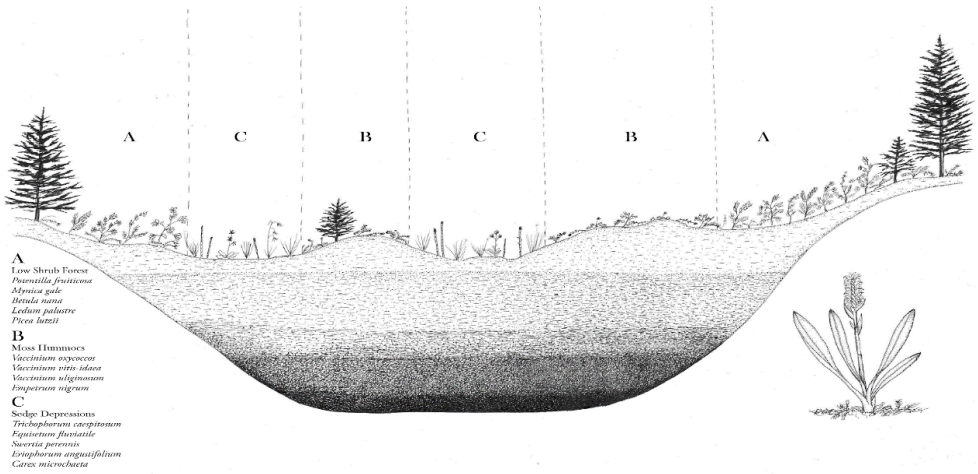
PEATLAND ECOLOGY: GR K-5 (LESSON 1-5)

Many schools across Alaska have accessible peatlands close by, and this curriculum will help teachers to implement using peatlands and highlight potential activities that can be done on site (3rd – 4th) and in the classroom (K-2nd). This guide will help schools improve knowledge of the importance of peatlands and encourage these sites for outdoor learning. These activities should be done in early fall before plants lose their leaves.

McNeil Canyon elementary school has been used as a case study for this curriculum to highlight these themes. The school has peatland on school property, but any school should be able to adapt the activities to a nearby peatland site, or similar habitats/outdoor locations. The curriculum is designed to build on student learning from year to year. By 6th grade, all students should have a comprehensive understanding of peatland and a deep sense of place for their school environment.



Core Concepts:

Peatland Ecology Learning Objectives:

Students will:

- Understand the value of peatlands
- Identify peatland plants and characteristics of peatlands
- Recognize peatland food web and relationships between peatland plants and animals
- Participate in Peatland soil sampling and peatland water quality monitoring/observation

Curriculum Focus:

Grade: K: What is a Peatland? Plant Shapes & Colors
Grade 1: Peatland Plant Parts and functions
Grade 2: Peatland Plant Adaptations and Food Web
Grade 3 and 4: Peatlands Explored! Field Trip to local peatland.
Grade 5/6th: Mapping of peatland plant communities

Importance of peatlands:

Peatlands are valuable for their cooling effect on climate, reduce of flood risk, and plant biodiversity. Peatlands reduce flood risk by slowing the flow of water from the uplands, and by providing floodplain storage in the lowlands. They also provide important habitat for many birds, as well insects and plants. Peatlands have a variety of plants and are sometimes referred to as the 'rainforests." of Alaska (Moffett, 2015).

Overview:

Alaska has about 127 million acres of peatlands. Peatlands are wetlands made of peat (plants and water combined together). Peat is the result of the accumulation of partially decayed plants over thousands of years. The dead plants don't rot because they grow in waterlogged conditions where there is little oxygen. The waterlogged conditions prevent plant material from fully decomposing and 'peat' soil is formed by the partially decayed material, which builds up slowly. Vegetation in Alaska peatlands is mainly mosses, sedges and shrubs. There are three types of Peatland/bogs in Alaska:

Blanket bog – large areas of peat found largely in uplands fed primarily by rainfall

Raised bog – localized domes of peat in lowland areas fed primarily by rainfall

Fens– fed by mineral-rich groundwater and river water, as well as rainfall

In addition, a peatland is often a mosaic of different habitats ranging from open-water, reed-beds, small sedge vegetation, to semi-terrestrial birch and alder woodland. This is one reason that peatlands contain such a large diversity of plants and animals. Peatlands in south central Alaska are the most common wetland type. Fortunately, Alaska peatlands are large and mostly untouched but facing increasing human development (AK Wetland and Wildlife, 2017).

