Alpine & subalpine habitats in SE Alaska

Richard Carstensen • 1983

Alpine & subalpine habitats in Southeast Alaska

Preface 2024: Helping to assemble an atlas for the 2010-2013 team that surveyed 10 highcountry sites from Chilkat country to the Haida Islands,[1] I found myself rereading, somewhat apprehensively, this paper that I wrote 41 years ago. Some of it gradually found its way into the highcountry chapter in *Nature of Southeast Alaska*, first edition, 1992, by which time I'd learned to write. I had no such expectations from a navel-contemplating dropout who'd dodged even the 'poet's biology' class at Oberlin in the 1960s.

To my relief, however, the original was actually not bad. Enough that I'm not too embarrassed to scan and reformat it for distribution on *JuneauNature*. To preserve the 'historical' flavor, I'm making only minor style and spelling changes. Where Lingít names are known, I've added some retroactively, with translation *in italic* and colonial in parentheses. More substantial changes are relegated to footnotes beginning "**2024:**"

Preface 1983: We know remarkably little about the mountains at our back door. This can't be attributed to underendowment of romantic appeal. Mountain goats scramble up vertical cliff faces and disappear into clouds. Grey expanse of ice and rock surprises with vivid color as we bend closer to examine brilliant lichens and delicately tenacious alpine wildflowers. Our ignorance of mountain environments is owed not so much to lack of interest as lack of money. Timber harvest isn't feasible above treelimit, and salmon don't run that high. While "*resource*" oriented studies of the forests and waters of Southeast Alaska have been reasonably well funded, almost nothing has been invested in alpine and subalpine environments. [2]

This report began as an attempt to summarize what I learned from Rita O'Clair's course in Alpine Ecology, given at the University of Alaska, Juneau, during the summer of 1983. I missed the final exam due to an ill-timed mountain-climbing venture and took an incomplete in the course. Rita says she'll accept this in lieu of an exam makeup.

The more longstanding motives however, are my affection for and fascination with the high places of Southeast Alaska, and a growing frustration with the inadequacy of published descriptions.

This is my attempt to promote a community dialogue on the various aspects of local mountain environments. In order that we begin to speak about mountain habitats in a meaningful way, I've offered some tentative definitions, reviewed some of the pertinent literature, and speculated a bit on community dynamics. By distributing copies to local botanists, wildlife biologists, geologists, etc. for comments and criticisms, I hope eventually to assemble a sort of collective report, a summary of what we know, and consensus on appropriate directions for future study.

For patience and companionship above treelimit, I thank my friends David Audet, Rich Bloomquist, Kipp Drummond, Dick Ellsworth, Greg Heubschen, Joe Lacy, Marty Peale, Sharon Raymond, Karen Terrel, Bart Watson, and Kathy Yurman. For showing me with their careers that curiosity needn't be a casual or part-time affair, I thank Rich Gordon, Chuck Jurasz, Don Lawrence, Mark Noble, John Schoen, John Thilenius, and especially, Rita O'Clair, who until I reach the belt of perfect enlightenment, will always be three jumps ahead of me.

Contents

Cover: Alpine tundra and bare rock at summit camp, 4,458 feet above T'aaḵú Kunaa Geeyí, *glacier-bidding bay* (Taku Inlet). The opportunity for a free plane dropoff at Dorothy Lake caused me to miss Rita O'Clairs' final exam for the 1983 Alpine ecology class. But I still have the 35mm slides taken by *Geo Magazine* photographer Jose Azel. And since I didn't even own a camera in 1983, those images are particularly valuable to me in 2024. ● **Left above**: Clipping my climbing buddy Kipp Drummond sent me in 1981. Kipp did *not* drop out of Oberlin. ● **Left below**: Goating from 'Intro Mountain,' 3 years before submitting this summary on mountain ecology. Marked "IM" on map, *fig-3.*

1 **2024**: Core members: Karen Blewjas (mammals, coordination), Kitty LaBounty (vegetation), Cathy Pohl (birds) Derek Sykes (insects), Jack Whitman (mammals), Joe Cook (coordination of field assistants).

2 Two exceptions from Glacier Bay, somewhat atypical of SEAK, are Sandgren & Noble (1978), and Worley, in Streveler *et al* (1977).

Introduction

Despite the obstacles I pursued the great monk
the misty mountains a million layers high
he pointed to the road back home
one round moon lantern of the sky

translation from the Chinese of Han Shan
by Arthur Tobias

Definitions

What is alpine, and what is subalpine? And while we're at it, what is montane? Untangling this terminology could occupy the greater part of this paper, as every biologist seems to have a unique personal opinion. I prefer to write about actual plants, animals and rocks. But I agree with Doris Löve (1970) that it's important to standardize our definitions. Here are the "belts" [1] she proposed, to which, with minor exceptions, I'll adhere:

> *"**the alpine belt**—the treeless alpine tundra, sometimes divided into low, alpine, and high alpine belts, of which the last may correspond to what is called the nival belt, which hardly supports any vegetation but lichens.*
>
> *"**The subalpine belt**—the forest-tundra ecotone, dwarfed tree growth and subalpine meadows.*
>
> ***The montane belt**—the forest belt, often subdivided in Europe into the submontane, middle montane, and upper montane with, respectively, deciduous forest, mixed forest, and dense coniferous forest: it supports silviculture; for North American conditions this European subdivision seems hardly adequate, and may need more special consideration and definitions, especially in the western areas."*

Applying the European definition of montane would give us only upper montane in southeast Alaska, beginning at sea level! I reserve montane for the high forests mountain hemlock. This usage is consistent with that of Fonda & Bliss (1969) for the Olympic Mtns. It seems misleading to call lowland forests montane, even if coniferous, and I will use Heusser's (1960) classification "*Pacific Coastal Forest*" for the lower western hemlock-dominated belt. [2]

The transition to mountain hemlock takes place at about 1,500 ft. Heusser called this high belt "*subalpine forest,*" but if we accept the European definition of subalpine as a forest-tundra "ecotone", then Heusser's next higher belt—the alpine-subalpine ecotone—would be an ecotone to an ecotone (*fig-1*) Löve's system is less complicated. An ecotone is an interfingering of elements from bordering communities, and except for occasional *Cassiope spp*. etc, there are few tundra species in the understory of closed mountain hemlock stands. I therefore feel justified in departing from the classification of Brooke *et al* (1970), who, like Heusser (1960) include a "Forest subzone" within their "Subalpine mountain hemlock zone."

In addition to altitudinal belts, let's define those boundaries—however elusive—that constitute their upper and lower limits. Wardle (in Ives & Barry 1974) defined treelimit as the upper limit of trees, krummholz and shrubs over 2 meters tall. Where treelimit is fairly stabilized, this line serves to separate the alpine belt from the subalpine belt. Forest limit is defined as the upper limit of closed forest (trees growing close together are a forest).

This line separates subalpine from montane belts. It often can't be distinguished clearly as one climbs; boggy openings or fern-hellebore glades within otherwise-closed forest shift imperceptibly into islands of krummholz in otherwise-open meadow. To further confuse us, lines and belts are being released from a recent suppression, brought on by the Little Ice Age that culminated in the mid 1700s. This has caused variations in sequence and width of belts, some of which are guessed at in following pages.

Sequence & elevation of belts

John Thilenius first drew my attention to the relative scarcity of genuinely alpine vegetation in southeast Alaska. He feels that we should resist the temptation to label everything above forest limit—even treelimit—as alpine, since, with increasing elevation, forests and alder thickets and krummholz parkland are usually replaced by lush waist-high meadows. This belt of succulent herbs often extends over the summits of moderately high mountains. *Figure 1,* next page, shows alternate sequences, labelled 1) through 4):

1) The montane belt can end sharply, followed by a subalpine alder belt, which in turn is replaced by a lush subalpine meadow belt (Heusser's "*low shrubs and cover*"), continuing sometimes to 3,500 ft.

2) Forest limit can coincide with treelimit, montane belt shifts abruptly to lush meadow.

3) The montane belt can blend gradually into krummholz parkland, making forest limit impossible to draw with precision. These parklands can end at treelimit, replaced by lush subalpine meadow, or . . .

4) the upper limit of krummholz parkland (treelimit) can coincide with the upper limit of subalpine meadows, shifting into alpine tundra.

The upper limits of tree growth—both altitudinally and latitudinally—are thought to correspond to the 10°C mean daily isotherm for the warmest month of the year. This hieght is usually only reached in ideal conditions on convex topography (Wardle, in Ives & Barry 1974) and many other factors—slope, aspect, wind, soil water regime, snow accumulation, etc—can depress treelimits below the potential 10°C isotherm. Löve (1970) noted that the subalpine belt is lowered in maritime climates.

This can't be due to summer conditions, though probably our high percentage of days with fog and overcast lowers the 10°C isotherm relative to more continental ranges of equivalent latitude. Treelimits in the northwest coastal ranges are simply not reaching those elevations at which one would expect summer

1 "*Belts*" are used by Löve to describe altitudinally distinct bands of vegetation, while "*zones*" describe latitudinal changes. Many authors cited herein use the terms interchangeably, but I will follow Löve's usage.

2 PS 2009: For my chapter on *Habitats* in Audubon/TNC conservation assessment, Alaback & Schoen asked me to dump "*montane*" and replace with "*subalpine forest*" This is a simpler system and works okay if you don't obsess over '*ecotones to ecotones*.'

reproductive functions to be impaired. Isolated conifers keep showing up hundreds of feet above apparent "treelimits" to prove this. Heusser (1960) found a Sitka spruce at 3,900 ft. on south facing slopes above upper Taku glacier. Calder & Taylor (1968) had similar experiences in the high ranges of the Haida Gwaii:

> *"Few areas in the mountains can truly be said to be above the treeline, as stunted trees are found near the summit on all mountains" (to 4,000 ft.)*

Seed reproduction at tree limit in coastal ranges may be another indication that the 10°C summer isotherm has not been reached. Krummholz is considered non-reproductive, relying on lower montane forests to produce the necessary seed. Dwarfed krummholz apparently has no reserves to spare after meeting annual requirements for respiration and some miniscule wood production (Wardle, in Ives & Barry 1974; Zwinger & Willard 1972).

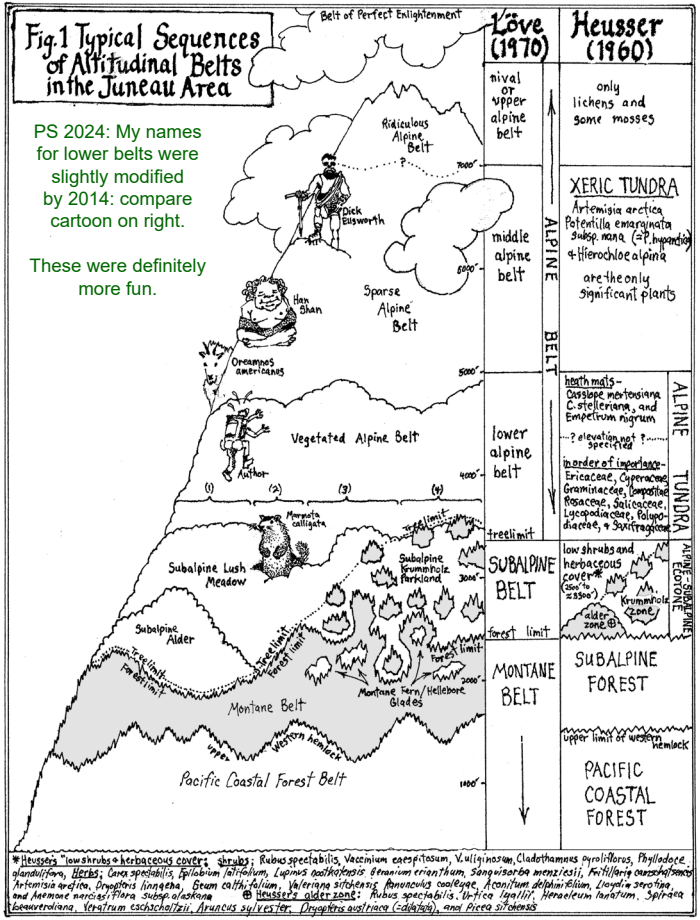
Yet in a subalpine study of southern coastal British Columbia, Brooke *et al* (1970) found seeds of mountain hemlock and pacific silver fir germinating on snow at treelimit. And the highest mountain hemlock I found above Dorothy lake, south of Taku Inlet, at about 3,500 ft. was studded with cones, containing normal looking seed.

Probably the major influence on treelimit in maritime ranges is snow accumulation. Our snowpack is heavy and wet compared to that of continental mountains, and thus more resistant to removal or drift-deposition by wind. Brooke *et al* (1970) found that

> *"wind does not appear to contribute much to development of deep snowbanks and thin snow-covered areas at subalpine elevations as it does in many other areas."*

This effect may be due not only to more sedentary snow, but lower actual wind speeds. Kuramoto and Bliss (1970), studying Olympics subalpine, found wind velocities surprisingly low in all communities. [3]

3 Supported by Wardle's observation in Ives (1974) that flagged or wind-trained krummholz is scarce in coastal ranges where cushion krummholz prevails.



