

# SOME THOUGHTS ON RECREATION GEOGRAPHY IN ALASKA FROM A PHYSIO-CLIMATIC VIEWPOINT

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For many fields of human endeavor the climate of Alaska constitutes an extremely marginal factor and it should always be considered in any economic undertakings in that state. Furthermore, the general public harbors many misconceptions about the realities of climate in Alaska. Tourism and the recreation industry occupy an important niche in Alaska's economy, and State officials have frequently expressed the desirability of having the recreational aspects of the state examined from a climatic viewpoint.<sup>1</sup> It is generally realized that non-climatic factors such as isolation, high cost of travel, inadequate accommodations, and lack of recreational facilities limit the number of visitors.

## PURPOSE

A possible analysis of Alaska's climate in relation to its physiological and psychological impact on man cannot be developed by utilizing existing, traditional climatic systems which base their findings largely on annual averages of temperatures and precipitation, leaving man (and the potential tourist) standing on the sidelines. This brief study attempts to throw light on Alaska's recreational potential as it might be related to climatology. To accomplish this purpose, this paper utilizes a physio-climatic system which was previously originated by the writer.<sup>2</sup> This scheme integrates the physiological and psychological reactions of the average person to maximum and minimum temperatures, maximum and minimum relative humidities, solar radiations, and wind chills. These considerations were applied to daytime and nighttime for certain selected months. Thus, "real" conditions rather than annual averages are stressed. An annual map of climates is considered to be unsatisfactory and too much of a generalization, since climates are viewed as dynamic phenomena which migrate over the surface of this planet on a seasonal basis. This latter fact should be appreciated especially in a region like Alaska where seasonal extremes can be considerable and demand a high price in human psycho-physiological endurance.

## CONSTRUCTION OF MAPS

The Comfort Index and the Wind Effect Index<sup>3</sup> were applied to over thirty-five stations, in addition to consulting maps of isotherms of the U.S.

<sup>1</sup> Outdoor Recreation Resources Review Commission (ORRRC), *Alaska Recreational Potential*, Study Report No. 9 (Washington: Government Printing Office, 1962), pp. 18, 47, 5.

<sup>2</sup> For further details and an extensive bibliography see W. H. Terjung, "Physiologic Climates of the Conterminous United States: A Bioclimatological Classification Based on Man," *Annals*, Association of American Geographers, Vol. 56 (March, 1966), pp. 141-179.

<sup>3</sup> The capital letter(s) of the physio-climatic symbolization (e.g., VC) indicates the Comfort Index; the Arabic numeral following as the second digit indicates the diurnal variability of that Comfort Index (see Table 1). The third digit (lower case letter) indicates the Wind Effect Index (e.g., f); the following Arabic numeral (fourth digit) shows the diurnal variability of the latter index. Thus, the higher the Arabic numeral (for either the second or fourth digit), the more diurnally variable

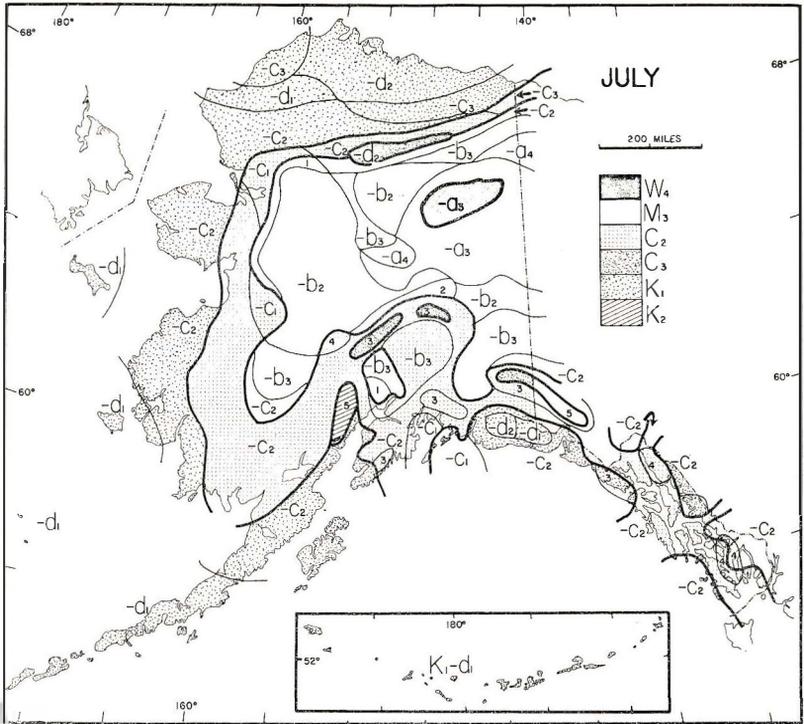


Figure 1. Physiological Climates — July. (1) — $b_2$ ; (2) — $b_3$ ; (3) — $d_1$ ; (4) — $c_1$ ; (5) — $d_5$ .  
See Table 1 for explanation of symbols.

