

## Mountain Sustainability Course Notes (Grades K-3)(1)

### Resources:

“On My Mountain” by Francois Aubineau  
Hand sanitizer  
Mars Bars  
Towel or blanket, folded lengthwise  
MS K-3 Field Guides  
Pencil  
Compass  
Anemometer  
Thermometer  
Soil thermometer

Please see corresponding  
Mountain Sustainability K-3 Field Guide

Notes to teachers and education guides: This is a circular program. We start by asking students what being on the mountain means to them. Their answer will be something along the lines of *“When I come to a mountain, I feel free/I can breathe/I’m out of the classroom/it reminds me of hiking with my family/I feel peaceful/I want to ski/I am afraid of bears...”*

At the end of the program, students have 15 minutes to reflect individually to embed some of the learned material on an emotional and visceral level by completing their sketches from their observations on the hike.

3 Things-to-Do at the end of the program are to empower this age group to build good habits of involvement in citizen-science, observation and record-keeping, and sharing and caring for mountains.

### **Mountain creation/destruction/movement.**

How does the mountain feel under your feet?

Solid, hard?

What if I told you it was moving? What if I told you it was moving so slowly that you can’t even feel it?

The earth is covered by large plates of rock and on top of them sit the land and ocean. The plates of rock are always moving. They bump into each other. They slide overtop

and below each other. They push up through the land and ocean on top of them as mountains and sometimes as volcanoes. Even as we stand here now, mountains are rising out of the earth, and moving, and changing shape. Himalaya mountains are rising more than 1 cm a year! Mountains growing as fast as your fingernails!

So we have rock pushing through the land and ocean because the plates underneath are colliding, pushing into each other. These are **fold mountains**.

### **Activity 1: The Beach Towel Shuffle**

Stand or sit on either end of a stack of towels or a large blanket. Here, you and your classmates will act as the layer of earth's crust found just below the surface (a.k.a. **tectonic plates**). As you shuffle towards your partners on the opposite side of the towel, watch as the folds and creases are formed in the towel or, in our example, the earth. This is similar to how the movement of earth's crust creates folded mountains!

Examples: the Andes in South America are fold mountains. They are the longest mountain range in the world, and still grow about 10 cm every hundred years.

How else are mountains made? **Volcanoes**! Where magma, hot liquid rock, is pushed up through the earth's crust, it cools into rock, and more magma comes up and cools on top of that, and on top of that, until you have a volcano.

Mount Garibaldi is a volcano— last erupted about 8,000 to 13,000 years ago. It's dormant now.

And what if magma is pushed only part-way through the earth's crust and not all the way through, and it pushes the land up above it? Those are **dome mountains**.

Now let's look at what shapes our mountains.

### **Mountains and weather**

Mountains influence on weather – rain and snow fall on mountaintops more than down below because it's colder up on a mountain. As air rises to pass over a mountain, it cools and can't hold as much moisture so it lets it go as rain. So one side of a mountain often gets more rain than the other.

Weather's influence on mountains – wind – trees grow in funny shapes, their trunks sometimes twisted, with short branches often growing off only one side, few leafy trees/bushes (salal!)

- Shape of trees you'll notice:
  - **Krummholz** = stunted or deformed vegetation in the subalpine
  - **Flagging** = where you have growth on only one side of a tree due to winds



Subalpine tree growth.  
Photo by Martha Warren

Easier for plants in the subalpine to have needles instead of leaves so they don't have to wait to grow new leaves in Spring to create food for themselves from sunlight!

## Activity 2: Recording weather

Support students in completing weather section of Field Guide. Small groups, 3-4 students.

Weather experiments: anemometer, soil thermometer, compass

How to measure wind direction? Wind direction – observation of vegetation, flagging, wet finger, **compass**...

How to measure the air temperature? **Thermometer**.

How to measure wind speed and temp? **Anemometer** (Repeat after me, ane-mometer!)

**Soil thermometer**. Measure 5 cm below ground. Measure the surface temperature. Then measure the air temperature 2 metres above.

Soil temp is important because warmer temperatures accelerate chemical weathering on mountains and determine what will grow. If our mountains grow warmer with climate

change, what changes in plants will we see? What changes will happen for microorganisms so small we can't even see them with the naked eye?

### **Mountains and water/glaciers.**

**Glaciers** form when layers of snow pile up over time. The weight of the snow squeezes it into a layered sheet of ice, and it begins to move slowly, pulled by gravity, scraping over everything in its path. It will sculpt the mountain and carve deep valleys. The Átl'ka7sem/Howe Sound was carved by glaciers. It will leave scratches on the mountain. It will carry rocks of all sizes with it.

