

Alaska: The Land and the People

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THE 20TH CENTURY has been dominated by science and attended by a rapid advancement in the condition of man. But, despite the enormous advances made in many areas of the world, we are just beginning to find answers to the environmental problems which must be solved if we are to inhabit and develop Arctic and subarctic regions.

In tackling the Arctic with its manifold problems, man is not modest; but his reasons are sound. This is a land- and resource-hungry world; the Arctic provides both. The challenge is to the scientific community to devise means of conquering an inhospitable environment so that man can live and work happily on a 20th-century basis in the North. To understand the full extent of the challenge, we must recognize that the problems are largely indigenous to the area and their solution will not come about as easily as the spin-off of other research conducted in more agreeable climates.

The nations rimming the Arctic are diverse and have very different economic needs and reasons for developing their northern regions. Consequently, the extent and pattern of development varies widely from country to country; undoubtedly, national research and development projects are equally diverse.

With this in mind, it may be appropriate to say a few words about how we think the Alaskan north will be developed.

Today, Alaska is in the initial stage of development. With a large land area and a very small population (largely confined to the coastal areas), it has yet to push inland with the surface transportation and economic development that would make the Alaskan Interior a contributing part of the US economy. We believe this is about to occur, spurred by the need to tap the vast mineral

Submitted for publication July 24, 1967; accepted Nov 18.

From the Federal Field Committee for Development Planning in Alaska, Anchorage.

Read before the Symposium on Circumpolar Health Related Problems, University of Alaska, College, Alaska, July 24, 1967.

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Table 1.—Weather in Alaska*

	Extremes										Means						
	Temperature		Precipitation				Snow		Wind		No. of Days Temperatures						
	Record Lowest	Mo and Yr	Maximum Monthly	Mo and Yr	Minimum Monthly	Mo and Yr	Maximum Monthly	Mo and Yr	Fastest Mile	Mo and Yr	Precipitation 0.01 in	Maximum		Minimum			
												70°F and Above	32°F and Below	32°F and Below	0°F and Below		
	53	-38	2/47	5.91	8/34	0.00	12/33	48.5	12/55	66	11/50	124	12	124	188	52	
Annette	89	6/58	+ 1	3/55	34.87	10/58	0.71	8/54	44.8	12/64	58	12/26	222	25	13	78	0
Barrow	78	7/27	-56	2/24	2.81	8/63	0.00	1/39	21.2	10/25	70	12/51	73	**	256	324	169
Barter Island	72	8/57	-59	2/50	4.91	9/54	T†	2/65	35.8	9/54	78	9/57	99	**	250	310	167
Bethel	86	6/59	-52	1/47	12.37	8/51	0.02	5/54	57.4	1/52	62	M‡	160	8	137	224	77
Cold Bay	78	8/48	- 9	12/50	9.97	8/51	0.02	4/48	23.4	2/65	67	3/58	207	‡	56	163	1
Fairbanks	93	7/55	-66	1/34	6.88	8/30	T	4/54	65.6	1/37	60	3/48	110	49	154	232	120
Juneau	84	6/58	-21	12/49	13.29	10/52	0.27	4/48	86.3	2/65	56	12/58	221	20	49	147	10
Kotzebue	85	7/58	-52	2/64	5.18	8/51	T	1/66	21.9	3/54	56	1/57	113	4	201	252	120
King Salmon	88	6/53	-40	2/54	6.44	8/53	0.00	6/48	16.2	3/62	82	2/M	152	10	116	219	5
Nome	81	8/64	-42	2/49	7.82	8/51	T	2/61	23.7	1/50	65	2/57	131	2	174	240	‡

* Data source, US Weather Bureau, Anchorage, Alaska.

† T = trace.

‡ Less than one-half day.

§ M = missing; for Bethel, wind velocity was recorded but not month or year; for King Salmon, velocity and month but not year.

resources of the area. When it happens, it will represent modern technology in its most advanced form, applied to a difficult and specialized problem.