Weather Bureau.<sup>4</sup> Then, separate daytime and nighttime maps for each index and for each month (January and July) were constructed. These eight single factor maps were superimposed (four for each month) and

are conditions. By using Table 1 any symbolization can be “unscrambled”. The Comfort Index relates the effects of maximum and minimum temperatures to those of the respective relative humidities, while the Wind Effect Index does the same for solar radiation and wind chills. The Comfort Index is considered to be of major importance since it will always be in effect, while the Wind Effect Index is regarded to be complementary to the former in that occasionally (nighttime, shade, overcast skies, lack of winds, etc.) is not in effect, or only partially so.

<sup>4</sup> U.S. Weather Bureau, *Climates of the United States, Alaska*, Climatography No. 60-49 (Washington: Government Printing Office, 1959); U.S. Weather Bureau, *Climatic Summary of the United States, Alaska*, Supplement for 1922 Through 1952 (Washington: Government Printing Office, undated); U.S. Weather Bureau, *Local Climatological Data*, for Anchorage, Annette, Barrow, Barter Island, Bethel, Cold Bay, Cordova, Fairbanks, Juneau, King Salmon, Kotzebue, McGrath, Nome, St. Paul Island, Yakutat, Shemya (Washington: Government Printing Office, 1963); U.S. Weather Bureau, *Mean Percentage of Possible Sunshine, Monthly and Annual*, Sheet of the National Atlas of the U.S. (Washington: Government Printing Office, 1960); U.S. Weather Bureau, *Prevailing Direction, Mean Speed, and Fastest Mile of Wind*, Sheet of the National Atlas of the U.S. (Washington: Government Printing Office, 1964); U.S. Army Air Forces, Weather Division, *Climatic Atlas for Alaska*, Report No. 444, 1943.

maps of the physiological climates for the respective months were drawn, which appear in this study. The problem of drawing delimitations or dividing lines in a continuum is, to a degree, an arbitrary one. Thus, lines drawn in such a continuum should be considered only as zones of transition. The centers of these different media are usually quite different from other centers, but no sharp border lines exist, except occasionally in mountainous areas, which, also because of lack of adequate data, should be viewed with caution. Generally, only average interfluvial surfaces were considered in an altitudinal sense, while actual summits have been ignored because of scale limitations.

### PHYSIOLOGICAL CLIMATES

From the recreational and tourist standpoint, July represents one of the most important months of the year, since over ninety per-cent of all tourists visit Alaska during summer.<sup>5</sup> During July a considerable mosaic of climatic variety ensues (see Table 1 for explanation of symbols). Physio-

TABLE 1 — PHYSIOLOGICAL CLIMATES OF ALASKA

Comfort Index		Wind Effect Index*	
Day	Night	Day	Night
W <sub>1</sub> = Warm	Keen	-a <sub>3</sub> = Warm wind effects	Cool wind chill
		4 =	Very cool wind chill
M <sub>3</sub> = Mild (Moderate)	Keen		
		-b <sub>2</sub> = Pleasant wind effects	Cool wind chill
C <sub>2</sub> = Cool	Keen	3 =	Very cool wind chill
3 =	Cold		
		-c <sub>1</sub> = Cool wind chill	Cool wind chill
K <sub>1</sub> = Keen	Keen	2 =	Very cool wind chill
2 =	Cold	3 =	Cold wind chill
CD <sub>1</sub> = Cold	Cold	-d <sub>1</sub> = Very cool wind chill	Very cool wind chill
2 =	Very cold	2 =	Cold wind chill
3 =	Extremely cold	3 =	Very cold wind chill
VC <sub>1</sub> = Very Cold	Very cold	-e <sub>1</sub> = Cold wind chill	Cold wind chill
2 =	Extremely cold	2 =	Very cold wind chill
		3 =	Bitterly cold wind chill
EC <sub>1</sub> = Extremely cold	Extremely cold	4 =	Exposed flesh freezes
Others (not in Alaska):		-f <sub>2</sub> = Very cold wind chill	Bitterly cold wind chill
H = hot; S = sultry;		3 =	Exposed flesh freezes
EH = extremely hot; UC = ultra cold		-g <sub>3</sub> = Bitterly cold wind chill	Bitterly cold wind chill
		2 =	Exposed flesh freezes
		-h = Exposed flesh freezes	Exposed flesh freezes

Source: Calculated by author

\*Removal or addition of heat from skin (in Kcal/m<sup>2</sup>hr)

<sup>5</sup> ORRRC, *op. cit.*, footnote 1, p. 15.

logical climates ranging from warm (W), to mild (M), to cool (C), and keen (K) appear. The different wind effects, subdividing further the major climates, add to the variety.

