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**Eye on the Environment:  
Ecology Lessons from Grizzlies**

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For 20 years at this time of year I hiked all over the Swan and Clearwater Valleys and Swan and Mission Mountains guiding spring black bear hunters. As the snow receded and uncovered the vegetation and fresh damp earth, the land and season became for me another chapter in the amazing ongoing story of natural history.

Interactions of all kinds between plants and animals were just waiting for discovery. Little did I know that my observations of several grizzly bear families and their activities during spring would fundamentally change my worldview and value system forever.

One day, I was guiding a black bear hunter from Chicago when we discovered an area of the forest that had been extensively excavated by grizzly bears. I had investigated many places where grizzly bears had dug bulbs and roots of a variety of plants, but this digging was very different.

At every excavation in the soil the bears carefully removed the thin dark mat of the organic layer to reveal the lighter colored mineral soil below. Here is the contact point between the organic layer and the mineral soil small distinct impressions remained as negative casts of some mystery element. When I got to looking around, I could see that this same site had been excavated year after year for many years in a row.

For many years, the bears and I returned to this spot, and for many years the mystery remained unsolved. One day, however, a friend and I

were examining fresh digging at the site and from under the organic layer next to a fresh dig found a small golden brown colored potato-like gem. It matched the size and shape of the recesses left where they had been removed elsewhere. What these bears were after were truffles, the fruiting bodies of a vast network for mycorrhizal fungi living under the forest floor.

These fungi, I learned, associate with the roots of trees and plants in the forest. The fungi significantly amplify plants ability to uptake water and nutrients which is of particular importance during drought and other kinds of environmental stress. The relationships I began to understand forced me to completely rethink my sense of the world.

I had always looks to the visible plants and animals on the landscape as the most useful barometer of ecosystem health, but what became revealed to me was that things such as bears and trees were nothing more than the tip of the proverbial iceberg. Underneath the surface, lie a world of ecological process that drives nutrient flow and increases vitality to everything we see in the forest.

The plants and animals that we observe daily owe their vitality to an invisible world that is much like the foundation and primary structure of a building. Think of the flora and fauna we see as the roofing, siding, interior wall covering and flooring of the building, important elements critical to the well being of the whole, but they are not what are holding up the structure.

The bear digging stopped abruptly at the edge of the unmanaged forest stand. The adjacent managed forest was a selectively logged area that had a nice diverse leave of overstory trees, and plenty of regenerating trees and native plants in the understory. But the entire forest stand had been mechanically scarified and the organic horizon had been removed, piled and burned. This was done to create a good seedbed for the germination of future trees, which it accomplished, but the removal of the top layers of the soil also removed the fungi and many of the links for key ecosystem processes.

After the bears initially demonstrated the importance of underground processes, I was fortunate to have attended a number of workshops by well-regarded soil scientists and ecologists Richard Hart and Mark VanderMeer.

These two added to my awe and regard for forest soils and their ecology. What I learned from them was that forest soils consist of wild and complex associations of soil fungi, other soil microbes and microscopic invertebrates, all critical elements of the nutrient cycling and flow to plants and animals. The truffles were one of the more visible elements of mycorrhizal fungi, but they were just part of a much larger story.

Healthy forest soils, I learned, also possess the ability to act like a sponge at the surface capturing precipitation and runoff and holding water on site. These characteristics of healthy soils help retain the available water-soluble nutrients on site, making them available to plants and animals, and help recharge underground aquifers. Where healthy soils are not present, water infiltration is significantly impaired, accelerating runoff, exporting nutrients into streams and robbing local aquifers of normal recharge.

One experiment Hart and VanderMeer conducted helped me to understand this very important aspect of soil integrity. They pounded large rings of steel which looked like 6" long sections or large well-casing into the mineral layer of undisturbed forest soils and then poured water into the ring. As fast as we could pour water in, the water penetrated the forest floor and saturated the underground environment. But when we moved, even to a well-worn game trail, the water remained in the ring like it had been poured in a bucket. This effect was even more evident in areas where heavy equipment had removed the top layers of the soil and/or compacted the forest floor.

What we learned is that a loss of porosity in forest soils can take centuries, not years, to repair. The current science is clear that protecting the soil's organic horizon from harmful disturbance and the subsoil from compaction is a critical consideration in

ecologically functional forest management. This is one of the reasons that low ground pressure equipment and methods which minimize soil disturbance are becoming recommended, or even required by land owners and land managers.

Recently, I've begun learning about another kind of fungi in the forest, the endophytic fungi. These are fungi that associate with most all plants and produce a wide range of chemical compounds that often assist plants with such things as disease resistance and generally amplify biologic vitality.

Many of the compounds they produce are not only valuable to the plants they associate with, but are of direct utilitarian value to man as curatives and treatments for everything from infections to cancer. I am looking forward to learning more about this emerging aspect of forest ecology.

As a hunter, I have always valued our visible wildlife and their necessary habitats. But what those grizzly bears illuminated for me years ago is that the foundation of the forests and animals that we value, lies in a wildly complex invisible world both above and below the forest floor. My hope is that all who value the natural world will take time to consider our short and long term impacts to the hidden realms of nature that lie just beneath the surface.