Plants:

Peatland soil has limited to no oxygen and plants and soil-dwelling animals that live there have adaptations to anaerobic conditions. Therefore, peatland plants and soil-dwelling organisms have developed unique adaptations that allow them to survive in these anaerobic conditions. Some of these specialized plants can in fact serve as indicators of areas that are typically wet (Moffett, 2015).

Peatland Plants Highlighted in this Curriculum.

Dwarf Birch - Dwarf Birch is a deciduous, low and spreading shrub. It has small leaves that are thick and leathery. Stems are hairy. It has large male catkins and small female catkins. Seeds ripen in July, producing narrow-winged seeded fruits, allowing pollination by the wind.

Low Bush Blueberry – Low bush blueberry is consumed by many species of wildlife. Many songbirds and game birds including ptarmigan and spruce grouse eat the berries. Many small mammals including chipmunks, squirrels, mice, and rabbits also consume bog blueberry leaves or fruits. Almost the entire red-backed vole's fall diet consists of berries, many of which are bog blueberries. Caribou and moose browse on bog blueberries. When available, bog blueberries are one of the most important fruits consumed by black bears in interior Alaska.

Low Bush Cranberry – Low bush cranberry is a slender stemmed plant with leathery leaves with pink to red flowers and red berries. Berries can be cooked to make jam, jelly, pie, or a beverage. Tea made from leaves was used to purify blood and to combat nausea.

Sweet Gail - Sweet Gail Is a low to medium shrub with slender reddish stems. Sweet gale tends to form dense thickets. They have deciduous leaves that are sword-shaped but not pointed with teeth on the ends and yellow wax glands that look like dots. The leaves release a sweet-spicy scent when bruised or even brushed. It is often used by campers to keep biting insects out of tents. It is also a traditional component of wedding bouquets. The leaves can be dried to make tea, and both the nutlets and dried leaves can be used to make a seasoning.

Sphagnum Moss - The most dominant plant in Alaska peatlands are *Sphagnum* mosses. They are keystone species, meaning that they modify their environment to create many peatland ecosystems. There are roughly 120 species of Sphagnum mosses worldwide. *Sphagnum* mosses are soft, small plants with short leaves. Mosses typically grow in humid environments. Since they do not have roots to gain water with, they absorb their water through their leaves, which are only a single cell thick. They also lack seeds and rely on wind to spread their spores around in order to reproduce. They can hold a lot of water in their tissues, like a sponge, which helps them survive in drier periods. Sphagnum mosses grow in mats, submerged or floating over water, which can often withstand the weight of a person or moose. (https://www.hww.ca/en/wild-spaces/peatlands.html)

Mosses found in bogs influence what else can or cannot grow there. Certain peat mosses facilitate waterlogged conditions by their ability to hold 200 times their weight in water – similar to a sponge. If they are not already saturated, mosses can also wick up groundwater. Sphagnum moss is one of the most important and abundant groups of moss found in McNeil peatlands. Due to its ability to lock away huge amounts of carbon it plays a vital role in preventing further climate change. Sphagnum also increases acidity in the water and soil, lowering the pH, and creating inhospitable conditions for bacteria to survive (AK Wetland and Wildlife, 2017).

Wildlife:

Peatlands are important for different wildlife species during all seasons. Insectivorous birds like songbirds, raptors like the harrier, and grazing birds like swans all use peatlands as feeding areas. Wood frogs use bogs and fens for breeding and depositing their eggs. Aquatic or semi-aquatic mammals such as beavers, mink, and otters often find their preferred foods in these wetlands. Moose browse on willows, as well as on the mineral-rich submerged vegetation (AK Wetland and Wildlife, 2017).

KINDERGARTEN: <u>Peatland Plants Come in all Shapes and Colors!</u>

<u>Objective:</u> In this activity students will observe peatland plants before creating pressed plant art. This activity integrates art and science concepts while encouraging students to observe plants found in their school surroundings.

<u>Note:</u> For this activity, all plants were collected by staff prior to classroom activity. An extension could include having students collect plants themselves.

<u>Concepts:</u>

1. Different plants have different roles in the peatlands.
2. Peatland plants come in different shapes and sizes depending on their role in the peatland.
3. These plants are important to the health of peatlands.

