

# Northern and Western Distribution of Tree Growth in Alaska

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THE southern coastal and the interior country of Alaska is fairly well wooded below normal timber line wherever soil and drainage conditions are favorable. However, north of about 67° or 68° north latitude, on a broad strip bordering Bering Sea on the west, on the Aleutian Islands, and on much of the lower Aleutian Peninsula, no tree growth of any importance is found. Why the absence of tree growth in these southwestern, western and northern regions? They are not, of course, the frozen wastes which might be pictured, but support a rich growth of hardy vegetation. Why no trees?

A determining factor is temperature. Toumey states: "Wherever the mean air temperature during the hottest four months of the vegetative period falls as low as 50 degrees F. the forest becomes scrubby in character, no matter whether the temperature results from latitude or altitude." This apparently is the key to the situation. Table I gives mean monthly temperatures for June, July, August, and September, for those Alaskan stations for which averages over considerable periods of time have been computed, and the record agrees very closely with his general statement. Incidentally, it is interesting to note that the mean monthly temperatures in Alaska have nowhere reached 50 degrees F. before or after those four months. In this table also is given for each station listed the cumulative total number of degrees of mean monthly air temperature above freezing for the seven summer months from April to October, inclusive, the latitude and longitude, the total annual precipitation, and a statement of forest condition.

At no place where the seven months summer cumulative number of degrees above 32 degrees F. is below approximately 80 are trees found. Stations where this figure is between 80 and 90 are at or near the limit of tree growth if in the dry region, or treeless if on the rainy Aleutian Islands or Peninsula. Stations where the figure is more than 90 are in general timbered or on the borderline except at Coal Harbor on the wet Aleutian Chain, which is treeless.

Apparently the cumulative summer temperature above 32 degrees F. is an indicator of tree distribution, with a less total number required in dry than in wet situations. Thus wet Atka, Dutch Harbor and Coal Harbor with the cumulative temperature figures near 90 are treeless, and even Kodiak at 105 is on

the borderline, while farther north drier sites with similar temperatures are within forested zones. No doubt the longer hours of sunlight in northern latitudes is a very pertinent factor and adjustment might be necessary on that account. In general, however, a lack of sufficient heat during the growing season apparently accounts for the absence of trees outside of their present natural range, with a possible minor exception in southwestern Alaska.

On the Aleutian Island Chain and territory adjacent thereto, some other entirely different factor than temperature may enter into the situation. This is a subject for study. At Kodiak the cumulative summer temperature figure above 32 degrees F. is 105.4—apparently ample for tree growth—and considerably more than is found at some other heavily forested sites. Why is this site at the extreme western limit of tree growth? Observations at Kodiak by the writer show that trees grown there make a rapid and healthy growth, that the trees are reproducing prolifically and that forest growth is being extended south and west gradually. Here and on Afognak and adjoining islands to the north Sitka spruce is the only coniferous tree species found. On Afognak Island are heavy pure stands of Sitka spruce of fairly rapid growth. Not a single hemlock tree was seen or reported although hemlock is common on the Kenai Peninsula a short distance to the north. Further there are broad areas on Afognak Island where the present forest is apparently an original stand. The trees are still immature and there is not the accumulation of logs and debris of a climax forest. It appears to the writer, therefore, that in this region the forest has not yet reached its southern and western natural extension. It seems possible that, left undisturbed, nature will eventually push the timbered zone farther south and west.

Several factors delay this extension. The heavy grass cover over this area greatly interferes with the starting of tree seedlings and no doubt often competes with them successfully. Probably periodic grass fires destroy many of the seedlings that start. These two factors alone would effectually delay the process on natural forest extension. The situation, however, has been studied too little to form definite conclusions, and is a fruitful and interesting field for further observation and study.

In this connection it is interesting to know that in 1805 the Russians planted a small grove of trees at Dutch Harbor which has a cumulative summer mean temperature above 32 degrees F. of 89.2. Regarding these trees Veniaminov wrote in 1834:

“In 1805, a few spruce trees were brought from Sitka to Unalaska and planted in various places. Those planted near the village continued to live but the ones planted on Amakhnak Island died. These trees were about two or three years old when trans-

TABLE 1. *Temperature and Forest Cover Data Regarding Various Alaska Localities.*  
From U. S. Weather Bureau