There is an emerging pattern to US development in remote areas. Because of the substantial capital requirements, high costs, and the need for highly skilled technicians and managers, development is undertaken by large national or international corporations. Relying on advanced technology and importing most supplies, equipment, and even whole plants, the economic infrastructure of the community tends to be simple. Management and technical personnel are assigned to the project for a tour of duty, after which they rotate to other parts of the world. This type of development requires a sophisticated and elaborate supporting transportation system.

In Alaska, we estimate that this type of development can, in the foreseeable future, produce a series of communities—possibly a dozen or more—across the northern part of the state, each with 5,000 to 7,000 people. If costs can be reduced sufficiently over a period of time, we would also anticipate the development of associated service industries and satellite industries; but, for the immediate future, we expect this type of develop-

ment to occur along the coast at major shipping points where costs are significantly lower.

This paper will deal with the land, its topography and climate, the people who inhabit it, and will close with a discussion of the problems of man in the environment.

The Land

As one of the circumpolar territories, Alaska exhibits within its boundaries a full range of the topographical and climatological conditions encountered within Arctic and subarctic regions. Over one quarter of the state (27%) lies north of the Arctic Circle and 56% between the Arctic Circle and the 60th parallel. North of the 60th parallel, most areas exhibit some Arctic or subarctic characteristics.

Size and Location.—The state contains 586,400 square miles (about 375 million acres) and extends from the southern tip of southeastern Alaska at 54° 40' north latitude (on a parallel with northern Ireland) to 71° 23' north latitude at Point Barrow (on a parallel with the northern tip of Norway), and from 132° 41' west latitude near Stewart, British Columbia, to 172° 26' east latitude at the end of the Aleutian chain.

Table 2.—Population of Aboriginal Stock by Principal Racial and Linguistic Groups^{1,2}

Year	Total	Eskimo	Aleut	Athapascan	Tlingit Haida Tsimshian	Unclas- sified
1740	74,700	40,000	16,000	6,900	11,800	...
1839	39,000	24,500	2,200	4,000	8,300	...
1880	32,996	17,617	2,628	4,057	8,510	184
1890	25,354	13,871	1,679	3,520	5,463	821
1910	25,331	13,636	1,451	3,916	5,685	1,643
1920	26,558	13,698	2,942	4,657	5,261	...
1929	29,983	14,500*	4,500*	4,935	5,885	125
1939	32,458	15,576	5,599	4,671	6,179	433
1950	33,861	15,883	5,400*	4,700*	7,300*	600*
1960	42,522	22,323	5,755		14,444	...

* Estimated or adjusted distribution by author.

The great expanse of the state from east to west and north to south, while equal to that of the contiguous 48 states of the United States from coast to coast and border to border, is due to the great length of the Aleutian chain and southeastern Alaska, which project from the main land mass of the state. The southern boundary of the state is 3,200 miles long; and the total length of the Alaskan coastline, including islands, is in excess of 32,000 miles—or 50% longer than the coastline of the conterminous 48 states.

Topography and Climate.—The general land form of the state divides, broadly, into four principal areas: (1) the Pacific mountain system, which forms the Pacific boundary of the state from the tip of southeastern Alaska to the end of the Aleutian chain; (2) the Brooks Range, a part of the Rocky Mountain system, which extends across the northern section of the state entirely above the Arctic Circle; (3) the Interior basin, which is a vast intermontane plateau between the Pacific and Rocky Mountain systems with a continental climate and many Arctic features; and (4) the Arctic Slope, which lies north of the Brooks Range to the coast of the Arctic Ocean.

The climatic belts of the state tend to follow the general land because of the dominating effect of the two mountain systems. The Pacific mountain system shields the interior of the state from the warm, moist air of the Pacific and provides a sharply breaking line between the continental climate of the Interior and the cool, temperate climate of the Pacific coast. Similarly, the Brooks Range in the north provides a transition zone between the Arctic climate of the North Slope

and the climate of the Interior basin.