<u>Background:</u>

Schoolyard Peatlands are an interactive way to introduce students to the importance of peatland plants and the environment. It will introduce students to basic plants and their parts through the creation of an art depicting peatland plants.

<u>Materials</u>

- Double sided tape
- Plant press (make your own using newspaper, cardboard, and books or another heavy weight)
- A collection of peatland plant leaves and berries – for this activity: the leaves from blueberry, geranium, birch, and willows, sphagnum moss, and blueberries.
- Watercolor paper 8.5” x 11”
- Quick dry glue
- Adhesive transparency paper

<u>Procedures</u>

<u>Preparation:</u> A minimum of 5 days prior to this activity, collect and press enough roots/stems/leaves/seeds/berries/cones of each plant you will be focusing per student. Press in a plant press. Collect one cup of moss per 10 students and let it dry in an open container. Immediately prior to activity, place double sided tape on watercolor paper.

1. Gather students together to discuss the definition of peatlands, and introduce the importance of peatland plants. Demonstrate the moss and berry techniques used in steps 4 and 6.
2. Provide each student with watercolor paper with double sided tape pre-placed 2 inches from the bottom of the page.
3. Show students the moss. Ask the students about moss – what color is it? What does it feel like? . Has anyone seen moss around the school? Discuss the importance of moss in the peatland and the adsorptive qualities.
4. Distribute enough dried moss for each student to press along the double sided tape.
5. Show the blueberries – ask what students think of when they think of blueberries? What color are they? Where do you find them? What color, shape, and taste are they? Talk about why blueberries are important in the food chain.
6. Hand out a blueberry and a paper towel to each student. Encourage them to smear it on their paper in patterns and be creative!

7. Show leaves from different plants with different shapes. Discuss why plant leaves would be different colors, size, and shape. Talk about willow leaves, blueberry leaves and geraniums.
8. Hand out different plant leaves and allow students to be creative with their placement, help students tape or glue their leaves.
9. After students have had time to glue leaves to their art, place adhesive transparency sheets on each student's art, and then regroup to allow for sharing artwork.

10. After sharing artwork, ask students why they think plants are important and what makes peatland plants special. Connect students with the nearest peatlands and encourage exploration.

FIRST and SECOND GRADE: <u>Peatland Plants – Parts and Functions</u>

<u>Objective:</u> In this lesson students will learn about peatland plants, plant parts and how they function in plant growth and reproduction. This exercise is an extension of the Kindergarten activity, with emphasis shifting from plant shapes and colors, to plant parts and function. First graders

<u>Concepts:</u>

1. The different roles of plants in the peatlands.
2. How 2 Peatland plants (in this example, Dwarf Willow and Blueberry) grow, reproduce, and survive.
3. The ways these plants are important to the health of peatlands.
4. Gain a better understanding of plant structures and photosynthesis (2nd Grade Only)
5. Appreciate the diversity of plants in your local area
6. Learn about the field of botany and sampling practices. (2nd Grade only)

<u>Background:</u>

The purpose of this lesson is for students to understand different parts of plants: roots, stems, leaves, flowers, fruits, and seeds. Students will identify these plant parts from peatland plants collected on school grounds. Schoolyard Peatlands are an interactive way to introduce students to the importance of peatland plants and the environment. This lesson uses the two plants Dwarf Willow and Dwarf Blueberry and compares and contrasts their parts and functions. The activity is similar for both 1st and 2nd grade, with 1st grade focuses on plant parts and functions, 2nd grade focuses on the roles of plants in the community – photosynthesis, habitat, etc.

Vocabulary

fruit: the part of a plant that develops from the flower and contains the seeds of the plant
leaf: the flat or needle like part of a plant where photosynthesis happens
root: the part of the plant that grows into the soil to anchor the plant and collect water and nutrients
seed/cone: the part of plant that contains an embryo within its protective coat and a stored food supply
stem: the main supportive part of a plant; part of the transport system carrying water from the roots and food produced during photosynthesis to other parts of the plant

Materials

- Double sided tape
- Plant press (make your own using newspaper, cardboard, and books or another heavy weight)
- A collection of peatland plants – for this activity: the roots, stems, leaves and seeds/berries/cones from blueberry plants, and dwarf birch (or other plants as you see fit) and sphagnum moss.
- Watercolor paper 8.5" x 11"
- Quick dry glue – one bottle per 2 students
- Brown Crayons
- Clear tape (can be used instead of glue)

Procedures

Preparation: A minimum of 5 days prior to this activity, collect and press enough roots/stems/leaves/seeds/berries/cones of each plant you will be focusing per student. Press in a plant press. Collect one cup of moss per 10 students and let it dry in an open container. Immediately prior to activity, place double sided tape on watercolor paper.