### **Activity 3: How is a chewy chocolate bar like a glacier?**

You will need:

1 volunteer

1 Mars Bar or chewy chocolate bar that's been in the freezer for 5 minutes

How is a *Mars Bar* like a glacier?



A Mars Bar is long and linear, u-shaped on bottom with steep sides, like a glacier. It's flat on the bottom and steep on the sides, like a glacier. Please gently bend your MB. You'll see it develops cracks like the crevasses of a glacier. The top layer of a glacier is brittle. It's a rigid zone.

Please pull apart your MB. The caramel undergoes “plastic flow”, like the inside top layers of a glacier. This is the **plastic zone** of a glacier.

The nougat layer underneath is formed like **firn**, glacial ice and snow, compressed, less bendy. It’s the intermediate stage between accumulated snow from snowfall and ice. It leads to the basal sliding zone, and the deepest layer of compressed ice in a glacier. If this were a Snickers bar, the peanuts could be the rocks carried along on the glacier. These are called **erratics**.

Lastly, please bite into the end of your MB; this is **glacier retreat!**

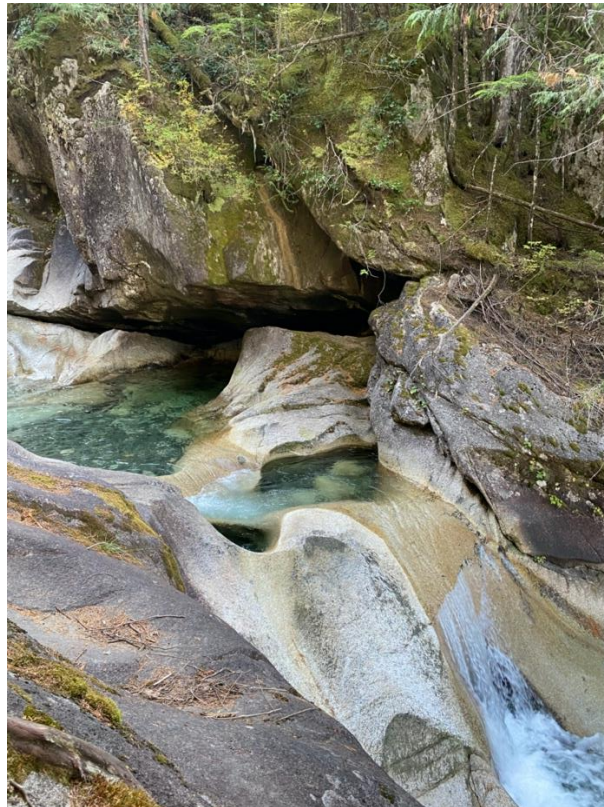
What this demonstrates is that different glacial materials flow at different rates under different conditions, and how pressure from the top layers pushes down and compresses the lower layers into glacial ice. Gravity further pulls the glacier downhill.

You can often see **striations**, scrapes left on rock by a glacier as it moves. And **talus** or **skree**, loose rock from erosion.

The water that comes from glaciers and snow melt is very important to us. It’s what we drink.

What else erodes our mountains?

1. rivers;



Weathering and erosion by water, Sea to Summit Trail, Squamish, British Columbia.  
Photo by Martha Warren

2. vegetation – lichen (fungus and algae together.) Plants and tree roots break up the rock of the mountain. Lichens slowly dissolve mountain rock, along with wind, ice and water, break down the rock into soil;
3. Us! Walking on the mountains.

## **Biodiversity.**

***What are the differences in the physical appearance of the environment up here at 885 metres? How does the summit of our mountain, in the subalpine, look different to the coastal rainforest at base below?*** (Smaller trees, not as thick of underbrush, not as much plant diversity).

Subalpine areas can be buffeted by hurricane force winds, scoured by ice crystals, and weighted down by heavy snow—life can be a challenge for mountain trees. At the upper edges, centuries old trees may sprawl along the ground bowing before the wind.

What do you see growing on the mountain? The plants that grow in this rocky soil have to be very hardy.

If mountain climates change, what lives on the mountains will also change. Plants and animals adapt to life on the mountain.

Goats and warmer winters. If trees start growing higher up the mountainside, then there will be less of the lichens, ferns, grasses, herbs, and shrubs that goats eat now. And goats will also have to go higher up the mountain in the summer to stay cool.

Yaks in Nepal can't live at the elevation they used to because it's too warm now for them. So they are moving further up the mountains for a cooler environment. They live in a smaller area. Water is harder to find and they need to be able to find food to eat.

