**Lesson 3**

**Environmental Observations**

**Learner Objectives:**

* Learners will identify, measure, and record characteristics of weather, plant life, and animal life.
* Learners will discuss how weather affects snowpack.
* Learners will discuss plant and animal adaptions in the upper reaches of the Nooksack watershed.
* Learners will hypothesize how climate change may affect the Nooksack River watershed and its inhabitants.

**Lesson Goals:**

* Learners will understand how to take and record accurate measurements of weather observations.
* Learners will understand specific plant and animal adaptions allowing for their survival in the Nooksack River watershed and its snowpack.
* Learners will understand how weather characteristics affect snowpack.
* Learners will understand how climate change will affect the Nooksack River watershed and the plants and animals living there.

**Materials:**

* Snow School field journal (optional)
* Thermometer
* Compass
* *Beaufort Scale Chart* handout
* *Snow School’s Common Species* handout

**Assessment:**

* Assessment is embedded in the activity as it progresses. Inquiry-based teaching techniques are recommended. Questions posed to the group will lead to answers and discussions the educator can use to assess student connection and content understandings.

**Time Frame:**

* 20-30 minutes

**Background Information:**

Northwest mountain weather greatly affects the Nooksack River watershed and the North Cascades ecosystem as a whole. Largely characterized by heavy precipitation in the form of snow, the upper reaches of the Nooksack watershed offer a unique ecosystem to study weather, snowpack and plant and animal adaptations in relation to the watershed. Students will first explore and measure different ways of observing weather characteristics. They will then work in pairs to explore and share the different plants and animals living in this unique, snow-filled ecosystem. They will discuss adaptations necessary for this and brainstorm how the ecosystem might be affected if the predicted change in climate decreases snowpack in the future.

**Weather Observations Activity:**

1. Begin a discussion by asking students about what they notice about the weather in their home town and the weather at Snow School in the mountains. Questions may include but are not limited to:
	1. What was the weather like when you boarded the bus at your school this morning? Rain? Snow? Sun? Warm? Cold?
	2. What is the weather like up here at snow school?
	3. What is the elevation where you are from (*instructors should look this up prior to students arrival*)? What is the elevation at Snow School (*3500’ or 4250’*)?
	4. What do you think affects the difference in observations? Could it be related to elevation? Why or why not? What is the evidence for your conclusion?

Encourage students to notice the differences in weather between locations. Use elevation as a component to discuss some of the difference. If necessary, guide the conversation to encourage students in making connections between the current weather and the effect it has on the snowpack. Keep this in mind as you ask the students to make some weather observations with tools you will provide.

1. Inform the students they will be making weather observations. If appropriate, encourage them to record their data in the *Environmental Observations* page of the Snow School field journals. From your instructor kit, pass out the thermometer, the *Beaufort Scale Chart* handout and the compass. Tell the students these are some of the tools used by field scientists to collect data. Ask students if they know how to use any of these instruments. If yes, ask students to demonstrate how to use them to the rest of the group. Students can work individually or collectively to gather observations. The following observations are recommended:
	1. Temperature – Have students use the thermometer to gauge the temperature. Ask them: How does temperature affect the kind of snow we have? How does it affect the snow on the ground (the snowpack)? How does temperature affect the type of snow that is falling?
	2. Precipitation – Have students observe the precipitation. Ask them: What is falling? Rain? Snow? Slush? Is it a heavy or light amount? What is the quality of the precipitation? Is this affected by temperature? Why or why not?
	3. Wind – Instruct students to use the *Beaufort Scale Chart* handout to determine the speed of the wind (students can record in numerical scale or description). Ask students: What is the wind speed? Is it constant or intermittent? What direction is it coming from (use compass to determine)? How might this affect snowpack?
	4. Aspect – Have students use the compass to determine what aspect their location is facing (N, S, E, W). Does this have an effect on any of the previous observations? Does it affect the snowpack? Why or why not?

If students worked independently, encourage them to share with each other and compare data. Suggest they discuss any similarities and discrepancies in data they gathered and explore how these occurred or what it might reveal.

**Plant and Animal Life Activity:**

1. This activity can be done individually, as a group or in pairs. Pairing is recommended in these observations, followed by sharing back with the larger trail group through discussion. Ask student pairs:
	1. Do you think the environment you are exploring up here at Snow School is a habitat abundant with life? Why or why not? Have you observed any plant or animal life while up here?
	2. What could we look for to help determine what might be living in this habitat? Answers may include:
		1. *Animal tracks, tree cones and needles in the snow, lichen in the snow, pink snow from algae, animal feces, bird calls and sounds.*
2. Encourage students to identify any plants, animals or signs of they observe. Inform students that this habitat is in fact abundant with life. Ask students:
	1. Even if we don’t see signs of some species, what do you think might live up here? Answers may include:
		1. *Douglas Fir, Mountain Hemlock, Lichen, Huckleberry, Raven, Gray Jay, Black Bear, Snowshoe Hare, Mice, Wolverine, Deer, Bobcat.*
	2. What are some of the adaptations we might see in plants and animals in this environment and why? Answers may include:
		1. *Shortened tree height (protect from wind and snow loads), thicker fir, camouflaged fir, broad feet (for snow travel), narrow hooves (for digging for food underneath snow), snow burrows.*
3. Encourage students to record any of their insights or observations in their Snow School field journal on the Environmental Observations page. If time permits, pass out the Snow School’s Common Species laminated handout. Challenge students to identify these species on the handout during their explorations at Snow School.
4. Begin a final discussion with students about how scientists believe climate change will have significant impacts on our (the Nooksack) watershed. There are several different predictions of snowpack levels for the future. Although scientists’ predictions differ on how much the snowpack will decline, there is little doubt that it will decline. Ask students:
	1. How will a decrease in snowpack affect plants and animals who have adapted to live up here? How will it affect humans? How will it affect plants, animals and humans down river?

**Key Terms:**

* **Field Location**: Snow School is located approximately 60 miles from Bellingham Bay at 3500’ of elevation.
* **Aspect**: The direction (N, S, E, W) an object or specific feature faces.
* **Watershed**: A watershed is an area of land that collects all the runoff and feeds it into a larger body of water.
* **Nooksack Cirque**: The glacial-carved valley (elev. 3,620’) situated on the eastern side of Mt. Shuksan. The Nooksack River headwaters originate here.
* **Climate Change**: The long-term change in weather patterns.