Discussion Paper

A Northern Place

ANCHORAGE AS A UNIQUE SUB-ARCTIC COMMUNITY

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Anchorage as a Unique Sub-Arctic Community

Context

According to the University of the Arctic, the Circumpolar North is the area traditionally covered by the terms "Arctic" and "Subarctic," and consists of the northern lands of the world's eight northernmost countries (the Arctic Eight): Canada, Finland, Denmark (including Greenland and the Faroe Islands), Iceland, Norway, Russia, Sweden, and the United States (Alaska).

Figure 1
Map of the Circumpolar North

The subarctic climate is found exclusively in the Northern Hemisphere between 50 and 70 degrees of latitude, typically in the interior of continents. There are no subarctic conditions in the Southern Hemisphere due to the absence of large land masses at the equivalent latitudes. The characteristic features of a subarctic climate are short, mild summers with temperatures that can go as high as 30 C and long, cold winters with the temperatures going as low as -40 C.

Anchorage, Alaska is located at 61.217 degrees North Latitude. It is the only major metropolitan area[1] on Earth at this general latitude. It is the only major metropolitan area (greater than 200K population) on the North American continent. Northern Europe has several major metro areas at similar latitudes but they are several times the population of Anchorage. See Table 1.

Table 1
Major Metropolitan Areas in Circumpolar North

Metropolitan Area	Latitude (Degrees North)	Population (2023)
Anchorage, Alaska (USA)	61.217	289,653
Stockholm, Sweden	59.329	985.000
Oslo, Norway	59.913	1,086,000
Helsinki, Finland	60.169	1,338,000
St. Petersburg, Russia	59.931	5,561,000

1. The U.S. Census Bureau and the FHWA classify urbanization above 200,000 persons as major metropolitan areas. This is why the Metropolitan Transportation Organization for Anchorage (AMATS) is a Transportation Management Association with a special direct relationship with FHWA.

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A Refresher on the Earth and Sun

The Sun has always heavily influenced the activities of human beings. From time immemorial, mankind has treated the rising and setting of the Sun as a core reason for life to exist on Earth. But the Sun does not really rise and fall, rather our planet rotates on an axis and it is the rotation of Earth that creates sunrises and sunsets. See Figure 2.

The Earth's seasons are due to an axial tilt of 23.5 degrees. Near June 21st, the summer solstice, the Earth is tilted such that the Sun is positioned directly over the *Tropic of Cancer* at 23.5 degrees north latitude. This situates the northern hemisphere in a more direct path of the Sun's energy.

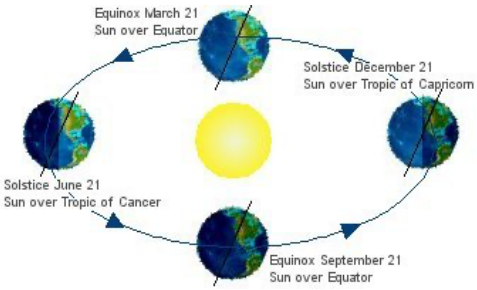

Figure 2
Axial Tilt and Earth's Orbit

Advancing 90 days, the Earth is at the autumnal equinox on or about September 21st. As the Earth revolves around the Sun, it gets positioned such that the Sun is directly over the equator. Basically, the Sun's energy is in balance between the northern and southern hemispheres. The same holds true on the spring equinox near March 21st, as the Sun is once again directly over the equator.

Lastly, on the winter solstice near December 21st, the Sun is positioned directly over the *Tropic of Capricorn* at 23.5 degrees south latitude. The southern hemisphere is therefore receiving the direct sunlight, with little scattering of the sun's rays and a high sun angle producing long days. The northern hemisphere is tipped away from the Sun, producing short days, a low sun angle and deep, dark winter-like conditions.

What kind of effect does the earth's tilt and subsequent seasons have on our length of daylight (defined as sunrise to sunset). Over the equator, the answer is not much. If you live on or very close to the equator, your daylight would be basically within a few minutes of 12 hours the year around. Using the northern hemisphere as a reference, the daylight would lengthen/shorten during the summer/winter moving northward from the equator. The daylight difference is subtle in the tropics, but becomes extremely large in the northern latitudes.