A *warm* climate (in this case W4-a<sub>3</sub>, warm days with warm wind effects, keen nights with cool wind chill) occupies a small section in the interior, north of Fairbanks. This area is comprised mainly of the area of the junction between the Yukon and Porcupine Rivers, including places such as Fort Yukon and Beaver. This climatic oasis seems to be the result of protective mountain barriers which partially surround it. Except for the wind chill, Los Angeles, California experiences a similar condition in July.

In considerable areas of the interior the average person feels *mild* conditions (M<sub>3</sub>, and its various wind effects) during the day and keen conditions at night. Again, several areas of coastal California experience these types of sensations during the same month. This climatic type is generally delimited in the south by the Alaska Range and the Wrangell Mountains, in the west by the Kuskokwim and Kaiyuh Mountains, in the north by the Brooks Range, and in the east, via the Klondike, it grades into the Yukon Territory of Canada. Some of the better known places within it are Fairbanks, McGrath, Tanana, Nenana, Big Delta, Tanacross, Circle, Bettles, Hot Springs, etc. Sections of Mount McKinley National Park are partially included in the above discussed climatic region. Only the central and southern parts of this extensive W and M area exhibits highway connections suitable to tourist trade. An outlier of M<sub>3</sub> occurs as an isolated pocket in the Matanuska and Susitna Valleys, north of Anchorage, containing towns such as Talkeen and Palmer. This section is tied in closely with the southern ecumene of Alaska.

*Cool* climates (especially C<sub>2</sub>, cool days, keen nights) dominate large portions of the state in summer and are distributed marginally to the above mentioned M climate, while the colder C<sub>3</sub> appears at higher altitudes. This climatic group already represents sensations on the undesirable cold side of the comfort continuum. During the day an average person, standing, would need about one standard layer of clothing, as established by the U.S. Army Quartermaster specifications,<sup>6</sup> while at night up to three of such layers would become necessary. Generally, camping is no longer enjoyed under these conditions by the average American vacationer. This climatic sensation constitutes a transition zone between the K climates (discussed below) and the above mentioned warmer climates. It contains places such as Kaskanak, Dillingham, Unalakleet and Selawik in its western sections; its southern portions contain some of the more populated areas of the south: Anchorage and areas surrounding Cook Inlet, Valdez and areas around Prince William Sound (including Chugach National Forest), and the sections around Eureka further inland. It is also felt among many islands of the Alexander Archipelago in the southeast, where Sitka National Monument is situated (major places: Juneau, Skagway and Ketchikan).

<sup>6</sup> D. H. K. Lee and H. Lemons, "Clothing for Global Man," *Geographical Review*, Vol. 39 (1949), pp. 181-213. See also: D. H. K. Lee, *Heat and Cold Effects and Their Control*, U.S. Dept. of Health, Education, and Welfare, Public Health Monograph No. 72 (Washington: Government Printing Office, 1964); D. H. K. Lee, "Physiological Climatology," in James and Jones, eds., *American Geography: Inventory and Prospect* (New York: Syracuse University Press, 1954), pp. 470-83.

C<sub>3</sub> is experienced at the mean altitudes of the Alaska Range and Wrangell Mountains.

The remainder of the state is subject to *keen* climates (K) with their many combinations of different wind chills. This group (especially K<sub>1</sub>, keen days and nights) is essentially a marine-influenced climate and exhibits, considering the season, rather unpleasant features. Up to three standard layers of clothing would be needed in this rather raw climate. Ironically, it is experienced in some of the more populated areas of Alaska. Strong and disagreeable winds are frequently associated with this type (e.g., d<sub>2</sub>, very cool wind chill during the day, cold wind chill at night). The coldest wind chills are felt in the north and among the Aleutian Islands. K<sub>1</sub> conditions are felt in the north along the littoral of the Arctic Ocean, containing large sections of tundra. Between Barrow and Barter Island (near Kaktovik) wind chills are especially unpleasant. Since this area also contains extensive swampy areas in summer (frequently underlain by permafrost), the insect problem can be considerable. In the west, the Seward Peninsula, St. Lawrence Island, areas bordering Norton Sound and the Bering Sea, containing such places as Nome, Kotzebue, Hooper Bay and Bethel, experience the same climatic sensation, but with some lesser wind chills. The latter problem increases again in the Aleutians and the Alaska Peninsula. Here, representative places experiencing K conditions are Attu, Dutch Harbor, Kodiak Island and areas on both sides of the outer Cook Inlet (e.g., Seldovia and Homer). Also included are sections along the southern coast from Montague Island to Chichagof Island in the Alexander Archipelago. Most of the national parks, forests, and monuments occur in this climatic region: Katmai National Monument on the Alaska Peninsula, Tongass National Forest in the southeast near Yakutat and its sections in the Alexander Archipelago, and Glacier Bay National Monument near Gustavus in the north of the same archipelago.