Station	Lat- itude deg. min.	Long- itude deg. min.	Mean Air Temperature				Apr.-Oct. cum. no. deg. mean mo. temp. above 32 degrees F.	Annual Precipi- tation in inches	Forest Cover
			June	July	Aug.	Sept.			
Barrow .....	71 23	156 17	35.3	40.9	38.5	32.1	18.8	5.34	None
St. Paul Island .....	57 15	170 10	40.7	45.3	46.1	44.1	57.4	31.35	None
Kotzebue .....	66 50	162 10	42.4	54.2	49.2	39.8	57.6		None
Nome .....	64 30	165 24	45.0	50.5	49.8	41.2	61.2	16.69	None
Candle .....	65 55	161 57	47.4	53.0	50.5	39.7	64.6		None
St. Michael .....	63 29	162 01	45.7	53.8	52.1	43.9	68.5	13.19	None
Kennicott .....	61 29	142 57	49.4	52.3	49.3	43.3	75.9	18.07	None
Nulato .....	64 43	158 4	52.2	56.5	51.8	39.7	79.5	17.00	Western Limit Interior Type
Akiak .....	60 52	161 23	54.8	53.0	51.8	42.7	81.7	17.55	Western Limit Interior Type
Attu .....	52 36	173 13	42.6		50.8	47.4	82.7	71.17	None
Sunrise .....	60 53	149 27	49.8	53.4	51.7	43.7	85.2	25.28	Northern Limit Coastal Type
Holy Cross .....	62 16	159 50	53.3	56.1	52.3	43.0	85.5	19.50	Western Limit Interior Type
Allakaket .....	66 34	152 44	55.9	58.2	51.9	39.0	86.2	12.05	Near North. Limit Interior Type
Atka .....	52 12	174 20	45.7	49.6	51.0	47.0	88.9	78.20	None
Kenai .....	60 32	151 19	49.6	53.6	53.9	46.0	89.1	18.64	Interior Type
Dutch Harbor .....	53 54	166 32	46.0	51.3	51.4	47.2	89.2	63.39	None
Copper Center .....	61 58	145 20	54.0	56.3	53.5	42.8	91.4	9.15	Interior Type
Valdez .....	61 7	146 16	51.1	53.6	51.2	45.9	92.3	52.23	Northern Limit Coast Type
Coal Harbor .....	55 20	160 38	47.5	52.6	52.8	49.1	93.1	48.51	None
Tanana .....	65 10	152 6	57.3	58.9	53.3	40.0	93.6	12.47	Interior Type
Eagle .....	64 46	141 12	56.0	59.2	52.9	41.9	94.7	10.87	Interior Type
Dillingham .....	59 00	158 28	53.1	55.7	54.5	46.6	94.8	28.51	Western Limit Interior Type
Chitina .....	61 32	144 27	54.5	57.0	53.7	46.2	96.0	11.50	Interior Type
Anchorage .....	61 13	149 52	52.2	56.0	54.4	47.4	96.4	15.68	Border-Inter.-Coast Type
Yakutat .....	59 33	139 44	50.0	52.8	52.6	48.1	100.8	115.28	Coastal Type
Matanuska .....	61 30	149 15	54.5	56.9	54.7	46.2	104.2	13.91	Interior Type
Fairbanks .....	64 51	147 52	58.5	60.7	54.9	43.0	105.2	11.74	Interior Type
Kodiak .....	57 48	152 22	50.2	54.5	54.3	49.5	105.4	61.03	Western Limit Coastal Type
Cordova .....	60 32	145 42	50.7	54.4	53.7	49.0	106.2	131.55	Coastal Type
Seward .....	60 6	149 27	50.7	55.6	53.9	48.6	106.3	62.87	Coastal Type
Dawson—									
Yukon Ter. ....	64 2	139 30	56.9	59.7	54.1	42.5	109.4		Interior Type
Killisnoo .....	57 28	134 33	51.5	55.2	54.4	48.0	111.2	52.79	Coastal Type
Rampart .....	65 30	150 15	58.6	61.0	55.8	41.5	112.2	9.96	Interior Type
Juneau .....	58 18	134 24	54.2	57.4	55.0	50.2	122.5	79.54	Coastal Type
Skagway .....	59 27	135 19	55.7	58.3	55.5	49.9	124.8	23.47	Coastal Type
Sitka .....	57 3	135 19	51.3	54.8	55.5	51.7	127.0	84.83	Coastal Type
Ketchikan .....	55 20	131 37	53.3	57.4	57.1	52.6	130.0	157.67	Coastal Type

planted. There are 24 of them growing and some of them have reached the height of 7 feet, while the butt measures 18 inches in circumference at the present time (1824) and the rest of them are from 2 to 5 feet high. In 1833 the cones appeared for the first time on the trees. By the study of the space between branches it is plain that the growth in thickness was more pronounced in the first years and very little in length. The lower branches are quite long and close one on top of another, but in the last 6 or 7 years the trees perceptively grew in height, so that the spaces on the trunk between branches shows the growth in the last 5 years equal to that of 10 or 12 years previous.

“These trees are planted in the midst of knolls, close to a lake in marshy soil and on an elevated plateau.

“It is worthy of note that some of the trees, while planted at the same time, are so small and thin that they appear as if they had come out of the ground not more than four years ago. They have very few branches. Why did they grow so slowly?”

Dr. Alberts, Director of Alaska U. S. Experiment Stations, reports in 1928:

“I was at Unalaska in the summer of 1928 and saw the trees. At that time, they were about 35 feet in height and 18 inches in diameter at the base. The trunks are quite conical in form and the sets of branches starting from the terminal bud each spring are very close together. It appears that the cones have formed in some years, but if the seeds were produced, they failed to produce seedlings, because at the present time, there are no other trees in the region aside from those which were planted in 1805.”

From this experiment it would appear that Dutch Harbor is outside of the range of natural tree growth.