Earth's axial tilt of 23.4 degrees results in distinctive seasonal patterns varying by location and where the Earth is in its orbit around the Sun. Anchorage at 61.2 degrees North Latitude has seasonal variations significantly different than the continental United States. The Lower 48, due to it being predominately located in the Mid-Latitudes, has four defined Seasons each approximately 3 months long. Anchorage's sub-arctic location creates a different and unique seasonal pattern. When Earth is tilted away from the Sun, we experience days dominated by darkness; when Earth is tilted towards the Sun, we experience days dominated by light. The

transition points between the periods of Darkness and Light are the Equinoxes – Autumnal about the third week of September and Spring about the third week of March. Thus, the Anchorage experience is for six months where Darkness is dominant and six months where Light is more pervasive. This physical reality creates a duality between light and dark – long summer days peaking at the June Solstice and long winter nights peaking at the December Solstice.

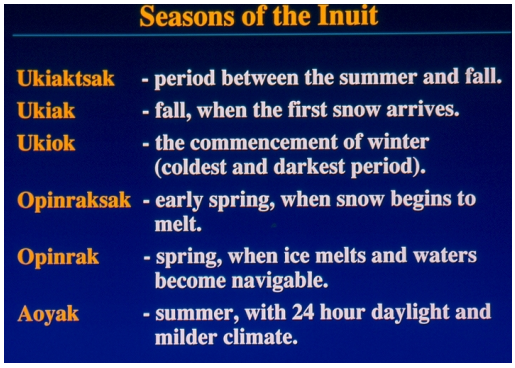

Figure 3

The unique and different seasonal patterns of the Far North are reflected in the languages of the indigenous peoples. Figure 3 lists the words used by the Inuit peoples to describe the six Seasons dominating the existence of life.

Subarctic North America

The Subarctic area of the North American continent covers most of Canada and Alaska. (See Figure 3) It is the northern section of the near-arctic realm with four sub-realms as defined in the Bioregions 2020 framework -- Greenland, Canadian Tundra, Canadian Boreal Forests, and Alaska -- containing nine bioregions in total. Greenland consists of a single bioregion defined by ice with coastal tundra, and the Canadian Tundra is also defined as one large bioregion. Alaska contains three bioregions, including the Far Northern Pacific Coast, which combines temperate conifer forests and coastal ice fields and is home to grizzly bears, wolves, puffins, salmon, and orca whales.

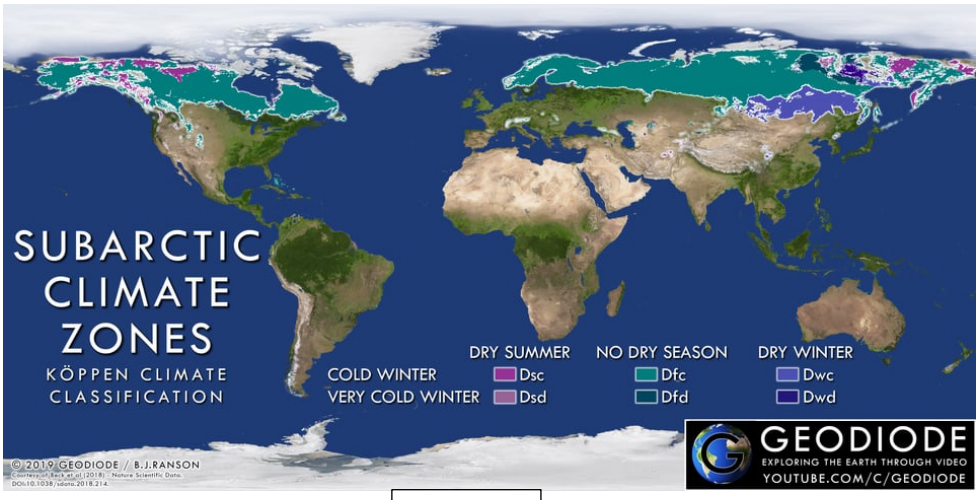

Figure 4

Alaska, located in the topmost northwest part of the continent, has arctic and subarctic climates. While much of the economic wealth produced by the State's economic activity is located in the far north Arctic region, the majority of the population is located in the sub-

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arctic region. Most of Alaska's population is located in the south-central part of the State, predominately in Anchorage.