What then, from a solely physio-climatic standpoint, can be considered a good potential vacation land in the state in summer? Southern and most of southeastern Alaska never really see summer arrive (K climates), and, paradoxically, the tourist has to go north into the interior to feel anything approaching summer-like conditions. An exception to this are the relative small areas of the Matanuska and Susitna Valleys and some minor areas in the southeast where M<sub>3</sub> is also experienced (e.g., areas north of Skagway, and the fjorded lands east of Ketchikan and Wrangell). Generally, the Alaska Range and the Wrangell Mountains separate the warm interior air from the colder, moister Pacific air. In the middle and upper Yukon and Tanana valleys, which are partially serviced by highways from the coast and Canada, outdoor activities such as camping, hiking, fishing, etc., would be comfortable, or even warm, to the average person (during the day, especially, since almost all areas exhibit considerable cooling during the short night). Thus, a rather considerable area which has climatically a recreational potential exists in the interior into which future expansion of tourist facilities mainly should be developed. This area of future promise generally appears within the confines of the M and W climates of Figure I. Areas of promise to increase tourist trade also exist among the fjords of the Inland Passage in the southeast, which is somewhat sheltered from the most disagreeable wind chills.

Unfortunately, most of the national parks and monuments are not within the above discussed comfort zone, but are situated mostly in C and K regions.

Swimming, or other water sports, one of America's most favorite outdoor activities,<sup>7</sup> could hardly be conducted under very comfortable conditions in most places of Alaska. Even the  $W_4$  of the Fort Yukon area will generally not create in the majority of people a desire to "go near the water." Furthermore, for water-oriented recreation, Alaska's windy shores are generally not suitable. Winter sports, on the brighter side, would be plentiful in many mountainous areas.

Since winter, represented by this month, is only of little importance for the short-term tourist trade, the reader is mainly left in charge to make his own analysis of the map and only a cursory description will be given.

Over eighty percent of the state has climates (VC and EC) which tax the limits of human existence and endurance. This is further emphasized by the extremely high wind chills which will freeze exposed flesh (-h) in many northern regions. All these effects are compounded by the long

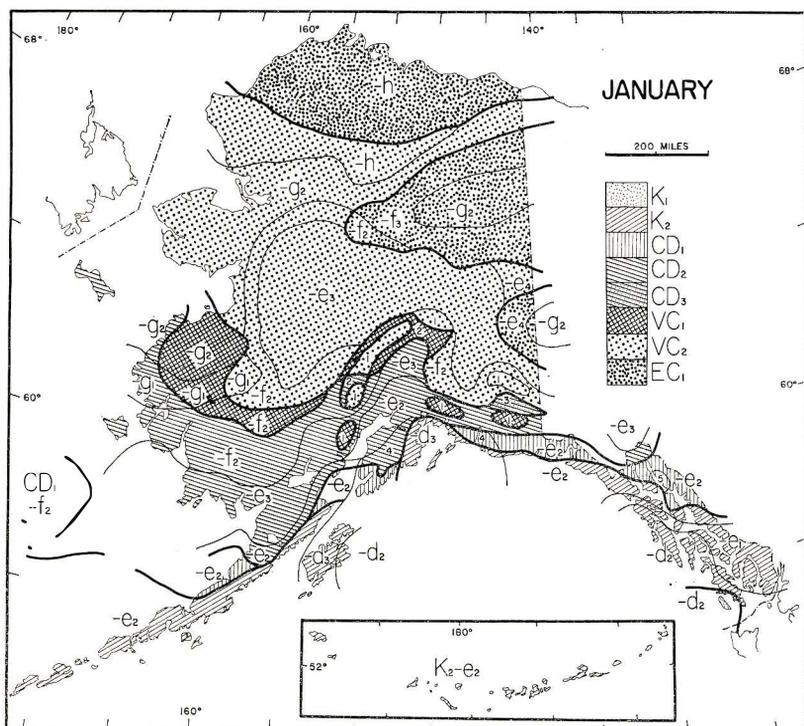


Figure 2. Physiological Climates — January. (1) — $g_2$ ; (2) — $f_2$ ; (3) — $e_3$ ; (4) — $d_2$ ; (5) — $e_1$ .  
See Table 1 for explanation of symbols.

<sup>7</sup> Outdoor Recreation Resources Review Commission (ORRRC), *Private Outdoor Recreation Facilities*, Study Report No. 11 (Washington: Government Printing Office, 1962), p. 134.

nights and short, wan days. *Extremely cold* climates ( $EC_1$ ), with temperatures between  $-4^{\circ}F$  and  $-40^{\circ}F$ , demanding about seven standard layers of clothing, are felt along the Arctic coast and central inland areas (especially upper Yukon river valleys). Vicious wind chills are dominant. *Very cold* climates ( $VC_2$ ) requiring about five standard layers of clothing during the day and at least seven at night (outdoors), occur in a vast region from the Bering Strait to the Canadian border, and from the Brooks Range to the Alaska Range. These above areas truly represent a frozen wilderness. *Cold* climates ( $CD$ ) are not much of an improvement on the above conditions.  $CD_3$  (cold days, extremely cold nights) appears in the Alaska Range and near the lower course of the Yukon River.  $CD_2$  (cold days, very cold nights) takes up large portions of areas around Bristol Bay and the populated sections of the south (requiring about four standard layers of clothing during the day).  $CD_1$  occurs only in a few isolated pockets.