Mountain belts from 3rd edition of Nature of Southeast Alaska (2014). This followed modifications suggested by Alaback in 2007.

Perhaps in colder and windier inland ranges, drifting powdery snows accentuate microclimatic differences between hummock & depression, or windward & lee slopes, while in

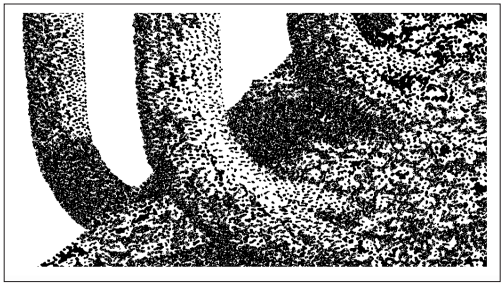


Fig 2 Basal *snowcrook* in mountain hemlock begins when flexible saplings respond to *snowcreep*.

maritime ranges the distinctiveness of microhabitat is somewhat blurred by universality of snowpack. In some situations snow cover encourages conifers, as for example where highest outliers of cushion krummholz are protected from dessication in winter. These treelimit hemlocks typically occupy fairly level ridgetops and buttresses; sites that melt free earlier in summer than their surroundings.

Longer growing seasons on these microsites are important, but summer conditions are probably not limiting for trees in coastal ranges. More significantly, the steeper terrain surrounding these ridgetops is subjected to "*snowcreep*"—downslope movement of heavy spring snowpack that has been measured at rates of up to 5 inches per week (Brooke *et al* 1970). Mild levels of snowcreep cause breakage of less flexible species of treelimit conifers such as pacific silver fir in south coastal BC. But mountain hemlock and yellow-cedar—the most resiliant coastal species—respond by developing basal snowcrook that persists into maturity (*fig-2*) Severe levels of snowcreep eliminate conifers and even woody stemmed shrubs altogether, leaving the slope to succulent forbs and grasses whose above ground shoots compliantly die back every autumn.

Another explanation for variability in sequence and elevation of altitudinal belts—and not a contradictory one—is that some belts are climbing in response to recent lifting of the snowline. Although occasional references are made to late Neoglacial influences on treelimits in western North America (Wardle in Ives & Barry, 1974; Löve, 1970), most research on vegetational succession following the late Neoglacial maximum has been confined to dateable moraines in lowland periglacial sites. Little attention has been paid to analogous community development in alpine and subalpine belts.

In the Juneau area, Heusser (1960) suggested the alder belt was undergoing

> *"succession on slopes formerly covered by snow so late in the growing season that plant invasion could not take place. Mountain hemlock once grew at higher elevations than at present, but was killed as the snowline became lower, accompanied by destructive avalanching. [*Limbs of alder on these sites grow downslope*] owing to wieght of heavy snow, and to the fact that snow is on the ground during the early and latter part of the growth season".*

So these stands of Sitka alder in the subalpine belt may be playing much the same role as in recently deglaciated valleys at sea level; forming the advance wave of reforestation. Heusser (1960, p46) describes two types of transition from forest to tundra; an alder transition—equivalent to my sequence-1 in *fig-1*—and a more classic krummholz transition—equivalent to sequence-4. Evidence that the alder belt is successional is found in the nature of forest limit from which it arises; closed stands of ancient mountain hemlocks terminate abruptly along lower edges in a sort of 'trimline.' That krummholz parklands were comparatively unaffected by the Little Ice Age is indicated by equally ancient (though dwarfed) mountain hemlocks, proceeding doggedly upward right into alpine tundra.

A seral interpretation for subalpine alder stands is not universally accepted; Mitchell (in Trappe *et al* 1968) characterized sitka alder in the subalpine of south central Alaska as "*more enduring*" than in lowland periglacial and riparian sites. But I find Heusser's assessment more logical. Alder shouldn't be expected to transcend its role as short-lived colonizer, if, as pointed out by Lawrence (1979)

> *"it seems unable to establish seedlings beneath its own canopy ... this fact has not been adequately emphasized in the literature."*

The subalpine zone of Brooke *et al* (1970)—which includes the montane belt as defined herein—is marked by decreasing winter snow depths at *both* upper *and* lower limits. In the Pacific coastal forest below, this means western hemlock can dominate. In the alpine above, with the exception of benches, cornice lips, and snowslide accumulation areas, decreased snow depth exposes plants to dessication, and the lush subalpine growth is replaced by hardier heaths and grasses.

This peaking of snow depth in montane and subalpine belts of Pacific coastal ranges underscores the extreme importance of influences such as snowcreep on the mosaic of plant communities. It should also alert us to possible shifts in sequence and elevation of belts caused by climatic changes. Even minor fluctuations in temperature will change the altitude of greatest snow accumulation. Franklin (1966) for example, noted tree invasion of subalpine meadows on Mount Rainier between 1917 & 1935, attributed to a warm dry period. Cooling after 1940 ended this invasion.

Following a major cold period like the late Neoglacial, we should expect more drastic alterations in our altitudinal belts, and nature of boundaries between them. Probably the tidiest illustration of this is to be found in subalpine bowls at 1,800 to 2,200 ft, on slopes facing the sea. Lawrence (1950 & 1958) described an immature vegetation on the floors of these bowls that only recently were released from occupation by perennial snowfields. Ancient hemlocks predating the late Neoglacial advance extend high above the basins on ridges that remained snowfree. This phenomenon is discussed more fully below in *Ridges & prominences*.

Recent release of vegetation from more severe conditions, as well as more persisting influences such as snowcreep, make it hard for me to accept treelimit as the immutable threshold of alpine. I prefer Thilenius' impression that we are not in alpine

until we've left such succulent stuff as *Veratrum eschscholtzii, Valeriana sitchensis* and *Senecio triangularis* behind. Alpine in Southeast Alaska is not simply any "*land above the trees*." [4]

Habitats

In the mountains of Southeast Alaska, the major abiotic influence on vegetation is probably winter snow cover; its depth, character, stability, and duration. Deposition and removal of snow varies with altitude, and this variation may help to explain the recognizable sequence of belts encountered as we climb. But topographical features interact with elevation, producing strong contrasts even at microscale in snow cover, soil moisture, wind exposure, insolation, exposure to herbivory, etc. *within* belts.

Following is a tentative identification of some of our important mountain habitats, and a discussion of some characteristic species of each. These will differ according

4 **2024**: This conclusion to my *Introduction* saluted Ann Zwinger's (1970) *Land above the trees*: *A guide to American alpine tundra*. In those days her self-illustrated book was the best non-technical review of high-country habitats across the continent.

Table 1 Characteristic plant species in each niche shift with elevation.

*Habitat**	*Alpine belt*	*Subalpine belt*
rock crevice	Lecidea sp.*, Saxifraga ferruginea, Potentilla hyparctica, * Rita later changed to Huilia flavocaerulescens	Heuchera glabra, Cladothamnus pyroliflorus, Sedum roseq
boulderfield	Rhizocarpon geographicum, Luetkea pectinata	Dryopteris dilatata, Cassiope mertensiana, Vaccinium caespitosum
talus	Umbilicaria spp. Thamnolia vermicularis	Cryptogramma crispa, Luetkea pectinata.
solifluction slope	Solorina crocea, Marsupella sp?, Saxifraga lyallii, Ranunculus nivalis	Luetkea pectinata, masses.
ridges & prominences	Cassiope stelleriana, Vaccinium uliginosum, Loiseleuria procumbens, Artemisia arctica	Cassiope mertensiana, Vaccinium caespitosum, Phyllodoce aleutica, Tsuga mertensiana
frost hummock	Cladina rangiferina, C. stellaria, Carex macrochaeta, Hierochloe alpina,	no occurance
snowbed	Salix arctica, Polytrichum juniperum, Carex nigricans.	Fauria crista-galli, Ranunculus cooleyae, Veratrum eschscholtzii
stream edge	Philonotus fontana, Carex spp.	Leptarrhena pyrolifolia Pefasites hyperboreus Caltha leptosepala
bog	no occurance	Sphagnum spp. Eriophorum angustifolium
meadow	no occurance	Anemone narcissiflora, Valeriana silchensis, Senecio triangularis, Geum calthifolium, Geranium erianthum
krummholz	no occurance	Tsuga mertensiana, Rubus pedatus, Cornus suecica

* ranked roughly in order from least to most mature

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No camp stove, and we didn't expect firewood on top. At the time, I wasn't aware of the cultural significance of Wa'as'e, *giant's name* (peak 4,485), victor in battle over T'aakú, decapitator of Lkoodaséits'k, neighbor mountain to the north (Nyman & Leer, 1993).

José Azel, *Géo Magazine*

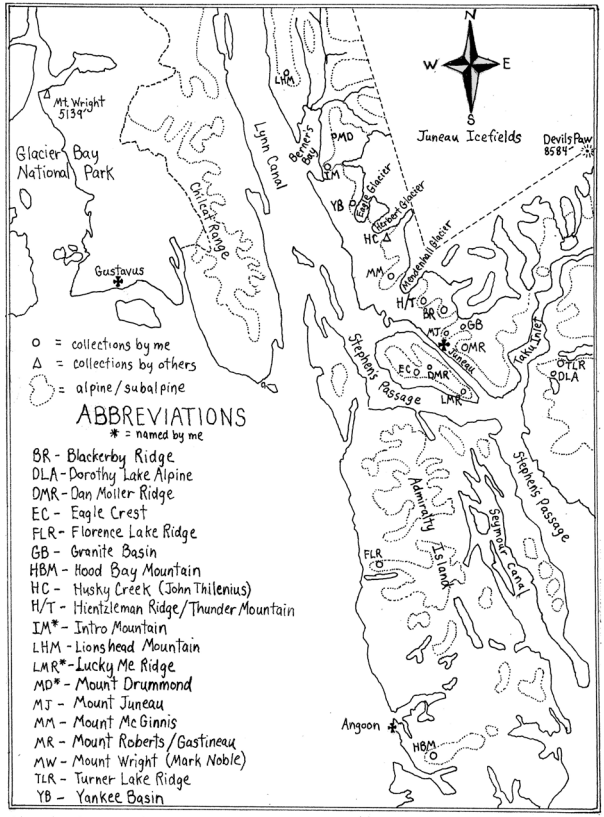


Fig 3 Distribution of Alpine/Subalpine in Northern Southeast Alaska

to altitudinal belt; so that alpine snowbed habitat, for example, supports a different plant community from a subalpine one. I'm not proposing veg-associations here, *á la* Brooke *et al* (1970). These are simply impressions based on 6 years of casual scrambling and on review of available literature (scanty!) concerning mountain environments of the North Pacific coast. Collections by Rita O'Clair, John Thilenius, Ray Gellote, Wayne Robucks, and Mark Noble have added to my species lists (*Appendix 1*). The map (*fig-3*) shows most alpine and subalpine areas visited, some of which are mentioned in following habitat descriptions. Additional collections were made on White Pass above Skagway, on Chilcat Pass above Haines, and on southern Baranof Island.

Rock crevice

Extensive areas of this habitat are available to plants and animals on many of our spectacular alpine cliff faces. These nooks and crannies are more familiar to mountaineers than botanists, however, who prefer to have their hands free. Most of us are better aquainted with humbler manifestations; outcroppings of bedrock or erratics—microhabitat really—scattered throughout other more uniform communities.

In the alpine only *Umbilicaria spp* and crustose lichens survive. In the friendlier subalpine, several vascular species take root in cracks; particularly members of the Saxifrage family. Abundant rainfall and absence of prolonged summer dry spells allows mosses to colonize bare rock surfaces.

Mountain goats have localized but significant impacts on south- to southwest-facing subalpine microhabitats because they are the first places to green-up in spring. Steep outcrops cocked into the day's warmest sun can melt free while slopes far below are still caked in snow. Mountaineer Dick Ellsworth reports a possible **raven** rookery on the cliffs of Mt. Stroller White above Áak'w Sít'i (Mendenhall Glacier). [5] And the **gray crowned rosy finch**—though never common in the alpine of Southeast Alaska—usually nests in this cliff habitat.

Boulderfield

Although colluvial in origin, this refers to stabilized boulders, as opposed to still-unraveling talus. In the subalpine, boulderfields can be difficult to detect at a distance due to luxuriance of plant cover. At about 2,800 ft. on a gentle slope above Dorothy Lake, we traversed a field of refrigerator-sized rocks, so completely vegetated with willows and blueberries that it was nearly indistinguishable from surrounding meadows with deeper soil developement; that is until one was actually clambering about in it.

From above however, we noticed that the boulderfield was betrayed by abundance of wood fern (*Dryopteris dilatata*) whose fronds showed pale yellow-green against darker shrubs and herbs. There is no graceful way for a biped to walk through a subalpine boulderfield.

