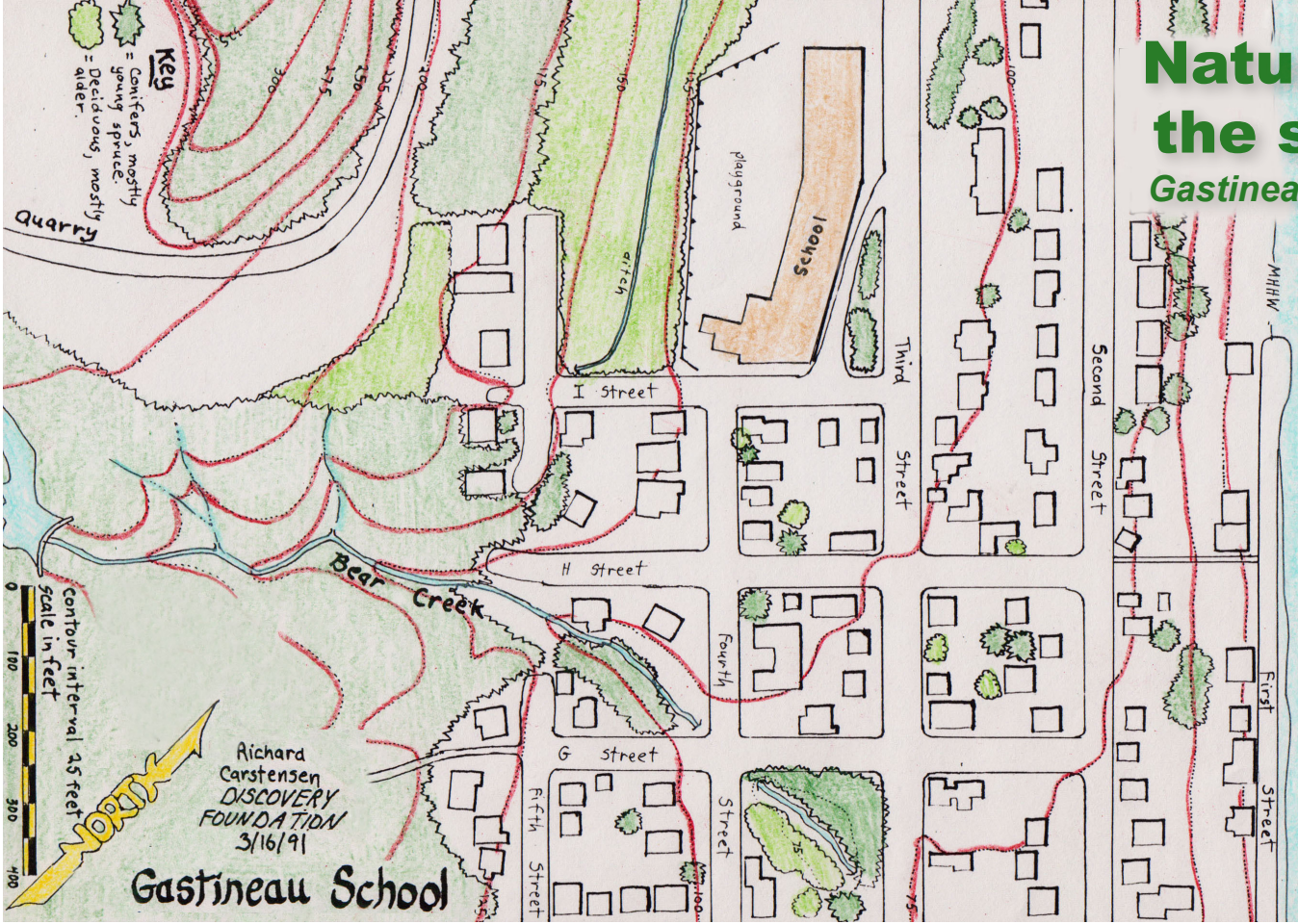


Nature near the schools

Gastineau Elementary (Sayéik)

1991

Richard Carstensen

Catherine Pohl

Cinda Stanek

DISCOVERY SOUTHEAST

Contents

Jack Hermle, late 1970s?

Cover: Discovery map of Sayéik Elementary—then called Gastineau—during workshop for teachers on nature activities in the school surroundings.

Discovery naturalists' outing on Bear Creek, 2021

Preface 2021

In the early 1990s, when Discovery Southeast was still called Discovery *Foundation*, Cathy Pohl and I—along with a rotating team of naturalists and biologists with deep local knowledge—offered site-based teacher-recertification workshops throughout the Juneau School District.

We thoroughly documented them. In the following decade—until onset of the digital age at turn-of-millennium—all school libraries housed 3-ring Discovery binders with printed text, maps and graphics, along with 35mm slide pages, color stereogram sheets for classroom use in sets of 15 (students paired), and a stereoscope for 3D viewing (sets for full-class use could be borrowed). Today of course, this stuff is easier to distribute in the form of pdfs, powerpoints and chromebook resources.

Discovery has learned a trick or two over subsequent decades in support of place-based education. Areas of fastest growth, not surprisingly, have been those where technological advances sharpened our observational abilities. Cartography is the best example. I've *mostly* resisted adding post-90s maps or photography to this collection, so that it remains fairly faithful to the original product. [1] *JuneauNature* is full of hot-off-the-laptop digital mapping resources for the schools, if you want that.

Another area of substantial content expansion since 1991 has been less dependent on technology than on abiding interests of Discovery naturalists, and a swelling movement within Borough, State and National educational communities. This of course is CRE (culturally responsive eduation). While Discovery doesn't presume to speak for Tlingit culture in the schools, we strongly support those who do. One practice we've helped to pioneer is Lingít place names in writing and cartography (*Place names convention*, below) Note, however, that in this 'historical document,' I haven't retroactively demoted all Euro-style place names. In some ways, it's good to be reminded of how we used to write and think.

As schools reopen in the time of covid, physically & virtually (online), Discovery strives to support the District with resources for place-based, culturally responsive education. I'm adding new 'wings & feathers' to *JuneauNature>SCHOOLS*.

This manual for **Sayéik Elementary (formerly Gastineau School)** is one of that wing's primaries. I hope it brings fond memories to older teachers, and inspiration to younger ones. A broader *Overview* of the workshop series—and supplementary materials not specific to any particular school—can be found at the link above.

***Place names convention*:** In my writing & cartography since publication of *Haa L'éelk'w Hás Aani Saax'ú: Our grandparents' names on the land* (Thornton & Martin eds 2012: abbreviated "T&M12"), I've used Lingít place names whenever available, followed by translation *in italic*, and IWGN (important white guy) in parentheses. Example: Kadigooni X'áat', *island with spring water* (Spuhn Island). Where Lingít went unrecorded I default to IWGN, and may acknowledge its inadequacy with "(*noTN?*),"

1 Exceptions include 1929 & 2013 stereograms, to fill out our historical series.

Gastineau School
Site Interpretation Workshop
3/15/91

Instructors: Richard Carstensen, Catherine Pohl and Cinda Stanek
Teacher Representative: Rocky Eddy

Introduction

This collection of school resources from the early 1990s was developed in conjunction with a workshop given for Sayéik Elementary School; then named Gastineau. After the workshop, they were provided to the school library in a 3-ring binder containing text, 35mm slides, and stereogram sheets. More than 30 years later, I'm scanning and reformatting the collection for easier dissemination through *JuneauNature>SCHOOLS> Schools of Áak'w & T'aakú Aaní> Sayéik (Gastineau) Elementary*.

To preserve the historical flavor of this document, I'm *not* updating the school's name in this document, however preferable its Lingít successor. It's better to resist 'white-washing' our backtrail on the path to equity—and that includes names our children may one day scratch their heads over, like "Gastineau", whomever he (or it?) was. [1]

Gunalchéesh to the T'aakú Yanyeidí, on whose homeland Sayéik Elementary resides.

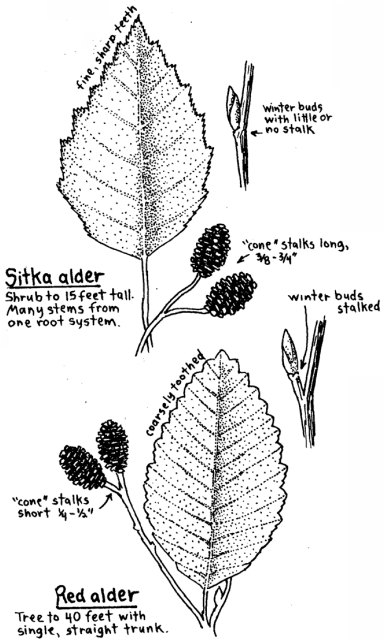
1 Gastineau was not even an IWGN (important white guy name; see previous note on placename convention). Historian Jim Geraghty tells me that even in the early mining days there was unhappiness with this name, partly because nobody was sure whom it commemorated. Some said for an obscure prospector; others claimed for an equally undocumented steamship.

Gastineau 3/15/91 Instructors:
Richard Carstensen, Catherine Pohl and Cinda Stanek

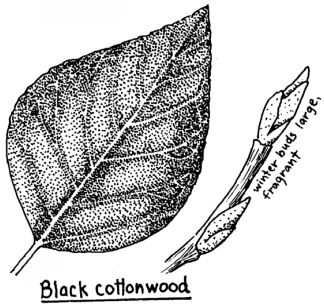
Teacher Representative: Rocky Eddy

Name	school	grade
Rocky Eddy	gst	3/4
Betty Marriott	gst	3
Gary Dabney	gst	4
Judy Jones	jdh	corr
Vickie McLaughlin	sub	

PS 2021: these were early enrollees; list doesn't include late sign-ups.