Other factors affect the climate of the state which we should note.

As a subcontinent surrounded by water on three sides, it is strongly affected by ocean temperatures, air flows, moisture conditions, and the direction and intensity of storms moving inland from the sea. Contact between the intensely cold waters of the Arctic and

the warm waters of the Japanese current in the Pacific is through the Bering Sea. But the entry of the warm Pacific waters into the Bering Sea is blocked by the Pacific mountain system, which extends across the Pacific as a submarine wall, its peaks protruding above the sea to form the Aleutian Island chain. As a result, the Bering Sea is cold; and the winter ice pack extends further south in this area than in any other part of the northern hemisphere. But having an east-west axis, the Pacific mountain system does not shield the Bering coast from the frequent intense storms that sweep inland. The net effect is to give the Bering Sea coast a harsh, subarctic climate; and this is reflected in the barren, windswept terrain which extends northward from Bristol Bay until it finally merges into the Arctic coast.

Unlike northern Europe, which is warmed for its full length by the Gulf Stream, Alaska has only a narrow belt along its southern coast which is warmed by the Japanese current. North of the Aleutian chain, the entire western coast of the state quickly assumes a

Table 3.—General Population Trends in Alaska, 1740-1960^{1,2}

Year	Total	Native	Non-Native
1740-80	74,000	74,000	...
1839	39,813	39,107	706
1880	33,426	32,996	430
1890	32,052	25,354	6,698
1900	63,592	29,536	34,056
1909	64,356	25,331	39,025
1920	55,036	26,558	28,478
1929	59,278	29,983	29,295
1939	72,524	32,458	40,066
1950	128,643	33,863	94,780
1960	226,167	43,081	183,086

Table 4.—Distribution of Native Alaskans by Size of Place*

No. of Places	Total Size of Place	Native Population	Cumulative Total	
			Places	Native Population
74	25-99	2,634	—	—
79	100-199	9,132	153	11,766
34	200-299	6,703	187	18,469
21	300-399	5,391	208	23,860
9	400-499	3,093	217	26,953
5	500-599	1,743	222	28,696
4	600-699	809	226	29,505
1	700-799	220	227	29,725
1	800-899	825	228	30,550
1	900-999	400	229	30,950
13	1000-2499	7,728	242	38,678
Urban places:				
1	2,700	1,850	243	40,528
1	2,700	275	244	40,803
1	3,500	500	245	41,303
1	3,800	1,100	246	42,403
1	10,500	1,500	247	43,903
1	12,500	1,950	248	45,853
1	45,000	1,950	249	47,803
1	93,600	2,860	250	50,663
Other and undistributed:		706	—	51,369

* Data calculated on the basis of estimates of the Bureau of Indian Affairs, September 1965.

subarctic appearance bearing no resemblance to equivalent latitudes in Europe.

With these factors in mind, we can divide the state into four major climatic zones, affected by—but not identical with—the four topographical areas: (1) a temperate maritime zone along the Pacific coast of Alaska bounded by the Pacific mountain system and the Pacific Ocean; (2) an Interior basin zone between the two major mountain systems; (3) a coastal zone along the Bering without clear-cut boundaries, but merging gradually into the Interior zone on the east and the Arctic zone on the north; and (4) the Arctic zone from the Brooks Range northward to the Arctic Ocean.

The Pacific Mountain System and the Zone of Maritime Influence.—The Pacific Mountain System, the great wall that determines much of the weather and climate of the state, is a continuation of the mountain system running up the west coast of the United States through British Columbia with a marked difference that it rises sharply in Alaska and presents some of the most spectacular mountain and glacier scenery in the world. Being a growing mountain chain, it is also an area of intense and frequent earthquakes and many active volcanoes.

