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AGRICULTURE IN ALASKA: 1976-2000 AD

INTRODUCTION

Sharply rising food prices and the possibility of food shortages have increasingly focused national attention on existing sources of food production and potential new areas of production in the United States. This subject is especially relevant to Alaskans who receive the largest part of their food supply by transport from the other states, and as a result pay some of the highest prices in the United States.

Just where Alaska fits into the picture as a food producer is yet undetermined. Clearly, agriculture in Alaska is small; however, it has potential for significant increases in production which could benefit Alaska, the rest of the United States, and the world.

To provide a clearer view of Alaska agriculture, its present capabilities and future possibilities, this issue of the *Review* looks at agricultural development in Alaska, analyzes past changes, and discusses future prospects for several types of agricultural production in Alaska.

Historical Development

Our knowledge of Alaska's agricultural past begins with some of the first Russian settlers who transported cattle and goats from Siberia to Kodiak Island in the latter part of the eighteenth century.[1,2] These early settlers also grew such vegetables as potatoes, cabbages, radishes, and lettuce, although with limited success because of a wet climate.

After U.S. purchase of the territory in 1867, there was little agricultural activity beyond the food that the small white populace grew for their own tables. In fact, until the first territorial governor's report in 1884, U.S. officials had been led to believe through erroneous reports that the Alaska climate effectively ruled out agriculture. Such thinking changed during the next few years, however, and by the late 1890s, the U.S. Government had established agricultural experiment stations at Sitka, Kenai, and Kodiak to conduct research toward adapting certain grains, vegetables, fruits, and livestock to Alaska conditions.[3]

The gold discovery near Nome in 1900 brought thousands of prospective miners to that area, and this new market gave a boost to a fledgling experiment in Alaska animal husbandry—reindeer. Reindeer were first imported by the U.S. Government from Siberia in the early 1890s to be used as a subsistence resource for the Natives. But when the gold rush created the nearby market, Natives and others began to sell reindeer meat to the miners. After the gold rush population subsided, reindeer in Alaska continued to

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[1] However, some researchers believe that southeastern Natives may have cultivated tobacco in aboriginal times. See F. Laguna, *Under Mount St. Elias: The History and Culture of the Yakutat Tlingits* (Washington, D.C.: Smithsonian Institution Press, 1972), p. 410.

[2] Alford Jake Barron, "History of Agriculture in Alaska" (Thesis, University of Oklahoma, 1939), Chapter 2.

[3] *Ibid.*, Chapter 1.

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Robert W. Hiatt—President, University of Alaska
Lee Gorsuch—Director, ISEGR

Editor: Ronald Crowe
ISEGR, University of Alaska
Fairbanks 99701

Author: Wayne Thomas

increase, being used both for local subsistence and commercially for local as well as import markets in the United States. Reindeer herds increased steadily until they peaked in 1932 at approximately 640,000 animals. After that, for a variety of economic and other reasons, their numbers were allowed to decrease precipitously. Total numbers in 1968 were estimated at only 30,000 head.[4]

The 1902 discovery of gold in the north Tanana Valley led to development there of a significant market for agricultural products. A small agricultural industry developed in response to the growing numbers of gold seekers, and local farmers produced grains, vegetables, livestock, and poultry products. However, as gold production diminished and the boom population decreased, agricultural activity also decreased.[5]

A depression-inspired experiment in the mid-1930s renewed agricultural interest in Alaska when the U.S. Government transplanted a group of impoverished farmers from the mid-western United States to the Matanuska Valley to develop agricultural production in that region.[6] This experiment was a success to the extent that today, this valley produces the largest volume of agricultural products in the state.

During the late 1940s, the U.S. Department of Agriculture (USDA), in response to U.S. military concern for the vulnerability of Alaska's food supply, increased its efforts to make the territory less dependent on the other states. The USDA increased its agricultural research, expanding ongoing programs and introducing new ones. In addition, the military increased its purchases of locally grown products. As a result, partly of this and partly because of a growing population, Alaska agriculture grew steadily from that time until the early 1960s. By the sixties, however, because of an improving transportation network between Alaska and the lower U.S., Alaska's small scale, inefficient agriculture simply could not compete with the massive, cheaper output of its lower U.S. counterpart. Thus, agriculture in Alaska stagnated during the 1960s (Table 1).

TABLE 1

Summary of Alaska Crop and Livestock Sales 1960-1974

Year	Crops	Livestock	Total
1974	$ 1,987,000	$3,654,000	$5,641,000
1973	1,980,000	3,318,000	5,298,000
1972	1,343,000	3,040,000	4,383,000
1971	963,000	2,871,000	3,834,000
1970	903,000	3,112,000	4,015,000
1969	624,000	2,948,000	3,572,000
1968	1,031,000	3,060,000	4,091,000
1967	920,000	3,197,000	4,117,000
1966	1,025,000	3,299,000	4,324,000
1965	989,000	3,255,000	4,244,000
1964	1,332,000	3,025,000	4,357,000
1963	865,000	3,148,000	4,013,000
1962	1,139,000	3,265,000	4,404,000
1961	1,090,000	3,315,000	4,405,000
1960	1,020,000	3,116,000	4,136,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

Importance of Agriculture in Alaska

If large-scale agricultural development in Alaska were feasible, it could provide food products for a world market. In addition, it could provide employment and economic development for Alaskans. World population and incomes are rising, with a corresponding increase in demand for food. Greater food production is facilitated by increased

[4] Dean F. Olson, *Alaska Reindeer Herdsmen*, Institute of Social, Economic and Government Research Report No. 18 (Fairbanks: University of Alaska, 1969), pp. 8-16.

[5] Population in the area, including Fairbanks, grew to 10,541 persons by 1910. By 1920, however, declining gold production had caused the population to dwindle to 2,182. James W. Sullivan, "Fairbanks: An Economic Profile," *Alaska Review of Business and Economic Conditions*, 7 (January 1970):1.

[6] Evangeline Atwood, *We Shall be Remembered* (Anchorage: Alaska Methodist Press, 1966).

efficiency of production and development of new agricultural lands. There are only a few places left on earth with large areas of undeveloped land, and Alaska is one of these.

Another factor to consider in measuring the importance of Alaska agriculture is, even if it were only developed to provide for markets within the state, such development would provide employment opportunities and create secondary economic growth in rural areas. A developed, large-scale agriculture, if feasible, could provide Alaska consumers with a limited range of price-competitive food products. Another advantage would be the social benefits resulting from an attractive rural lifestyle enjoyed directly by farm families and vicariously by urban residents. There are, of course, some negative aspects to consider. The character of certain wild land areas would distinctly change. Development would affect habitat for wild game and fish to the extent that whole areas might become unsuitable for certain species. Stream and ground water pollution might increase due to use of agricultural chemicals and large concentrations of people.

Thus, we must ask several questions in considering agricultural development in Alaska:

- What is the present state of agriculture in Alaska? (What base have we to build on?)
- What, if any, types of future agricultural enterprises have been identified as feasible for Alaska?
- What is the potential for statewide and export markets?
- What would be the regional economic impact of such developments?
- What would be the social benefits of agricultural development; for example, the farm lifestyle?
- What would be the social costs of agricultural development—that is, pollution potential and impact on wild lands and wildlife.

The first four questions are explored in the remaining sections of this *Review*. Although the questions on social benefits and costs will need to be considered in depth, they are outside the scope of this article.

PRESENT SITUATION

Major agricultural production areas in Alaska are shown in Figure 1.

Livestock and Poultry Products

Milk Production. Milk is the largest component of reported agricultural sales in Alaska (Table 2). However, much of what is consumed in the state is imported.

TABLE 2

Sales of Alaska Livestock and Crops, 1974

Product	Sales	Percent
Milk	$2,449,000	43
Eggs	499,000	9
Potatoes	760,000	13
Hay	754,000	13
Beef	322,000	6
Lettuce	232,000	4
Reindeer[b]	150,000	3
Other Vegetables	129,000	2
Pork	77,000	1
Barley and Oats	104,000	2
Wool	98,000	2
Poultry Meat	10,000	—[a]
Silage	8,000	—[a]
Mutton	49,000	1
TOTAL	$5,641,000	100

[a] less than 1 percent

[b] Excludes antlers, hides, and other byproducts (worth $60,000 in 1974).

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

According to 1972 data, fresh milk sales from Alaska producers accounted for approximately 33 percent of the total fluid milk consumed in Alaska.[7] Another 33 percent (including all the fresh milk consumed in Southeastern Alaska) was shipped in fresh. Recombined milk accounted for the remaining 33 percent of the fluid milk market. It is shipped in as a dry powder and butterfat/cream, reconstituted in Alaska, packaged much like fresh milk and sold as a competing product.[8]

Alaska's dairy industry has been undergoing a readjustment period since the 1960s. Milk sales and production remained relatively constant in the Matanuska Valley for the entire period 1960-1974

[7] Except for some ice cream items, all other dairy products, including fresh milk, are shipped into Alaska, largely from Washington State.

[8] Wayne C. Thomas and Peter C. Lin, "Economic Factors in Alaska Milk Marketing," *Agroborealis*, 4 (1972):21-22. The milk data were taken from this article and updated.

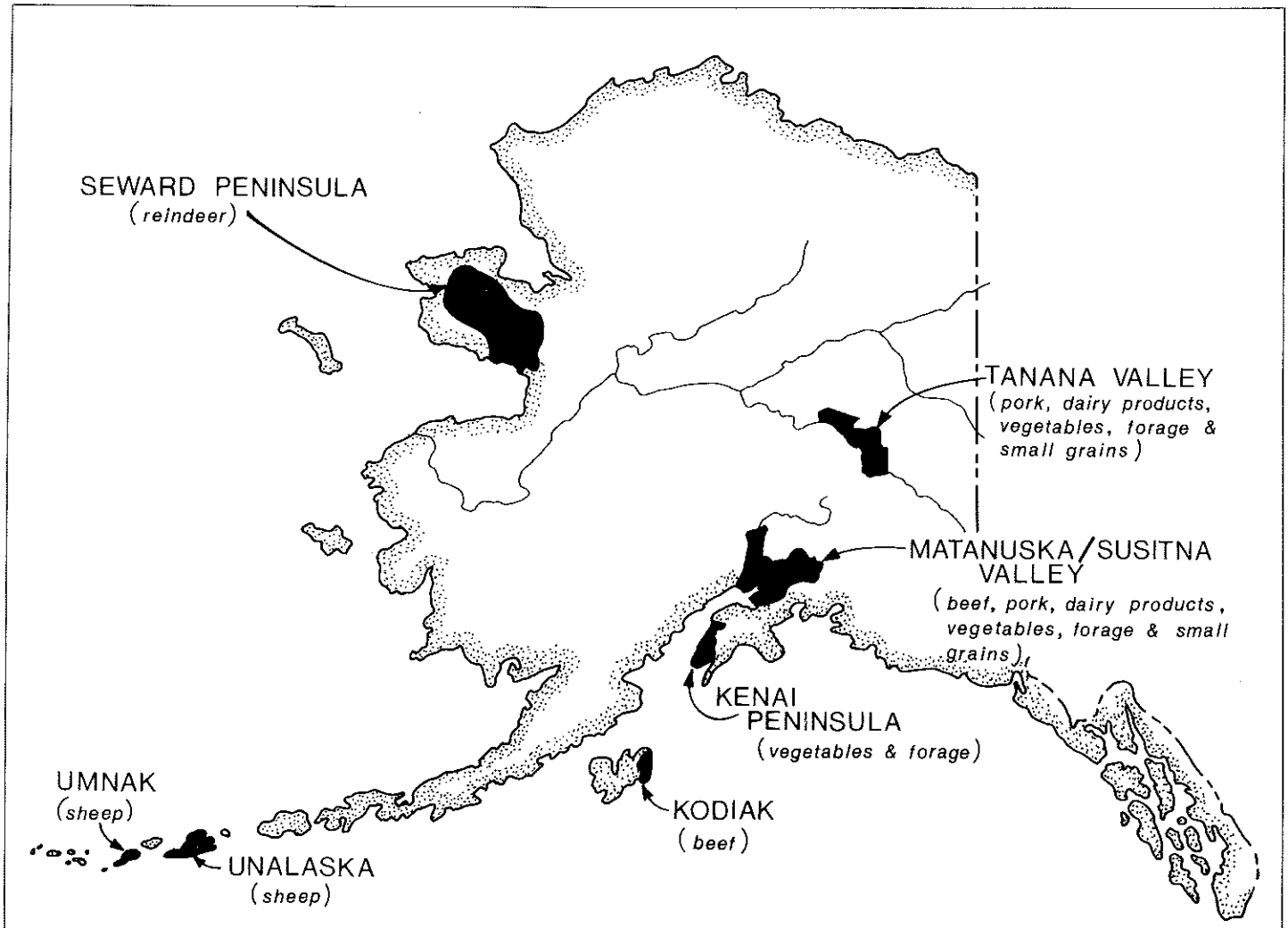

Figure 1: Main Agricultural Production Areas in Alaska.

