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Eye on the Environment:
Soil Links Rock Core With Life

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With the ground solidly frozen, I'm taking time to learn something about the Swan Valley foundation—the soils supporting all the plants and animals that thrive in this ecosystem, including the humans.

Glaciers had a major impact, of course. Only 11,000 years ago the last ice age began retreating, leaving a scoured landscape, laden with crushed bedrock—boulders, rocks, sand and silt. Without roots to hold the stone debris in place, annual springtime runoff pushed the rocks and gravels around, gradually sorting them by size and weight.

Our streams are still doing this on a smaller scale, confined more securely within their banks by the rooted soil. When we walk a gravel bar along the river, we find the heavier rocks grouped where they fell to the bottom of the slowing stream. The smaller stones, gravels and sands were carried farther into eddies and deposited, heaviest first, as the water swirled upstream, with the silts falling out in side pools when the waters stilled.

Driving up our forest roads we can find examples of unsorted glacial debris in the side cuts, where rocks of all sizes are mixed willy nilly, unaffected by flowing water.

Underneath the melting glaciers, rushing water flowed around dense ice blocks, depositing rocks, pebbles and silts as it coursed through the valley. The ridges of stone debris deposited by the submerged streams remain today, adding contours to the valley floor.

Lastly, the denser blocks of glacial ice melted, exposing thousands of depressions between the ridges to form the lakes, potholes, ponds and wetlands that characterize the Swan Valley landscape.

Seeds and spores arrived on the wind and the fur of wandering beasts to begin the process of growth and decay, creating the organic matter that lies atop the glacial debris. Microbes, fungi and tiny insects populated the leaf and twig litter, taking on their role as agents of decay.

Mount Mazama (Crater Lake) in the Cascade Range erupted and spewed a layer of volcanic ash on top of the new soil. The ash blew like snow into drifts. Digging down today, or scraping into the soil beneath the roots of a fallen tree, we can still find fragile patches of light grey ash that in places are nearly three inches deep, thinner elsewhere. The ash fertilized the soil and energized the plant life that in turn fueled the wild animal communities establishing homes in the landscape.

As time progressed the plants and animals thrived. The thin organic layer became more complex, taking on an ever more vital, supporting role, allowing our dense, diverse forests to cover the land.

In the Flathead Valley the organic soil may be a couple of feet deep. But in the Swan Valley it's only inches thick. Fire has played a part, at times adding rich nutrients and depth in

the form of organic ash, at times consuming the litter on the forest floor, exposing the mineral subsurface.

Our trees have adapted to this. Lodgepole, ponderosa and larch prefer the mineral soil as a seed bed, while shade-tolerant species such as cedar and alpine fir like to start in organic duff.

Regardless of where the seeds germinate, all our trees depend to a certain extent on the life within the duff to reach a viable old age. This is because there is a vibrant ecosystem within organic soil that converts fallen plant matter and animal droppings into useful forms rootlets can transport to the larger roots and up the stem—to greet the sunlight in the leaves and needles and become food for trees.

The soil ecosystem is a mysterious place without a microscope and a trained eye. Since I have neither, I rely on experts, books and Web sites to interpret all that's down there. I know there is a complicated web of fungal life connected to tree rootlets that aids in nutrient transport, and when that network is disturbed it's more difficult for trees to receive the nutrients they need.

Soil disturbance also interrupts the community of microbes, insects and small animals that convert flesh, hides, bones and scat into useful matter. Compaction from vehicles can set these communities back several years and change the type of vegetation the soil can support. Noxious weeds are successful because they are adapted to disturbed and compacted soils. Much of our native vegetation is adapted to friable soils, rich in nutrients, and simply can't compete in compacted dirt.

Freezing and thawing can help relieve compaction to a certain extent. We have that advantage over warmer climates. But freezing and thawing cycles are not enough to revive the soil ecosystem. It can take decades to fully restore it.

Luckily, we have strategies to prevent severe compaction. We can choose to use heavy equipment only after the ground has frozen. A thick layer of snow on thawed ground is scanty protection. This is illustrated in places where snowmobile tracks remain visible in summer months. Even cross-country ski tracks have been spotted in some fragile soils long after the snow has melted.

Often we can't avoid using heavy equipment during spring, summer or fall. But we can restrict travel as much as possible to identified roads and trails. Mark Vander Meer, a local soil scientist who is also a logger and restoration contractor, has this advice: "Don't drive to every tree." It's possible to develop a harvest plan that minimizes back-and-forth traffic.

"Don't work on wet soils," he says. "If the soil forms a ball in your fist, it's too wet. Wait for the ground to dry."

Leave 15 tons per acre of tree trunks and branches six inches in diameter or larger on the forest floor to support the small animal, insect and microbe communities and provide shade for seedlings. This large down woody component soaks up rainfall as it rots and slowly releases moisture to the rootlets as summer progresses. The cellular structure of rotting tree trunks, called lignin, can hold its shape and act like a sponge for decades.

Mark also recommends leaving an appropriate tree canopy after logging that will contribute fine litter and down woody, and continue building soil for the future.

It’s true many of the smaller plants that make the Swan Valley home can thrive on bare mineral soil, such as tiny alpine spring beauties, streamside willows, and fireweed. But to sustain a diverse forest of full grown trees and all the understory vegetation, we need to protect the thin organic ecosystem supporting it all.