The southern belt, including the wind-swept Aleutians, exhibits  $K_2$  climates (keen days, cold nights), a fact which is remarkable considering the season and latitude, though strong wind chills are experienced and climatic sensations are raw because of rather high humidities.

Little hope can be visualized to exploit this season for recreational activities. Even for skiing most areas are too cold to make winter sports enjoyable. Admittedly, the southern coast is relatively "mild," but certainly not enough to engender desires among would-be tourists.

**Table 2. CUMULATIVE STRESS INDEX**

Comfort Index	D	N	D <sup>2</sup>	N <sup>2</sup>	CS
$EC_1$	-5	-5	25	25	50
$VC_2$	-4	-5	16	25	41
$VC_1$	-4	-4	16	16	32
$CD_3$	-3	-5	9	25	34
$CD_2$	-3	-4	9	16	25
$CD_1$	-3	-3	9	9	18
$K_3$	-2	-4	4	16	20
$K_2$	-2	-3	4	9	13
$K_1$	-2	-2	4	4	8
$C_3$	-1	-3	1	9	10
$C_2$	-1	-2	1	4	5
$M_3$	0	-2	0	4	4
$W_1$	+1	-2	1	4	5

Weight of Comfort Index	
Extremely cold	-5
Very cold	-4
Cold	-3
Keen	-2
Cool	-1
Comfortable	0
Warm	+1

Source: Calculated by author

## ANNUAL SYNTHESIS

Even though it is realized that Alaska's tourist trade will probably remain a seasonal industry, a brief examination of the annual march of human climatic sensations may be advisable, not only to gain a broader picture, but also to determine the relative length of "summer" and "winter." Furthermore, a consideration of relative temperateness, expressed in biannual and annual Cumulative Stress (CS) might be of value.

Three typical stations, representing characteristic regions in a north-south cross-section across the state have been selected to illustrate the annual march of the Comfort Index via comfort climographs (see also Table 3).

**TABLE 3 — ANNUAL COMFORT INDEX FOR SELECTED STATIONS**

Station	J	F	M	A	M	J	J	A	S	O	N	D	Annual CS
Barrow	EC <sub>1</sub>	EC <sub>1</sub>	EC <sub>1</sub>	VC <sub>2</sub>	CD <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>2</sub>	VC <sub>2</sub>	EC <sub>1</sub>	374
Nome	VC <sub>2</sub>	VC <sub>1</sub>	CD <sub>2</sub>	CD <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>2</sub>	VC <sub>1</sub>	238
Fairbanks	VC <sub>2</sub>	VC <sub>2</sub>	CD <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	M <sub>3</sub>	M <sub>3</sub>	M <sub>3</sub>	K <sub>1</sub>	K <sub>2</sub>	VC <sub>1</sub>	VC <sub>2</sub>	234
Anchorage	CD <sub>2</sub>	CD <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	C <sub>2</sub>	C <sub>2</sub>	C <sub>2</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>1</sub>	CD <sub>2</sub>	163
Juneau	CD <sub>1</sub>	CD <sub>1</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	C <sub>2</sub>	C <sub>2</sub>	C <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>1</sub>	132
Cold Bay	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	K <sub>2</sub>	126
Annette	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	C <sub>2</sub>	C <sub>2</sub>	C <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	102
Barter Island	EC <sub>1</sub>	EC <sub>1</sub>	EC <sub>1</sub>	VC <sub>2</sub>	CD <sub>1</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>2</sub>	VC <sub>2</sub>	EC <sub>1</sub>	367
Bethel	CD <sub>2</sub>	CD <sub>2</sub>	CD <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>2</sub>	CD <sub>2</sub>	196
Cordova	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	C <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	K <sub>2</sub>	123
King Salmon	CD <sub>2</sub>	CD <sub>2</sub>	CD <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	C <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>1</sub>	CD <sub>2</sub>	181
Kotzebue	VC <sub>2</sub>	VC <sub>2</sub>	VC <sub>2</sub>	CD <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	CD <sub>1</sub>	VC <sub>1</sub>	VC <sub>2</sub>	304
McGrath	VC <sub>2</sub>	VC <sub>2</sub>	CD <sub>3</sub>	K <sub>3</sub>	K <sub>2</sub>	K <sub>1</sub>	M <sub>3</sub>	C <sub>2</sub>	K <sub>1</sub>	K <sub>2</sub>	VC <sub>1</sub>	VC <sub>2</sub>	252
St. Paul Island	CD <sub>1</sub>	CD <sub>1</sub>	CD <sub>1</sub>	CD <sub>1</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>2</sub>	CD <sub>1</sub>	156				
Yakutat	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	C <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	K <sub>2</sub>	123
Shemya	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>2</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>1</sub>	K <sub>2</sub>	K <sub>2</sub>	126