(Table 3), while they declined rapidly in all other regions of the state. A number of factors were responsible for the reduction. The cost of milk production is relatively high in Alaska due to insufficient farm size, rising land costs, and economically more attractive alternative uses of labor and capital in the other sectors of the Alaska economy.

Beef Cattle. Cattle for slaughter come from two major sources in Alaska. One source is the Matanuska Valley dairy farms where bull calves and cull cows make up 31 percent of total beef marketings. The other source is ranches on Kodiak Island, which represents the largest beef breed production area, with 48 percent of beef sales.[9] Most of the cattle slaughtered for beef in Alaska are marketed by the individual producers and sold privately as beef for frozen food lockers. At times, a small percentage goes into manufactured beef where the carcasses are ground for hamburger and other processed meats. Some cuts of Alaska beef are intermittently sold at retail in mainland Alaska on a supply-available basis.

Alaska produces less than 2 percent of the beef marketed within the state.[10] Total sales of Alaska beef in 1974 amounted to slightly less than 500,000 pounds (Table 4). As shown in Table 4, Alaska beef

[9] Alaska Livestock and Crop Reporting Service, *Alaska Agricultural Statistics,* various issues.

[10] Christopher Stephens, Wayne Thomas, and Virginia Burke, *Supplying Alaska's Red Meat and Poultry Markets,* Institute of Agricultural Sciences Bulletin 41 (Fairbanks: University of Alaska, May 1975), p. 23.

TABLE 3

Quantity Sold, Value of Sales, and Price Received for Milk Produced in Alaska 1960-1974

Year	Tanana Valley		Matanuska Valley		Kenai Peninsula		Southeast		Totals		Price/cwt.[b]
	Quantity (lbs x 10^3)[a]	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	
1974	645	$ 92	16,555	$2,357	–	$–	–	$–	17,200	$2,449	$14.24
1973	650	85	16,650	2,022					17,300	2,107	12.18
1972	800	135	16,100	1,828	–	–	–	–	16,900	1,963	11.62
1971	830	91	15,570	1,747	–	–	–	–	16,500	1,838	11.21
1970	950	141	16,850	1,853	–	–	–	–	17,800	1,994	11.20
1969	625	95	16,250	1,751	115	14	10	2	17,000	1,862	10.95
1968	470	65	16,400	1,726	120	14	10	2	17,000	1,807	10.63
1967	969	115	16,496	1,736	125	14	10	2	17,600	1,867	10.61
1966	1,700	168	16,430	1,684	120	21	50	8	18,300	1,881	10.28
1965	1,850	215	16,345	1,593	647	59	858	87	19,700	1,954	9.92
1964	1,520	184	18,280	1,720	640	60	1,060	103	21,500	2,067	9.61
1963	2,160	294	17,940	1,783	674	71	1,326	136	21,900	2,284	10.43
1962	2,420	323	17,760	1,817	460	51	1,360	149	22,000	2,340	10.64
1961	2,430	340	17,700	1,975	240	25	1,430	164	21,800	2,504	11.49
1960	2,170	308	15,504	1,763	221	25	1,505	181	19,400	2,277	11.74

[a] 10^3 = 1,000

[b] cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 4

Quantity Sold, Value of Sales, and Price Received for Various Meat Products Produced in Alaska 1960-1974

Year	Beef and Veal			Pork			Lamb and Mutton			Reindeer		
	Quantity Sold D.W.[a] (lbs x 10^3)[b]	Sales (x 10^3)	Price/ cwt D.W.	Quantity Sold D.W. (lbs x 10^3)	Sales (x 10^3)	Price/ cwt D.W.	Quantity Sold D.W. (lbs x 10^3)	Sales (x 10^3)	Price/ cwt D.W.	Quantity Sold D.W. (lbs x 10^3)	Sales (x 10^3)	Price/ cwt D.W.
1974	466	322	69.10	136	77	56.62	102	$49	48.04	220	$150	$68.18
1973	420	309	73.57	110	71	64.55	20	9	45.00	261	144	55.17
1972	483	$278	$57.56	124	$79	$63.71	20	9	45.00	239	121	50.63
1971	494	273	55.26	138	88	63.77	21	10	47.61	365	188	51.51
1970	681	355	52.13	123	75	60.98	33	17	51.53	479	241	50.31
1969	719	359	49.93	142	64	45.07	17	9	52.94	442	219	47.82
1968	692	292	42.20	191	83	43.46	19	11	57.89	608	260	42.76
1967	857	350	40.84	140	64	45.71	28	12	42.86	517	188	36.36
1966	854	350	40.98	145	77	53.10	34	14	41.18	546	190	34.80
1965	694	279	40.20	198	98	45.96	21	9	42.86	522	200	38.31
1964	624	249	39.58	128	51	39.84	16	8	50.00	504	195	38.69
1963	505	209	41.39	64	24	37.50	15	8	53.33	394	138	35.03
1962	507	237	46.75	121	51	42.15	14	8	57.14	372	139	37.37
1961	251	116	46.22	166	67	40.36	13	7	53.84	364	136	37.36
1960	305	122	40.00	145	59	40.69	9	5	55.55	330	132	40.00

[a] D.W. = Dress weight

[b] 10^3 = 1,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

production for the period 1960-1974 has fallen from its highest production level in 1967. Part of reduced beef production in Alaska was due to unsettled Native land claims. Until land titles become less clouded, existing beef producers, especially those operating on leased federal lands, are probably reluctant to make the major capital investments necessary to maintain or increase production.

Hogs. In 1972, over 6,000,000 pounds of cured and uncured pork (42,000 carcasses) were shipped to Southcentral Alaska.[11] In the same year, less than 800 carcasses were produced in the state. Alaska pork, unlike Alaska beef, can move into any existing market, because it is similar in all respects to shipped-in pork products. However, local pork production can only expand significantly if the higher costs of production in Alaska are no greater than cost of pork in the lower 48 states plus transportation to Alaska. A 1971 study indicates that a production cost range of $28.66 to $36.25 per hundredweight (dressed weight) can be achieved in Alaska with good-to-average management.[12]

Since 1965, Alaska farm-level pork prices have not dropped below $37.50 per hundredweight (dressed weight). Thus, increased pork production, if managed properly, should be profitable in Alaska.

Pork production through 1974 remained below that of 1965 (Table 4). In 1974, several pork producers in the Matanuska and Tanana valleys went out of business, both because of a lack of local feed and a lack of the processing facilities and other supporting services.

Sheep and Wool. Alaska sheep production occurs almost exclusively on the eastern portion of the Aleutian Islands. The production process is dissimilar to what is generally found in the western range areas of the lower states, because lamb production for meat is not the primary income generator. All lambs, both wethers and ewes, are kept for wool production. Only as the animals grow older and their wool production declines are they sold for mutton, generally to individual buyers (Table 4).

In 1974, a significant increase in mutton production occurred in the Aleutian Islands after a new slaughter house went into operation on Umnak Island. This mutton was sold to institutional buyers from the lower United States.

The wool is also sold to markets in the lower states. Production of wool in Alaska has diminished in recent years, largely because of reduced national wool prices. In 1973 and 1974, the price received locally for wool increased fourfold over 1971 (Table 5), but production of wool in Alaska has continued to decline.

Eggs and Poultry. Egg markets in Alaska have fluctuated periodically since statehood. The current production level is greater than that of 1960, but less than that of 1965-1968 (Table 6). The farm price received for eggs showed little response to inflation; it was only seven cents per dozen higher in 1974 than in 1960.

Egg production is carried on by a few large operators. There are presently two commercial-size egg producers in Alaska and both are importing most of their feed. A locally developed feed base would reduce feed supply problems.

Poultry meat production in Alaska is primarily a byproduct of egg production, providing a means of getting rid of older birds.

Reindeer. By federal law, reindeer in Alaska are entirely owned and managed by Native herders. Most of the animals are located on the Seward Peninsula and Nunivak Island. Roundup and slaughter generally occur in the fall of the year. Most slaughter animals are marketed and consumed in Nome and in Native villages in northwest Alaska. Only a limited amount of reindeer meat on a supply available basis is marketed in Anchorage or Fairbanks. In addition, a small portion is shipped outside the state for use in the exotic meat trade.

The price received by reindeer herders has nearly doubled over that of the low year 1966, while production has fallen to its lowest level in the fifteen years of data reported in Table 4.

Herd management over vast areas in the arctic and subarctic north is difficult at best. Disease and predator problems along with range management and supply problems hinder herd management. The Native lifestyle, to a degree, prevents reindeer production from achieving market potentials.[13] In addition, federal and state laws controlling methods of slaughter also hinder market growth in urban Alaska.

Crops

Hay and Silage. Hay and silage are forage crops produced to feed livestock. Dairy cows and horses

[11] *Ibid.*

[12] Wayne Burton, *Alaska Agriculture*, Institute of Social, Economic and Government Research Report No. 30 (Fairbanks: University of Alaska, 1971), p. 181. These cost figures have increased through 1975, as has the price for hogs.

[13] D. Olson, *Alaska Reindeer Herdsman*, Chapter 8.

TABLE 5

Production, Value of Sales, and Price Received for Alaska Wool 1960-1974

Year	No. of Sheep Shorn	Wool Production (pounds)	Sales	Price per pound
1974	11,000	110,000	$ 98,000	$0.89
1973	11,000	129,000	115,000	0.89
1972	13,000	145,000	55,000	0.38
1971	16,000	225,000	43,000	0.19
1970	21,000	239,000	72,000	0.30
1969	23,000	269,000	94,000	0.35
1968	23,000	264,000	92,000	0.35
1967	21,000	246,000	98,000	0.40
1966	19,000	215,000	123,000	0.57
1965	18,000	209,000	111,000	0.53
1964	16,000	189,000	115,000	0.61
1963	14,000	167,000	97,000	0.58
1962	12,000	146,000	72,000	0.49
1961	12,000	128,000	51,000	0.40
1960	11,000	125,000	50,000	0.40

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

constitute the primary markets for Alaska hay. This crop is so important that milk production in the Matanuska Valley has to some degree fluctuated according to hay productivity. A reduction in milk production in 1971 can be partially explained by the smaller hay crop that year. In 1972, 1973, and 1974, the Matanuska Valley, in response to favorable climatic and economic conditions, produced the largest hay crops in its history.[14]

In 1974, hay produced in Alaska was worth approximately $2,000,000. Of this, 39 percent or $754,000 came from off-farm sales to Alaska horse owners (Table 7). Pleasure and work horses in Alaska in 1971 numbered nearly 3,000 head.[15] Although data are not available, the number of horses would appear to be increasing in Alaska in conjunction with the population growth. If this is true, the demand by horse owners for roughage should continue to be strong, thereby increasing demand for hay.

The other important forage crop, silage, can be

[14] However, Alaska milk sales did not follow the upward trend of hay production for the period 1972-74.

[15] *Alaska Agricultural Statistics*, various issues.