In the alpine, tops of boulders are more often unvegetated except for lichens. Even at their bases, vascular plants may be discouraged by absence of soil. Last diehards are usually moss campion (*Silene acaulis*), bittercress (*Cardamine bellidiflora*), coast saxifrage (*Saxifraga ferruginia*), alpine azalea (*Loiseleuria procumbens*), and dwarf sedges such as *Carex concinna*. Subalpine boulderfields are favored habitats of the **hoary marmot**, often found in colonies there.

Marmots are salad eaters, and would also occupy meadow, snowbed, and stream edge habitats, except that, when full, they can be run down even by a fit human being, and are thus limited to immediate proximity of burrow entries. Their burrows in some area are limited to habitats containing rocks too large for a **brown bear** to move. Although grizzlies do dig for marmots

5 PS 2009: More likely just a roost. No SE AK **raven** nests I subsequently found or heard of were communal. They do, however, roost together in large numbers. Fascinating that Cosmos saw this in such a remote and spectacular location.

elsewhere, I've never seen evidence of marmot-digging by brown bears in the subalpine of southeast Alaska; I can only assume that marmots and bears worked this out for themselves long before my arrival, with marmots ending up in relatively bear-proof habitats.

I *have* noticed, however, that marmots in areas frequented by brownies—such as Lionshead Mountain and other summits above Da̲x̲anáak, *between 2 points* (Berners Bay)—do not achieve high numbers. Their small colonies are restricted to outcroppings and boulderfields. By contrast, in places where brown bears are infrequent, such as Blackerby Ridge and Tlei̲x̲satanjín, *hand at rest* (Heintzleman)/Thunder Mtn, marmots proliferate, their colonies expanding into apparently unprotected (though well-drained) meadows. **Black bears**, common on Blackerby and Thunder, are apparently less fond than brownies of boulder-rolling.

Talus

The broad class of colluvial landforms—material moved downhill by gravity—can subdivided by decreasing particle size: boulderfields, talus and scree. Talus has loose rock; fist-size and larger. In the maritime ranges, small rocks are uncommon in talus, and scree (loose gravel) is almost non-existant(except in solifluction barrens, described next). In contrast, sparsely vegetated scree and very loose talus is a common habitat wherever I've wandered in the Sierra, the White Mountains of Nevada, the Rockies from the Gila to Jasper, the volcanic peaks of Oregon and Washington, and even the North Cascades—which in most other respects closely resemble Southeast Alaskan alpine/subalpine. Calder & Taylor (1968), in the Haida Gwaii ranges, found talus almost exclusively of large boulders:

> *"The type of bedrock and the humid climate have not been conducive to formation of extensive talus slopes of finely weathered material."*

In Southeast Alaska, as in all of the drier aforementioned ranges, we have a considerable variety of bedrock types, so maritime climate is probably the more important of C&T's two factors. If this is true, then we should expect more weathering in alpine than subalpine, since the former, with shallower snow and greater temp-swings, is more exposed to freeze-thaw cycles.

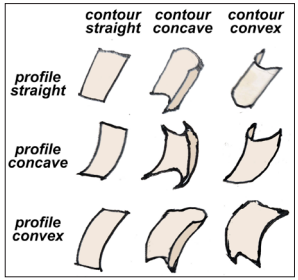
This does seem to be the case. Loose alpine rubble is unsuitable for slow-growing crustose lichens, but may support worm lichen (*Thamnolia vermicularis*) and mosses. In the subalpine, a few vasculars such as the insatiable partridgefoot (*Luetkea pectinata*) rapidly move onto the shifting debris, and probably accomplish stabilization (followed by soil building, and invasion by meadow species) faster than in continental ranges.

Size of rocks is important in suitablity of alpine and subalpine habitats to small mammals. (Hoffmann, in Ives & Barry 1974) Boulders are **marmot** habitat, while smaller sized talus is used by **pikas** & **golden-mantled ground squirrels**, and finer rocks and scree by assorted **voles, deer mice,** and **shrews**. Pikas and ground squirrels are absent from Lingít Aaní. There are probably more important factors involved than interstitial space characteristics (*Mammals* below); rodent fauna of our alpine & subalpine belts can only be as rich as source-pops in adjacent lowlands. But if mammal studies in the Beartooths are representative, we should expect to find strong habitat fidelty linked to rock size.

Solifluction barrens

This is heavily eroded and largely unvegetated terrain, often saturated due to late snow-lie, and unprotected from hard rains in summer. Soil and rocks move slowly downslope, aided by needle ice in season. Typical of northern aspects, subject to cold air drainage. Nice place for an insectivore to visit but you wouldn't want to live there. Brooke *et al* (1970) named this the Saxifragetum tolmiei, where it occurs in the subalpine of south coastal BC.

I've botanized little here, but don't think *Saxifraga tolmiei* is significant locally. In the alpine, solifluction slopes fall away on north sides of ridges and summits. In one such area on Tsaagwáa Shaanák'u, *T's old woman* (Hood Bay Mtn) I collected *Saxifraga lyalli* only 2" high, *Ranunculus nivalis* (?), a tiny unidentified *Salix*, and *Tofieldia coccinea*. As with talus, this habitat is more common and resistant to colonization in alpine than subalpine.



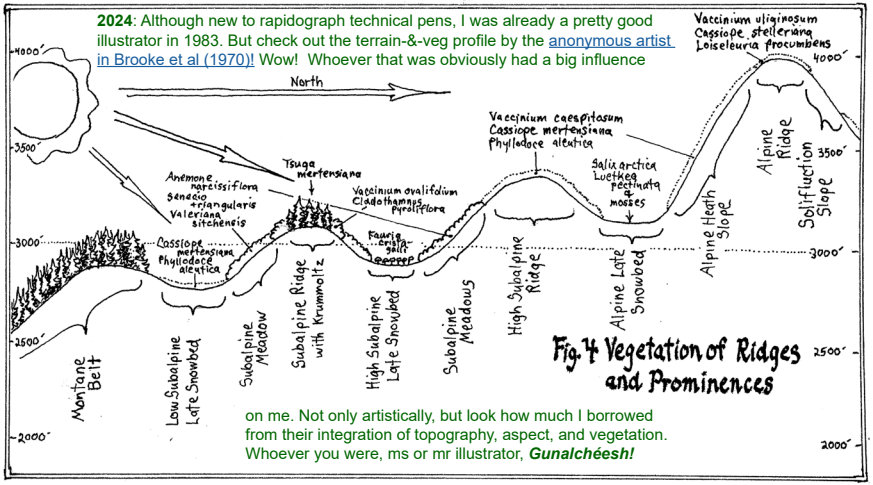
Brooke *et al* (1970) thoroughly pegged down their erudite '*etum*' & '*alia*' micro-associations by assigning them to one or more of 3 profile types—straight, concave or convex—and the same for contour types, yeilding 9 permutations. ● **2024**: I somewhat randomly scribbled these 9 types in the margins of my obsessively annotated copy. Just now, realized they're more 'eye-friendly' when arranged into this grid. Now it's more clear what straight contours or concave profiles have in common.

Ridges & prominences

Influence of topography on vegetation is unmistakeable on broken and undulating terrain. Convex microsites, with better drainage and shallower, earlier melting snow than adjacent concave snowbed habitats, support distinctly different plant communities, often arranged in successive bands of contrasting color and texture, especially in fall as leaves begin to turn.

Figure 4 on next page is not based on any quantitative study, but illustrates a gradual shift in habitat preference of the heathers *Cassiope spp*. and *Phyllodoce aleutica*, from late snowbed terrain in the subalpine, to ridgetops in the alpine. Heather dominated communities cover well over 50% of the upper subalpine and lower alpine belts. I had associated heather communities with ridges and assumed that drainage factors were involved, until reading in Brooke *et al* (1970) that, while heath occupied ridges at upper limits of their subalpine study, it was found in concave topography in the lower "*parkland subzone*" often tolerating temporary seepage.

That heath occupies either ridges or basins, depending on elevation, suggests that duration of snow-lie is more important than soil moisture regime. Heath is "*chinophilous*," or snow



loving, [1] and is probably released from the parkland snowbeds about the same time as higher ridges are melting clear.

On high alpine ridges, thin winter snow cover and resulting dessication favors the smaller ground-hugging ericaceous species. *Vaccinium uliginosum* goes higher than *V. caespitosum*, and *Cassiope stelleriana* outclimbs *C. mertensiana*, which tends to shade it out in less exposed sites. Xeric ridges have drought-tolerant species such as *Hierochloe alpina* and *Artemisia arctica*.

In the subalpine, ridges and buttresses support the highest krummholz. In addition to factors of drainage, and freedom from snowcreep already mentioned, the restriction of krummholz to such locations may reflect Little Ice Age snow conditions. Although most of our subalpine bowls are too small and too low in elevation to have been glaciated during this brief episode, they developed snowfields that buried forests that undoubtedly had clothed their floors:

> *"Higher on slopes facing the sea, and completely isolated from present glacier systems, are saucer shaped basins, until a few decades ago perennially filled with snow. More recently, reduced snowdfall and extended summer growing conditions have allowed meadow vegetation and then shrubs, and now a few trees to grow, their youthfulness mute testimony to this climatic change. Above a sharp line on the walls of these basins are gnarled elfin forests that have stood over the drifted snows for many centuries." (Lawrence 1958)*

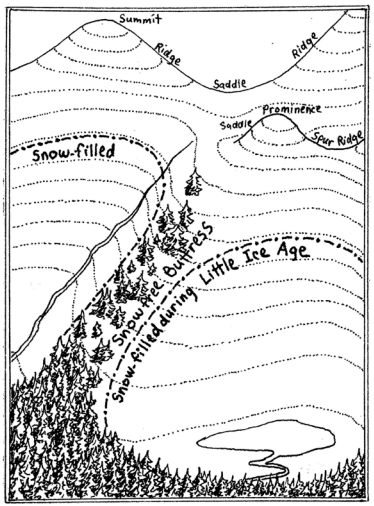
Any krummholz of reasonable size at treelimit probably predates the last glacial maximum (approximately 1760 AD).

> *"Mountain hemlock may reach a hieght of only 4 feet at 100 years at high elevations in the parkland subzone." (Brooke et al 1970)*

I've seen what Neoglacial thought were clear examples of Lawrence's release in Yankee Basin, and in a cirque at 2,200 above Berner's Bay. Ridges are the natural through-routes for all large mammals who use the alpine and subalpine belts. In Southeast Alaska this includes **Sitka deer, mountain goats, brown and black bears, wolves, wolverines,** and less commonly, **coyotes,** and **lynx**. This habitat is also a preferred bedding area for both predators and herbivores, affording views of approaching animals, and often their scent, carried upward on thermals. Winds on ridgetops in summer can also discourage **mosquitos**.

Before leaving ridges and prominences, let's consider **fellfields**, since if they occur at all in Southeast Alaska, it'd be on such sites. Fellfields are extremely dessicated habitats—often blown clear in mid winter—characterized by bare rock and cushion plants. Our wet snowpack is not so easily removed by wind as the powder snow of continental ranges where fellfields are important habitat.

Summer conditions are also significant; high insolation and rapid evaporation keep fellfields dry during the growing season. It's therefore not surprizing that the classic fellfield plant—moss campion (*Silene acaulis*)—is meagerly



1 **2024**: Conversations with plant ecologist John Thilenius made me skeptical of the '*phile*' suffice as regards habitat preferences. For example John insisted that in tidal salt marshes, "*halophyte ≠ halophile*." Salt tolerant plants don't "love" salt, but gravitate to those areas where less competition from intolerant species is encountered. Similarly, I doubt that supposedly chionophilous snowbed species actually "love" being buried all but 2 or 3 months of the year. They endure it because nobody else there grows tall or thick enough to shade them out.

Several terminology errors in this caption don't bear correcting. But clearly no ecologist was consulted. **Fig 6 Frost Hummocks** (Alaska Magazine Photo)

distributed in Southeast. Moss campion supposedly can only be pollinated by butterflies. (Zwinger & Willard 1972) And Lepidopterans—lovers of sunlight—have a hard time here. So where you see moss campion you probably have **1)** gale force winter winds, and **2)** sunny exposures attracting homesick migrants. (Colorado has 250 species of butterflies!)

Frost hummocks

This habitat is scarcely more common than fellfields in Southeast Alaska, which makes sense considering what we think we know about their formation. [1] Frost hummocks, like fellfields, are found on wind-exposed sites. They usually occur only where the wind-leveled snow surface lies right at the tops of the hummocks; resultant dessication promoting development of needle ice.