After entering Alaska as the Alexander Archipelago and the coastal range, it extends north in two spurs. The coastal spur presents an almost solid wall of high peaks, snowfields, and glaciers rimming the Gulf of Alaska and ending in an island chain with Kodiak Island as its terminus. These mountains, are, in turn, enfolded within a series of ranges that sweep in a great arc across the center of the state with the Mt. McKinley massif at the apex. Turning 90° to the southwest, they continue across the Pacific Ocean as the Aleutian Island chain.

On the seaward face of the Pacific mountain system, the climate is dominated by maritime influences; the coast is often described as one of the world's stormiest. Precipitation in southeastern Alaska averages 100 inches a year, with a record of 221 inches at Little Port Walter on the southern tip of Baranof Island. Snowfall over the glacier areas occurs at all seasons of the year and in many places amounts to over 100 feet a year. Habitable areas are generally below 2,500 feet, and true Arctic conditions occur above 7,500 feet.

Between sea level and 2,500 feet elevation, the climate can be described as cool, north-temperate, with small temperature variations, both seasonal and diurnal. Here, temperatures in the warmest months of July and August average in the mid-50's; and few stations have ever recorded a maximum as high as 90 F. In winter, temperatures average in the mid-20's, with few readings below -20 F. As this belt of temperate climate along the coast affords the only habitable area, it is not one that presents environmental problems of an Arctic nature.

Despite a heavy snow cover along much of the coast, the coastal waters are ice-free ex-

Table 5.—Crude Rate of Natural Increase, Alaskan Native Population*

Year	Crude Birth Rate	Crude Death Rate	Crude Rate of Natural Increase
1960	47.8	9.4	38.4
1961	47.6	9.8	37.9
1962	47.6	9.4	38.2
1963	45.9	9.4	36.5
1964	41.07	9.5	31.6
1965	40.51	8.8	31.8

* Data calculated on the basis of statistics provided by the Bureau of Vital Statistics, Department of Health and Welfare, Alaska.

cept for long estuaries such as the Cook Inlet. Icebergs from the many glaciers melt rapidly in the warm sea currents and rarely constitute a problem for shipping. It has, therefore, been relatively easy to establish and supply coastal settlements. On the other hand, the rugged coast has prevented a coastal road system and all but a few routes to the Interior.

The change from a maritime climate to a continental or semi-continental climate is abrupt throughout southeastern Alaska and as far west as Anchorage, where the mountains run in a north-south direction and intercept the moisture-laden Pacific air. The change becomes less abrupt as the mountains assume a westerly drift. The Pacific winds carry the maritime influence inland with the result that there is no clear line of demarcation once we enter the Bristol Bay area. It is interesting to compare a map of the treeless areas of Alaska with maps of temperature ranges and wind velocities. They clearly show that the treeless areas of western Alaska are associated with wind conditions more than with temperature ranges.

The Interior Basin.—The Interior basin is the broad plateau area between the Pacific and Rocky Mountain systems. Its dominant features are the drainage systems of the Yukon and Kuskokwim Rivers, which, for the most of their length, are only a few hundred feet above sea level (these rivers are navigable and give access to much of the interior of the state for five to six months of the year). As the third largest river in North America, the Yukon drains much of the area between the Pacific and Rocky Mountain systems in northern Canada before entering Alaska. The Kuskokwim lies wholly within Alaska and drains the area south of the Yukon watershed and north of the Pacific mountain divide. The two rivers fan out into large deltas of low relief, where the wooded, rolling landscape of the interior gradually merges into the typical coastal plain dotted with lakes and covered by a mixture of muskeg and tundra.