TABLE 6

Production and Value of Sales for Alaska Eggs and Poultry Meat 1960-1974

Year	Eggs Sold (dozen)	Sales (dozen)	Farm Price per dozen	Poultry Meat Sales
1974	525,000	$499,000	$0.95	$10,000
1973	575,000	546,000	0.95	17,000
1972	576,000	518,000	0.90	17,000
1971	492,000	418,000	0.85	13,000
1970	408,000	341,000	0.84	17,000
1969	425,000	328,000	0.77	13,000
1968	617,000	496,000	0.80	19,000
1967	750,000	592,000	0.79	26,000
1966	842,000	648,000	0.77	16,000
1965	758,000	584,000	0.77	20,000
1964	408,000	328,000	0.80	14,000
1963	458,000	369,000	0.81	19,000
1962	493,000	400,000	0.81	18,000
1961	526,000	410,000	0.80	24,000
1960	518,000	454,000	0.88	17,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

produced from the same crop, grass or grain, as can hay. Determination of which harvest method to use depends on market, weather, crop, and storage conditions, as well as on feed and labor requirements of individual farms. In 1974, over 98 percent of the silage produced was used on the producing farms (Table 8).

Barley and Oats. Barley is used for cattle, hog, chicken, and horse feed. More barley was sold in 1973 than any year since 1960 (Table 9). However, in 1974, one large farming operation switched from barley to straw production (for pipeline construction), and the quantity of barley produced in the state decreased dramatically. This feed base instability has a detrimental effect on livestock production in Alaska.

Oats is the other feed grain grown commercially in Alaska. Oats production dropped from around 1,000 acres annually in the early 1960s to 500 acres in 1974 (Table 10). This crop is used for horse and dairy feed.

Potatoes. The Matanuska Valley accounts for 87 percent of the potatoes harvested in the state. The remainder comes from the Tanana Valley, with a small portion also produced on the Kenai Peninsula. Potato production in Alaska is highly mechanized with hired labor needed only for harvesting. After harvest, potatoes can be stored by the producer until the next harvest period. This allows for a more continuous market supply and helps to prevent short-term market gluts which drive down the farm price.

Potato acreage fell to near its lowest level in 1974 (for period 1960-1974), while price received was more than double that of 1967 (Table 11).

Alaska-grown potatoes are commonly found in food stores throughout the state. However, a lack of potato-processing facilities in Alaska has limited the product to only the fresh market.

Several attempts, yet unsuccessful, have been made to develop frozen-food processing facilities in the Matanuska Valley. Until this occurs, both civilian and military markets will continue to look outside the state for frozen and dry-processed potatoes.

Vegetables

Lettuce. In 1974, lettuce had the largest dollar

TABLE 7

Production, Value of Sales, and Sale Price Received for Alaska Hay 1960-1974

Year	Harvested Acres	Yield Per Acre (tons)	Quantity Produced (tons)	Production Value	Quantity Sold (tons)	Sales	Price per ton
1974	12,600	1.19	15,000	$1,950,000	5,800	$754,000	$130.00
1973	11,600	1.28	14,800	1,332,000	4,400	396,000	90.00
1972	10,900	1.33	14,500	1,160,000	4,200	336,000	80.00
1971	7,000	1.03	7,200	576,000	1,500	120,000	80.00
1970	8,000	1.17	9,400	705,000	1,700	128,000	75.29
1969	8,100	.95	7,700	539,000	1,600	112,000	70.00
1968	7,900	1.25	9,900	545,000	2,200	121,000	55.00
1967	8,700	1.51	13,100	721,000	1,800	99,000	55.00
1966	8,200	1.38	11,300	655,000	3,200	186,000	58.12
1965	6,900	1.28	8,800	528,000	2,200	132,000	60.00
1964	8,300	1.30	10,800	626,000	1,800	104,000	57.78
1963	7,600	1.25	9,500	551,000	1,000	58,000	58.00
1962	7,800	1.37	10,700	674,000	3,200	202,000	63.12
1961	7,400	1.34	9,900	653,000	3,100	205,000	66.13
1960	6,900	1.52	10,500	772,000	1,300	96,000	73.85

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 8

Production, Value of Sales, and Price Received for Alaska Silage 1960-1974

Year	Harvested Acres	Yield Per Acre (tons)	Quantity Produced (tons)	Production Value	Quantity Sold (tons)	Sales	Price per ton
1974	2,800	4.46	12,500	$500,000	200	$8,000	$40.00
1973	2,900	4.41	12,800	320,000	700	18,000	25.71
1972	3,800	5.08	19,300	367,000	500	10,000	20.00
1971	4,200	4.64	19,500	351,000	200	4,000	20.00
1970	2,900	4.69	13,600	245,000	800	14,000	17.50
1969	3,000	3.40	10,200	184,000	700	13,000	18.57
1968	3,500	5.26	18,400	276,000	400	6,000	15.00
1967	3,800	5.13	19,500	312,000	500	8,000	16.00
1966	3,900	4.69	18,300	329,000	200	4,000	20.00
1965	4,300	5.05	21,700	412,000	500	10,000	20.00
1964	5,600	5.21	29,200	540,000	1,500	28,000	18.67
1963	6,600	4.86	32,100	594,000	1,600	30,000	18.75
1962	6,500	4.03	26,200	498,000	900	17,000	18.89
1961	4,700	4.70	22,100	464,000	800	17,000	21.25
1960	4,400	4.59	20,200	411,000	80	1,600	20.00

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 9

Production, Value of Sales, and Price Received for Alaska Barley (produced for grain) 1960-1974

Year	Harvested Acres	Quantity Produced (cwt)[a]	Production Value	Quantity Sold (cwt)	Sales	Price/cwt.
1974	1,000	13,400	$116,000	7,400	$ 64,000	$8.65
1973	3,100	48,400	363,000	39,700	298,000	7.51
1972	2,800	24,900	101,000	13,200	54,000	4.09
1971	3,100	21,600	83,000	6,300	24,000	3.81
1970	1,500	22,300	88,000	6,800	27,000	3.97
1969	1,200	14,400	53,000	4,500	16,000	3.56
1968	1,900	27,400	117,000	12,000	51,000	4.25
1967	1,800	36,300	144,000	16,000	63,000	3.94
1966	1,600	34,600	140,000	22,100	90,000	4.07
1965	1,600	32,300	131,000	14,800	60,000	4.05
1964	1,900	35,600	144,000	19,600	80,000	4.08
1963	2,200	31,700	135,000	18,000	77,000	4.28
1962	2,200	40,100	176,000	18,000	79,000	4.39
1961	2,000	35,000	172,000	21,400	105,000	4.91
1960	2,300	42,000	192,000	16,800	77,000	4.58

[a] cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 10

Production Value of Sales, and Price Received for Alaska Oats (produced for grain) 1960-1974

Year	Harvested Acres	Quantity Produced (cwt)[a]	Production Value	Quantity Sold (cwt)	Sales	Price/cwt.
1974	500	5,900	$50,000	4,700	$40,000	$8.51
1973	600	8,100	58,000	5,600	40,000	7.14
1972	500	4,800	21,000	3,400	15,000	4.41
1971	200	3,800	17,000	2,300	10,000	4.35
1970	500	7,200	29,000	2,500	10,000	4.00
1969	500	4,800	17,000	2,700	10,000	3.70
1968	900	15,000	68,000	10,000	46,000	4.60
1967	600	14,800	62,000	10,300	44,000	4.27
1966	400	10,200	42,000	6,800	28,000	4.12
1965	600	13,400	57,000	5,800	24,000	4.14
1964	500	12,000	53,000	6,600	29,000	4.39
1963	1,000	14,400	65,000	8,400	38,000	4.52
1962	1,100	21,500	97,000	7,900	36,000	4.56
1961	900	14,700	71,000	3,200	16,000	5.00
1960	1,400	25,500	120,000	8,400	39,000	4.64

[a]cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 11

Harvested Acres, Quantity Sold, Value of Sales, and Price Received for Alaska Potatoes 1960-1974

Year	Harvested Acres	Quantity Sold (cwt)[a]	Sales	Price/cwt
1974	570	72,400	$760,000	$10.50
1973	500	82,500	949,000	11.50
1972	550	69,300	658,000	9.49
1971	630	71,700	502,000	7.00
1970	610	72,800	480,000	6.59
1969	620	56,100	297,000	5.29
1968	620	94,400	538,000	5.70
1967	690	108,000	502,000	4.65
1966	710	93,700	520,000	5.55
1965	780	100,100	578,000	5.77
1964	730	120,000	889,000	7.41
1963	760	107,400	467,000	4.35
1962	730	120,000	576,000	4.80
1961	770	103,400	651,000	6.30
1960	730	96,000	614,000	6.40

[a]cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

sales of any year since Alaska statehood. Lettuce acreage peaked in 1968 and has not since attained these levels (Table 12). A serious problem of perishability limits field production of lettuce for the Alaska market. Only one field crop of lettuce is possible during Alaska's short growing season. This is harvested between July and September, and the crop cannot be stored for any length of time. This means the market season is short and market glut problems are always a possibility.

Field Vegetable Crops. Field production of carrots, cabbage, radishes, celery, and broccoli amounted to 90 acres in 1974, a reduction of 115 acres from 1968 (Table 13). The decline has resulted from extensive labor and management problems and the high requirements for capital investment.

Controlled Environment Agriculture. Tomatoes and ornamentals are produced in Alaska on a limited basis. Production takes place in greenhouses on the Kenai Peninsula, in Southcentral Alaska, and in the Tanana Valley. Since these greenhouses can operate for longer periods (up to year-round), and the production process is faster than for field-grown varieties, crops can be marketed at different times during the year. Greenhouse production, as compared to field production, requires higher input costs and

TABLE 12

Harvested Acres, Quantity Sold, Value of Sales, and Price Received for Alaska Lettuce 1960-1974

Year	Harvested Acres	Quantity Sold (pounds)	Sales	Price/cwt[a]
1974	65	860,000	$232,000	$26.98
1973	65	600,000	142,000	23.67
1972	60	580,000	143,000	24.66
1971	75	930,000	223,000	23.98
1970	60	770,000	157,000	20.39
1969	60	510,000	62,000	12.16
1968	80	910,000	115,000	12.64
1967	60	720,000	100,000	13.89
1966	60	600,000	93,000	15.50
1965	50	620,000	95,000	15.32
1964	50	690,000	95,000	13.77
1963	60	790,000	72,000	9.11
1962	50	780,000	111,000	14.23
1961	50	670,000	85,000	12.69
1960	50	610,000	77,000	12.62

[a]cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

results in increased production per square foot of growing space.

Controlled environment agricultural production can go beyond greenhouse production in that all the light is artificially supplied and greater control is exerted on the growth process.[16] Experimentally, this method has shown substantially increased yields over greenhouse and field production.

Practical applications of controlled environment production are now being attempted in several locations around the world, including Alaska's Kenai Peninsula. Should the Alaska venture prove economically successful, the quantity and quality of local produce available to the Alaska consumer should increase markedly.

[16] Donald Dinkel, et al., "Controlled Environment Agriculture," *Agroborealis* 5 (1973):6-8.

FEASIBILITY STUDIES

Regions

The basis for agricultural feasibility and development is land[17] (see Appendix). In March 1974, a group of studies was published under the title of "Alaska's Agricultural Potential,"[18] which included a report by the Soil Conservation Service, U.S. Department of Agriculture. This report stated that over 15,000,000 acres in Alaska were suitable for cultivated agricultural production (this figure has since been increased to over 17,000,000 acres). To achieve a better understanding of where these soils are located, an enclosed map (Figure 2) and Table 14 contain regional districts[19] as recognized by the

[17] Greenhouse and associated methods are excluded from this analysis, because these types of production do not require extensive quantities of land.

[18] Alaska Rural Development Council, *Alaska's Agricultural Potential*, Publication No. 1 (1974), p. 19-20.