1. Gather students together to discuss the definition of peatlands, and introduce the importance of peatland plants.
2. Provide each student with watercolor paper with double sided tape pre-placed 2 inches from the bottom of the page.
3. Show students the **moss**. Ask students – what do the leaves of moss look like? What do you think the leaves of moss are designed to do? How tall does moss grow? Does moss have a stem or roots? Discuss the importance of moss in the peatland and the adsorptive qualities.
4. Distribute enough dried moss for each student to press along the double sided tape.
5. Discuss the peatland found below the moss and the qualities of the peat. Hand out brown crayons and have students color the peat layer below the moss layer.
6. **Dwarf Willow** – Show a branch of willow, with leaves attached, if possible. discuss the role that willows play in the peatland. Where do students

see willows around their school? How tall do they grow?

7. Hand out a willow stem to each student and ask what role the **stem** plays in the plant. Ask them to describe the stem (what color? Is it rough/smooth? Is it straight or divided?) Have students glue and label the willow stem on their paper.
8. **Dwarf Willow Leaves**: Show the willow leaves – ask what leaves are for? What color leaves do willows have? Are they smooth or serrated? Lobed? Do they change throughout the year? Explain the importance of willows in the peatland.
9. Hand out willow leaves to each student and have them glue and label leaves onto willow stems.
10. **Dwarf Willow Roots** – Hand out roots to students, have students describe the roots, discuss the role of roots in a plant and the different root strategies plants have to gain water and nutrients in the peatland.
11. Have students tape/glue the roots below the moss layer.
12. **Low Bush Blueberry –** Show a branch of blueberry, with leaves and berries attached, if available. Discuss the role that blueberries play in the peatland. Are they common in the nearby peatland? How tall do they grow? Students think of when they think of blueberries? What color are they? where do you find them? What color, shape, and taste are they? Talk about why blueberries are important in the food chain.
13. Hand out a blueberry stem to each student and review the role the **stem** plays in the plant. Ask them to describe the stem (what color? Is it rough/smooth? Is it straight or divided?) and compare it to the willow stem.
14. Have students glue and label the blueberry stem on their paper.
15. **Low Bush Blueberry Leaves**: Show the blueberry leaves – ask what leaves are for? What color leaves do blueberries have? Are they smooth or serrated? Lobed? Do they change throughout the year? Compare them to the willow leaves. Explain the importance of blueberries in the peatland.
16. Have students glue/tape and label the leaves to the blueberry stem.
17. Blueberries. Discuss the role of the berry. What animals eat blueberries? What ways do humans use blueberries?
18. Hand out a blueberry and a paper towel to each student. Encourage them to press it gently around the stems and leaves to create the look of a berry on their paper – they can be creative or realistic depending on their mood!
19. **Low Bush Blueberry Roots** – Hand out roots to students, have students describe the roots, review the role of roots in a plant and compare to the willow root.
20. Have students tape/glue and label the roots below the moss layer.
21. Once students have completed their art project, regroup for sharing artwork. Have students share one thing they like about their art or one thing they learned.
22. After sharing artwork, ask students why they think plants are important and what makes peatland plants special. Connect students with the nearest peatlands and encourage exploration.

THIRD AND FOURTH GRADE: <u>Peatland Plants – Adaptations, Food Webs, Food Webs, Species Interactions.</u>

<u>Objective:</u> In this lesson students will learn about peatland plants and how different peatland plants provide important habitat and food. This exercise is an extension of the Peatlands Exploration activity, with emphasis for 3rd Grade on plant parts, reproduction and seed dispersal and 4th grade on plants' role in the community, people and animal interactions.

<u>Concepts:</u>

1. The different roles of plants in the peatlands.
2. How Peatland plants (in this example, Sweet Gail, Dwarf Willow and Blueberry) interact with other species.
3. The ways these plants are adapted for life in the peatlands.
7. Learn about the field of botany and sampling practices.