Habitats near Gastineau School



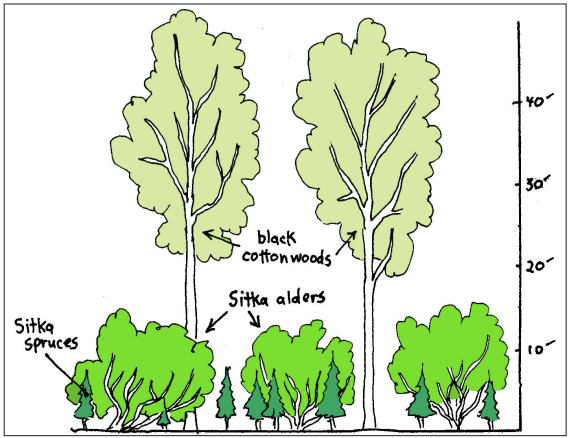
Thicket Just behind the school playground (coordinates 2—4.7 on following map of school vicinity) is a young deciduous thicket with overtopping cottonwoods. This is an early successional community, cleared just before the 1962 photos (see slide show and stereogram series). Therefore even tallest trees must be less than 30 years old. Parts are cut back regularly for power lines. Elsewhere, cottonwoods reach 50 feet in height, and 10 inches in diameter.

A good math question: If some of those cottonwoods are 50 feet tall and 30 years old, how fast (in feet per year) are they growing? Answer: 50 feet divided by 30 years = 1.67 feet per year. You can also look at treetops and estimate annual growth from branch patterns. And of course the question would be more interesting to your students if they measured tree height themselves. [1]

Beneath the cottonwoods is a layer of Sitka alders (multiple-stemmed; red alder has a single main trunk). And beneath the alders are smaller Sitka spruces, 6 to 10 feet high, and 10 to 15 years old.

One red alder we cored was 25 cm in diameter at the core, taken 40 cm above mineral soil (AMS). The tree was 40 feet high. Cottonwoods can also be cored but the rings are paler and more difficult to

1 A simple method for measuring tree height is described on page 8 of my treehuntingmanual.pdf, downloadable from *JuneauNature*. It's also explained on page 20 of 20171003cemeterymapping.pdf, along with many more ideas about tree studies with elementary students. A 13-minute video on our Evergreen Cemetery re-mapping project can be streamed from *JuneauNature*.



read. Cores taken on our field trip—mounted, sanded and annotated—were left with Gastineau teacher Betty Marriott. [2]

The successional story in this area will in some ways resemble that of recently deglaciated areas. First Sitka alder, eventually overtopped by cottonwood (the stage it's in now, 1991), then joined by spruces. Little ones have already established. For a time, a mixed spruce and cottonwood forest will prevail, gradually shading out alders below them. Then, about a century after the initial 1960 clearing, spruces will crowd out cottonwoods. In the year 2060, the area behind the playground will probably look like the spruce forest described below (coordinates 1—3.5 on Carstensen map [3]).

A good way to teach this story is to have your students draw profiles such as the one I've included here, but for times in past and future as well. Include a vertical scale for tree height, and account for rate of growth in your future projections. For example, spruces will probably top out of alders by about the year 2000, [4] and then start growing at about one foot per year. Cottonwoods will reach about 70 feet at present growth rate and mostly stop growing, while the spruces will pass 100 feet and keep going. If you have a math whiz in class, ask what year will spruces catch up to the cottonwoods. To give you ideas for profile drawings check out my post-glacial sequence on page 35 of *Nature of Southeast Alaska* (Carstensen, Armstrong & O'Clair, 3rd edition, 2014). [5] I encourage you to do some calculation and make your own for the playground thicket.

Common understory plants in the thicket are salmonberry, elderberry, lady fern, angelica and ground cone.

This habitat should be exceptionally good for songbirds in May. Listen for hermit and varied thrushes, robins, ruby-crowned kinglets, orange-crowned warblers, Lincoln's sparrows and winter wrens. Young deciduous communities usually have more singing birds than we hear in early or even late coniferous forest.

We found bear claw marks on the red alder. Probably mink run up the ditch occasionally, but dog sign is abundant, and this will discourage most wild mammals except squirrels, deer mice, several species of shrews and voles, and porcupines.

Creek in ditch behind playground This stream should have good production of aquatic insects, and will be a great site for collecting for indoor examination, or better yet, outdoor studies, which allows return of critters to the stream. The ditch can be seen in the slides, Carstensen map and 1984 stereograms. It runs through deciduous thicket, which contributes nutritious litter for invertebrates. Sunlight also reaches the stream bed in many places, which encourages aquatic sedges, forget-me-nots, and burreed. The ditch is probably not accessible to fish, but I wouldn't be astonished to find dollies.

Even-aged spruce forest Historical photos of Douglas and Treadwell show them clearcut, apparently between 1907 and 1912. Figure this out for yourself with your

2 **PS 2021:** Apologies for the mix of english and metric measures. While comfortable with metric units on the horizontal plane, I've never adjusted to metric in the vertical realm: tree heights, tidal elevations, or mountain contours. Another issue; foresters tend to be irredeemably english, yet my diameter tape (converting tree circumferences to diameters) was, and remains, metric. Anyway, another good math exercise for your students!

3 **PS 2021**: On 2013 stereopair, following, that spruce stand has been replaced by a new housing tract. 3D examination is best for assessment of tree height and forest structure. But for easier point-to-point comparisons through time, 2D images in *series-sayeik.pdf*, [add link] precisely scaled and aligned, show changes to this and other sites with succession and disturbance.

4 PS 2012: There's a good class project! Check my prediction. Have the spruces indeed "topped out?"

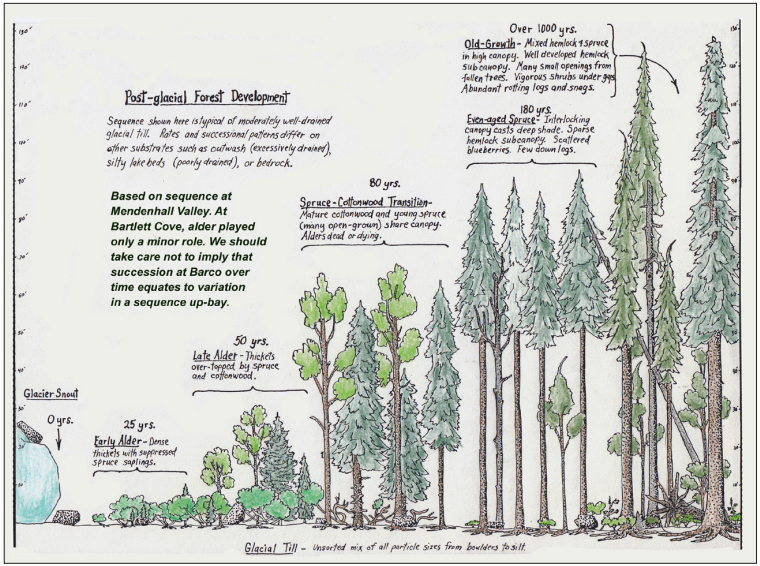
5 PS 2012: The workshop was given while *Nature of Southeast Alaska* 1st edition, was still in press. Photocopies of the B&W illustration (color version, next page) were distributed. One potential class project we identified at Sayéik would be to compare **secondary succession** on the school grounds to this sequence for **primary**, **post-glacial succession** in Mendenhall Valley.

PS 2021: Occurs to me that in 2004 I helped with a Science Fair project on this theme. Joey Bosworth and Erika O'Sullivan measured plots in an 80-year successional series on post-glacial and post-logging surfaces.

class by examining Trevor Davis' wonderful collection of historical photos, called *Looking Back on Juneau; the first 100 years*. Crow Hill and surrounding forests are probably about 80 years old (*PS 2021: Well, as of 1991 they were ~80 yrs. They're now ~110 years! I'll leave this way of expressing stand age uneditted as a cautionary reminder. Those of us studying and describing forest succession are better served by giving year-origin than stand-age at time of writing, which will soon become confusing.*)

The stand above the school's thicket habitat (coordinates 1—3.5 on my following schoolsite map, and slide 13 in site interpretation show) is almost pure spruce, suggesting a good deal of disturbance to soils during logging. Trees are growing slowly, with sparse, narrow crowns. Therefore more light penetrates to the understory than in most post-logging stands of this age. Blueberry, menziesia and devil's club are the main understory shrubs.

We cored a spruce in this stand that was about 85 years old. It was 60 feet high, 41 cm in diameter at the core, taken 70 cm AMS. Many blueberries here have been browsed, so deer use this stand in winter, certainly at risk from neighborhood dogs. Gastineau is the only school out of 8 in the district where we found considerable deer activity during our site workshops and reconnaissance. [6] It's worth emphasizing this uniqueness. Seeing deer sign is much less common on the mainland.



Sphagnum bog behind Crow Hill The Quarry access road leads to a delightful shore pine bog, extending back about a mile to Treadwell Ditch. This is a sphagnum moss bog, an ancient type of wetland, probably about 10,000 years old. It lies on poorly drained "blue clay," a local term for ancient marine sediments. This will be a fantastic area for fall or spring hikes (rubber boots!) or winter cross-country skiing. The Nordic Ski Club (call Foggy Mountain) has enough childrens' skis for a class outing.

6 PS 2021: Thirty years after giving this workshop, deer are becoming more common on the mainland—probably due mostly to increasingly milder winters. But nowhere are they as abundant as on Sayéik. On a recent Discovery staff outing at Bear Creek, we discussed how exciting it would be for students of this school to host teams from other, mainland schools, comparing animal sign, landforms, and other features of their well-known field destinations.

Notes from Cinda's wrap-up

Topics we covered

- trees
- aquatic insects
- raven tracks
- tree coring
- devil's club aging (nodes)
- skunk cabbage
- sedges
- mosses & lichens
- fungi
- deerberry
- deer browse
- mapping
- stereoscopes
- plant succession
- marine terraces
- treadwell ditch
- animal signs
- landforms
- birds in spring
- mining history
- food chains

Questions to ask:

Plants:

- how are roots laid out?
- basic IDs
- why are the 2 alder species different (niche)?
- ageing methods
- why is there change?