[19] Wayne Burton, *Defining Parameters of Agricultural Potential in Alaska*, Institute of Agricultural Sciences Bulletin No. 44 (Fairbanks: University of Alaska, 1975), pp. 3 and 4.

TABLE 13

Harvested Acres and Value of Sales for Alaska Carrots, Cabbage, Radishes, Celery 1960-1974

Year	Harvested Acres	Sales
1974	90	$129,000
1973	100	119,000
1972	110	127,000
1971	130	80,000
1970	140	87,000
1969	190	114,000
1968	205	154,000
1967	120	104,000
1966	95	104,000
1965	95	90,000
1964	105	107,000
1963	125	123,000
1962	105	118,000
1961	100	111,000
1960	130	115,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

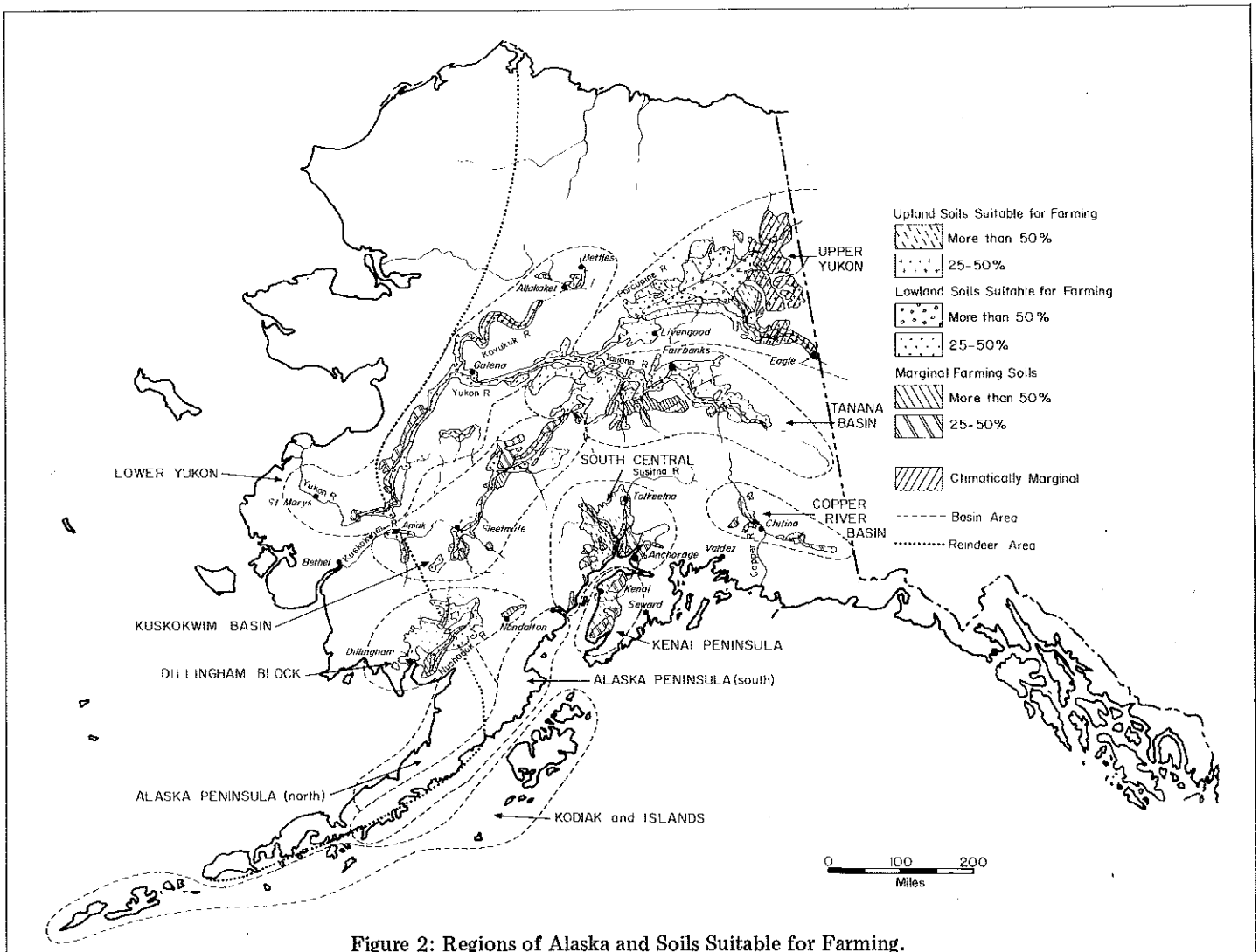

Figure 2: Regions of Alaska and Soils Suitable for Farming.

SOURCE: Wayne Burton, *Defining Parameters of Agricultural Potential in Alaska,* Institute of Agricultural Sciences Bulletin No. 44, (Fairbanks: University of Alaska, 1975).

Federal-State Land-Use Planning Commission for Alaska.[20]

Yukon Basin. The largest amount of the class 1 and 2 soils[21] in Alaska are in the Upper Yukon Basin. These are mostly located in the Yukon Flats, a major water fowl nesting area.[22] Prior to the construction of the trans-Alaska Oil Pipeline, the Upper Yukon was one of the most isolated areas in the state. The human population was small, and year-round transportation was limited to air, although water transportation was available during the summer. The pipeline road, when (or if) opened, will provide the first year-round surface access to the region. As (if) a secondary road network develops in conjunction with the pipeline road, the region will become much more accessible, and movement of commodities into and out of the region will be enhanced.

Tanana Basin. The other major area with soils suitable for agriculture is the Tanana Basin. This region already has a developed transportation system

[20] Federal-State Land-Use Planning Commission for Alaska, *Resources of Alaska: A Regional Summary* (1975).

[21] Soils are divided into group and capability class for agricultural use. Group A and B soils have properties that make them suitable for crop production. Group C tends to be more susceptible to drought, has greater erosion potential, and tends to have more slope problems. Soil capability classification (1 through 6) considers both properties and slope, which are related to soil damage during use.

[22] FSLUP, *Resources of Alaska,* p. 283.

TABLE 14

Estimated Lands Available in Alaska for Agriculture (Thousands of Acres)

Region	Class 1 (Group A)	Class 2 (Group A)	Class 3 (Group B)	Class 4 (Group B)	Class 5 (Group C)	Class 6 (Group C)	Range	Total
Upper Yukon Basin	1,626	1,571	1,625	724	--	--	a	5,546
Lower Yukon Basin	--	233	--	1,372	75	232	a	1,912
Tanana Basin	311	1,915	--	610	480	--	a	3,316
South Central	1,247	--	--	116	--	409	1,134	2,907
Kenai Peninsula	545	--	--	--	--	237	210	992
Alaska Peninsula, S.	--	--	--	--	--	--	2,233	2,233
Dillingham Block	--	883	--	138	102	--	2,096	3,219
Alaska Peninsula, N.	--	--	--	--	345	674	1,163	2,182
Kuskokwim Basin	--	406	355	355	189	426	a	1,731
Copper River Basin	153	--	--	14	15	104	a	286
Kodiak and Islands	--	--	b	b	b	b	1,200	1,200
Reindeer Grazing Areas	--	--	--	--	--	--	100,000	100,000 [c]
TOTAL	3,882	5,008	1,980	3,329	1,206	2,082	108,036	125,524

[a] No grazing lands were identified or included in calculations because of possible conflict with wildlife or other environmental factors.

[b] Not available.

[c] Estimates include only traditional reindeer grazing areas.

SOURCE: USDA-SCS field notes adjusted by Federal-State Land Use Planning Commission work group. This is Table 1 in Wayne Burton, *Defining Parameters of Agricultural Potential in Alaska,* Institute of Agricultural Sciences Bulletin No. 44, (Fairbanks: University of Alaska, 1975).

which includes all modes: air, water, rail, and road. One area near Nenana has also been identified as having good agricultural potential, but it is limited by lack of a secondary road system.

Grain and hay farms have recently been organized in the Delta-Clearwater area of the Tanana Basin, approximately 100 miles southeast of Fairbanks. A land base of sufficient size is also present to provide for further extensive development. This area already has a primary and secondary road system and is located near the Alaska Highway.

Other Areas. The South Central and Kenai Peninsula areas have good transportation networks and are easily accessible to the Anchorage market. These regions have significantly less cultivable lands than the Upper Yukon and Tanana valleys, but they enjoy locational advantages because of their nearness to the population base of the state and tidewater ports. The remaining areas (Lower Yukon, Alaska Peninsula, Dillingham, Kuskokwim, Kodiak and the Aleutians) are either islands off the coast or are isolated from the road network of the state. These all contain lesser amounts of tillable agricultural lands, although significant livestock (including reindeer) range lands are present (Table 14).

Previous Studies

In 1969, average farm cost of production per acre was significantly higher in Alaska than it was in the other states ($124.69 per acre compared with $49).[23] Some of this difference results from the

[23] U.S. Department of Commerce, Bureau of the Census, *Census of Agriculture, 1969* (1972).

higher costs of doing business in Alaska, but a significant part is caused by individual farming operations that are too small to realize the economies of scale enjoyed by farmers in the other states. The reason for small operations here is that farm land in Alaska had its origin either in homesteading or other government programs, such as the Matanuska Valley colony program of the 1930s.[24] These programs tended to place small acreages (160 acres or less) in the hands of individual farmers.

According to a 1970 study[25] that cited 1967 statistics, average farm size for the Matanuska-Susitna region was only 79 acres. Farming operations were based largely on dairy enterprises. The report suggested that high production costs in the region were due in part to the small size of the farming operations and their resulting inefficiency. The report also developed budgets for dairy, grain, and potato enterprises and included both explicit costs of operations (such variable input expenses as labor, fertilizer, etc., and interest charges on loans) as well as implicit farm costs (such as payments to operator labor, management, and owner equity). The budget analysis of grade A dairy and grain farms showed that both explicit and implicit costs of operations were not covered until farm size approached 280 acres for dairy and 320 acres for grain. For potato farming, however, a land area of only 30 acres was needed to cover all costs of production.

Given this budget analysis (even though it is ten years old) and the continuing small sizes of Matanuska farms, it is not surprising that agricultural production and sales in that region have shown little change over the period 1967-74.[26]

Agriculture in the Matanuska Valley has a significant advantage over other areas of the state, because it contains the most sophisticated market infrastructure. It has farm supply and service dealers, milk-processing facilities, a well-organized transportation system, and an easily accessible market. Its major drawbacks are the insufficient size of individual farms and highly speculative land values.

To gain a more complete view of agricultural potential in Alaska requires consideration of lands beyond the Matanuska-Susitna area. A 1967 study by the U.S. Bureau of Reclamation[27] centered on livestock production. The results indicated only limited prospects for a finished beef industry on the Kenai Peninsula, Kodiak Island, and the Aleutian Islands.

The study considered an integrated system with feed produced in the region and with cattle produced both locally and shipped in. Budgets were constructed for (1) cow-calf operations on Kodiak and adjacent islands, (2) "stocker" cattle operations that primarily used cattle imported from outside the state, and (3) a cattle feed-lot finishing operation. In all cases (except for a slaughter house) revenues were insufficient to cover explicit and implicit costs of operations. An important aspect of this study was concentration on the USDA choice retail market in Anchorage which requires significant quantities of grain to bring cattle to finished weights. This tends to reduce the advantage of the large amounts of natural grass lands found in Alaska. A subsequent study indicated that a large market for grass-fed cattle (using only limited quantities of grain) is currently available for boned-out beef (over 10,000 carcasses per year) in the Anchorage-Fairbanks area.[28] Although no production feasibility analysis has been completed, such a study seems warranted. A corollary analysis would be necessary to consider the regional infrastructural components required in this type of red meat production.

In a 1968 study,[29] updated in 1971,[30] Burton examined the developmental problems associated with Alaska agriculture and surveyed state markets and types of crop and livestock enterprises. He viewed quite optimistically future marketing possibilities for pork, beef, reindeer, and milk production. However, he saw the expansion potential of potato, vegetable, and fruit production as more limited. Budgets using 1965-67 data indicated that revenue from hogs, dairy products, and potatoes could cover all explicit and implicit costs of production. Production costs were based on techniques and farm sizes prevalent at that time. Of

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[24] U.S. Department of the Interior, Alaska Power Commission, *Development of New Lands in Matanuska-Susitna Borough* (February 1970).