The barrier formed by the Pacific mountain system and the rapidly weakening influence of weather moving off the Bering Sea causes the upper Yukon Basin to share the continental climate of interior North America. Rainfall is light, averaging 10 to

13 inches each year with little cloudiness, and 24 hours of summer sunlight (or winter darkness). Summer temperatures may reach 100 F. The frost-free growing season has rather fixed beginning and ending dates and is approximately 90 days in length. Although the air temperature is warm, the land is underlain by continuous permafrost and the soil is cold. This, combined with inadequate rainfall in the summer, is a barrier to extensive farming without artificial irrigation. Winters are long with temperatures below -50 F. being relatively common, and extremes in the -70 F to -76 F range have been recorded at many stations. Table 1 summarizes Alaska's weather extremes and means. The extended cold periods which accompany the standing high-pressure cell are normally accompanied by a temperature inversion. Under these conditions, dangerous ice fogs occur in the area of large communities; the concentration of chemicals in the Fairbanks area during such periods is a hazard to health and even to life.

The Bering Coastal Zone.—The Bering coastal zone is sometimes listed as one part of the transition zone between the mountain coastal zone on the south coast of the state and the Interior zone.

Its climate is not like that of the Interior basin with which it is usually associated topographically. Nor is its terrain and climate like that of the maritime zone which it abuts on the south. It is essentially a land with very special features of its own. These, in turn, present their own range of environmental problems, many of which require the same solutions as those of the true Arctic.

Topographically, the area is dominated by the broad, featureless deltas of the Kuskokwim and Yukon rivers in the south and the more rugged and mountainous Seward Peninsula on the north. In the east, the area blends into the forested lands of the Interior basin. North of the Seward Peninsula and Kotzebue Sound, the coast becomes true Arctic.

The climate of this area does not exhibit the extremes of the Interior basins. Winter temperatures are higher, and summer temperatures are lower. Precipitation is also higher—almost 20 inches each year. The moderate precipitation is due largely to the relatively drier cool air that comes off the

Bering and not to the lack of winds off the sea. Being unprotected along the coast, the area is subject to strong winds which gradually diminish as they move inland. These winds are more frequent and more intense during the winter months when the mainland is dominated by a strong high-pressure system and lows dominate the central and northern Bering Sea. Intense lows may result in 60 to 70-mile-an-hour winds persisting for two to three days, while wind speeds may average as high as 25 to 30 miles per hour for an entire month. Wind conditions prevent normal tree growth, and the land is covered by tundra and muskeg.

As the land is not subject to the intense cold of the Interior basin, the permafrost is discontinuous.

In terms of environment, the low land and the permafrost create water and sewage problems, while the persistent winds create real housing problems and seriously hamper winter travel on the ground.

The Brooks Range of the Rocky Mountain System.—The Brooks Range of the Rocky Mountain system crosses the entire northern part of Alaska in an east-west direction above the Arctic Circle. Rising on the Bering coast as a low range of hills, it gradually rises to a maximum height of 9,200 feet near the Canadian border. Unlike the Pacific mountain system, the Brooks Range consists of relatively even peaks with forests on the south slopes gradually giving way to tundra.

The true Arctic begins on the North Slope of the Brooks Range and extends northward across the Arctic plateau to the coast. It is an area of continuous permafrost with only low-growing vegetation except for a few trees and shrubs in protected areas along the rivers flowing into the Arctic Ocean.

While the Brooks Range dominates the southern edge of the Arctic area, it does not cause a precipitous and drastic change in the climate. Rather, it is an area of transition. Low temperatures in the mountain areas are not as low as in the Yukon Basin due to the influence of the Arctic Ocean while the extremely warm temperatures of summer are absent. On the South Slope of the Brooks Range, the number of frost-free days varies from 60 to 90; while, north of the Range, freezing can occur any month of the

year. A frost-free period in excess of 40 days is not common. Along the coast of the Bering Sea, the southwesterly winter winds have a moderating effect; and the Kotzebue area, for example, experiences warming trends in the winter. The effect of these winds, however, does not extend beyond the Brooks Range.