Source: Calculated by author

In the far north, Barrow (Figure 3) represents the Arctic coast. About three and a half months are dominated by K climates (from approximately June to September), about two months by CD, three by VC, and the remainder by the rigorous EC. This is truly a forbidding climatic regime. Fairbanks (Figure 4) exhibits about two months of M conditions (a "tourist climate") from June to August, while the remainder of the year has two months for C, three for K, one for CD, and four months of VC conditions. Thus, as the sensation isolines indicate on the graph, only a little more than two months is suitable for outdoor recreational activities. Anchorage (Figure 5) is already outside the realm of potential recreation activities. Its "warmest" conditions never reach, on the average, higher than C, though its winter months also never go below CD.

When the two seasonal maps (January and July) are superimposed, a biannual map of Cumulative Stress can be constructed (see Table 2 for the

CS Index).<sup>8</sup> The map (Figure 6) is largely self-explanatory. Regions of greatest CS appear, as expected, along the Arctic coast, while least CS appears in the south, especially in the southeast in the Alexander Archipe-

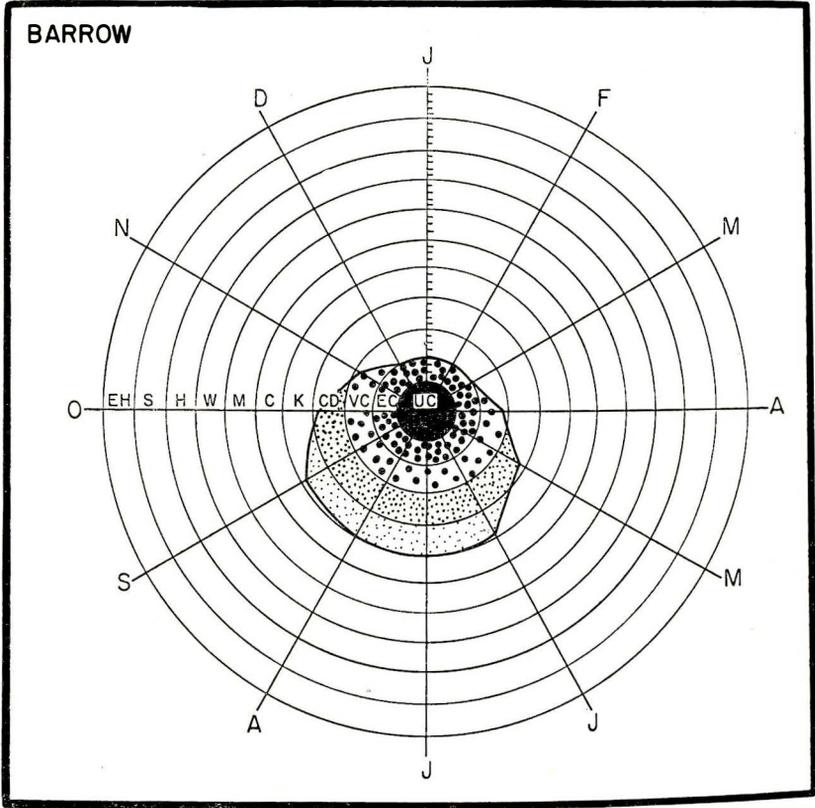


Figure 3. Annual Comfort Climagraph — Barrow. Tick marks on the vertical January bar designate the different types within a respective climatic group, e.g., VC<sub>1</sub>, VC<sub>2</sub>, VC<sub>3</sub> etc. Numbering begins on the outward-facing circle which is designated as 1 for each respective climatic group. Intensity of shading indicates the degree of discomfort. See Table 1 for climatic symbols.

<sup>8</sup> Each Comfort Index (for day and nighttime) was given a statistical weight (see Table 2) based on its degree of deviation from conditions comfortable for the average person. The following expression is utilized:

$$CS = \frac{12}{1} (D^2 + N^2)$$

where CS is the Cumulative Stress Index (annual), D the weight of the respective daytime Comfort Index, and N the weight of the respective nighttime Comfort Index. Annual, not biannual, CS is the sum of all twelve monthly CS indices. In the case of biannual CS only the two extreme seasons are considered. The CS index in its present form was first proposed in W. H. Terjung, *Physiological Climates of Africa* (UCLA: unpublished P.h.D. dissertation, Dept. of geography, 1966) and utilized as part of W. H. Terjung, "Annual Physio-Climatic Stresses and Regimes in the United States," *Geographical Review*, in press.

lago. Topographic control is especially noticeable in the Alaska Range and Wrangell Mountains.

For sixteen representative stations (see also Table 3) the *annual* Cumulative Stress has been computed and its values entered on Figure 6. This type of CS is generally preferred (depending on available data) since it encompasses all the yearly fluctuations of the physio-climatic regime.