But opinions on hummock formation differ. Zwinger & Willard (1972) claim they overlie permafrost. This is confirmed by that unquestioned authority on tundra ecology; *Alaska Magazine* (*fig-6*). John Thilenius disagrees; he says frost hummocks are surface phenomena, and can occur in the absence of permafrost (*pers. comm.*)

Be that as it may, frost hummocks require at least a few feet of soil build-up. There's often that much relief between troughs and mounds. Such depth of soil is unusual above treelimit. I've only seen frost hummocks on tops of broad table mountains on Xutsnoowú (Admiralty Is) and on Thunder Mountain above Áak'w Táak (M-word Valley). [2] In each case they occupied plateaus at 3,000 ft; the level site is probably essential for soil build-up (primarily sedge peat?) and the elevation is equally critical. Any lower and snow's too wet to blow clear. Any higher and plant productivity's too slow to create sufficient soil, not to mention that 4,000-ft. table mountains are rather scarce here.

Snowbed

This is concave topography; flip side of ridges and prominences. Vegetation depends less on elevation than on how late snow persists, and on drainage conditions during short growng seasons. Brooke *et al* (1970) described a "*Caricetum nigricantis*" association for this habitat in south coastal BC, with snow cover lasting 9 months or more, cold, usually water-saturated root environment, and soils stratified by sediments accumulated on snow and washed in from snow melt and erosion on adjacent slopes. Even in August, days with frost were frequent, while in bordering heath associations frost was uncommon.

In smaller nivation depressions, concentric rings of vegetation, as described by Zwinger & Willard (1972), are noticeable, albeit communities differ here. In fact two of their "*snow-bed indicators*" are nearly ubiquitous here. I've found *Sibbaldia procumbens* at Asx̱'ée (Eagle River delta), 27 ft above sea level, and *Solorina crocea*—though a pioneer soil builder—is also characteristic of solifuction habitats. Our concentric ring sequence is much as characterized below for alpine stream edge communities.

Vegetative reproduction is usually necessary, and this probably accentuates the distinctiveness of concentric rings. Below snowbeds are flush habitats in which *Veratrum eschscholtzii, Ranunculus cooleyae,* and *Caltha leptosepala* are often found.

To me, subalpine basins mean deer cabbage (*Fauria crista-galli*). Maybe this is because I spend so much time looking for **deer**, who are looking for *Fauria*. But the association of *Fauria* with bowls and depressions is strong, especially on Xutsnoowú. *Fauria crista-galli* is one of very few vasculars endemic to this region. Our alpine/subalpine flora tends to be a compromise; an overlapping of the southern extensions of arctic species with the northern limits of Pacific Cordilleran elements. If any local species deserves an autoecologic study it is *Fauria crista-galli.* My hypothesis concerning relationship of deer to *Fauria* is offered below in the description of *Animal-maintained habitat.*

Snowbeds are important feeding habitat for several alpine birds. **Water pipits** forage on the snow surface for numbed insects. **Gray-crowned rosy finches** patrol margins of snowbanks for seeds. **Rock ptarmigan** also follow this edge as it receeds, selecting from a wider variety of foods, including fresh leaves of forbs and dwarf shrubs. The meeting of gray rocks and brilliant snow camouflages them in the transition between summer and winter plumages.

Mammalian grazers as well as ptarmigan are attracted to edges of receeding snowbeds, especially in late summer, when tenderest and most nutritious greens are concentrated there.

1 **2024**: Actually, even 41 years later, we really don't know jack. The 2010-13 survey team uses the term '**patterned ground**,' which is less commital as to mechanisms.

2 **2024**: I've subsequently found frost hummocks just above the reflector on Shaa Tlaax̱, *moldy top* (Mt Juneau). Image behind table of contents in our 2024 *Alpine inventory maps* was taken there.

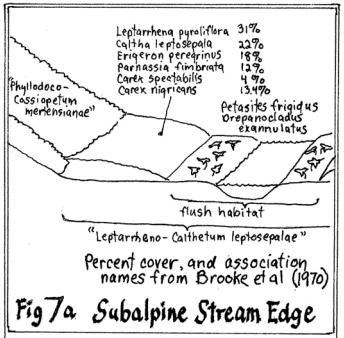


Fig 7a Subalpine Stream Edge

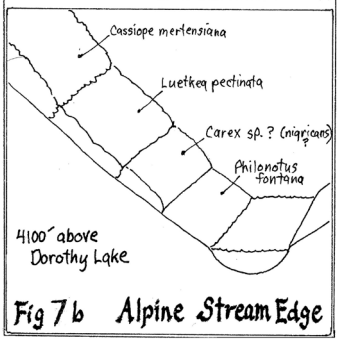


Fig 7b Alpine Stream Edge

Stream edge

As with snowbed and bog habitats, stream edges have cold water at or near the surface throughout the growing season. However, water here is moving, causing snow to melt earlier than in adjacent, typically heath, communities. At subalpine elevations this may promote a lush, species-rich forb community, best developed on broad peripheral flats. Brooke *et al* (1970) called it the Leptarrheno-Calthetum leptosepalae.

Soil pH was the least acidic of associations they studied (5.4 to 7.2). Included in this association were "*flushes*";

> *"strongly irrigated habitats where water flow may prevent developement of a closed vegetation cover."*

Species most tolerant of flushes (though of low % cover in the association as a whole) were *Petasites frigidus, Salix commutata , Parnassia fimbriata,* and *Ranunculus eschscholtzii*.

Where surfaces had risen slightly from organic accumulations, *Leptarrhena pyrolifolia* (31% cover), *Caltha leptosepala* (22%) and *Erigeron peregrinus* (18%) dominated. This closely resembles the subalpine stream edge vegetation of Calder & Taylor (1968) in the Haida Gwaii, and my observations in Lingít Aaní.

Shrub willows are restricted to stream margins in the subalpine This is the nesting for **golden-crowned sparrows**. I rarely hear them singing elsewhere. At about 4,100 ft. above Dorothy Lake I found distinct zonation along margins of a small creek. Alpine drainages are generally V-bottomed, without peripheral flats, so its unusual for snow to melt earlier there than in surrounding habitats, as in the subalpine. True alpine streams may still be bridged with snow in August at high elevations.

Bog

True sphagnum bogs are non-existant in the alpine, and uncommon in the subalpine. Their best development is in small openings within highest reaches of otherwise-closed montane forest. Naturally, they are most frequent where forest limit occurs on gently sloping terrain, but for some reason that's a fairly unusual combination in Áak'w & T'aaḵú Aaní.

I found bogs at 2,000 feet on a broad ridge below Lionshead Mountain, occupying slight depressions surrounded by hemlock forest. [1] Southern Sayeik, *spirit-helper* (Douglas Is) also has good examples. The ideal place to look would be a large, flat, 2,200 ft table mountain, but who wants to climb 2,200 ft. and never break out of the forest?

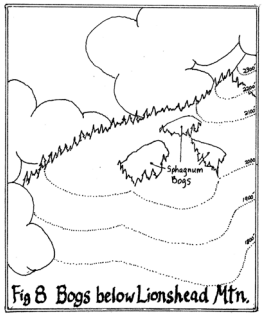


Fig 8 Bogs below Lionshead Mtn.

Brooke *et al* (1970) report an Eriophoro-Sphagnetum association for this habitat. Drainage is impeded, decomposition is slow, and peat accumulates in bench-like lobes. Water table is at or near the surface. Roots are poorly aeriated, pH averages 4.9. Initial stages have *Carex aquatilis* and *Drepanocladus aduncus*. Succession usually leads to *Eriophorum angustifolium*, and *Sphagnum spp*.

Meadow

Waist high, forb-dominated vegetation covers many slopes in the subalpine belts of Southeast Alaska. *Anemone narcissiflora, Geum calthifolium, sitchensis, Senecio triangularis, Geranium erianthum, Valeriana* and *Dryopteris dilatata* are common, along with many other species. The meadow is rich and variable, quite productive given short growing season. Luxuriant meadows on well drained soils are puzzling. Why no trees or shrubs? The 10°C isotherm seems unlikely.

Two answers have been suggested already; snowcreep, and recent release from colder conditions of the Little Ice Age. These influences are hard to separate. Many subalpine species are common in coastal meadows as well; *Lupinus nootatensis, Epilobium angustifolium Castillejia unalaschensis, Fritillaria camschatcensis, Heracleum lanatum*, and even some of the 'understory' plants like *Trientalis europaea,* and *Rubus arcticus.*

I consider this further support for an 'early sere' interpretation of subalpine meadows. Such lowland meadow species are typical of recently uplifted beach ridges that are rapidly being colonized by spruce, and of disturbed sites like road and river margins, and avalanche fans where trees could grow but are discouraged by periodic decapitation and uprooting.

Subalpine meadows are important to Southeast wildlife that we may not think of as high-country species. Wherever possible, **deer** spend summers fattening there. **Bears** sometimes slide downhill on their bellies raking food into their mouths as they go. **Blue grouse** hens explode underfoot, usually clucking warnings to hunkered broods.[2] **Insects** abound, as in any lush meadow with rapid photosynthesis and floral extravagance. Two ground-nesting passerines from our

1 **2024**: LiDAR has since convinced me those bogs are usually *domed*, not depressed, relative to surrounding forested wetland.

2 **2024**: 'Hooters' have since been split. Our coastal *Dendragapus fuliginosus* is now called the **sooty grouse**.

coastal wetlands are commonly seen nesting in subalpine meadows; the **Lincoln's** and **savannah sparrows**. Not as restricted as the **golden-crowned** to brushy areas, they are sometimes found higher on the slopes.

Krummholz or elfinwood [3]

Both the vascular plants and mosses beneath tight krummholz canopies are more representative of forest than subalpine flora. *Rubus pedatus* reaches its highest elevations in the krummholz understory as do *Cornus suecica, Streptopus amplexifolius,* and *Rhytidiadelphus spp*. Krummholz is probably more valuable as cover to the rich subalpine fauna than for its primary productivity. The krummholz parklands, with interspersed copses, blueberry brush margins, and subalpine meadow, have perhaps the greatest wildlife concentrations of any terrestrial habitat in Southeast Alaska.

Long winters and great snow depths are challenging to the treelimit flora and *resident* mammalian fauna. But the fairweather visitors face no such hardships, so we find reverberating densities of birds normally associated with Pacific coastal forest and montane belts nesting in dwarf hemlocks and shrublands. To judge from bird song, breeding populations of some of our "lowland" **thrushes**, **warblers**, and **sparrows** may actually peak there. *Appendix 2* names some of these. [4]

Another indicator of avian richness is the bird-eating **goshawk**—considered an uncommon and secretive woodland hunter in Southeast Alaska—but which soon becomes a familiar sight to any frequenter of forest limit. The attraction no doubt is the gourmet blend of adolescent **hooters** and fledgling **songbirds**. Goshawk is the trophic kingpin of the subalpine. [5]

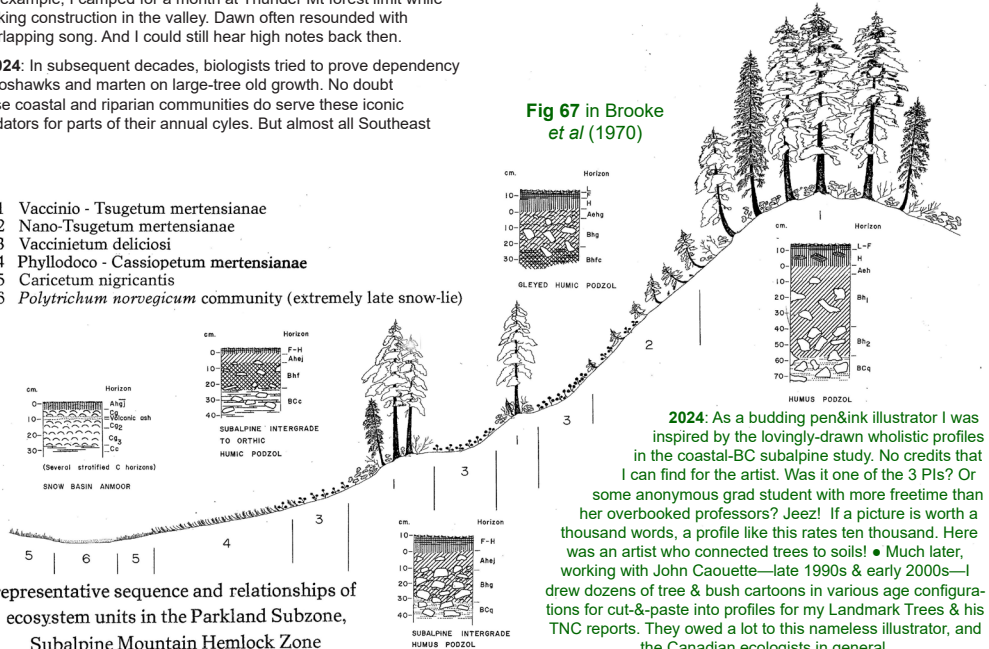
fauna—particularly the largest and most mobile—are supreme generalists. At the height of 'baby-time', when little birds and mammals are taking their first clumsy flights and scurries, there's nowhere a 'gos' or marten would rather be than the highcountry parklands. Lowland-old-growth true-believers don't always appreciate it when I point this out.

