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Subnivean Zone

Inside

- What is the Subnivean Zone?
- Animals of the Subnivean Zone
- Predators of the Subnivean Zone
- Build a Brush Pile!



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Subnivean Zone

“What is the subnivean zone?” you ask. The subnivean zone is the space between the bottom of the snowpack and the ground. The word subnivean comes from the Latin “sub” meaning under and “niv” meaning snow.

A World Beneath the Snow

The subnivean zone is created in two ways. It can be created when snow falls and is blocked from hitting the ground by plants or rocks. The plants and rocks act as umbrellas to create a pocket of clear ground under the snow. The other way the zone is created is by a process called sublimation. Think of freezer burned food. Food that has been left in the freezer too long or not properly sealed, will have ice crystals inside the bag or wrapper. The food will have areas that are discolored. This is sublimation at work. The cold air in the freezer vaporized the water in the food. This created ice crystals. The discolored areas on the food are dry areas where the water was drawn out. Sublimation happens under the snow when heat from the ground changes the snow

from frozen water directly into water vapor. As the vapor cools, it condenses and forms a layer of ice on the snow. This makes a nice roof to a cozy air pocket. It only takes six inches of snow to insulate this area. Air temperatures can be well below freezing, but the subnivean zone stays right around 32°F.

When looking across a field of snow, it may seem like a quiet, deserted space. But the subnivean zone is a microhabitat beaming with life. It provides food and relative safety for many animals, plants, invertebrates and tiny organisms. The health of our planet may just be dependent on the health of the subnivean zone.

Tiny but Important

Some of the most important creatures living in the subnivean zone you can't even see. They are billions of tiny organisms. These microorganisms drive the health of the whole ecosystem.

One thing these organisms do is to help plants get the nitrogen needed to grow. They absorb nitrogen from the snow and from dead plants and animals in the soil. As snow melts in the spring, some microorganisms die. This releases nitrogen back into the soil at the exact time plants are waking from winter and need it most. In areas where snow falls, microbes hold nitrogen until plants can use it.

Microbes can also release large amounts of carbon dioxide. Over time, this may have affects on our planet's changing climate. How much carbon microorganisms release is tied to when the snow falls. Cold temperatures before snow falls will cause some plants and microbes to freeze and die. Scavenger microbes will eat the dead plants and microbes as food. This will produce large amounts of carbon dioxide as the microbes eat and breathe. Half of the carbon that plants take up in the

summer is released back into the atmosphere by microbes in the winter. As snow depth increases, temperatures rise under the snow and microbes continue to multiply and grow. This creates 25% to 200% more carbon dioxide than normal entering the atmosphere.

If snow arrives too late and the ground remains bare and frozen for too long, water will sublimate into the air. There will be no snow to trap and condense the water vapor. The ground will lose water and become dry. Microbes will have food but no water; their growth will slow down. This means less carbon entering the atmosphere but also less microbes to hold onto the nitrogen plants need. Plant growth may slow, affecting the animals that depend on them for food.

The subnivean zone is a complex and dynamic ecosystem. Small changes in when it snows and how much it snows could mean huge changes in how the ecosystem functions year-round and year-to-year.



Animals

of the Subnivean Zone

Voles and Mice

There are more voles living in a mountain meadow than any other animal. These little brown rodents are frequently called “mice”, but mice are different. Voles are a bit chubbier than mice, having a rounder body shape. They also tend to be a bit larger and have thicker and softer fur. Voles and mice also differ in their facial features and tail shapes. Voles’ faces often look less pointy, have smaller looking eyes and shorter, rounder ears peeking out of fur on the sides of their heads. Mice have larger eyes and ears that look large compared to the size of their heads. Voles’ tails tend to be shorter, bushier and blunter than those of mice.

Voles and mice are the most common mammals living in the subnivean zone. They seek shelter under the snow from freezing temperatures and predators, creating elaborate homes. Since they are active throughout the winter, they need everything that they would need during the summer.