[25] *Ibid.*

[26] *Alaska Agricultural Statistics*, various issues.

[27] U.S. Department of the Interior, Bureau of Reclamation, Alaska District Office, *Livestock Industry in Alaska* (January 1967). That portion of the U.S. Bureau of Reclamation that previously operated in Alaska is now called "The Alaska Power Commission."

[28] Stephens, et al., *Supplying Alaska's Red Meat and Poultry Markets*, p. 23.

[29] Wayne Burton, *Alaska's Agricultural Production Potential* (Ph.D Dissertation, Montana State University, 1968).

[30] Wayne Burton, *Alaska's Agriculture, An Analysis of Development Problems*, Institute of Social, Economic and Government Research Report No. 30 (Fairbanks: University of Alaska, October 1971).

the budgets given, only that for beef production could not generate sufficient revenue to cover all costs. This, however, was not surprising since Burton used the budgets from the Bureau of Reclamation's Kenai Peninsula livestock study.

Burton (1971) identified a large farming venture in the Delta-Clearwater area as an example of large-scale agricultural development. The goal of this farming operation, as defined in 1970-71, was to develop an annual production of 6,000 acres of barley and 14,000 hogs. Actual development to date has been somewhat different than planned. Although information is difficult to obtain, this same Delta farm as of 1976 has developed approximately 4,000 acres and, depending on market conditions, raises barley, straw or hay. There is presently no hog production enterprise, due in part to insufficient market facilities. A primary bottleneck was lack of hog slaughter facilities near the farm. All things considered, however, this large-scale farming operation must be considered a success to the extent that the owners continue to operate the farm, borrow funds, employ people, and produce large quantities of crops.

A 1969 study by Olson reviewed and assessed the Alaska reindeer industry.[31] The report states that Alaska Native owners of reindeer have only sporadically tapped markets beyond the traditional areas of production and consumption. In fact, because production is so tied to Native custom, Olson concludes that only non-Native management will bring about greater efficiency and increased production. He views this possibility with some dismay, because it may alter village life style. The advent of the Native corporations formed under the Alaska Native Land Claims Act may provide the stimulus for greater reindeer management efficiency by Native groups. From a marketing standpoint, significant markets, both locally and for export, exist with quite minimal input requirements (capital investments, labor, etc.) and production costs.

In 1972, the Tanana Valley irrigation study team completed the first in-depth agricultural study of a region other than the Matanuska-Susitna Valley.[32] The study, which was sponsored by the Alaska Power Commission, included information on soils, climate, water, crop yields, and irrigation, as well as economic analyses of crop and livestock enterprises. The study team identified 272,000 acres as potential farm land in the Delta-Clearwater, Wainwright-Eielson, and Totchaket regions of the Tanana Valley. It identified five types of potentially profitable farming operations: grain-hay, dairy, grain-hog, potato, and vegetable. The team then worked out projected budgets for grain-hay, grade-A dairy, and grain-hog farms at two levels of operation: 240 acres and 720 acres. It also worked out projected budgets for potato and vegetable farms of 40 and 120 acres. The study showed that a profit could result from all projected enterprises, with and without irrigation.

Yields, output prices, and input costs of this budget analysis were of 1970-71 vintage. Documentation in the report suggests that reasonable estimates were used. For example, higher labor costs were included because of the general difficulties in obtaining and retaining qualified labor in Alaska.

However, as with all previous studies mentioned, there are also problems with the Tanana Valley Irrigation Study. It emphasizes analysis of individual crop and livestock enterprises, but does not consider the aggregate situation. For example, the study does not consider the possibility of production increasing by 50,000 to 100,000 acres in Delta-Clearwater, and the resulting impact of increased competition among farmers in both the input and output markets. How would attempts by more farmers to purchase these inputs or services affect price and availability of fertilizer, labor, land, or loanable funds? As a greater supply of feed grains or red meat enter the local market, how quickly would price deteriorate? What are the sensitive economic variables involved in producing food products in Alaska for export markets? The answers to these questions will identify the major problems which may retard the development of a greater market share from local farm sources. The implication is a severe one. Farm sector feasibility is limited by the markets and market infrastructure and vice versa. As of yet, no one has developed a regional economic analysis that predicts the interplay between these factors to determine how each influences the other.

The studies mentioned have all contributed to economic knowledge about agriculture in Alaska. However, none of them has addressed the significant issue of regional economic feasibility in considering both farm and market questions. A review of two feasibility studies[33,34] shows the problem of limited

[31] Olson, *Alaska Reindeer Herdsman.*

[32] Tanana Valley Irrigation Study Team, *Irrigation Potentials—Tanana River Valley Alaska,* Supporting Report, (February 1972).

[33] Norman Whittlesey and Walter Butcher, *Irrigation Development Potential in Washington,* College of Agriculture Research Center Circular 579 (Pullman: Washington State University, February 1975).

[34] Washington State University, *Horse Heaven Hills Irrigation and Development Potential,* College of Agriculture Study Team Report (Pullman: 1970).

infrastructure and market potential for new agricultural development to be less pronounced in the lower states. Generally, in every other state in the United States, significant variety and quantities of farm inputs, such as fertilizers and herbicides, are available locally, as well as some type of large-scale agricultural processing facilities. In addition, all the other states have sizeable markets for their agricultural products. None of the above is true for Alaska. This means that projected budgets measuring farm feasibility may not be meaningful if local inputs, including labor, are not available, and if there are no transportation, processing facilities, or clearinghouse functions for marketing within the state (or within 1,000 miles) for the particular product involved. And finally, feasibility studies in other regions of the United States do not have to deal with a banking system that knows little about local agricultural production except that, based on past history, it is a highly speculative venture.

In concluding this section, it seems obvious that too little is known about the interplay between enterprise production and markets to determine if, and under what conditions, large-scale agriculture in Alaska would be feasible. Just because an Alaska crop has a high production potential in a biological sense does not mean that its production is economically feasible. Nothing has been estimated regarding the impact of large-scale agriculture on employment, population, and income in a regional sense. However, in many respects a good start has been made toward understanding farm feasibility.

MARKETS AND THEIR INFRASTRUCTURE

For the following market analyses, the author makes two assumptions: (1) no long-term market gluts will occur in red meat or feed grain world markets, and (2) land in large units will be available for agricultural production in Alaska.

State Markets

There is little to be gained by developing estimates of statewide food markets in 1976 when there are few local agricultural products to be supplied to those markets. Even if development of large-scale agriculture in Alaska were to begin now, it would take ten years to obtain significant increases in production. Because knowledge of large-scale farming in northern latitudes is incomplete and because the private sector and the government lack adequate knowledge to deal with the problems, an estimate of twenty-five years seems more appropriate for obtaining significant increases in agricultural production.

Projecting statewide market size for the year 2000 (twenty-five years hence) requires estimating both state population and per capita consumption of agricultural products. Present consumption rates should provide some insight into the future. State per capita consumption or use-rate estimates are available for a few food products, such as red meat,[35,36] but these figures are either limited to regions, or they include tourists and short-term workers. Another source of information is the U.S. Army Corps of Engineers port-to-port data,[37] which includes food shipped to Alaska but does not divide it into discernible categories. We will therefore assume that Alaska consumers have consumption patterns similar to those in the rest of the United States. As Alaska becomes more urbanized and is increasingly populated by immigrants from the other states, its consumption should increasingly approximate national patterns.

Table 15 presents Alaskan consumption and production estimates for crop and livestock products in the year 2000 at a projected population of 820,000. It would be unrealistic to assume that in twenty-five years Alaska will be producing enough food to meet local needs. Agriculture in the other states is tied to a large, sophisticated agri-business complex which processes, packages, and transports more agricultural products than anywhere else in the world. Alaska agriculture cannot compete in providing a wide range of fully-processed food products to Alaska consumers at competitive prices. In addition, even where Alaska products can compete, consumers in Alaska have acquired store and brand preferences that might well preclude them from purchasing home-grown products. All of these factors suggest that state production required to supply local markets will be significantly less than potential consumption. Table 15 shows that in the year 2000, only reindeer production will be greater than 50 percent of the projected state consumption.

To supply statewide markets would require more land than is currently in production. According to

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[35] Wayne Thomas, Charles Marsh, and Christopher Stephens, *An Economic Analysis of Red Meat, Fish, Poultry, and Wild Game in Anchorage,* Institute of Agricultural Sciences Research Report 73-4 (Fairbanks: University of Alaska, March 1973), p. 4.

[36] Stephens, et al., *Supplying Alaska's Red Meat and Poultry Markets,* p. 9.

[37] U.S. Army, Corps of Engineers, *Waterborne Commerce,* 1974.

TABLE 15

Estimated Alaska Consumption and Production For Agricultural Commodities in the Year 2000

Product	Alaska[a] Consumption	Alaska[b] Production
Beef (Mil Lbs. Dressed Weight)	95.5	11.5
Pork (Mil Lbs. Dressed Weight)	51.7	20.7
Lamb and Mutton (Mil Lbs. Dressed Weight)	0.8	.0
Reindeer (Mil Lbs. Dressed Weight)	0.8	2.6
Milk (Mil Lbs.)	200.0	100.0
Eggs (Mil Doz.)	13.4	6.7
Vegetables and Potatoes (Thousand Tons)	79.3	36.2
Fruit and Berries (Thousand Tons)	1.4	.7

[a]SOURCE: Wayne Burton, *Defining Parameters of Agricultural Development Potential in Alaska,* Institute of Agricultural Science Bulletin No. 44 (Fairbanks: University of Alaska, 1975).

[b]SOURCE: Author's estimates.

this scenario, new land development will occur in the Tanana Valley and on the Kenai Peninsula (Table 16). The Matanuska-Susitna Valley (Southcentral) will produce high-value field crops (potatoes and vegetables) and will continue to produce milk only in large, concentrated farming operations. A net reduction of approximately 3,000 acres of cultivated land (primarily forage and grain crops) will occur in this region. Acreage in potato and vegetable production, both here and in the Tanana Valley, should increase but be constrained by limited processing facilities. Agriculture in the Tanana Valley should develop in both the Delta-Clearwater area and in the Totchaket area near Nenana in the form of small grains (barley and oats), pork, egg, and milk production.

This scenario also has agricultural acreage increasing on the Kenai Peninsula in the form of greater production of feed and forage for cattle. Greater range use will occur on Kodiak Island for cattle and on coastal grazing areas for reindeer. Cattle will be sold to provide lean carcasses for a state "manufactured-beef" market.[38] Reindeer production will supply local markets north of the Yukon River and be available at a retail level in more southern Alaskan communities.

Food prices will determine whether or nor this projection of agricultural development will occur in the next twenty-five years. Should prices continue to

TABLE 16

Acreage Necessary for Estimated Alaska Agricultural Production for the Year 2000

Commodity	South-Central	Tanana	Kenai	Kodiak	Reindeer Range
Beef					
Barley			5,000[b]		
Hay/Silage			14,900[b]		
Pasture			8,300		
Range				921,000	
Other			17,700		
Pork					
Barley		13,500			
Other		8,400			
Reindeer					
Range					20,000,000
Milk					
Barley	1,400[a]	8,000			
Oats	1,000[a]	3,300			
Hay/Silage	3,600[a]	10,000			
Other	3,800	13,300			
Eggs					
Barley		2,900			
Other		1,800			
Vegetable-Fruit					
Crop	1,950	650			
Other	1,300	450			
Total Acreage	13,050	62,300	45,900	921,000	20,000,000

[a] A total of 5,700 acres of barley, 2,200 acres of oats and 6,600 acres of hay/silage will be produced in Tanana Valley for Southcentral dairies.