So my experience in the early 1980s may have been fairly unique. For example, I camped for a month at Thunder Mt forest limit while working construction in the valley. Dawn often resounded with overlapping song. And I could still hear high notes back then.

5 **2024**: In subsequent decades, biologists tried to prove dependency of goshawks and marten on large-tree old growth. No doubt those coastal and riparian communities do serve these iconic predators for parts of their annual cyles. But almost all Southeast

Fig 67 in Brooke *et al* (1970)

1 Vaccinio - Tsugetum mertensianae
2 Nano-Tsugetum mertensianae
3 Vaccinietum deliciosi
4 Phyllodoco - Cassiopetum mertensianae
5 Caricetum nigricantis
6 *Polytrichum norvegicum* community (extremely late snow-lie)



representative sequence and relationships of ecosystem units in the Parkland Subzone, Subalpine Mountain Hemlock Zone

2024: As a budding pen&ink illustrator I was inspired by the lovingly-drawn wholistic profiles in the coastal-BC subalpine study. No credits that I can find for the artist. Was it one of the 3 PIs? Or some anonymous grad student with more freetime than her overbooked professors? Jeez! If a picture is worth a thousand words, a profile like this rates ten thousand. Here was an artist who connected trees to soils! ● Much later, working with John Caouette—late 1990s & early 2000s—I drew dozens of tree & bush cartoons in various age configurations for cut-&-paste into profiles for my Landmark Trees & his TNC reports. They owed a lot to this nameless illustrator, and the Canadian ecologists in general.

3 **2024:** In German, krummholz means “crooked wood,” which I kind of like. But 41 years after writing this report, I'm more suspicious of Euro placenames and landscape terms, less prone to uncritical acceptance. The German adjective *krumm* means “bent, crooked, warped, stooping, devious.” So yeah, in some minds a put-down? Elfinwood seems more playful, maybe less judgemental?

4 **2024**: Áak'w & T'aaḵú Aaní has a lot more good birders than we did 41 years ago. But this question of highcountry breeding bird density still hasn't seen a lot of attention. Even our ridgerunners don't get up there early enough. If anyone could estimate abundance, it'd be Cathy Pohl, who surveyed highcountry birds with the alpine team from Chilkat to Haida country. But when I asked just now she said their July visits—best month for vegetation—were post song-peak, often in hypothermic fog & wind (prohibitive usually for mist-netting)

Animal maintained habitats

I've tried not to chop things up taxonomically, except in the *Appendices*, for reference purposes. I've treated habitats and communities as my "units", instead of species or families of animals or plants. [1]

With increasing maturity, communities come increasingly under control of biotic factors; canopy cover and herbivory take their places beside wind and rain as regulating forces. I've noted animal influences as they applied to foregoing habitats. But the really *influential* animals—for whom communities might even he named—cannot be assigned to any of the habitats described thus far. Increasing maturity tends to slur community boundaries that are more apparent in younger and starker habitats. So by the time animals are significant elements, so many forces are involved that faunal influences typically go unacknowledged.

Pocket gophers stay put and leave sign. Unfortunately we don't have em. I could have inserted a "gopher-disturbed" section, between bogs and "normal" meadows, as Zwinger & Willard (1972) did. But I find the word "disturbed" somewhat judgemental. Flipping it, animals'd be "disturbed" by plants (having to detour around trees?). A maybe-better term *Animal maintained,* here describes animal eating, trampling, or seed distribution, 'maintaining' plants at some level 'below' their site-specific, edaphoclimatic destiny, or, alternatively, (by fertilization etc) above it. To really test it, you'd have to fence off an exclusion plot and wait a couple decades. In the alpine, maybe centuries.

Lets look at some implications of relative maturity in alpine and subalpine communities. Although animals tend to get underrated in community studies, Margalef (1963) offered guidelines to community maturation that wiegh flora and fauna equally. Ramon suggested that energy produced by immature communities can be removed by fauna and assimilated into adjacent, mature communities who thus gradually expand into immature ones along interfaces. This is another way of looking at succession. Such export of production suppresses development of immature communities. Krummholz-nesting **robins** forage numbed **Diptera** from late snowbeds, but rarely defecate or die there, and when they do, the **gos** usually carries em back into the krummholz to eat & crap. Thus, immature communities are 'generous,' while mature communities are 'greedy.' This has embarrassing implications in human sociology.

The phytosociologist, measuring biomass and percent cover, may consider such zoological shenanigans icing on the cake. But where are the calories? In the above example, the entire nectar production of 17 smelly *Fauria* blossoms has been sucked up by one **Stratiomyid**, who with hundreds of similar creepers and flitters is daily exported, shat out by robins singing from leaning leaders of a 350 yr. old mountain hemlocks.

The point of this, if there is one, is that where community boundaries are already distinct, as in topographically complex terrain, animal activities will perpetuate them; especially when animals breed, bed or cache in different habitats from where they feed. This tends to be the case in alpine and subalpine belts.

Even sedge-tussock nesting **pipits** forage in relatively less mature habitats such as flushes and snowbeds and solifluction slopes. After their 4 to 7 nestlings have fattened on the offerings of infantile plant associations, they leave the mountains altogether, to die in lowland fields and saltmarshes.

But this applies only to species using a diversity of habitats. Birds are very mobile. But what about herbivorous **voles** whose entire lives are lived within 1/10-acre territories? Are they merely meat for passing **harriers** and **redtails**, the more efficiently to lop the tops from tundra food pyramids? Or is their net effect enhancing, due to soil aeration, anti-gravitational seed transport to uphill caches (McAtee 1947, Grinnell 1936), and conversion of plant production into forms more palatable to understaffed alpine decomposers?

What about **deer**? Sitka blacktails are mobile as birds, in daily and seasonal movements. But they're less predictable. A **golden-crowned sparrow** nests in subalpine willow and feeds her nestlings insects from adjacent meadows, permitting generalizations as to direction of calorie flow. But on a nice day, a deer might bed in the middle of the same *Fauria* basin she feeds in, and those nearly-liquid *Fauria* plops scattered over Xutsnoowú's high meadows are clearly repaying the vegetation.

High density deer populations on the ABC Islands (Admiralty/Baranof/Chichagof—known to hunters as unit 4) constitute probably the heaviest impact of any animal species on subalpine vegetation of Lingít Aaní. But their versatility makes it hard to say just what that impact is. Deer eat everything from alpine *Potentilla hyparctica* to low-beach *Fucus distichus*, and the longer you watch them the more confused you get. Some selections from my confusion:

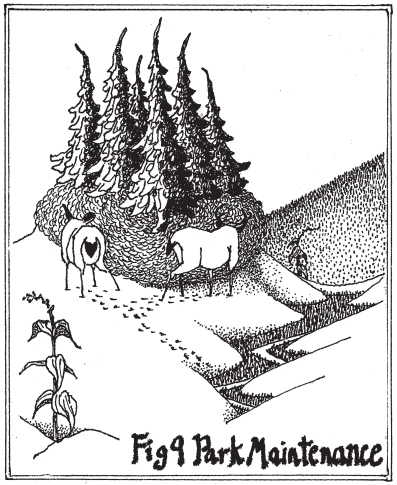
1) Deer usually die near sea level, torn apart by **bears** and **eagles**, thus exporting subalpine production. Right?

2) Deer accentuate the park-like character of the lower krummholz parklands by browsing back *Vaccinium ovalifolium*, which forms rings around conifer copses. This stops early blueberry's advance into adjacent meadow. When forbs are available, browse is second choice, so pruning activies are limited to the brief period between wilting of succulent forbs. and evacuation of subalpine as snow accumulates. But in Klein's (1964) study of summer feeding habits, favored browse of subalpine Coronation Island was not simply pruned, but restricted to inaccessible windthrow and rock outcrop. That's *heavy* use, since *Vaccinium* is remarkably tolerant of repeated removal of most of its annual growth (Schoen, in Wallmo and Schoen 1979). The warm maritime climate of Coronation Island usually fails to push deer out of the mountains as early as in other locations. [2]

3) Where a deer dies is not necessarily the key factor in net

1 **2024**: Hard to remember after 41 years, but this intro sentence was probably written partly in amusement at the Coastal BC team's kinda hoidy-toidy naming of plant associations after dominant genera: *eg*, Cladothamno—Tsugetum mertensianae. It made more sense to me, then and now, to name habitats by their landform, soil type or topography. Plants are fickle, differing across those "associations" according to elevation, aspect or winter-wind exposure.

2 Shrub willows—as with lowland 'ice-cream' browse species highbush cranberry and red osier dogwood—are rare on Admiralty, even in the subalpine, where presumably deer prefer to graze rather than browse. So *Vaccinium*—though more browse-tolerant—could at least be suppressed by deer use.



energy flow between communities. A 100-pound deer eats about 8 lbs. wet weight of plants per day and passes nearly as much. Where does a deer shit? This is probably the most pressing issue in scatology today. Otherwise-normal biologists have spent the better part of careers in search of deer shit.

Counting of deer turds is predicated on the assumption that levels of deer shit reflect levels of deer "use". If this is true, a quick eyeballing of alpine and subalpine habitats confirms that *Fauria crista-galli* is their major food—at least where my friends and I hang out. Nowhere on the mainland, where deer are relatively scarce, do *Fauria*-basins approach those of Xutsnoowú in magnitude or monoculturalness. It's almost as if ABCs *Fauria likes* to be trampled and eaten (and of course fertilized). Perhaps this is an example of co-evolution, with hardy clones of *Fauria* promoted by suppression of less resilient meadow species. In studies of the effect of other ungulates on woody browse species, those shrubs least tolerant of removal of annual growth were eliminated in favor of more vigorous species (Brandborg 1955).

If this is really happening, is resultant *Fauria* meadow more or less "mature" than the more species-rich community that would replace it in absence of deer? Less, I suppose—an arrested succession, with stronger production swings, higher ratio of primary production to standing biomass, and fewer resident consumers, making it more exploitable, and more 'generous' toward neighboring communities.

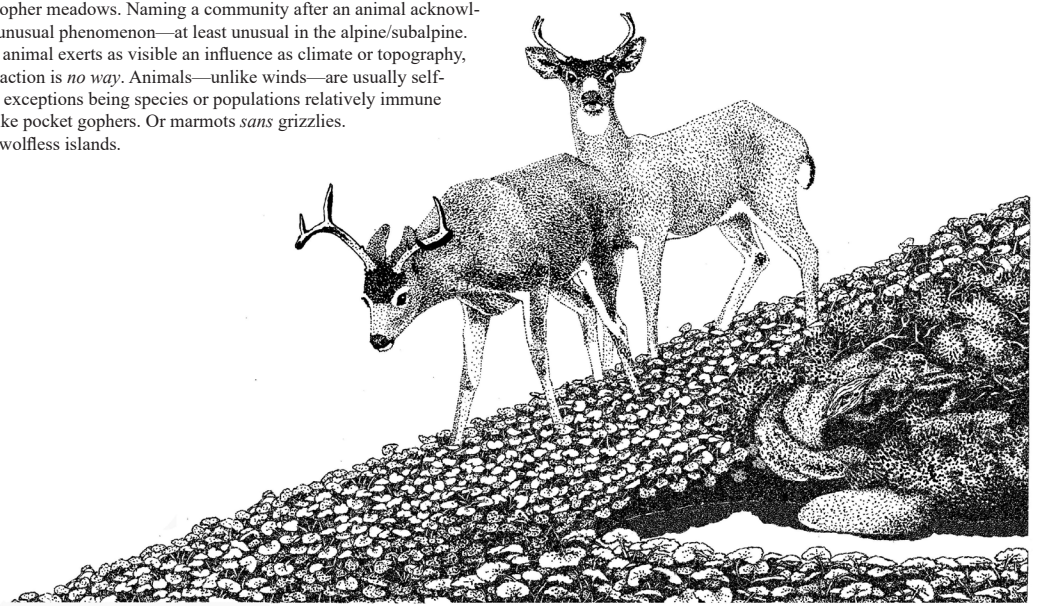
Such a community would merit the title *Animal-maintained* in the same sense as Zwinger's gopher meadows. Naming a community after an animal acknowledges a fairly unusual phenomenon—at least unusual in the alpine/subalpine. It suggests the animal exerts as visible an influence as climate or topography, and my first reaction is *no way*. Animals—unlike winds—are usually self-regulating, the exceptions being species or populations relatively immune to predation, like pocket gophers. Or marmots *sans* grizzlies.

Or deer on wolfless islands.

Birds

Most birds seen in the mountains of Lingít Aaní aren't unique to high country. Those few species closely affiliated with alpine and subalpine environments throughout their North American ranges tend not to be significant elements of our avifauna. Robins are trophically more important here than rosy finches. However, a review of habitat selection by those classic alpine birds who do use our area is informative.