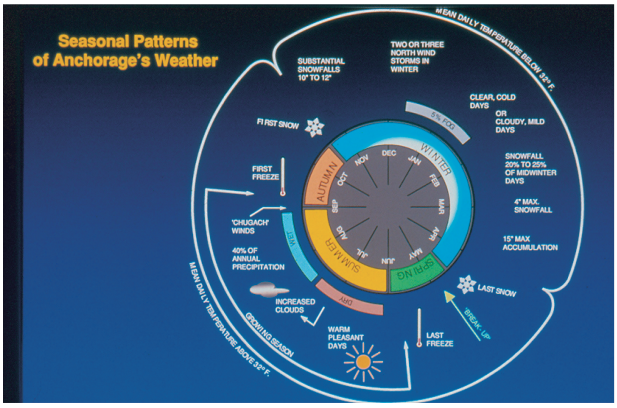

Figure 5

The Alaskan summers are short and cool, with temperatures averaging 17 C or 62.6 F. The winters are shaped by the degree of earth's tilt as our planet circles the sun. Shadows come early to the sub-arctic and they stay late. There is a duality to life in the North tied to whether light is dominant or whether darkness pervades the landscape. The tipping points are the Spring and Autumnal Equinoxes.

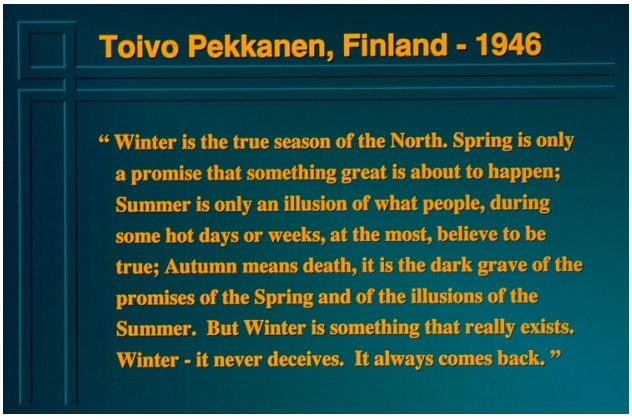

Figure 6

Winter comes with the deepening shadows. It is six plus months long at Anchorage's latitude and composed of three sub-seasons: *Early Winter* (October through end of November) when less sunlight is noticeable and temperatures start to creep below freezing on a regular basis. *Deep Winter* (December through mid-January) when darkness dominates the long nights and short days and temperatures are quite below freezing. *Late Winter* (mid-January to late March) when the Sun begins to return to the northern lands, temperatures start to rise and Alaskans prepare for the upcoming non-winter.

Non-Winter arrives when the power of the Sun overwhelms the shadows. *Break-Up* (April to early May) is when the heat of the ever-rising Sun melts the winters accumulation of snow and ice. Temperatures are consistently above freezing during the day, causing rapid transformation of winter and challenging how one drains the water. The budding of plants heralds Spring life. By the end of May, trees and shrubs are showing growth while the ground has warmed sufficiently to allow for plantings to occur. Summer in Anchorage runs from June to Early-July when light dominates the landscape and activity is everywhere. The rainy season begins about the middle of July as the remnants of western Pacific storms cycle north toward Alaska and expend themselves.

Alaska historically have had very little precipitation, most of which comes during the post-summer period into the November storms rising up from the western Pacific Ocean. Short

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Summers (typically three weeks on each side of the summer solstice) are mostly dry with only occasional rain during the periodic thunderstorm in the Interior. On clear nights during the Alaskan winter, and depending on sunspot activity levels you can have some pretty spectacular displays of the northern lights. The only other part of United States that has a subarctic climate is the High Rocky Mountains in Colorado, Wyoming and Montana, where height replaces latitude.

The North American continent has only one major metropolitan area in the sub-arctic – Anchorage, Alaska. This means there is no other similarly sized community in North America that share its unique urban challenges. The reality of this physical placement on the planet presents challenges to Anchorage and requires the community to develop innovative solutions to its unique sub-arctic circumstances.