Again, highest annual CS occurs in the far north, lowest (CS 102) in the far southeast. Areas in the south, which appeared as rather uniform with biannual CS values, are now further differentiated. An annual CS of

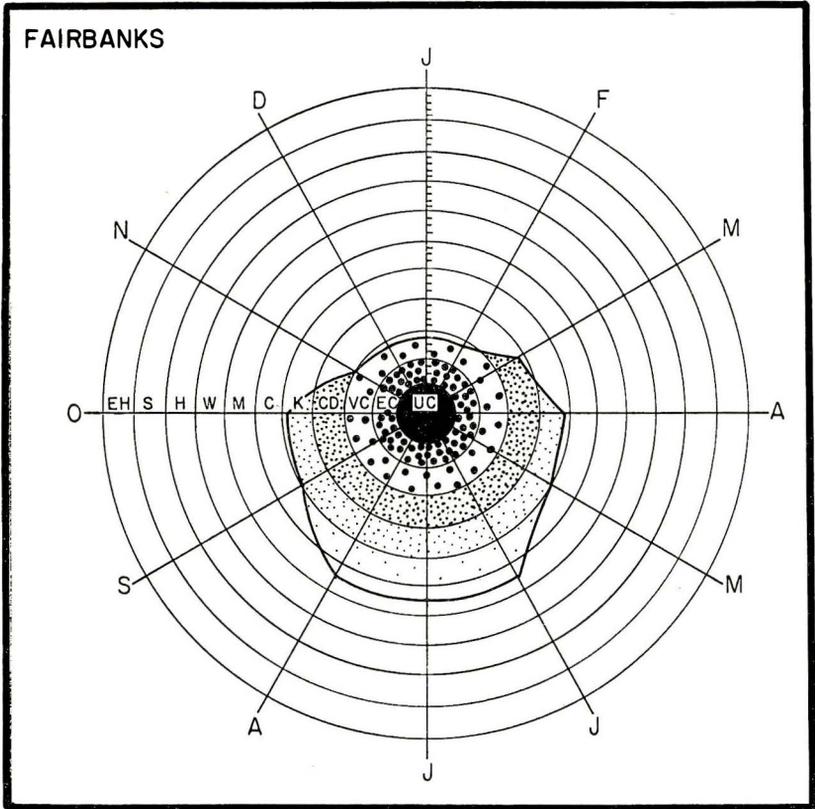


Figure 4. Annual Comfort Climagraph — Fairbanks. See Figure 3 for explanations.

about 100 is similar to stations such as Winslow, Ariz., Colorado Springs, Colo., Boise, Idaho, etc. A CS of about 150 compares to places similar to Caribou, Me., Sault St. Marie, Mich., Saint Cloud, Minn., etc. Cumulative Stress over 200 is generally not experienced in the conterminous United States (some exceptions are International Falls, Minn. which has CS 192, and Mount Washington, N. H. with CS 215), while large sections of Alaska are subjected to this type of climatic strain.

## CONCLUSIONS

Since "the American tourist just now has reached the threshold to achieve an Alaskan vacation" because of an increase in leisure, longer paid vacations, increased popularity of outdoor recreation, coupled with a curiosity for the 49th state and boredom with older vacation lands, and because up to date no agency has made use of available climatic data as a guide to recreation programs,<sup>9</sup> Alaska's recreation and tourist trade potential has been viewed briefly from a physio-climatic viewpoint which attempted to