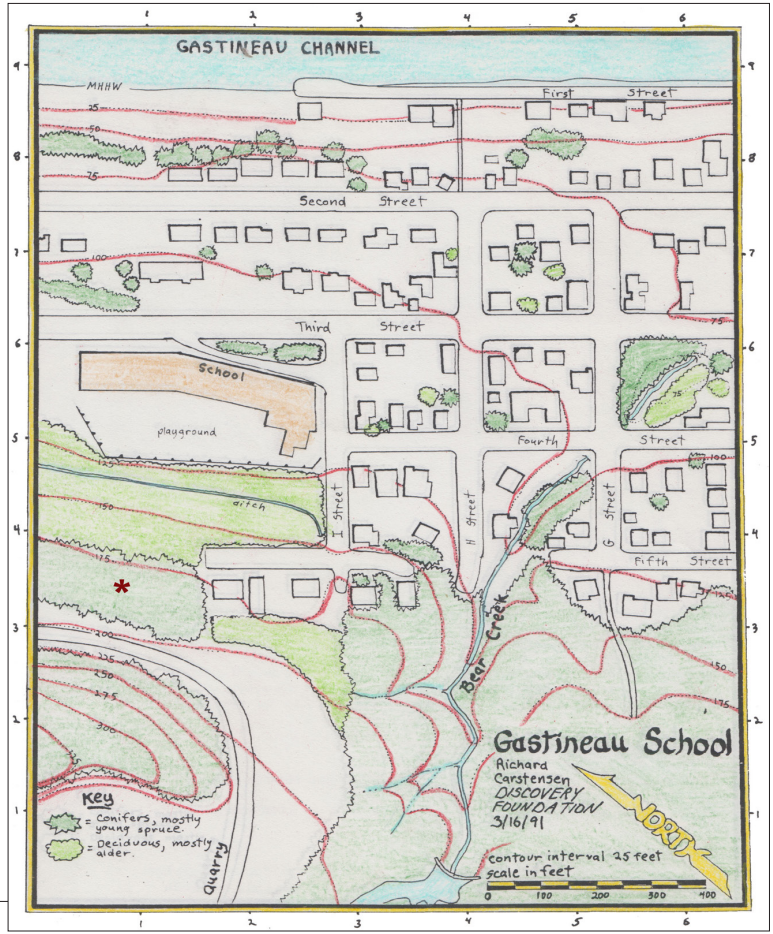
Pine bog behind Crow Hill, September, 1990. Lousy scan quality! Slide 14 of Crow Hill quarry, taken same day, is even worse. For a day I rummaged 35mm slide archives, wondering where the originals went to. Then Cathy remembered. On 19911204, our car window was smashed and my daypack stolen, with a carousel of slides for a forest ecology class—4 years of my best photography (never owned a camera until 1988). So this was scanned from a 35mm>35mm dupe that I later trashed after digitizing in 2012, assuming the originals were in my annual, chronologically-filed collections. Too bad. Scenes like these can be wonderful for repeat photography, but less informative when originals are this soft. • **2021**: This map is now an historical document in its own right! Many changes have occurred. Ask your students how many they can find. For example, that spruce forest at 1—3.5, marked with red asterisk, has been replaced by new homes.

- differences in young and old forests
- why are lichens colorful?
- ground cone—how does it parasitize alder?
- what is a bog?

Animals:
- why deer eat blueberry, not menziesia?
- track IDs
- what is commonest bird here? why?
- how do winter birds survive?

Geology:
- why the quarry?
- what is a delta?
- how can you tell a glacier was here?
- what's underneath the bog?
- why is this a good mining area?

History:
- what relation to mining?
- when was the logging? why?
- when was the school built?
- did mining fumes affect tree growth?



Discovery map for Gastineau School. See slide 12 in following interpretive script

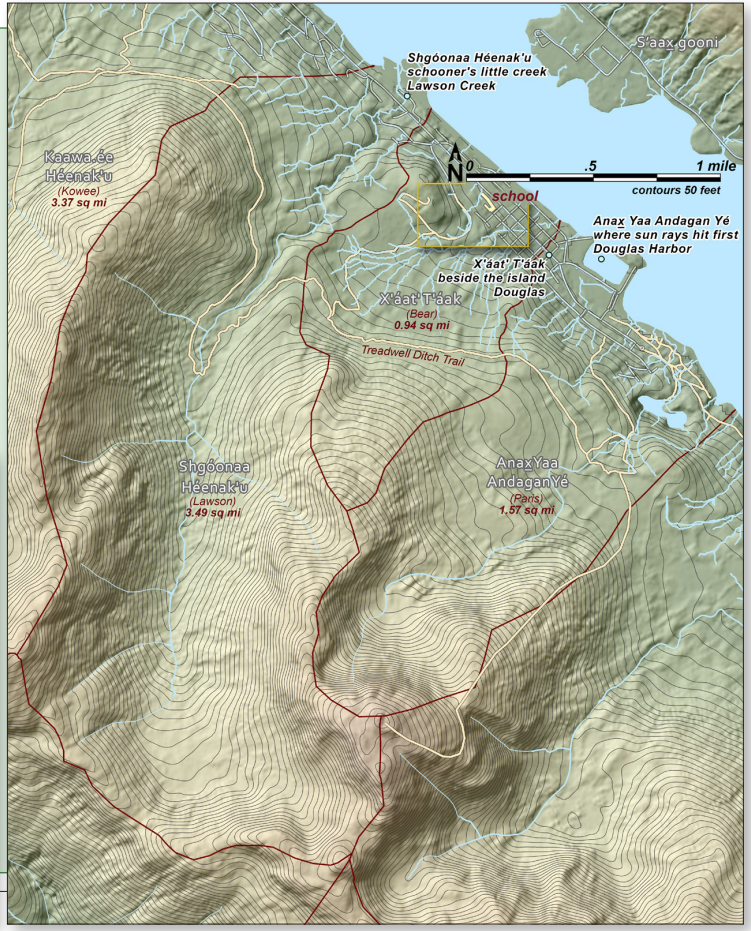
2021: GIS advances

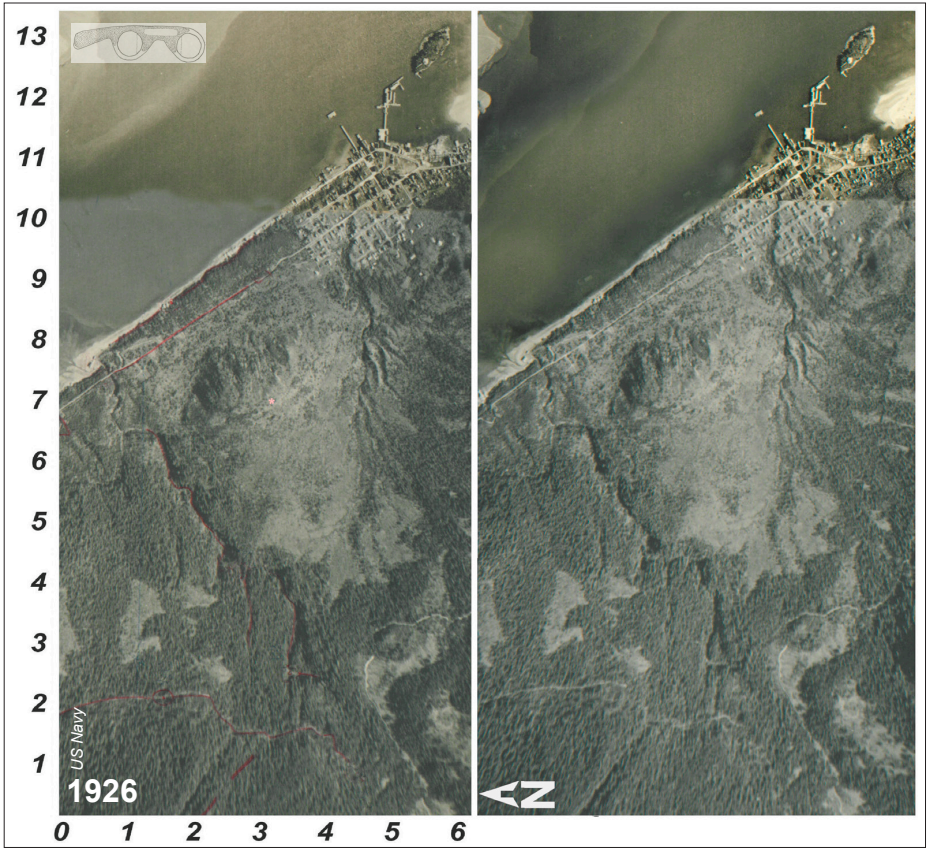
In 30 years since we offered the first Discovery workshop for what is now known as Sayéik Elementary, my cartographic tools have evolved enough to merit a sidebar.

In the following pre-GIS stereopair series and powerpoint, I made several estimates of watershed extent and size. Decades later, curious how these compare with more recent and powerful methods, I whipped out the map on right, based upon a DEM (digital elevation model) from 5-meter-pixel IfSAR remote sensing. Below is even better 1m-pixel LiDAR for the closer school environs, with model-predicted streams and fine contours allowing watershed boundary delineation on even the most gently sloping terrain.

Bear Creek watershed (re-christened with Lingít names here) is just under one square mile. Although I guessed that one fairly well without benefit of arcmap, turns out I was hugely off on the relative sizes of Bear and Lawson basins. Latter is only 3.7 times larger; not 10x!

Onto the finer-scale LiDAR 'bare earth' layer, I dropped 'normalized vegetation showing texture and relative height of trees—taller ones paler. Since acquiring this extraordinary cartographic resource, I can measure the height of any tree in the roaded CBJ to the nearest foot, sitting at home at the keyboard.





Stereograms For instructions, see *Using the stereoscopes and stereograms* in my Overview document for this workshop series. You could print these pages, but since students mostly now have chromebooks, a cheaper and brighter option is standing a pocket stereoscope over them

PS 2021: Although I've mostly resisted adding post-1991 materials to this workshop-materials package, this seems the obvious place to insert 2 stereograms: one preceding and one following the 1962-79-84 series in the original collection. I've modified the sequence of puzzlers accordingly.

Stereo is wonderful for the study of landforms and forest structure, but in an historical series it's impossible to orient stereopairs identically on successive pages for precise point-to-point comparison through time. For that, I've created a separate document, *series-sayeik.pdf*, using georeferenced historical imagery in simple 2D.