<u>Background:</u>

The purpose of this lesson is for students to understand different parts of plants, peatland plant adaptations and reproduction, food chain relationships and interactions. Students will learn from peatland plants collected on school grounds. Schoolyard Peatlands are an interactive way to introduce students to the importance of peatland plants and the environment. This lesson uses the Dwarf Willow, Sweet Gail, and Dwarf Blueberry and compares and contrasts their role in the peatland plant community.

<u>Vocabulary</u>

fruit: the part of a plant that develops from the flower and contains the seeds of the plant
leaf: the flat or needle like part of a plant where photosynthesis happens
root: the part of the plant that grows into the soil to anchor the plant and collect water and nutrients
seed/cone: the part of plant that contains an embryo within its protective coat and a stored food supply
stem: the main supportive part of a plant; part of the transport system carrying water from the roots and food produced during photosynthesis to other parts of the plant

rose gall: Alaska's willows are susceptible to infestation by gall midges which cause the plant leaves to distort into a rose shape.

Materials

- Double sided tape
- Plant press (make your own using newspaper, cardboard, and books or another heavy weight)
- A collection of peatland plants – for this activity: the roots, stems, leaves and seeds/berries/cones from LowBush Blueberry plants, Dwarf Birch and Sweet Gale (or other plants as you see fit) and sphagnum moss.
- Watercolor paper 8.5" x 11"
- Quick dry glue – one bottle per 2 students
- Brown Crayons
- Clear tape (can be used instead of glue)

Procedures

Preparation: A minimum of 5 days prior to this activity, collect and press enough roots/stems/leaves/seeds/berries/cones of each plant you will be focusing per student. Press in a plant press. Collect one cup of moss per 10 students and let it dry in an open container. immediately prior to activity, place double sided tape on watercolor paper.

1. Gather students together to discuss the importance of peatlands, and introduce the importance of peatland plants. Discuss plant communities and peatland wildlife.
2. Provide each student with watercolor paper with double sided tape pre-placed 2 inches from the bottom of the page.
3. Show students the **moss**. Ask students – what do the leaves of moss look like? What do you think the leaves of moss are designed to do? Does moss have a stem or roots? Discuss the importance of moss in the peatland and the adsorptive qualities. What animals depend on moss for habitat? Food?
4. Distribute enough dried moss for each student to press along the double sided tape.
5. Discuss the peatland found below the moss and the qualities of the peat. Show a sample of peatland soil and let students feel and smell it. Discuss what makes it so wet and cold. Hand out brown crayons and have students color the peat layer below the moss layer.
6. **Dwarf Willow** – Show a branch of willow, with leaves attached, if possible. discuss the role that willows play in the peatland. Where do students see willows around their school? Show an aerial photo of the peatland, can the students find the willows? How tall do they grow? What is their role in the peatland?
7. Hand out a willow branch with leaves to each student and ask what role the leaves and stem plays for the plant. Ask them to describe the branch. How many leaves are there? Are they bunched or single?
8. Do the stem or leaves serve as food or habitat for any animals? Discuss how you can identify the difference between rabbit and moose browsing. Have students try to make a straight

browse mark and an angled browse mark to represent both grazers. Have students glue and label the browsed willow stems on their paper.

9. Hand out a rose gall and ask students what it is? What causes it? Is this a positive relationship for Willow? Have students glue/tape rose gall to the stem. And label “bug” or “insect.”
10. **Dwarf Willow Roots** – Hand out roots to students, have students describe the roots, discuss the role of roots in a plant and the different root strategies plants have to gain water and nutrients in the peatland.
11. Have students tape/glue the roots below the moss layer.
12. **Sweet Gale –** Show a branch of Sweet Gale, with leaves attached, if available. Discuss the uses of sweet gale and the role it plays as habitat and food.
13. Pass out a branch of Sweet Gale and have students crush a few leaves in their hands and smell the plant. Is the smell familiar? What does it remind them of? Discuss the uses of sweet gale by plants and animals. What animals eat sweet gale?
14. Have students glue and label the Sweet Gale stem on their paper.
15. Sweet Gale Roots - Hand out roots to students, have students describe the roots, review the role of roots in a plant and compare to the willow root.
16. Have students tape/glue and label the roots below the moss layer.