[b] A total of 3,400 acres of barley and 10,100 acres of hay/silage will be produced on the Kenai and shipped to Kodiak.

SOURCE: Adapted from Table 2 and W. Burton, *Defining Parameters of Agricultural Potential in Alaska*, Institute of Agricultural Sciences Bulletin No. 44 (Fairbanks: University of Alaska, 1975).

[38] Stephens, et al., *Supplying Alaska's Red Meat and Poultry Markets*, p. 22.

rise in the developed world (primarily the United States) near the rates of the past three years, agricultural development of new lands will become more feasible. Production costs must be considered, but these are heavily influenced by government policy. For example, interest on borrowed operating and investment capital can be fixed by law. State governments (Alaska included) can provide state-backed loans at low interest rates. Increased fertilizer production can be, in part, brought about by favorable federal and state decisions regarding location and development of natural gas fields and pipelines. Government-owned land in large acreages can be cleared and made available to private farmers at low cost. Price of fuel can be reduced by government edict and taxation policies. Government can support development of such infrastructural components as grain elevators and agricultural processing sites, and can improve transportation access either by low-cost loans or by direct purchase and development.

These governmental activities are possible in Alaska. The state agricultural revolving loan fund presently exists and provides low-cost loans to farms. Alaska statute AS 38.07.010, enacted in 1967, provides a state subsidy for land clearing. Increased development is occurring near the gas fields in the Cook Inlet area, and fertilizer production capacity is being increased. In addition, the development of the North Slope natural gas field and the resulting gas pipeline, should it be routed through Alaska, may allow fertilizer production in the Interior.

If agriculture develops as suggested in Table 16, it would create a significant input market for this sector of Alaska's economy. The size of this particular market depends on the quantity of crops and livestock produced. Because the base of any production is land, approximately 74,500 acres of cultivated land will be required to meet the projected market in the year 2000. To this must be added 63 percent more land to be used for farmsteads, roads, and agricultural processing areas, bringing the total required land to 121,000 acres, excluding reindeer and cattle range (Table 16). The land market would quickly develop if large tracts were sold to private individuals. The complexities of leasing versus selling state land, with or without covenants, is beyond the scope of this paper, but must be considered before such decisions are made.

In addition to the required land base, certain quantities of production inputs are necessary for operation of agricultural enterprises. An estimate by commodity of labor, diesel, gasoline, liquid petroleum (L-P) gas, and electricity consumption is given in Table 17 by region. Fertilizer estimates by crop are given in Table 18.

How do these estimates compare with present Alaska agricultural requirements? In 1974, an average of 750 people were employed (full and part time) in Alaska agriculture.[39] The figure 1,054 given in Table 17 represents full-time jobs stated on an annual basis (for the year 2000). Since many of these can actually be accomplished by high school and college students and military people working part time, then the number employed, at least part time, will be greater than the 1,000 figure. No present cost estimates are available for farm diesel, gasoline, L-P gas, and electricity consumption; however, future use (year 2000) would be significantly greater than present use.

Fertilizer use in 1974 for Alaska approximated 3,517 tons.[40] By the year 2000, according to this scenario, the state total should be 16,460 tons—a 368-percent increase. Nitrogen-based fertilizer in 1974 accounted for approximately 52 percent of the total or about 1,828 tons. If one uses the same percentage for the year 2000, the present Kenai nitrogen fertilizer plant (Collier Carbon, Inc.) is already producing far more than the projected state requirements for the year 2000. Presently, and probably for the next twenty-five years, the non-nitrogen components of fertilizer will come into Alaska from external sources.

To farm 74,000 acres would require a capital investment in farm buildings and equipment significantly greater than presently exists in Alaska. Although precise data are not available, new investment costs of animal facilities, shop, shop equipment, farm equipment and farm storage would probably range between 50 million and 60 million dollars (1976 prices).

There is another aspect of statewide farm supply and service markets yet to be considered. Farm production requires numerous off-farm services. These include banks; equipment, feed, and fertilizer dealers; agricultural processing centers (grain elevators, animal and vegetable processing plants, etc.); and such general community businesses as construction firms and clothing stores. The amount of such related nonfarm economic activity will be determined by the amount of new land brought into production and the crop mix. Approximately 17,000 acres of cultivated agricultural land is presently in

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[39] Alaska Crop and Livestock Reporting Service, *Alaska Agricultural Statistics*, various issues.

[40] Alaska Crop and Livestock Reporting Service, *Alaska Farm Reporter*, November 1974.

TABLE 17

Labor, Diesel, Gasoline, Liquid Petroleum Gas, and Electricity Requirement for Estimated Alaska Agricultural Production in the Year 2000

	Labor (Person-Years)	Diesel (Thousand Gallons)	Gas (Thousand Gallons)	L-P Gas (Thousand Gallons)	Electricity (MKH)
Southcentral					
Milk	242	66	99	33	.94
Vegetables & Fruit	41	17	26	9	.07
Tanana					
Pork	167	119	179	60	.65
Milk	98	60	91	30	.32
Vegetables & Fruit	14	6	9	3	.03
Eggs	161	26	38	13	.10
Grain[a]	28	63	94	31	.04
Hay/Silage[a]	24	53	80	27	.03
Kenai Peninsula					
Beef	112	341	513	184	.86
Kodiak					
Beef	54	b	b	b	b
Reindeer					
Range	60	b	b	b	b
Total	1,054	751	1,129	390	3.04

[a] For transhipment out of region to Southcentral for milk production.

[b] Not estimated.

SOURCE: Adapted from Table 3 and W. Burton, *Defining Parameters of Agricultural Potential in Alaska,* Bulletin 44, (Fairbanks: Institute of Agricultural Sciences, University of Alaska, August, 1975.)

TABLE 18

Alaskan Fertilizer Use by Type of Crop for Estimated Alaskan Agricultural Production in Year 2000 (Tons x 1,000)

	Barley and Oats for Grain	Hay/Silage	Pasture	Vegetables and Fruit
Southcentral	.24	.94	-0-[a]	1.65
Tanana	1.42	2.00	-0-[a]	.55
Kenai Peninsula	.85	5.66	3.15	-0-
Total	2.51	8.60	3.15	2.20

[a] Pasture use was quite small.

SOURCE: Adapted from Table 3 using coefficients derived from W. Burton, *Defining Parameters of Agricultural Development Potential in Alaska,* Bulletin 44, (Fairbanks: Institute of Agricultural Sciences, University of Alaska, August, 1975).

production.[41] According to the scenario presented here, by the year 2000 there will be an additional 57,500 new acres. To assess the business development that may occur in conjunction with this new acreage, I used as a model a dry land farming area in central Washington.[42] However, the crop mixes in the Tanana and Matanuska valleys and on the Kenai Peninsula are more complex than the dry land example used. Therefore, the following projections are probably underestimated.

A total of twenty businesses, sixteen caused by

[41] *Alaska Agricultural Statistics,* various issues.

[42] A.L. Walker, et al., *The Economic Significance of Columbia Basin Project Development,* Agricultural Experiment Station Bulletin 669 (Pullman: Washington State University, September 1966).

new land development,[43] would be associated with agricultural development (Table 19). These businesses would employ 142 people with total off-farm population comprising 554 people. The distribution of businesses and people would be in some relation to the amount of acreage in each region. In the Tanana Valley, the businesses might well be located in or near the major urban center, Fairbanks, instead of in Delta Junction or Nenana.

In conclusion, it would be appropriate to review the projections of crop land and agricultural enterprises that provide the basis for a projected 57,500-acre increase in agriculture to serve state markets. Agriculture in the Matanuska-Susitna Valley (Southcentral region) is expected to decline in acreage from the present level, but to increase in quantity of milk, vegetables, and potatoes produced. Much of the feed for milk production would be grown in the Tanana Valley and shipped and stored in the Matanuska Valley. Agriculture in the Tanana Valley would expand more rapidly in the Delta-Clearwater area, but the Nenana region would have the greatest percentage increase since it is starting at a zero production level. Pork and egg production would center in the Tanana Valley. However, agriculture will not be limited to supplying local markets. As noted in the next section, significant growth in Alaska agriculture will probably come from sales to export markets. In fact, development of agriculture for in-state markets will probably follow development of agriculture for export markets.

[43] The remaining four businesses are associated with agricultural land in production in 1976.

TABLE 19

Total Employment, Number of Businesses and Population Generated by Agricultural Development in Alaska for the year 2000

Type	Per 10,000 Acres	Per 74,500 Acres
Secondary Employment		
Processing and Marketing (No. of Workers)	1.1	8
Tertiary Employment		
General Business (No. of Workers	13	97
Government (No. of Workers)	5	37
Total	19.1	142
Number of Businesses		
Contract Construction	.3	2
Manufacturing	.2	1
Transp., Communication, & Public Utilities	.1	1
Wholesale and Retail Trade	1.5	11
Finance and Real Estate	.2	1
Services	.5	4
Total	2.8	20
Population		
Off Farm	74	554

SOURCE: A. Walter, et al., *The Economic Significance of the Columbia Basin Irrigation Project Development,* Washington Agricultural Experiment Station Bulletin No. 669 (Pullman: Washington State University, 1966), and author's estimates.

Export Markets

Alaska can grow a variety of cold weather crops. An obvious crop is barley, which is used as both a human and animal food in a number of countries of the world; a significant potential market for barley and other grains is Japan.

Tokyo, Japan is about as far from Anchorage as is New York. Japan is a country with a large population and limited land area. The amount of cultivated land in Japan has dropped from 8,129,000 hectares (20,087,000 acres) in 1960 to 5,752,000 hectares (14,213,000 acres) in 1974.[44] During the period 1960-1973, grain, potato, and bean production declined in Japan (Table 20). On the other hand, production of livestock products, primarily pork and poultry, increased significantly during the same period (Table 21). Also, per capita consumption of pork and poultry products increased five-fold between 1960 and 1973 (Table 22).

Increased consumption of meat and poultry can be viewed as shifts to the right in the demand curve for those products (Figure 3). This increase in quantity consumed has occurred in large measure because (a) the taste and preference function of the Japanese population is shifting toward a more Western diet (higher in red meat and poultry protein), and (b) real income levels in Japan are rising. These factors tend to indicate a continued strong market in Japan for red meat and feed grains.

Since domestic supplies of feed grains have been declining in Japan, the resulting difference between what is produced and what is needed to supply feed

[44] "Food Problem and Japan's Agriculture, Forestry and Fisheries," *Look Japan,* 10 November 1975, p. 6.

TABLE 20

Japanese Output of Principal Farm Products, 1960-1973 (Tons x 1,000)

F.Y.	1960	1965	1970	1971	1972	1973
Grains	17,101	15,208	13,858	11,945	12,613	12,658
Rice	12,858	12,409	12,689	10,887	11,897	12,149
Wheat	1,531	1,287	474	440	284	202
Barley, Rye	2,301	1,234	573	502	324	216
Corn	113	75	33	25	23	17
Maize	2	1	--	--	--	--
Other Grains	296	202	89	90	85	17
Potatoes	9,871	9,011	6,175	5,312	5,598	5,030
Beans	919	646	505	417	510	451
Soybeans	418	230	126	122	127	118
Others	501	416	379	295	383	333
Vegetables	11,742	13,490	15,131	15,777	15,837	15,315
Fruits	3,307	4,025	5,454	5,351	6,420	6,501
Orange	1,034	1,331	2,552	2,489	3,568	3,389
Apple	907	1,132	1,021	1,007	959	963
Others	1,366	1,562	1,881	1,855	1,893	2,149
Crude Sugar	5	85	78	71	243	247

SOURCE: Japan Ministry of Agriculture and Forestry, "Food Consumption Statistics." This is Table 6 in *Look Japan,* Tokyo, Vol. 20, No. 235, November, 1975.

