This association occupies broad floodplains of the major rivers. Some areas are subject to occasional spring floods, but in most places this is not severe enough to prevent farming. The soils are mostly stratified silts and sands, are well drained, and are shallow to deep over loose gravelly substrata. They are generally covered with forests of white spruce, cottonwood, and birch.

Tidal Marsh-Clunie Association (TIC). This association occurs on nearly level tidal plains bordering Knik Arm and Cook Inlet. The soils are mostly poorly drained silty clays and very poorly drained peats. Parts of the area are occasionally inundated by exceptionally high tides. These areas are largely treeless and support a dense vegetation of sedges, grasses, and associated plants of coastal meadows. They are suitable for grazing and, at times, for the production of wild hay.

Torpedo Lake-Homestead Association (TOH). This association occupies footslopes of the Talkeetna Mountains. The area consists of many small drainageways and seep spots separated by narrow ridges and knolls. The soils in the drainageways are poorly drained and have firm clayey subsoils. The soils of the ridges and knolls are well drained and consist of shallow and very shallow silt loams over gravelly substrata. Forests of white spruce, birch, and aspen occupy the well drained sites below elevations of 1,000 feet. Grasses and alder occur above that elevation and in the poorly drained sites. The area has only limited suitability for farming, but parts of it may be used for summer grazing.

white spruce and birch, but dairy farms exist on the more gently sloping terrain.

Homestead-Nancy Association (HON). This association occupies hilly moraines, benchlike ridges, and high terraces in the vicinity of Willow. The landscape is complex, with many streams, lakes, and muskegs. The well drained upland soils are shallow to moderately deep silt loams over gravelly substrata. All soils are mostly forested, but a few homesteads are being developed.

Kashwitna Association (KAS). This association occurs on level to rolling outwash plains and terraces, and on rolling moraines bordering the mountains. The principal soils are well drained shallow silt loams over gravelly substrata. White spruce, birch, and aspen cover most of the area. With increased accessibility, the broad outwash plain in the southern part of the area will probably be more intensively utilized.

Knik Association (KN). This association occupies terraces, hilly moraines, and steep ridges in the eastern part of the area. Most of the soils are well drained, and consist of shallow silt loams over gravelly substrata. The steeper parts of the association are forested, but much of the level to rolling land is cleared and farmed. White spruce, birch, and aspen are the principal trees. Many lakes in the area have been developed for recreation and homesites.

Naptowne Association (NA). This association occupies rolling to hilly moraines, mostly in the southern part of the area. Many poorly drained soils are included in the association, but the dominant soils are well drained shallow to moderately deep silt loams over moderately firm gravelly substrata. Some of the soils are stony. In general, the forests are relatively mature and consist principally of white spruce and birch. There has been little agricultural development.

Nancy-Whitsol Association (NAW). This association occupies level to rolling terraces of the Susitna River. The soils are predominantly well drained moderately deep to deep silt loams over loose sand or gravel. For the most part, they are covered by forests of white spruce and birch, but a number of areas have been homesteaded.

Rabideux-Chulitna Association (RAC). This association occurs on terraces and moraines in the northern part of the area. The dominant soils are well drained and consist of shallow to moderately deep silt loams over sand or gravel. The soils are mostly forested (white spruce and birch), but a few areas have been cleared.

over gravelly substrata. Premafrost is generally deep or absent. The well drained soils support a forest of white spruce, birch, and aspen, but the moderately well drained soils are covered with dense forests of black spruce. Much of the area has been burned in recent years, and large areas have been cleared for farms. Strong winds are common.

Matanuska-Susitna Area

Bodenburg Association (BO). This association occupies broad nearly level to undulating terraces in the vicinity of Palmer. The soils are formed in moderately deep to deep windlaid silty material over gravelly substrata. These are the most intensively farmed soils in Alaska. Much of the area is cleared, but remnants of the original forest of white spruce and birch remain. Strong winds in the area create a soil blowing hazard.

Delyndia-Nancy Association (DEN). This association occurs in the southern part of the Susitna Valley, bordering major rivers and large muskegs. Well drained shallow to moderately deep silty soils over fine sandy substrata are dominant. Slopes are mostly nearly level to moderate. Forests of white spruce and birch cover virtually the entire area.

Doone-Knik Association (DOK). This association occupies high nearly level terraces and rolling to hilly moraines bordering the Matanuska River northeast of Palmer. The soils are mostly well drained, and consist of windlaid silts that are shallow to moderately deep over gravelly substrata. Most of the area is forested, but a number of dairy and vegetables farms exist. Strong winds are common, especially in winter.

Homestead Association (HO). This association occurs on rolling to steep moraines and nearly level outwash plains in the western Matanuska Valley. The area is dotted with lakes and muskegs. The upland soils are mostly well drained, and consist of shallow to very shallow silt loam over gravelly material. Most of the land has been taken up by homesteads, but few are fully developed. Second growth forests of aspen, birch, and white spruce cover most of the area. The soils are best suited for crops that require only shallow tillage, or for forestry.

Homestead-Knik Association (HOK). This association occurs in the eastern part of the area on hilly moraines, high terraces, and benchlike ridges bordering mountain footslopes. The soils are mostly well drained shallow silt loams over gravelly substrata. The soils are mostly covered with forests of

APPENDIX A

Brief descriptions of each of the major soil associations in the surveyed areas follow:

Tanana Valley Area

Fairbanks-Steese-Minto Association (FSM). This association occurs on high hills and ridges bordering the alluvial plains of the Tanana and tributary rivers. Elevations range from about 650 feet to 2,000 feet. Soils consist of micaceous silty loess over bedrock (principally schist). The silty material is many feet thick on lower slopes, but thins to only a few inches on the higher ridges. Large buried ice masses are common in the footslopes, and may result in irregular pitting after clearing. Soils on the south-facing slopes are generally well drained and free of permafrost, and support forests of white spruce, birch, and aspen. Soils on north-facing slopes and in drainageways are perennially frozen and poorly drained, and support sparse forests of black spruce.

Goldstream Association (GO). This association occurs in broad, nearly level portions of the alluvial plains. Most of the soils are perennially frozen under natural conditions and are poorly drained. Artificial drainage would be necessary to bring these soils into production. Even after drainage, the choice of crops in most areas would be restricted by low soil temperatures in the spring. Black spruce is the principal tree on these soils; many areas support only sedges and brush.

Salchaket-Tanana Association (SLT). This association occurs on the broad nearly level alluvial plains. Most of the soils are formed in waterlaid sediments over coarse gravelly substrata. Many of them are well drained and free of permafrost. Others are somewhat poorly drained with frozen substrata, but these soils can be farmed after clearing and the subsequent lowering of the permafrost table. Forests of white spruce, aspen, and birch are dominant on the well drained sites, but black spruce and willows grow on the somewhat poorly drained soils.

Volkmar-Nenana Association (VON). This association occurs on nearly level to gently sloping outwash plains and terraces and on undulating to rolling gravelly moraines in the vicinity of Delta Junction. Low stabilized dunes also occur, especially near the floodplains of major streams. The dominant soils are well drained and moderately well drained shallow silt loams

APPENDICES

APPENDIX A: Description of Major Soil Associations in Alaska

APPENDIX B: Estimated Annual Consumption of Selected Agricultural Products in Alaska