On the whole, the North Slope experiences intense and prolonged winters with strong winds which tend to parallel the coastline. Winds of 50 to 60 mph are common, with a record of 100 mph at Barrow. Snowfall averages 50 to 60 inches throughout the area with the snow hard-packed by the wind. Precipitation is usually between 4 and 10 inches annually with the larger amount on the west coast.

Sea ice is a problem north of the Aleutian chain. On the north coast of the Arctic, pack ice does not usually break up until late July and returns in late September or early October. On occasion, winds have held the Arctic ice pack against the coast throughout the summer. Along the Bering Sea coast, the length of freeze up decreases steadily towards the south. At Kotzebue, the freeze up comes in late October or early November; and breakup occurs in June.

The People

During the Wisconsin Glacier Period, which ended some 12,000 years ago, the ocean surface was about 300 feet lower than it is today and exposed the Bering-Chukchi land bridge. A slow and sporadic migration of man from Asia to North America occurred across this land bridge. Moreover, as the ice cap did not extend north of the Alaska range, man came to inhabit the Arctic coast as well as moving down the Pacific-Alaskan coast to warmer climates.

In historical times, initially marked by the voyage of Vitus Bering for the Russians in 1741, Alaska was occupied by peoples of four distinct cultures: (1) the Eskimos—the circumpolar people inhabiting, generally, the treeless areas of Alaska from Bristol Bay to the Arctic coast; (2) the Aleuts—inhabiting the Aleutian Islands and apparently closely related to the Eskimos; (3) the Tlinget, Haida, and Tsimshian Indians—the coastal people of southeastern Alaska and the most northern extension of the Salishan

people that occupied the Pacific Coast from California to Alaska; and (4) the Athapascans—predominantly, the Indians of northern Canada, who occupied the areas in Alaska between the Eskimos and the southeastern Indians, principally the interior Yukon Basin, the Copper River Basin, and the Cook Inlet areas.

As the original inhabitants of the state, these four groups are popularly referred to as "natives." Their total population is estimated to have been about 74,000 at the time of discovery (1741) and to have remained constant for the next 40 years (Table 2). The stability of the population in this period is usually ascribed to the fact that this number represented the maximum carrying capacity of the land as it was then used by people living in a Stone-age culture. The population trends for the next 200 years are shown in Table 3.

Early contact with the white man brought tragedy. Exploitation of the Aleuts in the hunting of the fur seal and the sea otter, accompanied by what appears to have been massacres to prevent uprisings, reduced their numbers to a few thousand. The primary killer, however, was the smallpox epidemic which spread northward from the west coast of the United States between 1836 and 1841, reducing the native population to an estimated 39,000 people.

Over the years, other diseases (such as tuberculosis and influenza) took their toll. These diseases were aggravated by the destruction or reduction of essential elements of the natural resource base on which these people depended and by many unfortunate changes resulting from the head-on clash of two disparate cultures. The Aleuts suffered the loss of their seal herds on which they depended for food and clothing. Later, the great whaling fleets of the world almost depleted the whale and walrus herds on which the Eskimos lived. Early commercial fishing methods also depleted the salmon runs which both Indians and Eskimos used to provide food for themselves and their dogs. Without any public regulation of the catch, streams were depleted and the canneries moved elsewhere, again to repeat the process.

Such adversity is reflected in the population figures, first declining slowly after 1840 and not fully recovering until 1940.

World War II focused the United States' attention on Alaska; and it is only since that time that broad-scale efforts have been made to provide the necessary educational, health, and economic development programs for the native peoples. On the whole, health programs have been effective in eradicating or controlling tuberculosis and other killing diseases with the result that the native population has grown from 34,000 in 1950 to an estimated 52,000 in 1965.