17. **Low Bush Cranberry –** Show a branch of blueberry, with leaves and berries attached, if available. Discuss the role that cranberries play in the peatland. Are they common in the nearby peatland? Who eats them? Talk about why cranberries are important in the food chain.
18. Hand out a cranberry branch with leaves to each student and review the role the leaves and stem play in the plant. ? Compare them to the willow leaves.
19. Have students glue/tape and label the blueberry branch on their paper.
20. Cranberries. Discuss the role of the berry. What animals eat cranberries? What ways do humans use cranberries?
21. Hand out a cranberry and a paper towel to each student. Encourage them to press it gently around the branch and leaves to create the look of a berry on their paper – they can be creative or realistic depending on their mood!
22. **Low Bush Cranberry Roots** – Hand out roots to students, have students describe the roots, review the role of roots in a plant and compare to the willow and sweet gale roots.
23. Have students tape/glue and label the roots below the moss layer.
24. Once students have completed their art project, regroup for sharing artwork. Have students share one thing they like about their art or one thing they learned.

25. After sharing artwork, ask students why they think plants are important and what makes peatland plants special. Discuss the peatlands at their school and how it is a living and vibrant habitat for many plants and animals discussed today.

THIRD AND FOURTH GRADE: <u>Peatlands Exploration!</u>

<u>Objective:</u> In this lesson students will travel to a nearby peatland and learn about peatland soil properties, peatland groundwater qualities, peatland plant communities, and the importance of peatlands in Alaska.

<u>Concepts:</u>

1. Sense of place of peatlands in the landscape.
2. Gain a better understanding of peatland plant communities.
3. Learn peatland core sampling skills
4. Groundwater and carbon storage in peatlands
5. Learn about the field of botany and sampling practices.
6. Different types of Peatlands - (bog/fen)
7. Interactions between plants and animals
8. How people have changed the landscape

<u>Background:</u>

The purpose of this lesson is for students to gain first hand experience in a local peatland. Students will rotate through three stations:

1. Peatland Cores
2. Water in peatlands
3. Peatland plant communities

<u>Vocabulary</u>

Fens: Fens are wetlands made of peat, plants and water combined together.
Peat: Peat is the result of the accumulation of partially decayed plants over thousands of years.
Groundwater:

<u>Materials</u>

1. Peatland Cores: Corer, pans and tools for students to look through peat
2. Water in peatlands – Jars to take water samples, thermometer, pH meter
3. Peatland plant communities – plant id guide, quadrat, flagging tape

<u>Procedures</u>

Preparation: Students should be divided into three groups, and dressed to spend two hours in the elements. Waterproof boots, rain coat, hat, and gloves.

1. Gather students together to discuss the importance of peatlands, and introduce the importance of peatland plants. Show drone footage of peatlands.
2. Divide the students into three groups and assign a peatland themed group name (blueberries, rabbits, etc). Each group will be assigned to a visiting biologist or other adult for the walk/trip to the peatland.
3. Begin the walk/trip to the peatland. Have students notice the sights, smells, any sounds of birds or water they hear.
4. Each group will start at one of the stations: Peatland Core Sampling, Groundwater and mosses, and Plant communities. Students will spend 20 to 30 minutes at each station and rotate through all three stations.

Station 1: Peatland Core
Students will help scientists put together augers, and assist with the taking of samples. Once the sample is laid flat on the ground, students will assist in cutting core and observing differences within subsections. Discuss how old the peat is at different depths, and the differences between peat at varying depths.

Station 2: Groundwater and mosses
Students will observe the "mat-like" quality of peatland fens by jumping on the moss. Students will sample moss and measure the amount of water being held in the sample. Students will test the temperature and pH of water. Discussion on where the water is coming from and where it is going and how important peatlands are for water and carbon storage.

Station 3: Plant Communities
Students will observe and identify the different plants present in the peatland. They will identify and determine the percent cover of each of these plants and learn the role they play in the community as habitat and food for wildlife.

Students will collect and eat blueberries at all stations most likely 😊

5. Student teams will return to their original station and walk back to the classroom.
6. Students will discuss what they learned in their small teams and pick three main lessons or take-aways to share out to the class. Scientists will review how both humans and animals use peatlands for a variety of purposes and how soil composition of peatland differs from other soil compositions in the Kenai Peninsula area.