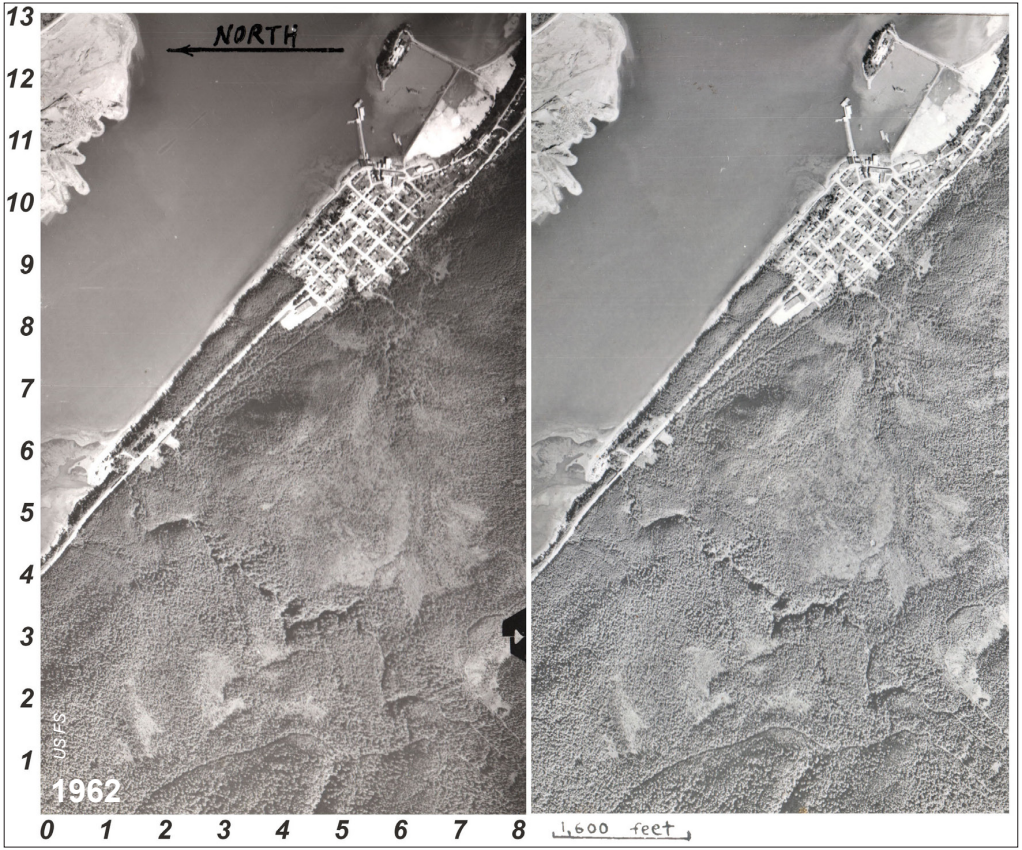
Gastineau School stereogram puzzlers

Before we begin, first locate the north arrows on all 5 stereopairs, as well as the surficial geology map. Because stereophoto orientation is constrained by flight direction, they're not all pointing in the same direction, and this can lead to confusion. On 1926, 1962 & 1984 pairs, north is to the left. In contrast, on the 1979 & 2013 pairs, and the geology map, north is at about 10-o'clock.

1) On this 1926 stereopair, locate the mouth of Shgóonaa Héenak'u, *schooner's little creek* (Lawson Creek; there was once a Tlingit village here). Its coordinates are over 1, up 7.5. We write this 1—7.5.

a) In stereo, move upstream along Shgóonaa Héenak'u, to where it cuts a deep ravine. Is this canyon cut into bedrock? or softer sediments? We'll return to this questions 7, 8 and 9, about surficial geology, and the last 10- to 14,000 years of postglacial history.

b) Find the summit of Crow Hill. This is impossible to specify on a single, 2D vertical airphoto, but easy in stereo perspective. I've placed a pink asterisk there, over 3, up 7 (3—7). It's also easier to



find the summit on these earliest images because there were essentially no trees there in 1926. Why?

c) Treadwell ditch trail ran across the bottom (west) portion of the 1926 pair. A cartographer highlighted part of it with red grease pencil. It's harder to find on the 1962 photos and almost vanished by 1979. Why?

2) Jump ahead to the 1984 color photos (scroll down 2 pages). Locate Gastineau School. Its coordinates are 3—5.

a) How long is it? Use the scale bar to measure its length. You can do this most accurately by marking the edges of the building on a piece of paper, then holding this paper against the scale bar.

b) Find the row of trees in front of the school. How tall are they compared to the building? (Next time you're across the street, look up and compare! Stereograms are great for measuring height of trees or mountains; in fact, this is how contour maps are made.)

c) Why do some of the cars on the street 'disappear' if you temporarily close one eye?

3) Now look for the school on the 1962 black and white stereogram, taken 22 years before the color photos.

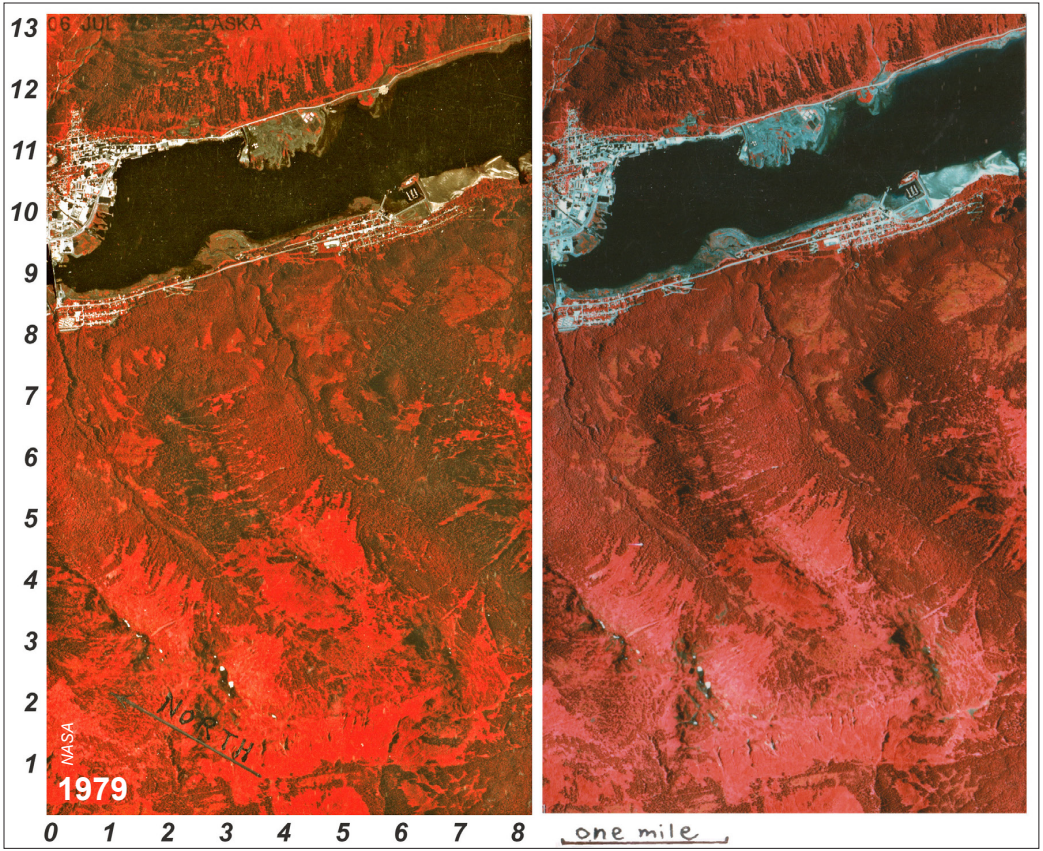
a) What differences can you find?

b) Did the trees in front of the building seem to be smaller? Are they fast or slow growing?

4) On the 1984's study the patch of land just behind the playground, and slightly uphill, at 3—4.5.

a) From your memory, what sort of trees grow there? It has a shorter, denser vegetation than the spruce forests just above it.

b) Now find this square patch on the 1962's, 4.5—8.



How is it different? Do the deciduous trees grow faster or slower than the evergreen spruces?

5) Find the highest point in the 1984's. In question #1 you did this on the 1926s but now it's covered by forest.

a) What are its coordinates?

b) Crow Hill is covered with dense forest, especially at 3—3. It looks like a tight shag carpet. (Compare it to the forest near the gully at 5—3.) Are trees on Crow Hill mostly the same size or variable?

c) Are they close together or far apart? Same age or different ages?

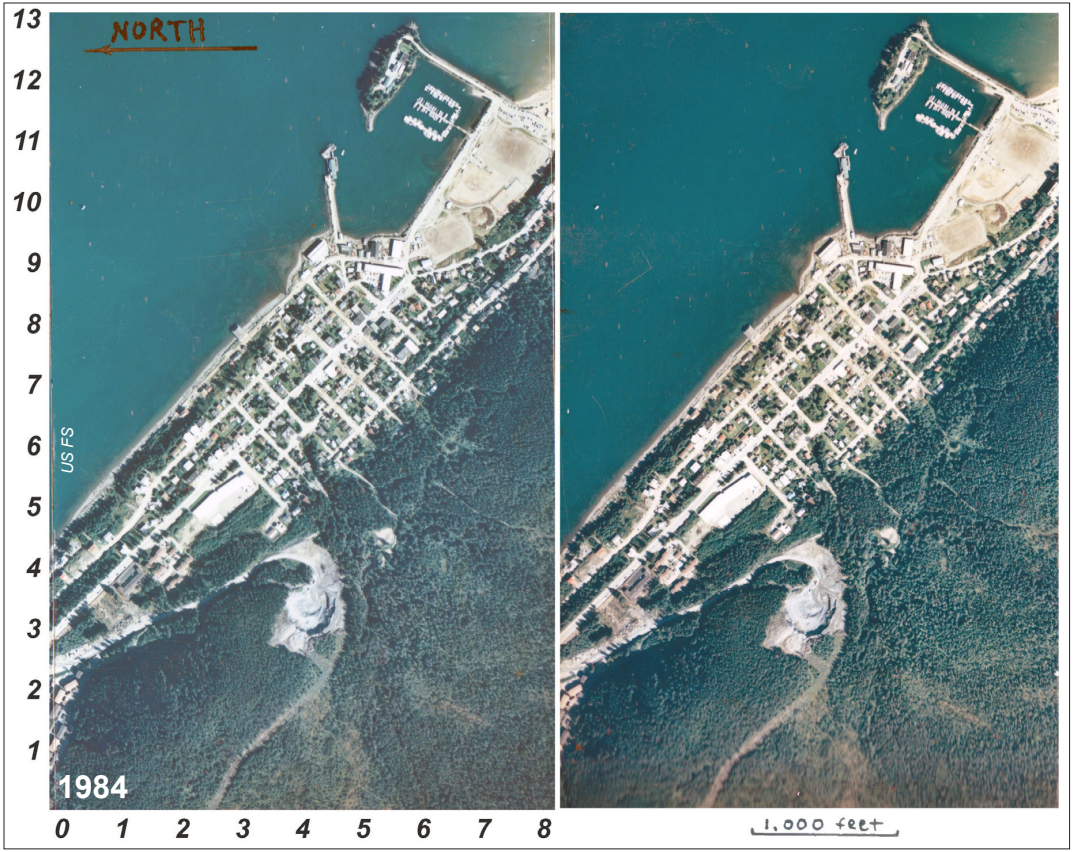
d) This is not an old-growth forest, which has a mix of big and small trees. What could have happened long ago to start all of the Crow Hill trees growing at once?

e) In 1984, was there water in the Bear Creek Reservoir? The concrete dam was built 50 years prior, in 1934, to supply water to Douglas.