The settlement of Alaska by non-native immigrants from the United States followed an equally erratic course. After the depletion of fur resources and the ultimate sale of Alaska to the United States in 1867, there were few white people in the state. In 1880, the white population was only 430. The discovery of gold at Juneau in 1880, quickly followed by major discoveries in the Klondike, Interior Alaska, and Nome, created the first real interest in the North. At about the same time, commercial salmon fishing was getting established, and these two industries led to a large influx of people. They were seasonal industries dependent on migrant workers from the states, however, and the contribution to the permanent population of Alaska was not great. The 1900 census showed 34,000 white people. This rose to 39,000 in 1910, but declined thereafter to a low of 28,000 in 1920, rising again slowly until World War II when it stood at 40,000.

Although military construction has been the largest single factor in postwar growth, its effect on the total economy of the state is diminishing. Other permanent activities in aviation and public health have had a major effect on population growth. In addition, primary industries (such as forest products, fisheries, and oil) and service industries have expanded, and are becoming a primary source of population growth. By 1950, population had grown to 128,643 and by 1960, it had grown to 226,167. Today we estimate that there are 273,000 people—native and non-native—in Alaska.

How is the population of Alaska distributed? What are the health, housing, and other problems which need attention? How do they relate to Arctic research?

A quick look at the map shows that Alaskan communities are largely along the coast with only Fairbanks and a few small com-

munities along the Alaska Highway. There is only one metropolitan area—Anchorage—which has over 100,000 population. It is however, a modern city and constitutes the banking, insurance, wholesaling, and transportation hub of the state. With the other communities along the railbelt from Seward to Anchorage, it contains over 60% of the state's population. Located next to the Cook Inlet and the Kenai oil fields, it is the center of the state's fastest growing industry.

Southeastern Alaska shows a number of small towns of 5,000 to 15,000 population, which have fishing, forest products, and government as an economic base.

Southeastern Alaska, the "Railbelt," and Kodiak constitute the predominantly nonnative areas of Alaska. On the other hand, Westward Alaska—that great expanse of the state west of a line between Anchorage and Fairbanks and all of the area north of Fairbanks—is predominantly native. Since we are concerned with man in the Arctic and subarctic environment, our major focus must be on this section of the state and the people who inhabit it.

Westward Alaska is big, with a total area of about 355,000 square miles. It includes the Aleutian Islands, the western interior area, and the coastal areas along the Arctic Ocean, the Bering Sea, and Bristol Bay; but the population is small. The Bureau of Indian Affairs estimates of September 1965 showed a total of 40,454 people of which three quarters (30,386) were natives.

In the state as a whole, the native population tends to live in small scattered communities; and these communities tend to be predominantly native. Thus, throughout the state, one half live in 217 towns and villages with less than 500 people; and only 22% (about 12,000) live in urban communities of 2,500 or more. Out of the 250 places in Alaska having 25 or more inhabitants, 175 are predominantly native and contain over 70% (about 37,000) of the total native population. Table 4 gives a detailed breakdown of the distribution of native Alaskans by size of place.

Statistics for westward Alaska reflect the same pattern of population distribution of native peoples. Of the 151 communities in the area having 25 or more people, 132 are predominantly native. Most of these (105)

have populations of less than 300 and two thirds have populations of less than 100. Only five predominantly native communities have more than 1,000 people. Of these, the only city is Nome, where 1,850 of a total population of about 2,700 are native. The four other communities and their approximate native populations are: Kotzebue, 1,500; Barrow, 1,530; Bethel, 1,450; and Dillingham, 700.

By way of contrast, there are only 19 predominantly nonnative communities in westward Alaska, and two thirds of these have populations smaller than 100. In all of the 19 places, only 580 natives live.

The native population is a young population. The median age is 16.3 years; 47% are 14 years or younger; and 67% are younger than 35 years of age.

The rate of natural increase in native populations is also abnormally high—at least 31 to 32 per thousand annually (Table 5). In 1960 the crude rate of natural increase was 38.4 as compared with 14.1 for the United States as a whole and 10.1 for Japan (1959). This rate is approached, but not equalled in Latin America; for example, 35.1 for Mexico in 1959. Improvements in the infant mortality (which are extremely likely in view of the 74.8 rate in 1960) and increasing life span will tend to further expand the rate of natural increase. The figures tell us that there is a population explosion in the Arctic.