Detailed studies of tundra-nesting birds have been conducted in the Beartooths of Wyoming, and on the arctic tundra at Cape



Thompson, Alaska (Hoffmann in Ives & Barry 1974), and habitat choice by birds in those areas can usefully be compared with habitat choice by those species in Southeast. There have been no serious bird studies in the alpine/subalpine belts of Southeast Alaska. [1]

But Weedon's paper *The Birds of Chilcat Pass, British Columbia* (1960) is a great example of cross-disciplinary natural history. Chilcat Pass is drier and more arctic than maritime mountain environments to the south. Several birds common in the pass as nesters or migrants are unusual in Southeast. But again, the differences in themselves are illuminating.

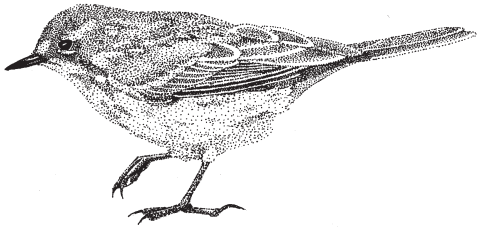
Horned larks are common in dry grassland at Chilcat Pass. To my knowledge they have not been sighted in the alpine tundra above Juneau. [2] I see them only in coastal wetlands during spring and fall migrations. On Wyoming's Beartooth Plateau they show primary affinity for xeric fellfields. So we shouldn't be surprised at their lack of interest in our soaked mountains. (Fellfields are noted above under *Ridges and prominences*.)

Lapland longspur is the most abundant migratory passerine at Asx'ée (Eagle River), but I've recorded it only once in the alpine in 6 years. At Chilcat Pass it's abundant in migration, but doesn't nest. At Cape Thompson its primary affinity is heath tussocks on permafrost; a feature of arctic tundra largely lacking in Southeast Alaska. If found nesting here I'd expect it to be in frost hummock habitat.

Snow bunting prefers xeric nesting habitat at Cape Thompson; like longspur, it's strictly an arctic tundra breeder. In fall and winter it passes through our coastal flats in large flocks with the other wandering sparrows and finches, but I've only seen occasional pairs in the mountains here, in early June, and in October, after nesting season, in all cases in foraging among rock outcrops high in the alpine. This agrees with Weedon (1960), who found them using rocky pool margins above 4,500 feet at Chilcat Pass.

1 **2024**: The first would be Cathy Pohl's bird surveys with the alpine team, 2010 to 2013.

2 **2024**: Cathy found them later at Flower Mountain, not far south of Weedon's study, and heard them at the Heintzleman site.



Gray-crowned rosy finch should be common here. With **white-tailed ptarmigan** it's 1 of only 2 bird species in North America who breed exclusively in alpine (& not arctic) tundra. We have no shortage of its cliff-nesting habitat in our high alpine. At Chilcat Pass it breeds on rock ledges above 4,000 feet. It's interesting that rosy finch does not accompany the **lark, longspurs, buntings,** and **pipits** who flood through our coastal flats in spring and fall. Perhaps it uses the alpine even in migration? [3]

Only 2 of the classic tundra-nesting passerines are common enough in mountains of Lingít Aaní to play significant roles in the trophic webs; the **golden-crowned sparrow**, and the **water pipit**. Goldencrowns at Chilcat Pass nest just above whitecrowns (who don't breed in Southeast)

> *"at the upper edge of the zone of shrubs (up to 3,800)" Weedon, (1960).*

My observations in Southeast are similar, except that it appears to be more confined to riparian willows here.

Water pipit is by far our most abundant alpine passerine breeder in Lingít Aaní. [4] Occupying a 'higher' trophic niche than seed & berry eaters—or salad eaters such as ptarmigan— it's important to mountain energy flow. By examining its habitat selection in other alpine areas, we may discover clues to success in Southeast, as well as to the lack of success on part of other classic tundra breeders.

On the Beartooth Plateau, pipits were the dominant bird in moist meadows, and in sedge/moss tussock communities with perennially impeded drainage. Gutters between tussocks were usually wet. No other passerines shared its affinity for this open, wet habitat. On arctic tundra the same held true, except thata few shorebird species nested with the pipits in wettest habitats. Tolerance of moisture makes pipit well suited to the otherwise empty insectivore niche in drenched alpine heaths and sedge meadows of Lingít Aaní.

Of the tundra-nesting passerines discussed above, only golden-crowned sparrow using dense shrub cover is even moderately successful. The only ground-nesters aside from pipit at all common in our mountains are **Lincoln's** and **savannah sparrows**, who gravitate to lush, waist-high subalpine meadows.

It's possible that heavy precipitation is the key factor in distribution of ground-nesting birds in the mountains of Lingít Aaní. Erratic fluctuations in populations of blue grouse and rock ptarmigan in Southeast are thought linked to precipitation (ADF&G, eds 1979). Severe winters and wet cold springs reduce nesting success and chick survival. It's easy to imagine the vulnerability of fluffy nestlings to prolonged rains, whether upland game birds, cliff-nesting rosy finches, or ground-nesting larks, longspurs, and buntings.

At Chilcat Pass several shorebirds nest, reflecting the semi-arctic character of the vegetation. In contrast, shorebirds are unusual as breeders in the mountains of Southeast Alaska. My only observations are of **common snipe, spotted sandpipers**, and **baird's sandpipers**. The first two species were probable breeders. [5]

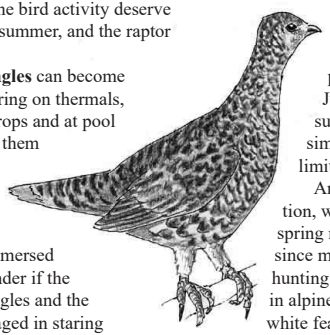
3 **2024**: Cathy Pohl says I may have been wrong in this. Birders are submitting photos to ebird of rosies migrating through the tidal flats. and some have been in mixed flocks.

4 **2024**: Water Pipit (*Anthus spinoletta*), was considered a wide-ranging global species until taxonomic studies showed that 3 North American subspecies and an easternmost asiatic are distinct, now called **American Pipit** (*A. rubescens*).

5 **2024**: I subsequently found a **semipalmated plover** nest near Ptarmigan Glacier, and Cathy Pohl documented them on the alpine-team's Flower Mtn & Heintzleman sites.

Two other aspects of alpine/subalpine bird activity deserve mention; the eagle pilgrimage in early summer, and the raptor migration in the fall.

On sunny days in mid June, **bald eagles** can become puzzlingly numerous in the alpine, soaring on thermals, and perched meditatively on rock outcrops and at pool margins. There's no 'logical' reason for them to be there; a few slip low over ridge crests attempting to surprise dozing marmots, but the season's supply of juvenile marmots are still nursing underground, and most eagles seem immersed in their yoga or aerial acrobatics. I wonder if the whole thing is a game—both for the eagles and the adult marmots. I've watched them engaged in staring contests at 15 ft. Any animal that enjoys screaming as much as a marmot surely gets some kind of satisfaction out of stress; akin to that of bullfighters maybe.



The one instance of nearly successful predation I witnessed was informative; an immature eagle plucked a mature marmot off the top of a snowbank, and managed to stay airborne with it for ten seconds. Instead of dropping the marmot to a certain death the eagle descended with it to the foot of the snowbank. The marmot tore free, ran uphill 10 ft, turned, and just sat there, as if thumbing its nose. All of this refuses to fit into a tidy theory of predation and calorie flow in alpine/subalpine ecosystems. [6]

Local eagle researchers have not been able to offer me any food-related explanation for 50 bald eagles on one alpine ridge. Only a fraction of the eagle population of Southeast Alaska nests each year. Mid June is a 'slack' time between spring herring and summer **salmon** runs. Maybe the alpine eagles are simply non-breeders giving the parents first choice of limited resources?

Another dramatic occasion is the fall raptor migration, which peaks in late September and early October. In spring most northbound raptors are confined to the coast, since mountain meadows are deep in snow. But in the fall, hunting is better; young voles and songbirds are plentiful in alpine and subalpine belts, and frequent tufts of scattered white feathers mark successful attacks on ptarmigan. **Harriers, goshawks, sharpshins, redtails, kestrils** & **merlins** and are common, and **roughlegs** occasional. Rich Gordon has also seen **peregrines** and **gyrfalcons** in the mountains above Juneau at this time of year.

Mammals

A study of mammal distribution in the alpine/subalpine belts of Southeast Alaska would improve our understanding of recent Quaternary glaciations, and would help in the search for refugia, from which mammals (and other flora/fauna) dispersed following major glacial episodes. To my knowledge, there have been few contributions to this field since Klien (1965).

Mammalian mountain fauna resemble island fauna in many respects due to the difficulty of colonizing isolated ranges. In the mountains of our archipelago, mammals have had to overcome both obstacles—that of water barriers, and of intervening lowlands. Thus, while mammals considered to be "obligate" mountaineers are few enough in mainland Lingít Aaní to begin with (*ie*. **goat** and **marmot**), even these are absent on most of the islands, where their mountain niches are taken over by more willing swimmers such as **Sitka deer**. Lingít Aaní is geographically very complex, and mammal distributions in the mountains are spottier and less uniform than those of bird species.

This doesn't mean that mountains are unimportant to our mammals. There isn't a terrestrial mammal in Southeast larger than an otter who doesn't make use of alpine/subalpine belts at some point in its annual cycle. Presently we don't know how much of this observed use represents altitudinal movements by the bulk of the population, and how much represents segregation of semi-resident individuals from lowland individuals, who use the mountains sporadically or not at all. Initial results of Schoen & Beier's radio telemetry studies of Xutsnoowú **brown bears** support the latter possibility.

Some bears use the high country all summer and fall, declining the feast on coastal salmon streams where most of the population gathers. On the other hand, scat containing salmon—frequently encountered above forest limit—indicates movement by individuals from sealevel to subalpine and back is common in late summer (Dave Hardy *pers. comm*.). But whether individual bears are subalpine residents, or only visitors there, the high country is critical habitat for the species, as for all other large terrestrial mammals.

Appendix 3 lists those mammals that I've seen or suspect to occur above forest limit, with a few guesses as to distribution and significance. Our knowledge of alpine/subalpine mammals in Southeast is slim, but here are a few observations and speculations.

Long-tailed vole is probably our most important high country vole. But longtails are not limited to mountain habitats. They're opportunists; using a broad range of seral stages in lowland meadow and coniferous communities. Van Horne (1982) added to our understanding of this vole, but her study didn't include subalpine habitats. John Schoen feels that longtails are episodically important prey for brown bears using Xutsnoowú high country (*pers. comm*). At least a lot of calories are burned hunting for them, and for this reason alone the voles merit consideration.

Snap-trapping voles is for the pros. But we can learn about rodent distributions simply by collecting incidental carcasses. These are frequently encountered along mountain trails and considering how little is known, it's a shame not to save them for

6 **2024**: In our Goatlandia studies it's become apparent that some of those supposed immature balds are actually **golden eagles**. In summer 1980 when I observed the 'airborne marmot,' goldens were not on my list of possibilities. We confirmed nesting in summer 2023. What remains unknown is trend. Are we just detecting more goldens because there's more birders? Have they always been present and reproducing at these levels in the local mountains?

Another thing to add *re* highcountry soaring; watching the horizon for hours over many years from sealevel through good optics, you become aware that **ravens** are *always* up there and eagles in way more seasons than the supposed June 'slack time.' I still don't think it's nutritional; more about the social world of these 'moiety-birds.'

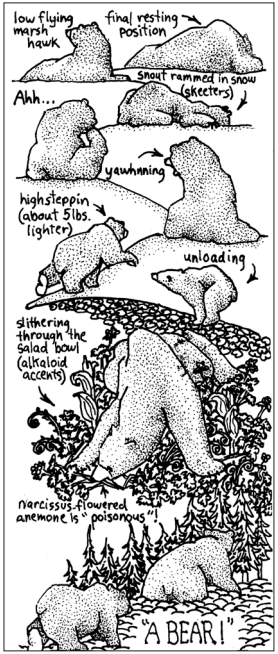


Fig 11 Field sketches, Yankee Basin, 6/12/81. Blackie climbed to 2,800-ft bald summit. Reads from bottom to top.