6) Check out the 2013 stereo, concluding the historical series (In my *series-sayeik.pdf*, with precisely aligned 2D images, there's one more-recent image, from 2020). Our 2013 aerial has by far the best resolution of the collection. [1] Even on my rather 'dumbed-down' pdf export, there's enough resolution that you can afford to zoom in digitally quite a bit, and keep seeing more detail. Zoom limit is reached when our ~70 mm eye separation can no longer 'hang onto' the stereo effect.

a) Was the Crow Hill rock quarry still active in 2013?

1 Resolution is expressed as pixel size, when zoomed way in. The City's 2013 mission was flown at 6-inch pixel. Next best, by comparison, was the USFS 1984 imagery at about 3-foot pixel.



b) Check out the ravine of Bear Creek at 5—8.5. Was there still water in the reservoir?

c) At 0.5—9 is a water tank. Can you find it on the 1984 stereopair? (series-sayeik.pdf has an intermediary B&W photo from 1996 on which the water tank is present but the reservoir has disappeared. Are these two things related?

d) Comparing 2013 to 1984, (and the preceding 2006 aerial) are there any new features in the pine bog at 2-6? This area is sometimes referred to as Bear Creek Meadows.

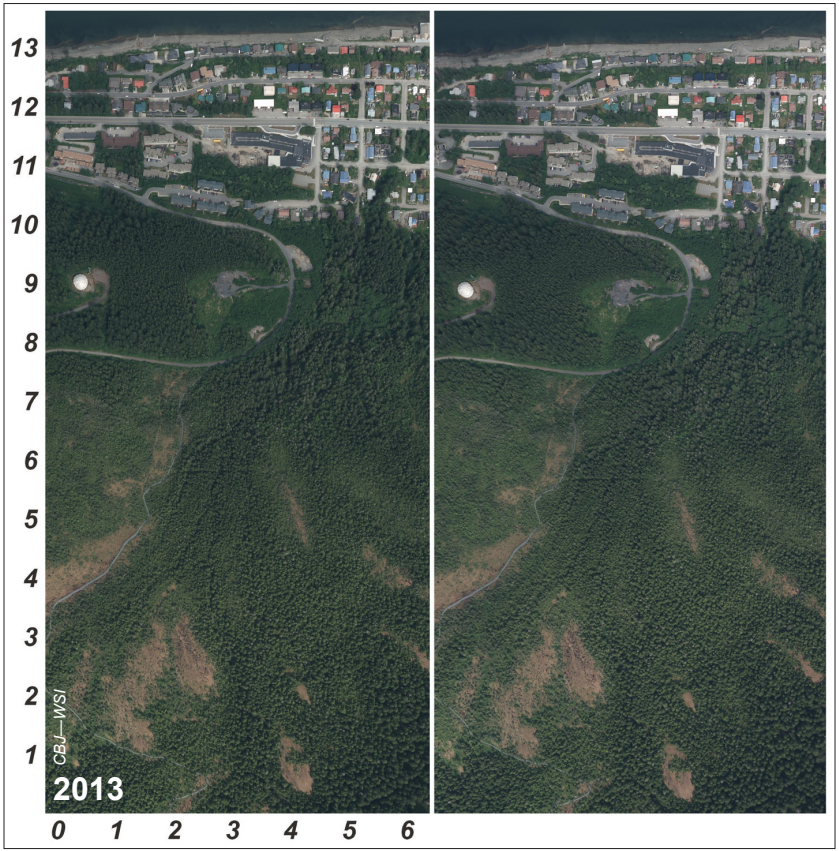
For earth science classes:

7) Look at the 1984's. Find the rock quarry behind the school, at 4—3. On the geology map this area is 9—9, one of the places without color, labeled "R". Bedrock outcrops here; not covered as elsewhere with loose surficial material. Slate is mined from this outcrop, and crushed for gravel.

a) Is this an old or recent quarry? (hint; look at the 1962s)

b) On the 1979 color infra-reds, clear sea water of Gastineau Channel appears black. Along the Douglas shore there are two greyish bulges at 3—9 and 6—10. What are the creeks that enter the sea at these places? What are these deposits? (*hint; check the surficial geology map*).

c) Also on the 1979 photos, compare the deltas to the similarly colored deposit on the opposite shore, at 4—11. Find this on the geology map, at 8—12. What caused the deposit? (*Hint; on the color infra-reds, there is no obvious creek gully on the mountainside above. Instead, look just to the left, and*



uphill from the deposit, at 6—12.)

d) Now find downtown Juneau on the geology map (3—10). Notice that, like Douglas, most of Juneau is built on ancient delta ("*do*," coded brown). This is not coincidence! Why do old deltas make good townsites?

8) On the 1962's, trace the course of Bear Creek from its present delta at 4.5—10, back up through the gorge by the school, into the pine bog at 6—4. Most of the city of Douglas is built upon a gently sloping ancient creek delta, deposited when sea level was at least 200 feet higher than today. This is shown on the geology map as a brown area labeled "*do*."

Now find Bear Creek on the 1979 photos. Its watershed is the relatively open bowl-shaped area behind Crow Hill, centered at 5—8. All rain falling into this watershed either evaporates, soaks into the ground, or flows into the sea through Bear Creek.

Find Lawson Creek on the geology map. It flows northeast through the center of the map. Now that you're oriented, locate Lawson Creek and watershed in 3D on the 1979 stereogram pair. It's the big watershed curving through the center of the scene. Notice how much easier it is to appreciate the depth of this U-shaped valley in stereo, than when looking at a 'flat' 2D photo.

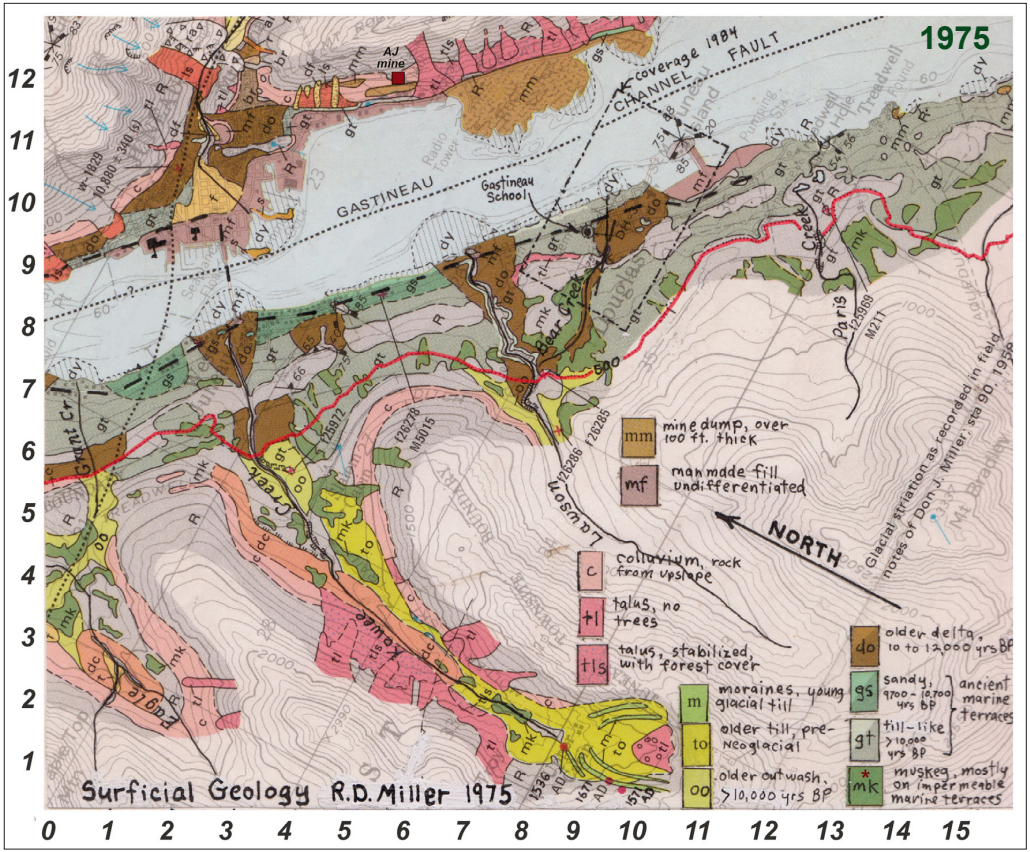
a) Compared to the Lawson watershed, how big is the entire basin feeding Bear Creek today? Now, let's think about the ability of such big and little streams to transport sediment . . .

Okay, brace yourself! Here comes the trickiest puzzler on the worksheet . . .

9) Do you think that the large ancient delta of Bear Creek could have been formed during the past 10 millennia or so, just by sediments washed out of tiny Bear Creek watershed?