Solutions to the problems of the native groups in Westward Alaska involve not only health, education and welfare programs, but also major efforts to provide a sound economic base so that the transition is from a use-subsistence economy to something more than a nonproductive welfare state. The government regards this as its major problem in the Arctic.

Efforts to solve native problems as well as to develop the economic potential of the Arctic will give substantial direction to scientific work in Northern Alaska. Obviously, the area has sufficient resources to offer employment to the modest-sized native population: fisheries, minerals, oil and gas, and tourism. As we see it, an effective program will involve the development of these resources, the building of associated transportation facilities, and, finally, the linking of communities at points of resource develop-

ment with a large urban center providing a full complex of services. Such communities could reasonably support a population of 5,000 or more people. Development on this scale raises the problems of water supply, sewage disposal, and air and water pollution. It also raises the hard question: How do we determine in advance where to put hospitals, schools, and other facilities; for life must go on and cannot wait until full economic development occurs.

As we have seen, Alaska is surrounded on three sides by water; and this, combined with the warm Pacific waters, gives a temperate climate to a narrow coastal belt below 2,500 feet elevation along the Pacific rim that is entirely habitable and well situated for world trade. In this area, one community of size (Anchorage) has grown up from less than 4,000 people in 1939 to 115,000 in 1967. It is perfectly situated to become the predominant commercial and transportation center for the northern section of the state. Its future growth will depend heavily on the rate of resources-development in adjacent areas and in the northern and western areas. This growth will reflect increasing national and international needs for minerals including oil and gas. The rapidity with which these needs are recognized will, in turn, govern an expansion of the transportation network of the state. We believe this development will be undertaken in the next decade.

The resource development picture will also lead to the growth of coastal communities. Fishing and lumbering are primarily coastal activities, and the mineralized areas of the Pacific mountain system will be attractive because of the inherently low transportation costs. This will be reinforced by the development of off-shore oil production, and mineral extraction on the continental shelf—Alaska has up to 70% of the continental shelf of the United States.

Development will occur in areas which are free of Arctic-type problems until we enter the Bering Sea. Here, we believe that the Bristol and Kuskokwim Bay areas will be the next to experience oil development. Fisheries will also be expanded, stimulated in part by the need to provide more employment for native groups along the coast.

At this point, we should examine the im-

portant part of the development of the potential of the Brooks Range and the North Slope. Running east and west across the state, development in the Brooks Range is the major step in opening up the Interior. If the mountains are as highly mineralized as many believe, there is a potential of dozens of mines, each supporting a substantial community. Surface transportation would, in all probability, be by either an east-to-west railroad or by highway or by both, with a major connection to the rail and road systems of the railbelt and an extension northward to the Arctic coast through the low pass at Anaktuvuk. Beyond the Brooks Range lie the potentially great oil and gas fields of the Arctic slope. While oil development does not require a large labor force, small communities will be necessary.

If this development pattern materializes, it is clear that Arctic scientists working in Alaska must find answers to all of the specialized problems of man living in urban communities along the cold and windswept Bering and Arctic coasts and inland along the highlands of the Brooks Range.

As this is a world in which all things economic are ultimately judged by cost, I would close by saying that we see research as being in two parts: First, we must determine what is to be done and how to do it. Next, we must devise the least costly way of doing it. To the extent that we cannot solve the latter and make the Arctic a competitive production area, the more we will occupy the Arctic as a source of materials, extracted by automated means and delivered elsewhere, with the fewest number of people possible to man the installations.

I would hope that the Arctic holds more promise than this for man in the 21st century. In any event, it is our challenge to begin the slow process of finding the answers upon which the future will make its decisions.

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