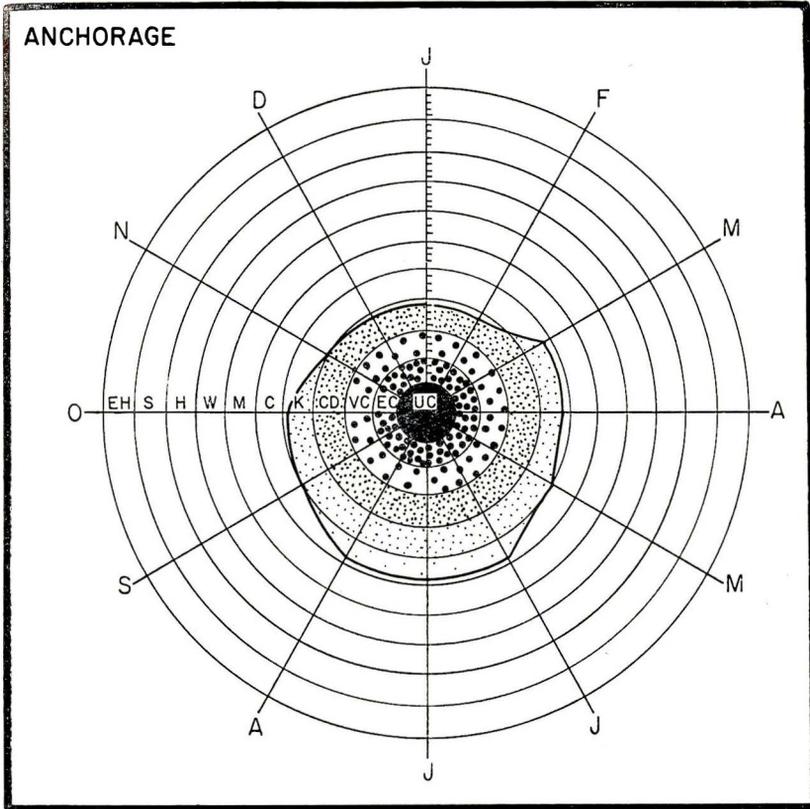


Figure 5. Annual Comfort Climagraph — Anchorage. See Figure 3 for explanations.

encompass the "real" psychological and physiological impact of climate on man. This was achieved by considering maximum and minimum temperatures and relative humidities, solar radiations, and wind chills for both daytime and nighttime, applied to January and July. Nonclimatic features, also strongly influencing the tourist industry, for purposes of this study were ignored.

It seems that Alaska will have to depend largely on a short-season type of tourist trade, lasting generally from June to August. This applies primarily to the interior sections between the Brooks Range and the Alaska Range.

<sup>9</sup> ORRRC, *op. cit.*, footnote 1, p. 17 and 47.

From a physio-climatic viewpoint the areas of the middle and upper Yukon and Tanana Rivers and areas along the fjorded Inland Passage in the southeast are the most suitable for certain kinds of outdoor recreational activities during this time period. Parts of the eastern sections of this "recreation climate" (see Figure 1) already have been developed somewhat in that sense, and are generally accessible via highways or boats, but it seems that vast areas farther to the west and north are still largely untapped and promise to be good investments for would-be owners of recreation facilities.

Unfortunately, most of the famous national parks, monuments and forests are not located in any of the described comfort zones, and generally

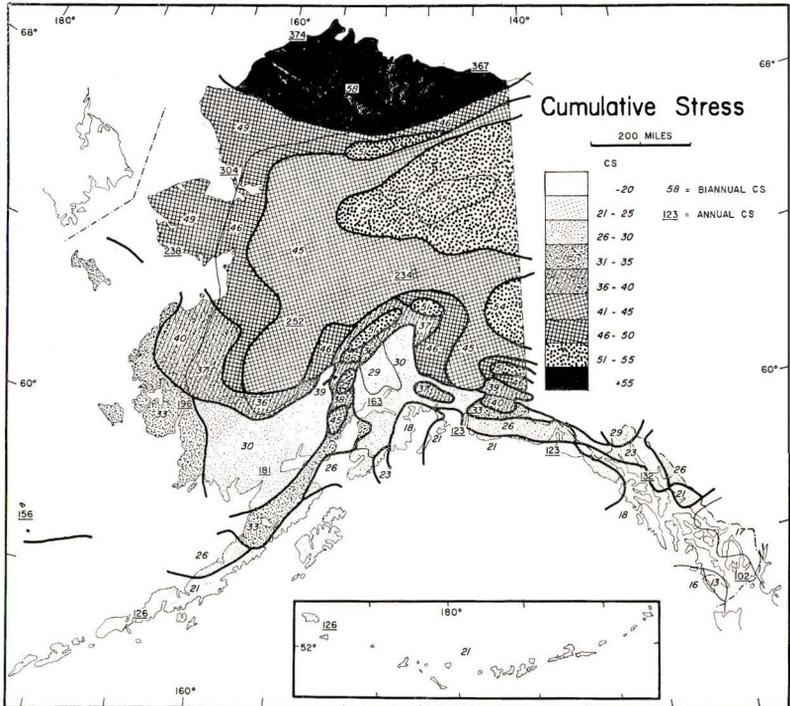


Figure 6. Cumulative Stress (CS) — Annual and biannual.

See Table 2 and footnote 8 for explanations.

exhibit rather disagreeable climatic conditions to the average person. Little promise seems to exist for any of the water sports so popular to the typical American tourist, while winter sports during summer are possible in many mountainous areas. Paradoxically, most of the more populated zones of Alaska do not experience comfortable or warm conditions, on the average, even during summer and are generally not suitable for extensive outdoor activities.

Winter is considered to be too extreme in the psychological and physiological burden it imposes on man's endurance, and few recreation activities can be visualized under these rigorous conditions, in spite of the fact

that the southern coast exhibits much less cold conditions than the interior.

Many of the southern coastal portions of the state exhibit cumulative climatic stresses similar to various stations in the conterminous United States, thereby indicating the habitability of that particular region on an annual basis.

Future investigators might find it profitable to examine in more detail the suitability of areas of positive "recreation climates" from an economic standpoint. Also, studies concerned with medical and military geography, the building industries, etc., could be of some interest in relation to the physiological climates of Alaska.