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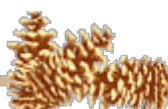
TREE FARM BULLETIN

Ruminations on Forest Soil Health Revisited: Duff or Litter?

By Carl Struck, NM Tree Farm #2 & Max Steenbock, Univ. of Colorado, Boulder

"What's in a name? A rose by any other name would smell as sweet." Or maybe not. Often words have an alternative meaning that carry a negative connotation. On a recent walk through our Ponderosa forest I realized we often refer to the accumulated woody material beneath our feet as either "duff" or "litter". You know...the spent pine needles, pine cones, twigs, branches, etc. that rain down, especially in autumn, when a cold wind strips all that is loose, dead or no longer necessary and blankets and past layers of woody material that overlay the forest soil. But when we refer to this layer as "litter" I always feel like this label carries with it the erroneous notion that it is somehow refuse, trash, messy, undesirable waste on the ground and we would be better off to clean it away. After all, any good scout knows you can make a "one match fire" with dry pine needles and pine cones that will then ignite your twigs and branches into a roaring bonfire in no time at all. This is the kind of childhood memory that might give some of us Tree Farmers food for thought on a hot, dry, windy summer afternoon. We might be forgiven for harboring the desire to "clean up" all this "litter" from our forest floor. And "hey...wouldn't that let the rain reach the roots more efficiently as well as encourage grass to grow?"

I've come to realize I much prefer to use the word "duff" these days after enjoying a springtime ramble with my friend Max Steenbock who is forest biologist with the University of Colorado. Max and I meandered slowly through the forest sharing our questions and observations about how we thought the forest might work, trying to track down the "who is connected to who" mystery of how seemingly simple forest ecosystems function. Yes, believe it or not, there is a complex community of microscopic organisms interacting and changing everyday beneath our feet. One study suggests that there are at least 8 billion bacterial cells, representing at least 50,000 different species, in one gram of soil¹. In this case we were discussing the role of the forest duff in maintaining nutrients in the forest top soil, which helps to support grass, shrub and tree development. And on the other hand, we also considered how our sporadic and frustrating 1/8"-1/4" rain events during our hot dry New Mexico summers, the kind of rain that only dampens the "duff", could possibly reach the roots of our Ponderosa Pine trees. In short, we wondered about the role our forest "duff" plays in a healthy forest ecosystem. About this



time Max will usually say something like “let’s take a closer look, shall we?” and with a conspiratorial look, will pull out a couple of pocket optical hand lenses and we’ll be laying on our stomachs down on the forest floor looking at the springtime cobwebby traces of the fungal mycelial mat left on the duff



surface as the snowbanks recede. Note the melting snow on the upper margin of the photo (above) & silky mycelium strands connecting the needles (photo by J. Riddick).

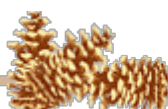


In this photo (left), the mycelia strands are a bit dryer and thus easier to see. As the top layer of duff dries out, these ‘cobwebby’ strands will no longer be seen near the surface. (photo by J. Riddick)

To understand just a small part of what is happening in this critical but often overlooked niche in our woodland, let’s take that “closer look” at the role of fungal mycelia. First, it is important to define the role of two different types of fungi.

Saprophytic fungi, with the help of other microorganisms, decompose woody material helping to break down their

chemical components into usable nutrients (adding to the topsoil) for new plant growth. An example of a Saprophytic fungus found among conifers is the *Agaricus silvicola* group (Woodland Agaricus) which is edible, with caution...very easy to mistake with poisonous look-a-likes! Another saprophytic

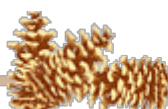


mushroom associated with woodland meadows in our area is the *Calvatia booniana* or Western Giant Puffball, one of our favorite choice edibles. Below is a photo of some I found a few years back (photo by J. Riddick).



Mycorrhizal fungi, on the other hand, utilizing their extensive network of mycelia as a sort of delivery system, can help transport nutrients and moisture that originate in the duff and the topsoil, to the roots of our trees and other plants. The mycorrhizal fungi in return gets excess sugars from the photosynthesis of the plant, thus making this a symbiotic relationship (and arrangement beneficial to both parties). Examples of mycorrhizal fungi associated with Ponderosa pines are *Boletus barrowsii* (a form of Porcini mushroom) and *Suillus granulatus* (Slippery Jack), the former edible and choice the latter edible but slimy and not very tasty, in my opinion anyway. Our forest duff is basically a huge mat infiltrated by competing and cooperating fungal mycelium strands interwoven with pine needles, wood chips, twigs, etc. The mycorrhizal mycelium component of the mat greatly expands the effectiveness and area of absorption for the deeper roots of our Ponderosa trees, as well as the roots of other forest plants, thus answering the question about how a light rain can penetrate to those deeper roots! Amazing!