NOTE: Figures preceding fiscal 1971 do not include Okinawa Preference.

for the increasing livestock industry comes from import sources. The United States is a large supplier of feed grains, primarily corn and grain sorghum, to Japan. Other countries exporting feed grains to Japan include Australia, Thailand, Argentina, Canada and South Africa. In 1974, the United States supplied only 4 percent of the barley imported by Japan;[45] the total Japanese barley imports were 1,418,000 tons.[46] Barley imports are not presently controlled by the Japanese government and have a duty-free status.[47]

During the twenty-five-year period to 2000 A.D. Japanese consumption patterns will probably tend toward higher per capita consumption of red meat and poultry. Likewise, Japanese production of barley (for human and animal use) may increase, but not in proportion to feed requirements. Given these assumptions, Japan should be importing at least 2,000,000 tons of barley by the year 2000.[48]

There are three broad reasons why Alaska will probably not be able to capture a significant amount of this Japanese market:

1. To supply the entire Japanese import market for barley by 2000 A.D., would require that over 1,100,000 new acres of Alaska land be cleared, planted, and harvested, along with the corresponding development of a large agricultural infrastructure (this assumes a yield of seventy-five bushels per acre). The technical problems associated with such a large project over a twenty-five year period make it unlikely to occur.
2. Significant price competition might develop if the other suppliers of Japanese barley come to fear the loss of a major market.[49] An intense

[45] Bruce Greenshields, "U.S. Farm Exports to Japan May Rebound in 1975-76," *Foreign Agriculture* 13 (October 1975):4.

[46] "Food Problem and Japan Agriculture...," *Look Japan,* p. 21.

[47] Greenshields, "U.S. Farm Exports to Japan...," p. 3.

[48] The Japanese government estimates that in 1985, domestic consumption will reach 2,500,000 tons and imports 1,600,000 tons. Japan Ministry of Agriculture and Forestry, *Long Term Prospect of Production and Demand for Agricultural Products in Japan* (August 1975), p. 3.

[49] This assumes the numbers of suppliers to be small, and each therefore would be able to assert some influence on price.

TABLE 21

Japanese Output of Livestock Products, 1960-1974

Actual Figures (1,000 Tons)

Products	1960	1965	1970	1971	1972	1972	1974
Dairying	1,887	3,221	4,761	4,820	4,939	4,908	4,864
Meats	392	793	1,410	1,575	1,694	1,776	1,990
Beef	142	208	261	275	295	227	293
Pork	147	364	648	750	769	858	964
Poultry	75	204	490	540	622	685	729
Eggs	—	1,063	1,734	1,801	1,794	1,800	1,803

SOURCE: Japan Ministry of Agriculture and Forestry, *Milk and Dairy Products Statistics* and *Egg Distribution Statistics,* Ministry of Health and Welfare, *Sanitation Administration Duties Report.* Figures on Poultry obtained from Livestock Bureau, Ministry of Agriculture and Forestry. This is Table 8 in *Look Japan,* Tokyo, Vol. 20, No. 235, November, 1975, p. 6.

TABLE 22

Japanese Annual Per Capita Consumption of Principal Foodstuffs, 1960-1973

(In Kilograms)

F.Y.	1960	1965	1970	1971	1972	1973
Grains	149.6	145.0	128.5	127.0	125.0	124.6
Rice	114.9	111.7	95.1	93.2	91.7	91.1
Wheat	25.8	29.0	30.8	31.0	30.9	31.0
Barley, Rye, etc.	8.9	4.3	2.6	2.8	2.4	2.5
Potatoes	30.5	21.4	16.2	16.5	16.6	16.2
Starch	5.5	8.3	8.1	7.8	8.0	7.9
Beans	10.2	9.4	9.8	10.0	9.8	9.8
Vegetables	99.7	109.6	115.6	119.5	117.8	112.4
Fruits	22.3	28.5	38.2	38.1	44.2	43.7
Meat (excluding Whale Meat)	3.4	6.7	11.5	13.3	14.2	16.2
Beef	1.1	1.4	2.0	2.3	2.4	2.3
Pork	1.1	2.7	4.7	5.1	5.6	6.4
Poultry	0.8	1.9	3.7	4.3	4.7	5.1
Others (Mutton, etc.)	0.4	0.7	1.1	1.6	1.5	1.4
Chicken eggs	6.3	11.6	14.8	14.9	14.6	14.5
Milk, Dairy Products	22.3	37.4	50.1	50.7	51.8	52.9
Sugary Foods	4.3	6.6	9.5	9.9	10.6	11.1
Marine Foods	27.8	29.2	31.8	33.3	33.3	34.3

SOURCE: Japan Ministry of Agriculture and Forestry, "Food Consumption Statistics." This is Table 2 in *Look Japan,* Tokyo, Vol. 20, No. 235, November, 1975.

NOTE: (1) Figures above relate to unadulterated foodstuffs. (2) Figures for fiscal 1972 include Okinawa Preference.

price competition and resultant market uncertainty would have greater impact on new land development in Alaska than on an existing land settlement in other regions of the world.

3. Japan would likely find it undesirable to break old trade arrangements and buy a majority of its barley from Alaska, given the spotty history of agriculture in the state and its limited experience (even twenty-five years hence) with large-scale barley production.

Considering these reasons, I assume that only a small portion of the Japanese market, less than 10 percent (or about 100,000 acres), will be easily accessible to Alaska grain producers by the year 2000. The Tanana Valley area near Delta Junction contains over 200,000 acres of land which could be used to grow barley. Large scale development for barley there would require at least one grain elevator for necessary drying and storage before shipment to a tidewater port (probably Anchorage). Rail transportation would probably be the cheapest way of moving the grain to port. If a rail spur were constructed to Delta Junction, the elevator and the acreage would probably develop in that area.

A 1972 study analyzed the feasibility of growing grain and hay in the Delta-Clearwater area on several farms varying in size up to 720 acres.[50] Total farm

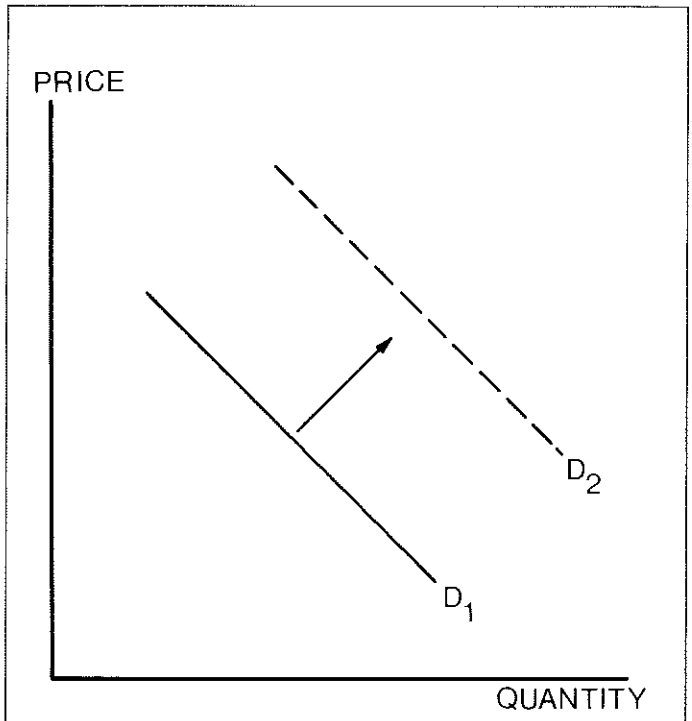

Figure 3: A Representation of the Japanese Demand Curve For Red Meat and Poultry, Where D_1 = 1960 and D_2 = 1974.

expenditures[51] (fixed plus variable costs) for a 720-acre grain/hay operation was estimated at $88.98 per acre assuming yields of 1.2 tons per acre. The variable expenses portion of this was broken out at $54.23 per acre for this same farm.[52] Revenue from sales to Japan would have generated $76.49 per acre F.O.B. Japan in 1972.[53]

The implication is that although revenue could

[50] *Tanana Valley Irrigation Study,* p. VI-20.

[51] Based on 1971 data.

[52] A transportation cost per ton from point of production to Japan is not included in these total or variable cost figures.

[53] *Look Japan,* p. 21. This assumes an average price of $63.74 per ton F.O.B. Japan.

have covered variable expenses in a synthesized Delta-Clearwater grain/hay farm for barley production, it could not cover fixed expenditures. Thus, while the farm could operate over the short run, it could not replace plant and equipment over the long run and would cease to operate. However, the revenue picture changed significantly in 1973 and 1974. On a per acre basis (assuming 1.2 tons of barley production per acre), revenue would have increased to $129.80 in 1973 and to $202.26 in 1974, using average price F.O.B. Japan for imported barley.[54] Revised cost estimates are not available; however, we can safely assume that farm costs also increased, but the rate was probably significantly less than the rise in revenue per acre.

If world feed grain supplies increase more rapidly than world demand, Alaska may not be able to compete in world markets. If the opposite occurs and the grain price increases of 1973 and 1974 are not a short-term aberration but indicate an upward price trend, Alaska will probably become competitive.

To be more specific, achievement of an export market by the year 2000 would require a significant use of agricultural inputs and development of an agricultural infrastructure (Table 23). Grain production for export alone would increase the on-farm labor force by an estimated 150 full-time jobs[55] and fertilizer useage by 10,000 tons.[56] Estimated increases in diesel useage (over that shown in Table 17) would be 106 percent; gasoline, 106 percent; L-P gas, 90 percent; and electricity, 16 percent above requirements for state markets.[57]

Using a major small-grain, dry-land production area in Washington[58] as a model for Tanana Valley development, 100,000[59] acres of new agricultural land would create 191 nonfarm jobs (agricultural processing, general business, and government). A total of twenty-eight businesses would be needed to support this farm production. The production of 174,500 acres of cropland in all three farming regions of the state would generate employment throughout

TABLE 23

Estimated Employment and Number of Businesses Required to Serve Both Export and State Agricultural Markets for the Year 2000

	Export	State	Total
Employees			
Agricultural Market and Processing	11	8	19
General Business Firms	130	97	227
Government	50	37	87
Total	191	142	333
Number of Businesses			
Contract Construction	3	2	5
Manufacturing	2	1	3
Transportation, Communication & Public Utilities	1	1	2
Wholesale and Retail Trade	15	11	26
Finance and Real Estate	2	1	3
Services	5	4	9
Total	28	20	48
Population			
On-Farm	585	4,111	4,696
Off-Farm	745	554	1,299
Total	1,330	4,665	5,995

SOURCE: A. Walter, et al., *The Economic Significance of the Columbia Basin Project Development,* Washington Agricultural Experiment Station Bulletin 689 (Pullman: Washington State University, Sept., 1966), and author's estimates.

the entire agricultural sector, including state and export markets. Total population of the state, attributable to agriculture and related off-farm employment, would total 6,000, with 1,300 of these associated with the export market.

The required farm capital investment in buildings and equipment to provide for the export market would be extensive. If the 100,000 acres comprised 50 individual farming operations, they would require approximately 100 tractors, 50 combines, several hundred farm implements, trucks, and small buildings. New investment costs for farm equipment, shop, shop equipment and farm storage for 50 farmsteads would total approximately 8 to 10 million dollars (1976 prices). A grain elevator would also be necessary, with an investment cost of around three million dollars (1976 prices), to provide sufficient

[54] *Look Japan*, p. 21.

[55] Calculated for 100,000 acres of production using coefficients from U.S. Department of Agriculture, *Agricultural Statistics* (1973), p. 449.

[56] Calculated for 100,000 acres of production using coefficients from W. Burton, *Defining Parameters of Agricultural Production in Alaska*, pp. 13 and 28.

[57] *Ibid.*, pp. 14-17, 28.

[58] Walker, et al., *...Columbia Basin Project...*, AES Bulletin 69.

[59] Depending on method of farming used, as much as 200,000 acres of land might have to be cleared to obtain a yearly average of 100,000 acres in production.

drying and storage capacity for both export and state markets.