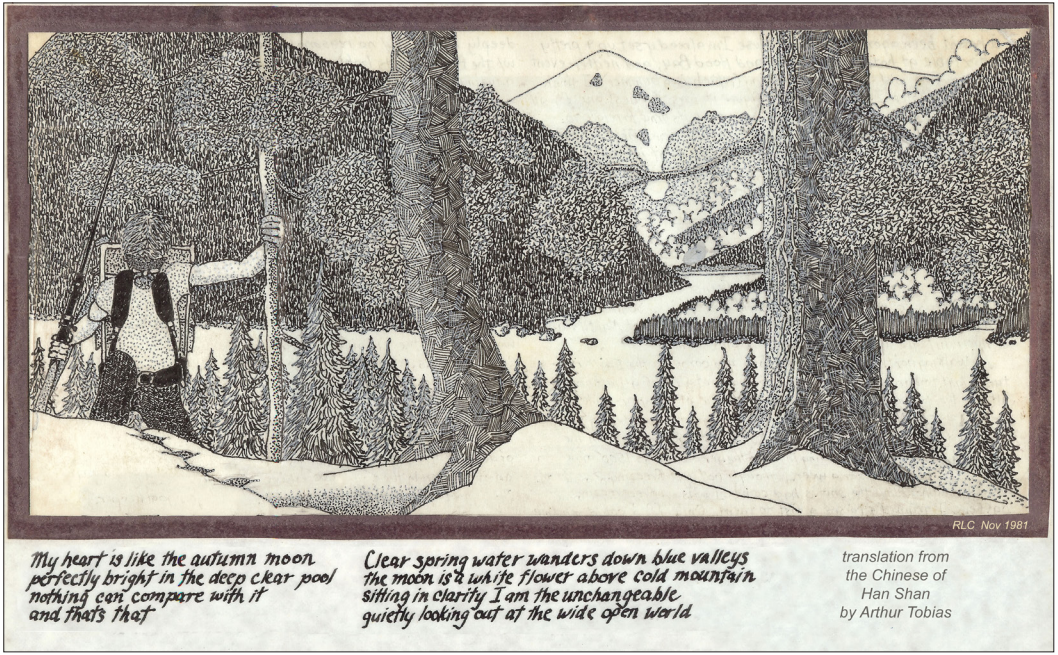


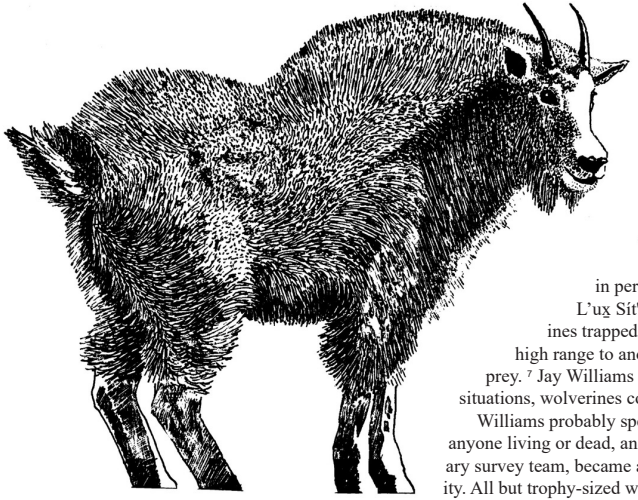
Fig 12 I became a time-displaced acolyte of the old mountain monks during solo sojourns at Tsaagwáa, *harbor seal ice flows* (Hood Bay), birthplace of the Tsaagweidí seal people. My heart probably never achieved autumn moon brightness, but it sure helped to burn off worldly distractions with a brisk bushwack to forest limit. View is southeast to opening of East Arm, from 2,400-foot inflection of Tsaagwáa Shaanák'u, *Tsaagwáa's old woman* (Hood Bay Mtn)

ID. Stick em in your freezer and drop me a card. I'll be happy to come by for them.

The iconically alpine **pika**—like some of the characteristically alpine bird species discussed above—is absent from most of mountains of Lingít Aaní. I'm told it occurs on the north side of Chilcat Pass, and on the drier east side of the AK/BC boundary ranges. So there are 'seed' populations at our portals from which maritime ranges could be colonized. But the pika seems to have no more use for our moldy mountains than horned larks do.

This makes sense, remembering that pikas are haymakers. Instead of storing up fat and hibernating like hoary marmot, the pika (a lagomorph) dries hay in fall, and stays active throughout the winter, relying on its caches. Sunny days are rare in September and October here. It'd be frustrating to attempt to sun-dry a winter's supply of forbs and grasses in autumn in Lingít Aaní.

Marmot wanderlust. For such hobbity burrow-tenders, marmots show up in unexpected places. Like goats, marmots have relinquished speed for dexterity in precipitous terrain. Neither can elude predators in the lowlands, and both go there at great risk. On July 3rd, 1982, I saw an adult hoary marmot at Asx̱'ée (Eagle Beach); a good 5 miles through dense forest from the nearest subalpine colony! Marmots are regularly reported at sea level along Thane and North Douglas roads. These are nearer to subalpine populations, but still involve considerable descent through bear and wolf country.



2024: Today I have about 16 thousand pictures of Janwú from which I could have done the pencil roughout for this rapidograph drawing. But in the early 1980s I didn't even own a camera. So I modelled this young female after a photo in one of the library books I was reading. I wish I could credit the photographer but after 4 decades I can't remember even the book title.

I've heard these coastal marmots eat glasswort (*Salicornia virginica*) in the intertidal, which is intriguing, as this is about the saltiest plant in the coastal marshes. Is the marmot's wanderlust only dietary then? I'd rather think my Asx̲'éé marmot had higher motives—the Daniel Boone (Amelia Earhart?)—of marmotdom. But as with humans, for every Daniel and Amelia there are a hundred homebodies, fertilizing their burrow entries. Don't misunderstand me! I love marmots—and find it vaguely comforting that of all the mammals in Lingít Aaní, marmots stand the best chance of surviving a nuclear episode.

In Lingít Aaní, **wolverines** are probably the most characteristically alpine/subalpine of our mammalian predators. Local trappers feel they are most often found in periglacial habitats such as the terminus area of the L'ux̲ Sít'i (Herbert Glacier). But it could be that wolverines trapped in such locations were merely enroute from one high range to another, rather than visiting lowlands in search of prey. [7] Jay Williams (1951) mentioned evidence that in certain tight situations, wolverines could be effective predators on **mountain goats**.

Williams probably spent more time above treelimit in Southeast than anyone living or dead, and as a meat hunter for the U.S./Canadian boundary survey team, became a leading authority on the subject of goat mortality. All but trophy-sized wolverines should be able to fit down a **marmot** hole. That tells us something interesting about marmots, doesn't it! I wouldn't recommend sticking ones arm into an occupied burrow.

Wolves hunt virtually every habitat available in Southeast Alaska, from mudflats to xeric summits. Though less restricted to the high country than wolverine, they still—by virtue of numbers—have a greater impact there.

The influence of wolves on mountain environments is enormous. Biomass and calory flow can't measure this. Wolves influence the system every time a deer jerks up its head in a meadow; every time a grazing goat or marmot turns back for the safety of the rocks. The wolf even tells us something about the difference in vegetation between mainland and island ranges. The shadow of the wolf at some time touches just about everything.

As for distribution of **mountain goats** in Southeast, it's well documented that goats will cross timbered valleys to it get to other ranges. They're exposed to predation during such crossings. Imagine what goes on in a goat's mind—staring at a mountain several miles away, and separated from it by a 3,000 foot drop into forested bottoms—as it contemplates the journey. It's reassuring that sense of adventure is not exclusively a human abberancy—that curiosity has proven adaptive to other mammals.

If the spirit of the high country is summed up in one creature, it has to be the mountain goat. All of the mammals discussed in this paper can survive in a zoo except *Oreamnos*, who usually dies within a year. Maybe goats have overspecialized; burned a few too many bridges. Maybe mountains have warped the goat's priorities. Maybe, like some of the old Rocky Mountain fur trappers who stayed out til they got weird and giggly, *Oreamnos* is just too proud to come dowm.

7 Periglacial willows are sometimes productive of **snowshoe hares** and **ptarmigan**, so probably both explanations at times apply.

Appendices

1 Highcountry plants

My printed copy of this report refers to *Appendix 1* on Plants, but it seems to be lost. Instead, here's Rita O'Clair's list titled *Alpine and subalpine plants of the Juneau Area,* dated 7/85. * = most abundant or characteristic of alpine.

ARALIACEAE (Ginseng Family)

Echinopanax horridum	devil's club

BETULACEAE (Birch Family)

*Alnus sinuata	Sitka alder

CAMPANULACEAE (Bluebell Family)

*Campanula lasiocarpa	mountain harebell
Campanula rotundifolia	harebell, bluebell

CAPRIFOLIACEAE (Honeysuckle Family)

Sambucus racemosa	red elderberry

CARYOPHYLLACEAE (Pink Family)

Cerastium beeringianum grandiflorum	large-flowered Bering chickweed
Sagina saginoides	arctic pearlwort
*Silene acaulis	moss campion

COMPOSITAE (Daisy Family)

Achillea borealis	yarrow
*Antennaria pallida	pussytoes
*Arnica latifolia	broad-leaved arnica
*Artemisia arctica	wormwood
*Aster alpinus	alpine aster
*Erigeron peregrinus	coastal fleabane
*Hieracium triste	woolly hawkweed
*Petasites hyperboreus	arctic sweet coltsfoot
Prenanthes alata	rattlesnake root
*Senecio triangularis	groundsel
*Taraxacum kamtschaticum	alpine dandelion

CORNACEAE (Dogwood Family)

Cornus canadensis	bunchberry

CRASSULACEAE (Stonecrop Family)

*Sedum rosea	roseroot

CRUCIFERAE (Mustard Family)

*Cardamine bellidifolia	alpine bittercress
Cardamine umbellata (aka C. oligosperma)	no common name

CYPERACEAE (Sedge Family)

Carex circinnata	coiled sedge
*Carex macrochaeta	long-awn sedge
Carex nigricans	blackish sedge
Carex pluriflora	many-flowered sedge
*Carex sitchensis	Sitka sedge

EMPETRACEAE (Crowberry Family)

Empetrum nigrum	crowberry

ERICACEAE (Heather Family)

Arctostaphylos sp.	
*Cassiope mertensiana	Merten's cassiope
*Cassiope stelleriana	Alaska moss heath
*Cladothamnus pyrolaeflorus	copperbush
*Loiseleuria procumbens	alpine azalea
Menziesia ferruginea	rusty menziesia
*Phyllodoce glanduliflora	yellow mountain heather
Vaccinium alaskaense	Alaska blueberry
Vaccinium caespitosum	bog blueberry
Vaccinium ovalifolium	early blueberry
*Vaccinium uliginosum	alpine blueberry

GENTIANACEAE (Gentian Family)

*Fauria crista-galli	deer cabbage
*Gentiana glauca	glaucous gentian
*Gentiana platypetala	no common name
Gentiana propinqua	no common name
Gentiana prostrata	moss gentian

GERANIACEAE (Geranium Family)

*Geranium erianthum	cranesbill, northern geranium

GRAMINAE (Grass Family)

Calamagrostis canadensis	bluejoint
*Hierochloe alpina	alpine holygrass
*Phleum commutatum	mountain timothy
*Poa alpina	alpine bluegrass
*Trisetum spicatum	downy oatgrass

JUNCACEAE (Rush Family)

*Juncus mertensianus	Merten's rush
*Juncus triglumis	no common name
*Luzula arcuata	arcuate wood rush
Luzula parviflora	small-flowered wood rush

LEGUMINOSAE (Pea Family)

Lupinus nootkatensis	Nootka lupine
*Oxytropis campestris	field oxytrope

LENTIBULARIACEAE (Bladderwort Family)

*Pinguicula vulgaris	butterwort, bog "violet"

LILIACEAE (Lily Family)

*Fritillaria camschatcensis	Kamchatkan fritillary, Indian rice
*Lloydia serotina	alp lily
Streptopus amplexifolius	clasping twisted stalk
Streptopus roseus	rosy twisted stalk
*Tofieldia coccinea	northern asphodel
*Veratrum eschscholtzii	false hellebore

ONAGRACEAE (Evening Primrose Family)

*Epilobium hornamannii	no common name
Epilobium latifolium	river beauty

ORCHIDACEAE (Orchid Family)

Listera cordata	heart-leaved twayblade
*Coeloglossum viride (aka Habenaria viridis)	long-bracted bog orchid
Platanthera dilatata (aka Habenaria dilatata)	white bog orchid
Platanthera saccata (aka Habenaria saccata)	green bog orchid, slender bog orchid

OROBANCHACEAE (Broomrape Family)

Boschniakia rossica	ground cone

POLYGONACEAE (Buckwheat Family)

*Polygonum viviparum	alpine bistort

PORTULCACEAE (Purslane Family)

Claytonia sibirica	Siberian spring beauty

PRIMULACEAE (Primrose Family)

*Dodecatheon jeffreyi	Jeffrey shooting star
*Primula cuneifolia	pixie eyes, wedge-leaf primrose
Trientalis europaea	arctic starflower

PYROLACEAE (Wintergreen Family)

*Pyrola minor	lesser wintergreen

RANUNCULACEAE (Buttercup Family)

*Aconitum delphinifolium	monkshood
*Anemone narcissiflora	narcissus-flowered anemone
*Anemone parviflora	northern anemone
*Anemone richardsonii	yellow anemone
*Caltha leptosepala	mountain marsh-marigold
Coptis asplenifolia	fernleaf goldthread
*Ranunculus cooleyae	Cooley's buttercup
Ranunculus occidentalis	western buttercup