During the summer, these little mammals dig burrows to rest, give birth and store food. On the surface of the ground, their burrows are



small holes that are about as round as the end of a toilet paper roll. In the winter, they burrow through the snow. They make a series of tunnels under and through the snow that connect bedrooms, toilets, stored food, and other places where food can be found. They may also make tunnels that connect their summer burrows. They eat stored food, like grasses and seeds, and the bark from bushes and shrubs they can reach with their tunnels. They also have tunnels that lead to the surface of the snow. These entrance holes allow them to explore above the snow for food and act as ventilation shafts. The holes allow carbon dioxide created from breathing and carbon dioxide released from the ground to escape. This helps to keep the concentration of the gas low, so the animals don't die. In the spring or during a thaw, their elaborate tunnel systems become visible. The tunnels look like hardened snow or beaten down grasses in winding patterns.



Shrews

Have you ever seen a little mouse with a long, pointed nose with lots of whiskers? If you have, you might not have been looking at a mouse; you could have been looking at a shrew. Shrews may look a bit like mice, but they sure are different.

Seven species of shrews can be found in Idaho. All shrews are small. Even the largest shrews are mouse-sized. Shrews have tiny eyes, pointed noses, small ears and sharp pointed teeth. Most shrews are brown, but they may also be black or gray.

The subnivean zone and the tunnels of voles and mice are perfect places for shrews to spend the

winter. The warmer temperatures allow shrews to find their favorite food. Unlike voles and mice that mostly eat plants, shrews eat insects, spiders, worms and other invertebrates. To catch food in the dark, shrews put their outstanding noses, ears and whiskers to work. They smell, hear and feel vibrations of their prey. Some shrews even use echolocation. Once located, shrews use their pointed snouts like shovels to burrow after food.

Shrews eat a lot of insects. Masked shrews eat their own weight in food every day, and water shrews must eat every three hours! If they don't eat frequently, they could starve to death. Shrews love to eat insects, but they will eat just about any worm, spider, or small animal they can find.



Red Squirrels

If you have ever walked through an Idaho forest, you've heard red squirrels. These tree squirrels do not like to have anything in their home. They will stomp their feet, wave their tails, and scold you with a churring, rolling chatter. They may even growl at you.

Like all subnivean animals red squirrels do not hibernate. Winter can be cold and harsh in Idaho's forests, so red squirrels gather as much food as they can to make it through the winter. They eat the seeds in pine, fir and spruce cones.

For about a month each autumn, red squirrels are running around gathering as many cones as they can. They gather the cones in piles called middens.

Middens can be huge. They may be three feet deep and over twenty feet across. Middens are used year after year. They contain cones and the broken apart cones from past years. The composting piles create a damp, warm environment. When snow falls on and around middens, the perfect recipe is created for sublimation to happen. Small pockets are created where red squirrels can find refuge from winter weather and predators. They are even known to burrow through snow to locate their middens.

Predators

of the Subnivean Zone



Weasels

Weasels are perfectly designed to hunt in the subnivean zone. Idaho has two species of weasels, the ermine or short-tailed weasel and the long-tailed weasel. Ermine is a French word that means “white winter coat.” As you might guess, ermine have white coats in the winter. In the summer, they have light brown backs and white bellies. Long-tailed weasels also turn white in the winter. They have light brown backs and yellowish, buff-colored bellies in the summer.

Weasels are the smallest carnivores, or meat-eating animals, in Idaho. They have long slender bodies, short legs and pointed faces. Their bodies are perfect for slipping down ventilation shafts and running through tunnels in the subnivean zone. All around their faces they have whiskers that help them feel where they are going. They even have whiskers in a strange place, on the backs of their front legs! These whiskers help weasels to locate voles, mice and shrews as they reach out to grab them. Once weasels are finished eating dinner, they may move into their prey’s home, taking advantage of the shelter it provides.



Red Foxes

Some predators attack from above. This is what red foxes do. They move very slowly or stand still listening for the slightest squeal, squeak or swish. Red foxes have an amazing sense of hearing. They can hear a mouse squeak from 150 feet away. That's half the length of a football field! When they hear something under the snow, red foxes suddenly jump up into the air and drive headfirst into the snow. Sometimes all you see are their back feet and tails sticking straight out of the snow.