The export market would also require development of specialized rail transportation to Anchorage and a grain-loading facility there. Since 100,000 acres could produce only 180,000 tons of export, an extensive port-loading facility would not be necessary. According to 1975 prices, an investment of approximately $2.5 million would be required. The tonnage of grain would require eighteen ships of 10,000 dead-weight ton capacity (Liberty or Victory steamship types) to transport the grain to Japan. This type of ship is presently being operated by firms involved with the international grain trade.[60] This means that once Alaska grain reached a tidewater port such as Anchorage, the existing distribution system could handle transportation to Japan.

Japan should not be the only country considered for grain exports from Alaska. Numerous countries in Western Europe, as well as the Soviet Union, also import feed grain. The west coast area of the U.S. is also deficient in feed grain. I have emphasized the Japanese market for feed grains here because it is reasonably close; Alaska and Japan have had long-established trade ties, and Japan is looking for politically stable supply areas to provide food products for its home market.

From an Alaska viewpoint, the creation of an export feed grain base would stimulate development of a red-meat industry within the state. Large quantities of locally produced grain would reduce the difficulties of obtaining feed for animal rations. This would provide for the development of both small and large scale pork and beef enterprises. The state then would be able to supply a greater portion of Alaska's pork and beef consumption needs (Table 15) and possibly produce pork and beef for an export market.

SOME FINAL THOUGHTS

I have indicated no agricultural development for the Yukon Basin, Alaska Peninsula, Copper River Valley and Kuskokwim Basin. Development beyond small farms supplying local markets is possible in the next twenty-five years, but not expected. Little is known of the agricultural potential of these areas; many are remote from surface transportation systems; and land ownership at this time is unsettled. Having the potential for and achieving a large-scale agriculture are two different things. In the next twenty-five years and beyond, only the possibility of a high return on investment, which would depend on food prices continuing to increase, will cause development in these areas.

What about the regions identified in this report—Kenai Peninsula, Kodiak, and the Tanana Valley? The amount of beef produced in Kenai and Kodiak should increase, because the state, through its Division of Agriculture and University of Alaska, is working on an expanded red meats and forage research and development program which should pay off by the next century. The industry will, for the first time, be receiving technical production support and, at the same time, facing an expanding manufactured (lean carcass) beef market.

The Tanana Valley has the most possibilities for agricultural development because of a large land base, a developed transportation system, and an embryonic agriculture. Land-use planning projects are underway in both Delta-Clearwater and Nenana, which when complete, will describe and promote use of new lands for agriculture. If the economic incentive is present, and positive state and federal land policies are put into effect, these lands will be developed.

The export market for grain is the base for large-scale development of agriculture. There are risks involved here, however. During soft market conditions, local producers in Alaska and elsewhere might be faced with world grain prices that are lower than cost of production. If a significant agriculture is to be developed in Alaska, the state may have to develop a support and subsidy program (in conjunction with Federal programs) to protect against weak market years. Agriculture in Alaska may not be able to sustain itself in the early period of major development (the next twenty-five years) without such state support. This type of policy decision must be much more fully explored before an intelligent decision can be made for or against state involvement.

Finally, other commodities besides barley and pork could be produced in Alaska and exported. Reindeer could easily move into the exotic meat trade and be shipped in small amounts to many markets throughout the world. Milk could be produced in the state, dehydrated, and shipped to export markets such as Japan. Another possibility is foreign export of beef and pork. One problem associated with foreign exportation of milk and red meat is the strict sanitation regulations placed on these products by foreign governments. Another problem is that markets are never certain because many foreign governments place quotas on red meat

[60] Letter from Kenneth Casavant, Associate Professor of Agricultural Economics, Washington State University, 1976.

and milk, and these vary by year. A major advantage of feed grains is that in countries like Japan, a quota system is currently not used, and the commodity has low perishability; therefore, minimum sanitation regulations are issued by the importing nation.

In conclusion, it should be observed that the estimated projections presented here are meaningless unless (1) a land base is made available to agriculture and (2) world market forces provide an economic incentive for agricultural production in Alaska.

Wayne Thomas is an associate professor of economics with the Agricultural Experiment Station, University of Alaska, Fairbanks.

APPENDIX

PERCEPTIONS OF REALITY—ALASKA'S AGRICULTURE AND FOOD DISTRIBUTION SYSTEM*

In this section we set forth a number of our perceptions concerning Alaska's agriculture and its food distribution system. Readers of this report may disagree with a number of our perceptions, and in fact, some disagreement is expected. However, this disagreement can be helpful in focusing on those areas of inquiry where additional information is needed.

Our perceptions take either the form of statements of fact or issues that need an answer. They are presented in six major categories, with sufficient detail to attempt a clear, but concise, presentation.

Land

1. Land serves as a base for renewable and nonrenewable resource industries.
2. There will be competition between various renewable industries for the use of the land.
3. Land can be classified on a single-use basis or a multiple-use basis. A major question is which lands for which purposes?
4. Alaska currently has a scarcity of private land. Other than the Native lands, the amount of privately owned land comprises an area smaller than the District of Columbia. Agricultural development has been seriously hindered by this scarcity of land. Not only has there been little opportunity for agricultural expansion into large commercial farms, but land has been bid away from agricultural uses in favor of subdivision settlement or homesites.
5. There appears to be a relatively strong demand by individuals for homesites and recreational sites of 5 to 160 acres. This demand could most likely be satisfied from land other than large blocks of potential agricultural land. Land that has good potential for commercial agriculture could be primarily reserved for agricultural use.
6. Large quantities of land suitable for cereal grain and forage production are located in the Interior along major rivers. The exact acreage is somewhat indeterminant, but it amounts to millions of acres. (The Soil Conservation Service estimate is 17 million acres of agricultural land in Alaska.)
7. Native corporations control sizeable quantities of potential agricultural land. At some point in time, these corporations may choose to develop these lands for agricultural production or enter into an arrangement to have the lands developed. The decision processes would be more internalized than that of the state.

The Development Process

1. Agriculture was the basic industry in the early development of the lower 48 states. Industrialization came later as agriculture moved through the nation, especially the West. In Alaska, agriculture never developed into a sufficiently large or pervasive enough industry to be called basic. Because Alaska can now be considered somewhat industrialized, agriculture would have to be added to the industrial base rather than vice versa. One would not expect agricultural development in Alaska to follow the general pattern experienced by most of the lower 48 states.
2. There is no large, strong political and economic power base for agriculture. There appears to be little opposition to agriculture *per se*. Thus there appears to be a more or less indifferent attitude toward agriculture. Opposition would be expected to occur when and if conflicts between the uses of land arise and agriculture is a contender.
3. The perceptions that most individuals have concerning the potential of agricultural development in Alaska is negative. This perception would need to be changed if agriculture is to succeed in Alaska.
4. Agricultural development policy is interrelated with general economic development, e.g., growth policy, settlement policy, land and other resource policy.
5. The 40- to 160-acre homestead type of farming operation has not led to significant agricultural development. It is not likely to lead to significant development in the future. There may be some exceptions for very intensive crop production.
6. Alaska contains large land areas, so the creation of large commercial farms is possible at the start of the development process. The situation is more comparable to the development of large farms on the west side of California's San Joaquin Valley than the smaller farm units in the Columbia Basin Project of Washington State.
7. If expansion of agricultural output in Alaska takes place, it will not come from the expansion of the current system. Not only would the type of farming likely be different, but the farm operators would be expected to primarily come from the lower 48 states or from nonfarm employment in Alaska.
8. Agricultural development occurs in a process of stages or steps. A strong and dependable grain and forage economy is the first step to a strong livestock economy. Thus, one would expect the grain and forage to be produced internally or be imported. For Alaska the latter does not appear to be economically feasible on a large scale. Vegetable production

*From a report prepared by J. Edwin Faris and R. J. Hildreth for the Joint Federal-State Land-Use Planning Commission for Alaska in cooperation with the Agricultural Experiment Station, School of Agriculture and Land Resources Management, University of Alaska.

on a large scale requires a rather sophisticated infrastructure. Such an infrastructure is most difficult to create from scratch.

9. Many people see a dilemma in agricultural development: Which comes first, the land reservation or the proof of success? Agricultural lands need to be available before agricultural development can take place. But it may be necessary to demonstrate that agricultural production is economically viable before lands could or would be set aside for agriculture.

Agricultural Output

1. Alaska, as compared to the lower 48 states, has unique climate conditions. This uniqueness makes it extremely unlikely that agricultural production practices would be directly transferable from the lower 48. At the minimum, adaptive research would be needed to make production technology applicable to Alaska's conditions. Systems of producing, storing, and marketing agricultural commodities would apt to differ from those in the lower 48 states. This is consistent with differences among these states; e.g., irrigation in the West and lower grain yields in the Southeast than in the Midwest.

2. The current and future state, national, and international needs for agricultural output will greatly influence the need for agricultural development.

3. The development of an agricultural industry in Alaska could lead to increases in gross state product and gross national product over time.

4. Limited data prevent performing a rigorous estimate of costs and benefits of a potential agricultural industry. First, there is really very little comparable agriculture in Alaska at the current time. Second, public and private costs of the necessary infrastructure are not known. Third, the social costs and benefits need to be estimated.

5. There are a number of specialty crops, such as seed crops, where Alaska has a unique advantage over other production areas.

6. Very satisfactory yields of barley and oats have been attained on the type of agricultural soils found in interior Alaska. Yields of wheats tested recently are less certain. This land might need to be irrigated in some areas or summer fallowed in others to obtain satisfactory and dependable yields. It appears that the rivers could serve a most important role in the transportation network.

7. Heat losses from pipeline pumping stations or other industrial endeavors may in some cases be useful to agricultural production or processing. A controlled environment greenhouse production unit could probably be developed using the heat losses to produce such crops as vegetables, flowers, and house plants. The heat might also be used to help power a pelletization plant for agricultural forages.

8. The recreational horse population is a most serious competitor for the limited amount of hay and grain produced in Alaska. This drives up the cost of hay and grain which makes it less profitable to produce milk and red meat animals. With a strong grain economy in Alaska, this distortion would not occur.

9. Agricultural research, although limited, indicates that the production potential is great. One way to determine if it would also be economically profitable is to promote agricultural development in an area based on the large, efficient-size farm concept.

Agricultural Infrastructure

1. Significant development of the agricultural potential in Alaska would absolutely require major public and private investments in the infrastructure. Without attempting to determine which investments are public and which are private (or perhaps both), some major infrastructure investments would need to be made in (a) water-based transportation facilities; (b) roads; (c) education; (d) agricultural research and extension; (e) storage, drying, and processing facilities; and (f) input supply firms such as those supplying fertilizer and insecticides.

2. It is possible that Alaska's farmers could have a competitive advantage in obtaining certain fertilizers and other petrochemicals in the future relative to a number of farming areas in the lower 48 states. This is contingent upon more of the petroleum being processed in Alaska.

3. Transportation rates may tend to work adversely against agriculture. The rates have been based on low volumes or historical patterns. With larger volumes and competitive pressures, the rate structures should change and become more favorable toward agricultural production and marketing. This includes both rail and water freight rates.

4. The South and and Kenai Peninsula areas have a reasonably adequate transportation network to the Anchorage market. These lands have potential for vegetable production on a small scale until a better infrastructure is developed. Grazing of cattle also could increase, with increased slaughter capacity and marketing channels.

5. A large portion of Alaska's population is in, or adjacent to, urban centers. The well-developed food distribution system serves a large majority of the state's population. The food chain infrastructure is based on a food-import economy.

The Environment

1. The side effects of various types of agricultural enterprises and organizations upon the environment need to be given attention.

2. If agriculture were to develop on a very large scale, it would undoubtedly affect the Native culture and style of living in some areas. Some adjustments could be made to minimize these effects. Opposition to the development of agriculture in these areas may materialize.

3. There would be environmental effects resulting from agricultural production. The type and magnitude of these effects as now seen appear to be based more on value judgements than on analytical data. For example, a conflict may not exist between the use of land for agricultural purposes and for certain wildlife habitat. In fact, agricultural production could increase the number of some types of birds and decrease others or perhaps decrease the number of large fur-bearing animals.

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