**Vernal pools/ephemeral wetlands** – these are shallow ponds of water in the winter and spring, and dry out to be mud and dirt in the summer and fall. So they only contain water for part of the year. So what can live in these? Frogs. Salamanders. When mountain climates change, if there are longer droughts, these species can't live there.

## **Activity 4: Hike**

Theme: Interconnectedness

Look for things like -

Átl'ka7tsem/Howe Sound fjord  
Duff  
Lichen  
Old Man's Beard  
Salal  
Tree roots breaking up rock to make soil  
Nurse logs  
Krummholz and flagging trees  
Vernal pools/ephemeral wetlands  
Erratics  
Folded mountains – Skypilot, Copilot, the Ledge  
Volcano – Mount Garibaldi  
Olsen Creek  
Woodpecker holes

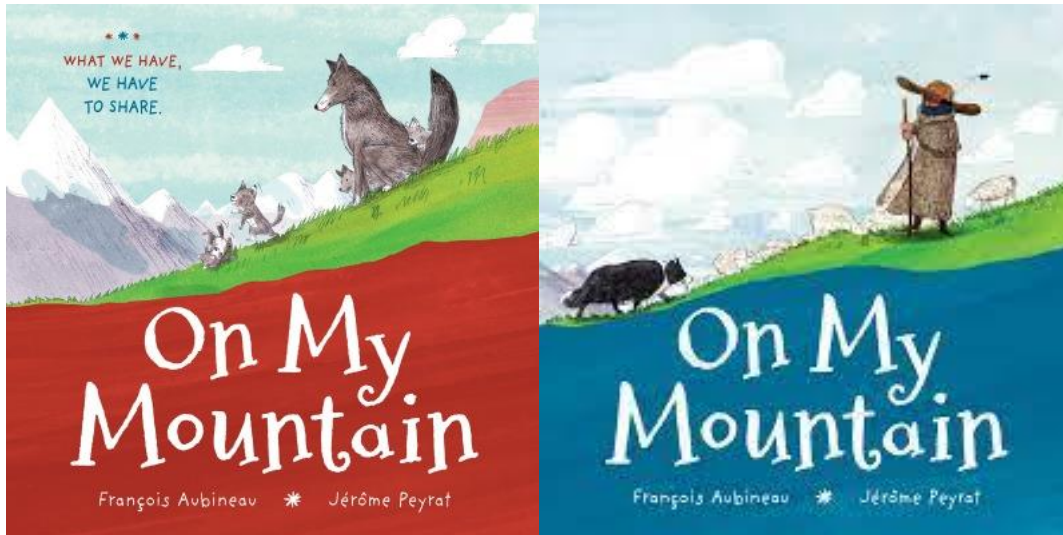
How are animals adapted to live in the subalpine? Here are some examples:

The Red Breasted Sapsucker get their name from how they eat! The drill rows of holes into tree trunks and then returning to those holes later to feed on the running sap and the insects attracted to it. Hummingbirds also use the Sapsucker feeding holes. The Rufous Hummingbird will follow the Sapsucker around during the day, feeding at the wells the Sapsucker keeps flowing.

Cougars will use the thick underbrush of the forest for shelter and to stalk its prey. Squamish is located in prime cougar habitat. Cougars are active throughout the year and are elusive animals that prefer to avoid contact with humans. Cougars prefer habitats with dense underbrush and rocky areas for stalking, but can also live in open areas.

Can you spot any places chipmunks might live? They live in trees and gather food on the ground in areas with underbrush, rocks, and logs, where they can hide from predators like hawks, foxes, coyotes, weasels, and snakes. They feed on insects, nuts, berries, seeds, fruit, and grain which they stuff into their cheek pouches and carry to their burrow or nest to store. Chipmunks hibernate, but instead of eating a lot and fattening up before they sleep, they keep a store of nuts and seeds to eat throughout the winter.

**Activity 5: How do we live together on a mountain and look after it? Read aloud On My Mountain by Abineau.**



Half of the story is from the wolf's point of view. When you flip the book over, it's the same text, word-for-word, from the shepherd's point of view. Have a discussion about sharing and preserving mountain resources for others.

### 3 Things-To-Do:

What are 3 things you can do to share your mountain with other living things – animals, plants, and people?

1. Stay on the trails
2. Take your garbage with you
3. Look but don't touch

### Activity 6: What do mountains mean to you?

**Individual work.** 15 minutes to complete sketches in Field Guide from the hike.