Kits, or baby foxes, are born in January and February, so foxes are busy hunting in the snow looking for food. Kits spend the first four or five weeks in a den being nursed by their mother. The male fox will bring the mother food when she is in the den with the kits. Kits come out of

the den and start to explore the world around them at about five weeks of age. This is when they start to learn to hunt by watching their parents. By 12 weeks, they can hunt on their own and leave to find their own place to live.





Great gray owls

Listening to the subnivean

Idaho is home to an amazing subnivean predator, the great gray owl. These large, beautiful, gray owls live deep in pine and fir forests. They are one of the tallest owls in North America, about two and one-half feet tall. Even though they are tall, they only weigh a few pounds. As it turns out, they are a big ball of feathers. These feathers are the key to their success at hunting for small mammals, like voles, in the subnivean zone during the winter.

Most owls have serrations on the leading edges of their flight feathers. It's like the teeth on your

comb. The air moves through the serrations, giving owls nearly silent flight. Another cool adaptation for this silent flight is a thick, velvety coating on the feathers. Great gray owls have the longest feather serrations and the thickest layer of velvety coating of any species of owl. This makes them quieter than any other kind of owl. Some scientists think this helps prevent prey animals from hearing the owl as it flies. This is called the mouse ear hypothesis. Other scientists are beginning to think differently. Instead, they think silent flight helps prevent the bird from hearing its own wings as it flies. This is called the owl ear hypothesis.

In order to understand why such silent flight is so important for the great gray owl, you have to know a bit about snow. It muffles sound. This makes it harder to hear the sounds of prey animals in the subnivean zone. In addition, high and low frequency sounds pass through snow in different ways. Snow can also bend or refract sound. This means that a sound that seems to be coming from one place, is actually coming from another. Scientists call this an acoustic mirage. It is kind of like when you put a pencil in a glass of water. The part of the pencil under the water looks like it has separated from the part above the water, moving away from it.

A great gray owl hunting over snow must be able to pinpoint the sound of its prey under the snow and not get confused by the acoustic mirage. Their huge facial discs are a perfect adaptation to gather the low frequency sound a vole makes as it moves under the snow. Being able to hover silently over the snow, makes it possible for the owl to hear only the sound of its prey. Plunging feet-first, great gray owls can catch prey that is under 18 inches of snow. They are strong enough to break through a snow crust hard enough to support a 175-pound person! Great gray owls need to eat about seven voles each day. Being able to hunt successfully in the winter by catching prey under the snow, helps these owls survive Idaho's harsh winters.



Build a Brush Pile

If you would like to provide some shelter for wildlife in your yard, try building a brush pile. Many small animals, birds, reptiles, amphibians, and insects will use brush piles for shelter. They can stay dry when it rains or snows, find shade when it's hot and avoid predators. Small predators might check out a brush pile, looking for a meal. When it snows, your brush pile can act like a mini-subnivean zone, giving small animals a safe place to live during the winter.

First, talk with your parents to locate a good spot for your brush pile. A corner of the yard, away from the activities of people and pets is a good place. If your yard borders a woods or open meadow, place your brush pile along this border. Start your brush pile by laying some logs or larger limbs on the ground. Layer smaller limbs in a crisscross pattern over the larger ones. This will help create small pockets for animals to

get into the brush pile. It also allows air to move through the brush pile, keeping it drier. If you have some dead branches that still have leaves attached, add those. The leaves will help create some cover. You can also add flower stems and trimmings from shrubs when your family does yard work in the spring. If your family cuts a live tree for Christmas, instead of putting it out for composting after the holidays, cut it into pieces and add it to your brush pile.

Spend some time watching your brush pile. What kinds of animals do you see in and around it? If it snows, check for tracks of animals going into and out of the pile. See if you can identify the tracks. Install a trail camera near the brush pile to see if you can get photos of the animals using it. You might be surprised by what is living in and near your brush pile!

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Wildlife Express is published by the Idaho Department of Fish and Game

Editor: Adare Evans

Layout: Nancy Jasper

Contributors: Vicky Runnoe

Lead Writer: Adare Evans



WE WOULD LIKE TO HEAR FROM YOU!

If you have a letter, poem or question for Wildlife Express, it may be included in a future issue!

Send it to: victoria.runnoe@idfg.idaho.gov

or

Wildlife Express, Idaho Fish and Game

PO Box 25, Boise, ID 83707