Of course, there are other forces and communities at work here... witness the invertebrate diversity (nematodes, ants, beetles, termites), uncountable bacteria, as well as the soil dwelling mammals (mice, moles, voles and the like), all leaving their debris and contributing to the nutrients that give richness to



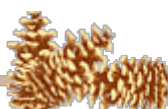
our soil. Fascinating viewing not unlike a Jurassic world in miniature! In order for these communities of organisms in our forest duff to remain effective and tend to our topsoil creation and the health of our trees it is incumbent on us to understand their role and how we might support them. This comes mainly by us minimally disturbing coarse woody debris (CWD, branches and trunks 3" in diameter or larger laying on the ground), duff and topsoil. More on managing woody debris for forest health can be found in a wonderful paper put together by [the Univ. of Idaho Forestry Extension and the US Forest Service](https://www.nrs.fs.fed.us/pubs/33615) (or <https://www.nrs.fs.fed.us/pubs/33615>). While such a prescription is broad and perhaps vague, this is largely due to the scientific community's ongoing investigation into the mechanisms that link CWD, microbial soil communities, soil nutrients, and forest health (see Achat et al. ² for a recent review of our current knowledge). This said, it does appear that leaving in place CWD and duff/litter layers (as much as fire risk management will allow) can maximize the total available nutrients in soils – and this alone is compelling. So, in reviewing our best practices for disposing of slash, at least from the standpoint of forest duff health, it would seem that the lop and scatter method, the pile and leave to rot method or the scattered chip method would be the most supportive. The first two methods, because of the imperfect contact between woody matter and the duff, results in the slash being a fire hazard for a few years at least. The scattered chip method forms a more intimate connection between the mycelium rich duff and the chips with the added benefit of mulching the previously air exposed duff layer, thus speeding up decomposition and retaining moisture. For five years this has been my preferred method and in my experience, provided the scattered chips are 2" deep or less, they have lost a great deal of their fuel potential within a year or so. The pile and burn method of slash disposal, again from the forest duff perspective, deprives the microorganisms of some of the raw material they need to make our topsoil, although it certainly deals with the fire hazard aspect of slash disposal, provided the burning itself is done safely. In addition, depending on how hot and deep the pile burns, this method may leave a severely damaged or destroyed hole in the mycelial/microorganism mat that could take decades to restore. In a forest, widely spaced, scattered burn holes may not pose a measurable problem in the long run but in an intensive thinning practice with closely spaced, large slash piles this practice may pose more of a long-term issue and should be considered carefully. See Certini (2005) ³ for a review of the effects of fire on forest soils.

Returning from our Springtime woodland ramble I ask myself again is it "duff" or "litter"? I guess as long as we understand the complex but crucial role this hardworking membrane covering our forest topsoil plays in the long and short-term health of our forest ecosystem, it really doesn't matter!

¹ [Roesch LFW et al. ISME 1 283-290 \(2007\)](http://www.nature.com/ismej/journal/v1/n4/abs/ismej200753a.html) or <http://www.nature.com/ismej/journal/v1/n4/abs/ismej200753a.html>

² [Achat DL et al. Forest Ecology and Management 348 124-141 \(2015\)](http://www.sciencedirect.com/science/article/pii/S0378112715001814) or <http://www.sciencedirect.com/science/article/pii/S0378112715001814>

³ [Certini G. Oecologia 143 1-10 \(2005\)](https://link.springer.com/article/10.1007/s00442-004-1788-8) or <https://link.springer.com/article/10.1007/s00442-004-1788-8>



1) WHEN WAS YOUR LAST TREE FARM INSPECTION?

When was the last time your property was inspected by a Tree Farm Inspector? If it has been longer than five years you are overdue. A Tree Farm inspection should be conducted every five years. If it has been longer than five years, you are no longer a "Certified" Tree Farmer and you need to be inspected. As we work towards getting our tree farmers some form of agricultural or "Tree Farm" tax status, it is imperative that we make sure the inspections and management plans for our certified tree farmers are current, concise and correct, with addendums where needed. If you have not had your tree farm inspected in the last 5 years, please call your inspector and set up a date and a time for an inspection. All you need to do is call your Tree Farm Inspector at one of the numbers below and have the coffee pot on when your inspector gets there.

Chama District 575-588-7831
Socorro District 575-835-9359
Capitan District 575-354-2231

Cimarron District 575-376-2204
Las Vegas District 505-425-7472
Bernalillo District 505-867-2334

2) BUY, SELL OR TRADE

Are you looking for forestry related equipment to buy (i.e. chipper, splitter, chainsaw, etc.)? Or, do you own forestry related equipment you would like to sell or trade? Forestry related equipment only, please, no homes or land. We would like to help you make the connection with other New Mexico Tree Farmers. Provide us with a description of the equipment, price, photo and contact information and we will post it in the New Mexico Tree Farm Bulletin. If you would like us to help you make the connection, please provide information to Arnie Friedt at arnie.friedt@state.nm.us

3) COMMUNITY CORNER

If your community is having a forestry related public event let us know the details and we would be delighted to promote your event in the New Mexico Tree Farm Bulletin. Give us the event details, Who, What, Where and When with contact information and we will include in our monthly bulletin. If you would like us to help you promote your event, please provide information to Arnie Friedt at arnie.friedt@state.nm.us

4) E-MAIL INSTEAD OF SNAIL MAIL

Would you prefer to receive your Tree Farm Bulletin by e-mail instead of snail mail? If so, contact Doug Boykin at doug.boykin@state.nm.us and provide him with your contact information. By receiving your Tree Farm Bulletin by e-mail our operating costs are reduced. Thank you for considering this option.

5) COMMITTEE MEETING

All Tree Farmers are invited and encouraged to attend our 2nd New Mexico Tree Farm Committee Meeting of the year (three held annually). Please join us at 1:30 pm on Wednesday, August 9, 2017 (location to be announced). Come out and hear what other tree farmers have been up to and share your tree farm accomplishments with the group. We look forward to visiting with you. If you have any questions, please contact Arnie Friedt at arnie.friedt@state.nm.us