Probably not. The delta is composed of sand and gravels more than a hundred feet deep. So how come such a big deposit? On the coarse-scale 1979 color infra-reds, study the hills and valleys of Douglas Island above Gastineau School, and see if you can figure out what happened.

Hint; On the 1979 color infra-reds, we noted earlier that Lawson Creek is



deeply incised into a canyon in its lower reaches. Do you think this stream (PS, more properly called Shgóonaa Héenak'u, *schooner's little creek*) has always flowed in such a deep gorge?

* PS 2021: Darkest green on this map—keyed in lower right corner—represents "muskeg." a problematic habitat label. In the 1990s, like visiting geologist RD Miller, I followed the colloquial nomenclature and spoke of "muskegs." Then, a soils scientist named Terry Brock came to work for the Forest Service and began a campaign to retire this term, in favor of more standardized wetlands terminology. A better name for these dark green polygons is "peatland," an umbrella term for both sphagnum bogs and sedge fens. For background, see page 74 of *The Nature of Southeast Alaska*, 3rd edition.

Teachers may also note that I've made extensive modifications to this 'surf-geo' map in GIS since around 2005, using simplified overlays in for almost every local watershed description. These adaptations are more student-friendly than the original USGS map, which can be overwhelmingly detailed for the first-time user.

PS 2012 'Deliverables' from our 1990 teacher workshop series were 3-ring binders placed in every school library. These included limited sets of stereograms and stereoscopes for group viewing. In this re-issue we're only offering the stereograms in digital form. But, depending on availability, you may be able to borrow a set of viewers and images from our office (463-1500). See *Using the stereoscopes & stereograms* in my *Overview document*. for more suggestions on viewing options.

To Teachers

The stereogram series for CBJ schools provide insights into cultural history, geology, and natural communities. Most air photos used in these stereopairs are also included in associated slideshows [*PS 2012 - now a downloadable powerpoint*]. But if you study them first in stereo, it'll be easier to interpret features, and you'll do a better job of guiding your students around on the projected photos. We also suggest leaving a stereoscope and printed stereograms, along with the puzzler sheet, out in your room for students to use during free time. Some teachers at other schools report high interest. (Watch out for wet hair after recess! Causes irremovable stains on color printouts!)

Surficial geology map Fifth grade teachers will be especially interested in this USGS map by R.D. Miller, which has a wealth of local information to apply to your earth science studies. [1] I've excerpted just the portion centered around your school. You may want to order the original map from USGS, which has a more complete description of the surface types. It's a beautiful map to leave up on your wall.

Teacher's answers for stereogram puzzler sheet I've given coordinates to the nearest half-unit. Answers in that vicinity are fine.

1) 1929 aerials

a) This dominant stream has trenched into soft marine sediments over the past ~10,000 years.

b) All of Crow Hill, and most of the slopes behind Douglas and Treadwell, were logged during the mining era. Many that weren't cut were killed by air pollution. Extent of this logging is mapped in my brochure on Treadwell, downloadable from *JuneauNature*.

c) Treadwell ditch trail is now almost completely overhung with conifers. You can find traces of it in the 1979 aerials, but closure was nearly complete.

2) 1984 aerials

a) The school building is about 400 feet long. You can have students check their estimates by also measuring the building on the Discovery school grounds map.

b) The trees are a little taller than the school. Notice also that their shadows are slightly longer.

c) Moving cars are not in the same position on the two photos because several seconds went by between shots from the plane. This makes them seem to 'jump around.'

3) 1962 aerials

a) The photo is smaller scale, so things look smaller and more area is covered. But also, the school was just plain smaller in 1962. This picture was taken before the addition on the northwest end. And Douglas itself expanded between 1962 and 84. There were fewer surrounding houses in 1962.

b) Same height in 1962, so the spruces are slow growing.

4) 1984s - playground stand

a) Cottonwoods, alders, willows.

b) In 1962 the patch looks recently cleared, These deciduous trees grow faster than spruces. In 22 years quite a little forest has grown here, while the spruces in front of the building hardly look any different.

5) 1984s, Crow Hill

a) 2—1.5.

b) Same size.

c) Close together. Same age.

d) In the early 1900's most of the hillsides above Douglas were logged. If you count rings on some of the recently cut spruces on Crow Hill, you'll find most trees are about eighty years old. [*PS 2021: Now they're about 110 old. Visiting and measuring this forest would be a great field trip project!*]

e) On the 1984 aerials you can see the reservoir pretty clearly. It's a little more challenging on the 1962s, but zooming in you should find it. Flipping back to 1929—5 years before dam construction—there was no open water there.

6) 2013s, high-res

a) A small part of the quarry was still raw in 2013, with dark grey exposed slate. The rest of the big 'scoop-out' that showed in the 1984 aerials had grown in densely

1 PS: Science standards have shuffled a bit since 1991, when geology and landforms were addressed mostly in 5th grade.

with alders. By 2020 (see *series-sayeik.pdf*) that last little opening also appeared to be filling in with brush.

b) No reservoir by 2013 (or for that matter on the preceding 2006 aerial, or the 1996 B&W image in *series-sayeik.pdf*)

c) The water tank, and its hill-climbing access road are absent on the 1984 aerials but present by 1996. Once the tank began feeding water to Douglas, Bear Creek Reservoir was drained. I have no exact dates for this

d) Pine bog is now transected by a raised gravel trail that shows as a clear grey line, one of several new connecting spurs to Treadwell Ditch Trail. It wasn't present in 1984, nor on the 1996 orthophotos in *series-sayeik.pdf*), or even on the 2006 aerial, although I did overlay a line on that image, showing its future location. When Discovery naturalists led field trips in this bog, only a few local residents used the wonderful savannah-like complex behind Crow Hill. The large majority of Alaskan outdoors people (hunters & trappers excepted) rarely step off trail

We typically left the watertank access road close to where the new-spur trailhead was established, eventually creating a rather muddy track from decades of traffic by full elementary classes—it shows on the 2006 aerials. The new trail has become extremely popular, especially with Douglas dogwalkers. On the positive side, it provides unlimited 'jump-off' options for Discovery bushwacks, allowing us to fan out, avoiding the erosion associated with our original 'bottleneck' entrypoint.

For earth science classes:

7) 1984s & 1979 color infra-reds

a) Relatively recent. Not there in 1962.

b) These deposits are labeled "*dy*," for young deltas, and coded with slanting lines. They're actively forming at the mouths of Lawson and Bear Creeks.

c) On the geology map this is sandy colored and labeled *mm*, for mine dump. These are tailings from the old AJ mine, at at 6 —12.

d) Most of the land near Gastineau channel is too steep to build on safely. Avalanches are common, and road and foundation building is expensive. You can see many flat places on marine terraces of Douglas Island, but they are mostly green-coded peatlands—too wet for buildings. Most of the well drained, fairly level places in the Juneau-Douglas area are either active stream fans (*f*, tan-colored: *eg* Gold Creek fan in downtown Juneau) or ancient deltas, now perched high above sea level, but once formed by streams.

8) 1962s & 1979s

a) On the 1979 color infrareds, Lawson Creek watershed is the curving valley with U-shaped profile that heads at 8—2 and drains down to the delta at 3—9. Bear Creek watershed is roughly a tenth the size of Lawson. [2]

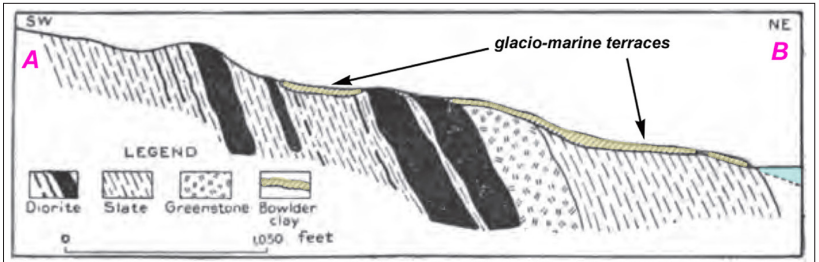
9) 1970s and geology map

We (Streveler & Carstensen) propose that Lawson and Bear Creeks only began to cut deeply into their deposits (and other parts of the marine terrace) since sea level dropped to its present elevation, probably over the last ~6000 years. When ancient deltas were forming (still in aggrading phase), creeks flowed at their surface.

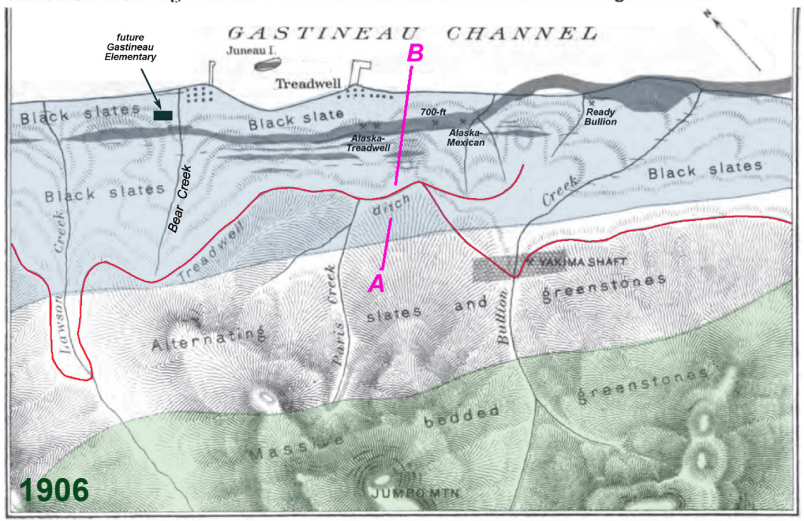
Modern Lawson Creek has a much larger watershed than Bear Creek. If Lawson Creek wasn't as deeply entrenched 9 to 12,000 years ago, it could then have flowed into what we now know as Bear Creek watershed, entering the sea to the east of Crow Hill, instead of to the west as it does today. For more than a thousand years, before falling sea levels and down-cutting streams isolated Lawson Creek in its present channel, it dumped sediments on the present Douglas townsite.