ROSACEAE (Rose Family)

Aruncus sylvester	goatsbeard
*Geum calthifolium	caltha-leaf avens
Geum macrophyllum	large-leaved avens
*Luetkea pectinata	partridge foot, luetkea
*Potentilla sp.	
Rubus arcticus	nagoonberry
Rubus pedatus	creeping red raspberry, five-leaf bramble
Rubus spectabilis	salmonberry
Sanguisorba stipulata	Sitka burnet
*Sibbaldia procumbens	sibbaldia, hop clover
Sorbus sitchensis	Sitka mountain ash
*Spiraea beauverdiana	Beauverd spiraea, Alaska spiraea (Dorothy Lake only)

SALICACEAE (Willow Family)

*Salix arctica	arctic willow
*Salix reticulata	netted willow

SAXIFRAGACEAE (Saxifrage Family)

Heuchera glabra	alpine heuchera
*Leptarrhena pyrolifolia	leather-leaved saxifrage
*Mitella pentandra	alpine mitrewort
*Oxyria digyna	mountain sorrel
*Parnassia fimbriata	fringed grass-of-parnassus
Ribes laxiflorum	trailing black currant
*Saxifraga bronchialis	spotted saxifrage
*Saxifraga cernua	bulblet saxifrage
*Saxifraga ferruginea	coast saxifrage, Alaska saxifrage
*Saxifraga lyallii	red-stemmed saxifrage
*Saxifraga mertensiana	wood saxifrage
*Saxifraga nivalis	snow saxifrage
*Saxifraga oppositifolia	purple mountain saxifrage
*Saxifraga punctata	brook saxifrage
*Saxifraga tolmiei	alpine saxifrage, Tolmie saxifrage
Tellima grandiflora	fringe cups
Tiarella trifoliata	lace flower
*Tiarella unifoliata	sugar scoop

SCROPHULARIACEAE (Figwort Family)

*Castilleja parviflora	small-flowered Indian paintbrush
*Castilleja unalaschcensis	Unalaska Indian paintbrush
*Pedicularis oederi	Oeder's lousewort
*Pedicularis parviflora	small-flowered lousewort (red)
*Pedicularis verticillata	whorled lousewort
*Veronica wormskjoldii	alpine speedwell

UMBELLIFERAE (Parsley Family)

Angelica lucida	angelica
Conioselinum chinense	hemlock parsley
Heracleum lanatum	Indian rhubarb
*Osmorhiza purpurea	Sitka sweet cicely

VALERIANACEAE (Valerian Family)

*Valeriana sitchensis	Sitka valerian

VIOLACEAE (Violet Family)

Viola glabella	stream violet, yellow violet
*Viola langsdorffii	Alaska violet
Viola palustris	marsh violet

Handwriting on the above scan looks like Rich Gordon's. It was his copy of the list.

During and after the years of highcountry botanizing with Rita, I kept a micrographic card-list of alpine flora. Hultén's *Flora of Alaska* was too heavy to pack around in the mountains so I xeroxed every species we deemed known or possible above forest limit. They were about the size of playing cards and numbered upwards of 300 species. I scribbled additional notes from our encounters with these plants—southeast distributions and info from other publications. So they'd be a good resource for someone wishing to dive into Southeast mountain flora.

I would never throw away such a treasure, so they're probably somewhere in our backroom or storage unit. But I haven't seen em in maybe 20 years. Guess it's time for a cleaning/purging/resurrecting session ***:)***

Alpine azalea (*Loiseleuria procumbens*), arctic willow (*Salix arctica*), and reindeer lichen (*Cladonia*) on a crack in alpine bedrock.

2 Highcountry birds

Most following species are on the *Birds of SEAK* checklist, distributed by ADFG & USFS, with either an *s* or *p* in their *alpine* column (secondary & primary habitat affinities, respectively). I have duplicated their listings here, but provided an additional column to distinguish alpine ("a"} from subalpine ("sb"} use. **?** in this column indicates I haven't personally observed this species above forest limit.

In the distribution column, **u** means ubiquitous; can be expected in any of the ranges of Southeast Alaska. When I have a limited number of sightings, I've tried to indicate where. Map, fig-3 has abbreviations (*eg* **YB** = Yankee Basin}. **b** in the last column means I suspect breeding above forest limit. Species marked * are birds I've observed above forest limit that don't have an *alpine* listing on the ADFG-USFS checklist.

	ADFG/USFS checklist	belt preference	Distribution in SE. AK.	Suspected alpb breeding
Order Gaviiformes				
Family Gaviidae				
Common Loon* (Gavia immer)		sb	DLA	
Order Falconiformes				
Family Accipitridae				
Goshawk* (Accipiter gentilis)		sb	u	
Sharp-shinned hawk (Accipiter striatus)	s	sb	YB, MJ	
Harrier (Circus cyaneus)	s	sb,a	YB, MJ	
Red-tailed hawk* (Buteo jamiacensis)		sb,a	HBM, FLR, YB	
Rough-legged hawk (Buteo lagopus)	s	?		
Golden eagle (Aquila chrysaetos)	p	sb,a	MJ MR	b
Bald eagle (Haliaeetus leucocephalus)	s	sb,a	u	
Family Falconidae				
Gyrfalcon (Falco rusticolus)	p	?		
Peregrine falcon (F. peregrinus)	s	sb,a	YB	b
Merlin (F. columbiarus)	p	sb,a	u	b
Kestril (F. sparverius)	s	sb,a	MJ	
Order Galliformes				
Family Tetraonidae				
Blue grouse (Dendragopus obscurus)	s	sb	u,	b
Willow ptarmigan* (Lagopus lagopus)		sb	IM, YB	b
Rock ptarmigan (L. mutus)	pb	sb,a	u	b
White-tailed ptarmigan (L. leucurus)	pb	a	MJ	b
Order Charadriiformes				
Family Scolopacidae				
Spotted sandpiper* (Actitis macularia)		sb	GB	b
Baird's sandpiper (Erolia bairdii)	s	a	YB	b
Common snipe* (Capella gallinago)		sb	YB	b
Order Apodiformes				
Family Apodidae				
Vaux's swift* (Chaetura vauxi)		a	DLA	
Family Trochilidae				
Rufous hummingbird (Selasphorus rufus)	s	sb,a	u	
Order Passeriformes				
Family Tyrannidae				
Say's phoebe (Sayornis saya)	p	?		
Olive-sided flycatcher*(Nuttallornis borealis)		sb	MR	
Family Alaudidae				
Horned lark[1] (Eremophila alpestris)		?	?	
Family Hirundinidae				
Violet-green swallow* (Tachineta thalassina)		sb	DLA	
Bank swallow (Riparia riparia)	s	?		
Barn swallow (Hirunda rusticola)	s	?		
Family Corvidae				
Common Raven (Corvus corax)	p	sb,a	u	b
Family Paridae				
Chestnut-backed chickadee* (Parus rufescens)		sb	HBM	b
Family Cinclidae				
Dipper[2] (Cinclus mexicanus)		?		b
Family Troglodytidae				
Winter wren* (Troglodytes troglodytes)		sb	u	b
Family Turdidae				
American Robin (Turdus migratorius)	s	sb,a	u	b
Varied thrush (Ixoreus naevius)	s	sb	u	b
Hermit thrush (Hylocichla guttata)	s	sb	u	b
Swainson's thrush* (H. ustulata)		sb	MR	
Townsend's solitaire (Myadestes townsendi)	p	?		
Family Sylviidae				
Ruby-crowned kinglet* (Regulus calendula)		sb	u	b
Family Motacillidae				
Water pipit (Anthus spinoletta)	pb	sb,a	u	b
Family Parulidae				
Orange-crowned warbler* (Vermivora celata)		sb	MR, HBM	b
Wilson's warbler* (Wilsonia pusilla)		sb	u	b
Family Fringillidae				
Pine grosbeak[3] (Pinicola enucleator)		?		
Gray-crowned rosy finch (Leucosticte tephrocotis)	pb	a	MR, YB	b
Savannah sparrow (Passerculus sandwichensis)	pb	sb	u	b
Oregon Junco* (Junco oreganus)		sb	HBM	b
Golden-crowned sparrow (Zonotrichia atricapilla)	pb	sb	u	b
Fox sparrow* (Passerella iliaca)		sb	u	b
Lincoln's sparrow* (Melospiza lincolnii)		sb	u	b
Lapland longspur (Calcarius lapponicus)	s	sb	YB	
Snow bunting (Plectrophenax nivalis)	p	a	YB, MR	

1. The only alpine report for larks I can find is Weedon (1960), for Chilcat Pass, which is drier than most S.E.AK. alpine.
2. I've never seen a dipper above forest limit in S.E.AK., but certainly would expect them, as they are characteristic of alpine elsewhere in North America.
3. Rich Gordon feels that grosbeaks may nest in high montane stands in S.E.AK.

3 Highcountry mammals

Abbreviations here are same as for bird in *Appendix 2*. **?** in the *belt* column are species I've not seen or tracked above tree limit, but that I suspect may occur.

	belt preference	Distribution in SE. AK.	suspected w/o breeding
Order Insectivora			
Family Soricidae			
Wandering shrew (Sorex obscurus)	?		?
Masked shrew (S. cinereus)	?		
Water shrew (S. palustris)	sb	sighted in stream below GD	
Order Lagomorpha			
Family Ochotonidae			
Collared pika (Ochotona collaris)	sb,a	Chilcoot Pass only?	b
Order Rodentia			
Family Sciuridae			
Hoary Marmot (Marmota calligata)	sb	u, except A/BC Is.	b
Family Cricetidae			
Deer mouse (Peromyscus maniculatus)	?		
Northern bog lemming (Synaptomys borealis)	sb,a	IM, YB	b
Red-backed vole (Clethrionomys rutilis)	sb	DLA	b
Longtailed vole (Microtis longicaudis)		u (YB, HBM)	b
Tundra vole (M.oeconomus)	?		
Family Erethizontidae			
Porcupine (Erethizon dorsatum)	sb	u, except A/BC Islands	
Order Carnivora			
Family Canidae			
Coyote (Canis latrans)	sb	mainland; spotty distr.	
Wolf (Canis lupis)	sb,a	u, except A/B/C Islands	b
Family Ursidae			
Black bear (Ursus americanus)	sb,a	u, except A/B/C Islands	b
Brown bear (Ursus arctos)	sb a	u,	b
Family Mustelidae			
Marten (Martes americana)	sb	u	b
Short-tailed weasel (Mustela ermina)	sb,a	u	b
Wolverine (Gulo luscus)	sb,a	u, except A/B/C Islands	b
Family Felidae			
Lynx (Lynx canadensis)	?	accidental? esp. in years following crash of northern hare cycle	
Order Artiodactyla			
Family Cervidae			
Sitka deer (Odocoileus hemionus subsp. sitchensis)	sb,a	u.	fawns born near sequeim
Family Bovidae			
Mountain goat (Oreamnos americanus)	sb,a	u, except Admiralty I, Chicagof	b

4 Letter from Rita

probably 1984, summer after our course →

P.O. Box 210094,
Auke Bay, Ak 99821
June sometime

Dear Richard:

Now that I have your address I can write to you from time to time.

I have just reread your alpine ecology project, and it has become clear to me that when I first read it a year or so ago I did not fully appreciate your crazy genius. So I am glad I gave you an A. The first time I read it I was just so sick with my allergies that my brain was in low low gear. Things are going much better in that regard.

I have enclosed a copy of an alpine ecology lecture on local alpine habitats that I wrote this morning based on the information in your project, so you can see what good use I have made of your efforts. I will also insert some of your info on birds and mammals into my lecture on that subject. So I wanted to thank you once again for your generous input.

I have finished with your two alpine notebooks, and you can either stop by to get them or I will bring them out to you in August (I am booked until then).

Also enclosed is a re-re-re-revised lichen list for the forest.

I also wanted to tell you that my friend in Ottawa identified another encrusting alpine lichen for me. It is orange and has scattered, widely spaced black bumps. It is Huilia flavocae-rulescens. The Lecidea that I saw and photographed in Denali Park may not be in SE.

Do you know what that moss species is that is so common in the forest in fresh water seeps? It is usually brilliantly green, at least at the tips. I have not noticed sporophytes on it, but perhaps they are there and just not emergent. It is so common.

I'm sorry I can't get excited about deer shit. It's just one of those things. In fact, I can't get excited about deer. Maybe this is because everyone else is excited about them (mostly with regards to their bullet-stopping value), and so I go off in a different direction. Plants and their adaptations in terms of anatomy and physiology are still the crux of my alpine ecology course, but I am happy to add a lecture on habitats and I'm sure my students will enjoy it too.

Cheers,

Rita P.S. Your attempts at spelling are wild

5 References

2024: I'm not updating these with any references post-1984. A good current list is in the Alpine surveys atlas.

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