How Light and Dark affects People

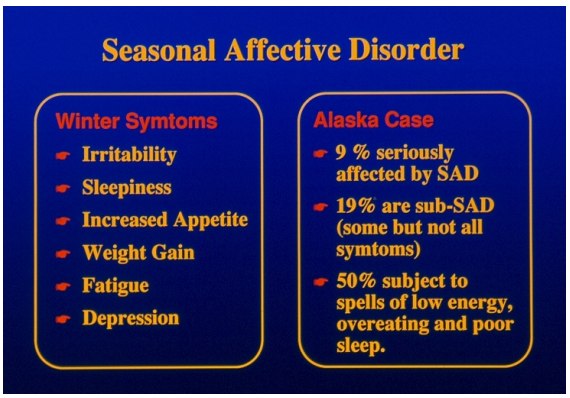

Figure 7

For the minority of people who are clinically diagnosed with Seasonal Affective Disorder (SAD), and for the large number of people who suffer to some degree from winter blues, winter is literally depressing. The recognition of SAD as a legitimate syndrome, dates to the late 1970's, when a group of researchers at the National Institute of Mental Health (NIMH) in Maryland, USA while researching how light affects biological rhythms noticed a relationship between melatonin secretion and mental depression. They discovered that long winter nights can produce an overabundance of melatonin. Excess production of which can drain energy from a person and make it difficult to concentrate. The body is preparing itself for sleep. This in turn generates a disconnect between what our society has established as a regular work routine – a schedule of work created for Earth's lower latitudes.

When melatonin reaches the brain's hypothalamus it alters the synthesis of the active thyroid hormone – a substance that regulates all sorts of behaviors and bodily functions processes, including the production of serotonin, which plays a well-established role in regulating a person's mood. During the subarctic winter half of the year, the morning end of melatonin secretion by the pineal gland drifts later and later. High melatonin levels caused by exposure to long periods of darkness will strongly suppress the synthesis of active thyroid hormone and by lowering brain thyroid levels, cause seasonal changes in mood, appetite and energy.

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Extended exposure to darkness causes a steady rise in melatonin levels in a cumulative manner and peaking in late January before starting to decline with the return of lengthening daylight. It is during this peak period of melatonin and suppression of serotonin that mood changes are most noticeable. This is reflected in popular culture with the anecdotal stories of "Cabin Fever."

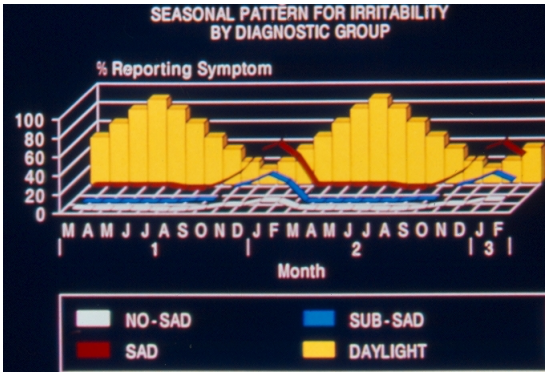

Figure 8

Winter darkness can be especially debilitating for people of low-income who cannot afford the expense of a personal automobile and forced to rely on other modes of transportation for mobility. The use of pedestrian infrastructure for snow storage makes it a hazardous proposition to try and walk for basic exercise or to access a bus stop. This results in many children, seniors and physically challenged being confined during winter and more susceptible to the negative effects of SAD.

Adapting to the Sub-Arctic North

How one perceives the short period of the Northern Winter makes a difference. Research in Norway conducted in 2013-2014[1] through a winter mindset questionnaire submitted to residents of Tromso, Svalbard and Oslo found that liking winter was associated with greater life satisfaction and being willing to undertake challenges that led to greater personal growth.

Figure 9

A vibrant, prosperous and reconnected Fairview requires a built environment conducive to generation of economic growth in a globally oriented 21st Century Digital Economy. This places a heavy emphasis on the productivity of human capital, particularly in the unfolding age of artificial intelligence.

The Reconnecting Fairview initiative is about more than healing the urban scars of the past. It is an opportunity for citizens to define what it means to live, work and recreate in a unique sub-arctic metropolitan area. It is an opportunity for a new generation of residents to embrace the Northern Duality of Darkness and Light and develop innovative solutions to the unaddressed challenges of winter livability.

[1] "Chasing the Sun: How the Science of Sunlight Shapes our Bodies and Minds," Linda Geddes, 2019, Pegasus Books.