We aren't sure this hypothesis is correct. Ask your students how they might test it. Perhaps a geologist could sample the sediments in the Douglas delta, and compare them to bedrock in the headwaters of Lawson Creek.

2 PS 2021. *Hmmmm*, so much for my pre-GIS ability to eyeball and estimate drainages. In the sidebar *GIS advances*, there's high-confidence watershed units, At 3.5 mi^2, Lawson basin is only about 3.7 times the size of Bear's ~.0.94 mi^2



Cross section through Alaska-Treadwell mine and northern side of Douglas Island.



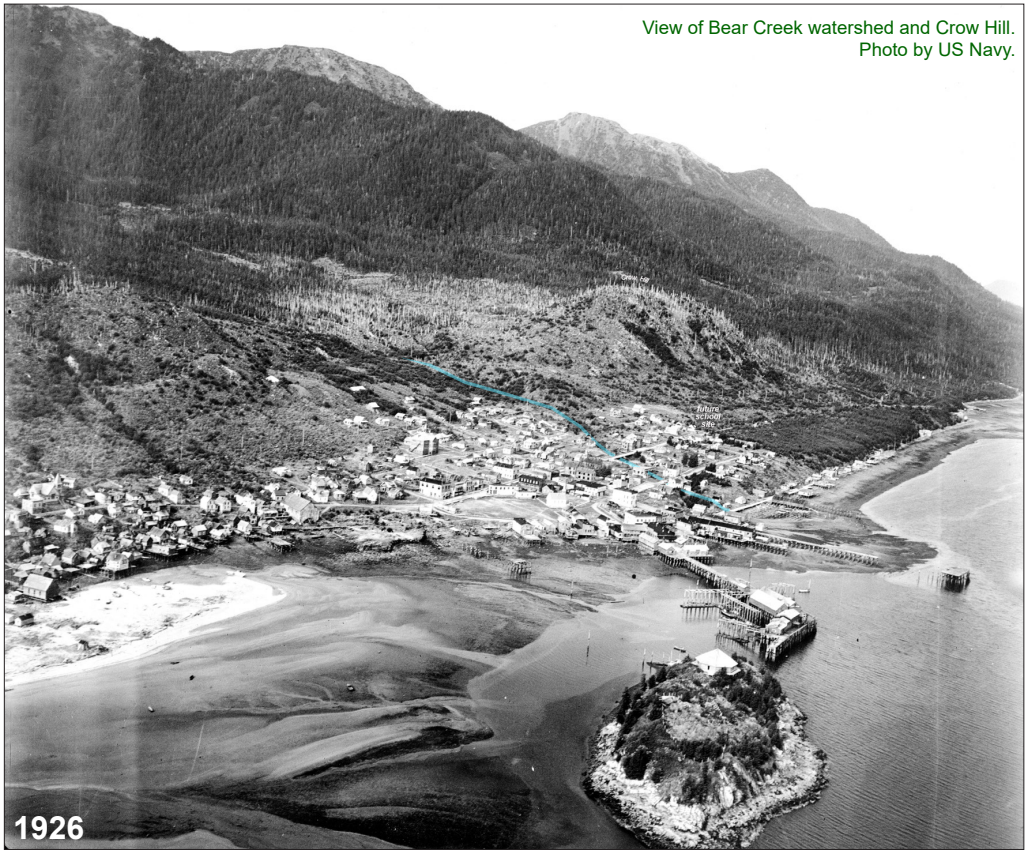
SKETCH MAP SHOWING GEOLOGY ON NORTHEAST SIDE OF DOUGLAS ISLAND IN THE VICINITY OF THE TREADWELL GROUP OF MINES
Scale
0 ¼ ½ ¾ 1 mile

Map and geologic section from a 1906 USGS report by Spencer.

PS 2012: I've labeled tiny Bear Creek and showed the approximate location of Gastineau School. Red line shows upper limit of glacio-marine overburden. More detailed geologic mapping has since been done, some of which I reformatted for the CBJ trails project. But this lovely hand-drawn map and profile gives 'unfiltered' insight into some of the historical dimensions of Gastineau's back yard.

PS 2021: More *JuneauNature* resources for Sayéik, *spirit helper* (Gastineau School). Natural history of the nearby Treadwell/Sandy Beach trails is well described. Contents of the 3-panel trailhead sign are downloadable to your phone, as is an interpretive brochure for the trail. You can load a choice of geopdfs to your phone for navigation in the school vicinity, using the app Avenza. A 2016 drone flight over the pine bog and gorge of Shgóonaa Héenak'u (Lawson Cr) is streamable from vimeo.

The page for this school is under a new header tab, specifically for teachers: SCHOOLS> Schools of Áak'w & T'aakú Aaní> Sayéik (Gastineau) Elementary. Related, downloadable items and streamable video is listed at bottom of the category page, under *In this section*.



View of Bear Creek watershed and Crow Hill.
Photo by US Navy.

PS RC 2012 Long after completing the Gastineau School teachers workshop, I delved into geology and mining history of the area during a study of Treadwell Historic Trail for CBJ Parks & Recreation. This is a great field trip destination within walking distance of the Elementary School. In the course of my work I came upon this oblique aerial taken by the Navy during the last days of Douglas' mining era.

T'aaku Kwáan village lines the waterfront on the left. On October 10th of the same year this photo was taken, most of these buildings and all of Treadwell burned to the ground in the second of 4 great Douglas fires. Part of the 4-mile-long Douglas clearcut is visible in this scene, completely encompassing Crow Hill in middle distance. Also visible are pale snags, broken-topped and long-dead. These killed trees first appeared in some of the earliest photos of Douglas and Treadwell, *prior to construction of the cyanide plant*. So, as Juneau historian Jim Geraghty points out, mortality probably can't be blamed on that facility as one sometimes hears. They did appear to die of air pollution, however, possibly from the earlier chlorination works. Note that these bleached, dead trees extend well back into the Bear Creek basin

Although logging began here a good 30 years before this photo was taken, very little regrowth had occurred by 1926. Possibly this retarded succession was also due to toxins from the mines.

Preface RC 2012: This and other slide shows in our *Nature near the schools* workshop series of course literally were ***slide*** shows in the early 1990s; collections of 35-mm slides were included in notebooks we placed in all school libraries. For this re-issue of the workshop notes, I've converted the shows to powerpoint format. You can download *xxxxx.pptx* from *JuneauNature*.

Slide show script

Note to Teachers The site interpretation workshop for Gastineau School encompassed bedrock and surficial geology, glacial and human history, plant succession, mapping, and other topics. These site interpretation slides are exclusively of maps and air photos. chosen to give the 'big picture' of the school surroundings. For other, more intimate views (mouse tracks in snow for example), please refer to slide shows on other topics in natural history contained in associated notebooks.

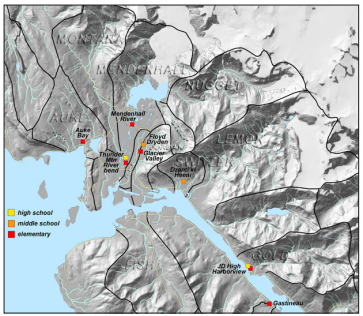
You may wish to present some of the technical words, printed **bold**, in a separate class before viewing the slides.

I recommend you review the stereograms and puzzlers (following this script) before presenting the slide show to your class, and decide which you'd like to do first There are several 'teaser' questions, repeated in both formats. Depending on which comes first—stereo exercises or projected slides—you might want to withhold some of the "answers" (given in *italics* within this script).

If you've never used air photos before, don't be intimidated. We've discovered students are fascinated (especially when they find their houses!), and take to the historical sequences like ducks to water. When time permits, I like to have kids come up and point out features on the screen. If you have any questions about photo interpretation, or need suggestions on classroom use, contact one of the Discovery naturalists. We're also happy to help you with the stereogram page and accompanying worksheet,. which allows students to see some of these air photos in 3D by use of a stereoscope.

1) title slide Juneau Public Schools sit in one of the most dramatic landscapes on earth, where lush rain forest is sandwiched between ocean and icy peaks. Maps and air photos can help us see the BIG PICTURE. Where do we live? What shapes this place?

2) CBJ watersheds context *[PS RC 2012: I've replaced the original context slide with this hillshade map created in GIS. It includes features such as Thunder Mt HS, and a more accurate watershed delineation, not present or available when we gave these workshops.]*



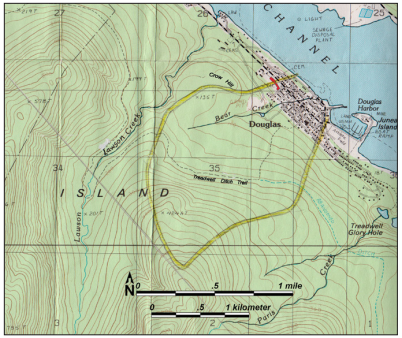
On this shaded relief map, the important watersheds for our schools are outlined, and labeled in caps. Gastineau Elementary is in the tiny Bear Creek watershed. The downtown schools are in the 12-square-mile Gold Creek watershed. Dzantik'i Heeni Middle School is in the Switzer Creek watershed, part of the greater Lemon Creek drainage.

Skipping past the valley, Auke Bay Elementary is in a loosely defined watershed that here includes Lake Creek, Auke Lake, and streams like Auk Nu and Waydelich. Tiny Bay Creek trickles along the edge of the school grounds.

Our remaining 5 schools are in the greater Mendenhall watershed, spanning about 100 square miles. But it's useful to subdivide it into 3 large basins: Montana, Mendenhall and Nugget. The smaller Jordan and Duck Creek watersheds are home to Floyd Dryden and Glacier Valley Schools. Thunder Mountain High and Riverbend Elementary are near a footbridge accessing the confluence of Montana Creek with Mendenhall River. Finally, Mendenhall River School is on the edge of the large Forest Service Recreation area. Few schools on earth are so privileged in terms of access to nearby wild land.

3) USGS topographic map The US Geological Survey has metric topographic maps for CBJ's road system, based on 1984 air photographs, which we'll see shortly. (Prior topos were based on 1948 aerials.) On these newer maps scale is in kilometers, and elevation contours are 20 meters instead of 100 feet. They're **coarser scale***;* that is, objects appear larger on them, and they cover less area. Each of the squares on this map is one kilometer on a side.

I colored the school red and roughly outlined Bear Creek watershed with a yellow line.This map shows the watershed of Gold Creek. Find the following features: Crow Hill, Lawson Creek (watershed north of

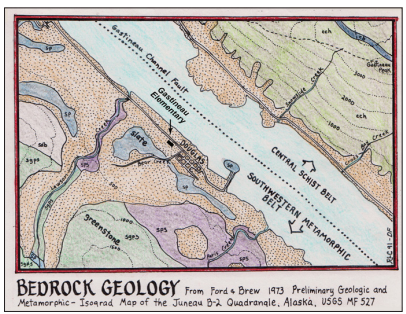


Bear), Paris Creek (feeding Treadwell Glory Hole), Treadwell Ditch Trail.

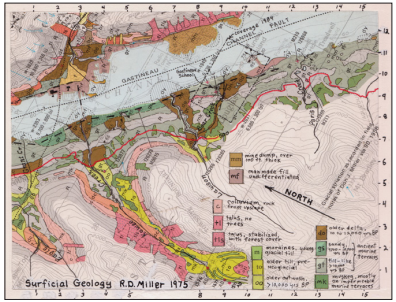
How big is Bear Creek watershed? (*About 2.5 square kilometers. Use squares to estimate.*) Does Lawson Creek drain more or less area than Bear Creek? Should it carry more or less water? (*Drains more area and should carry more water.*) [1]

4) bedrock map of Douglas area Bedrock is the solid mass of rock forming the earth's crust. This is a simplified tracing of a USGS map showing bedrock types. The main types are lined up in belts running southeast to northwest. Principle rock types on the hills above Douglas are **greenstone** and **slate**, **metamorphic** rocks altered deep in the earth by heat and pressure.

The sandy colored stippled area shows **surficial deposits**, loose materials left by ocean, glaciers and rivers. The next map shows the surface materials in greater detail. Most of downtown Douglas is built on surficial deposits. But Crow Hill just above town is a bedrock knob. On this map it's part of the bluish area labelled "slate."



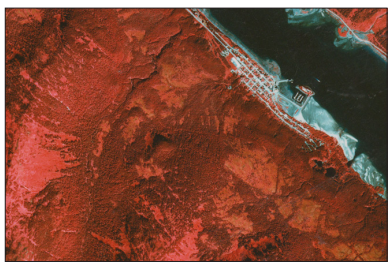
5) surficial geology map This map has been turned so that north is at "10 o'clock," rather than straight up. All bedrock types have been lumped as simply "R", and shown in grey, while the different types of surficial deposits are keyed by "color families."



Pinks (*c, tl, tls*) show **colluvium** --material fallen off steep mountainsides. The purplish "*mf*" stands for man-made fill, in this case **tailings** from the Treadwell and AJ mines. The playing fields near the Douglas boat harbor are built on fill. Greyish-green (*g, gs, gt*) is a **marine terrace**, left by the sea when it covered Southeast Alaska's shoreline up to as high as 500 feet above present sea level, 9 to 12,000 years ago.

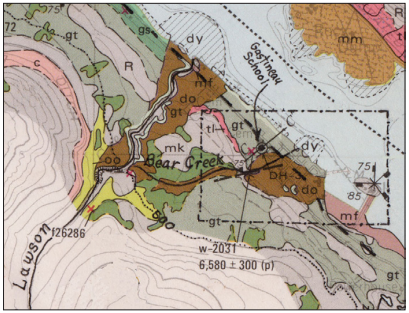
I've highlighted the 500 foot contour as a red line so you can imagine the shoreline of 12,000 years ago. The brown color, labelled "do" stands for "old delta." A **delta** is formed where a river or stream meets a lake or sea, and deposits sediments under water. We'll look more closely at Douglas' ancient delta in a moment. Just notice, for now, that much of downtown Juneau is *also* built on old delta!

6) 1979 color infra-red air photo of Bear Creek watershed Here's the first of several photographs taken straight downward from planes. This one, taken in 1979, is color infra-red: conifer forest appears dark red, alpine ridge tops and the alder thickets are brighter red, and the clear water of Gastineau Channel is black. This is the **coarsest scale** of the photos you'll be seeing; that is, objects like buildings appear relatively small, and it shows the largest area.



Find these features (flip back to the maps if you need help): Gastineau School, Bear Creek, Lawson Creek,

1 PS 2021: We can now do a more accurate depiction of the 'contributing area' to Bear Creek, measuring from the City's 2013 LiDAR. In the preceding sidebar GIS advances, I measured area as 0.94 mi^2 (2.43 km^2).

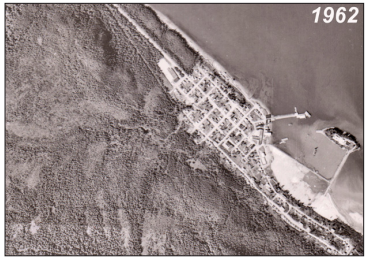


Treadwell Ditch, modern delta of Bear Creek. What is the name of the creek entering Gastineau Channel near the bridge? (*Kowee*) Now let's zoom in on the town of Douglas, and see what types of landforms it's built on ...

7) closeup of surficial geology map First, note that north is up again. Now, find the school. The rectangle shows the area you'll be seeing in a closeup air photo. Now we can see that most of Douglas is built on the landform colored brown, labeled "do" for "old delta." This delta was formed thousands of years ago when sea level was hundreds of feet higher. When you walk from the school downhill toward the harbor, you're following the slope of this ancient delta. (*To teacher - The history of this delta is complex, but we've attempted to describe it in Stereogram Puzzler #7.*)

8) 1984 true color air photo of Douglas On this finer-scale air photo, it's now easier to see buildings, boats, and differences in tree sizes. Shadows form to the upper right of houses and trees. Is anybody's house in this picture? North is up in this photo. At about what time of day was the picture taken? (*Early afternoon; at noon the shadow was pointing straight north.*)

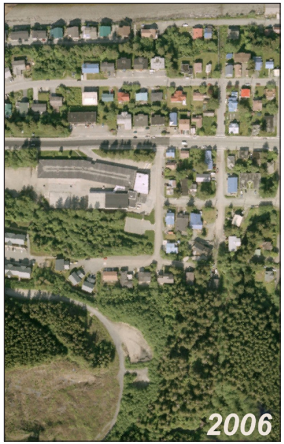
Trace Bear Creek from its present delta (*look for a little indentation in the beach*), back up through the gorge by the school. You can follow its path through town because it's lined with trees. The biggest area of shadow on this photo is in the upper left. This is the shadow of Crow Hill. At the base of the hill, near Gastineau School, is a big circular pit. What is this? (*A quarry, where slate is mined.*) Why is the forest on Crow Hill so smooth looking? (*Small, closely spaced trees, younger than the big trees along Bear Creek.*) Now study the school itself, and cottonwoods forest behind playground. Watch what happens there as we go back in time to 1962 ...

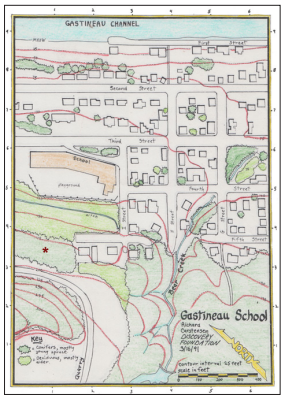


9) 1962 b & w Thirty years ago the school was smaller because the northwest addition hadn't been built. There was only low brush in the area behind the playground. What are some of the other differences between 1962 and 1984? (*To teacher - Flip back and forth between 1962 & 1984. Some changes: the quarry, the new road - 2nd street - between Douglas Highway and the beach. Also, the harbor slips hadn't been built, and the sandy area above the dike was still being filled.*)

Did anybody's house "disappear" as we went from 1984 back to 1962? Now let's zoom in again, for an even closer look at Gastineau School.. ..

10) closeup of Gastineau School, 1984 In this late April photo, it's easy to tell which are conifer forests and which are younger deciduous forests, just getting their spring leaves. Find these features: the school, the playground, the little ditched stream in the cottonwood forest behind the playground,





the quarry, Bear Creek, and the dam on Bear Creek (*bottom right*).

11) closeup of Gastineau School, 2006 [*PS 2012: added for the re-issue of this slideshow]* The most striking change is the greater luxuriance of deciduous trees and shrubs, especially in the area behind the school playground, and along the quarry road.

12) Discovery map of Gastineau School Find the contour lines running across this map. The contour interval is 25 feet. How high is the school above the beach? (100 to 125 feet.) Notice how the contour lines are close together and deeply "indented" along Bear Creek. What does that tell you? (*The creek is in a steep-sided gorge.*)

Let's finish by looking at 3 photos taken in September, 1990. We'll first go up the young spruce forest upslope from the school, then the quarry. Finally, we'll see the Bear Creek pine bog behind Crow Hill, which doesn't show on this map.

13) Young spruce stand This forest is older than the brushy area in the last picture, but these spruces are actually young as conifers go; about a century old. You might call this a "teenage forest." What are your clues that this isn't an ancient forest? (*1) Stubs of whorled branches, all coming out from the same level, tell you that the bases of these trees got much more light when they were younger; they didn't come up through an older forest. 2) Most of the trees are spruce, while old-growth forests are mostly hemlock. 3) The trees are all about the same size. They all got started at about the same time, while old-growth forests are "uneven-aged."*)

Let's look at a view of this forest where it's been" sliced away" above the quarry ....

14) Crow Hill quarry Here it's easier to see that all the trees are about the same size and age. An old-growth forest looks much more ragged and uneven. All of this forest is second growth, which has come back since the original old growth was logged in the early 1900's. The Crow Hill quarry has been mined for slate. Can you find the bedrock outcrops?

15) Bay Creek bog Behind Crow Hill is the watershed of Bear Creek, mostly sphagnum bog with small shore pines. Although these pines look smaller and scrubbier than the "teenage" or second-growth spruce forest, this bog is actually an ancient community. The trees are stunted because the soils are so wet. In the distance the forest drops into an unseen valley, before rising to the mountain skyline. That valley is the watershed of Lawson Creek.