WONALANCET OUT DOOR CLUB

Newsletter December, 2017

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FOREST MANAGEMENT PART II SANTA CLAUS DECONSTRUCTED ! CELEBRATING 125 YEARS OF WODC !

Can't See the Soil for the Trees

By Serita D. Frey

We've all heard the expression that so and so "can't see the forest for the trees" because they are too involved in the details of a problem to see the situation in its entirety. This might be applied to forest management when the focus is on the trees without considering the soils that underlie them. Soils provide the physical support for trees, as well as the water and nutrients needed for their optimal growth. About a third of all freshwater on the planet is stored in soils, and all plant nutrients, in an unfertilized ecosystem, come from the soil. Not all soils are created equal, however, when it comes to growing trees. There are over 20,000 described soils in the United States, varying widely in their physical, biological, and chemical properties. These properties determine a soils suitability and limitations for a wide range of uses, including forest management.

Soil properties of particular relevance for growing and maintaining healthy, productive forests include texture (proportion of sand, silt and clay), pH, depth, and water and nutrient holding capacity. These properties vary widely among soils depending on the material from which the soil formed (the parent material), climate (particularly temperature and precipitation), topography, vegetation, and the amount of time the soil has been in the landscape. These so-called soil forming factors vary regionally. Here in New Hampshire, our soils are relatively young, having formed just since the last glaciation ended about 15,000 years ago. For comparison, soils in other parts of the world untouched by glacial action or other disruptive forces (e.g., volcanic eruptions, flooding along major river systems) can be millions of years old. Because of our glacial history, New Hampshire's soils are primarily formed from deposits left behind when the glaciers receded. Our relatively wet, temperate climate has allowed soils in the region to develop rather rapidly given their young chronological age. All of these factors combined give us the soils we see in the landscape today.

In the vicinity of Wonalancet, NH there are at least 20 different soils (see Map 1); however, one is of particular importance—the Marlow soil series which represents nearly 30% of the soils in this area. Other soil series (e.g., Becket, Podunk, Ossipee, Monadnock) represent less that 5-10% each. The Marlow series was named for the town of Marlow in Cheshire County, NH where it was first described in 1939. It was later designated as New Hampshire's State Soil because of its local and regional importance (see Map 2). This series covers nearly a million acres in Northern New England and is one of the most productive soils for New Hampshire's farmers and foresters. It is particularly important economically for timber production, with the trees most commonly associated with this soil series being sugar maple, eastern white pine, balsam fir, red spruce, white spruce, white ash, yellow birch, paper birch, and red pine. Why are Marlow soils so important for healthy, productive forests in NH? They formed on broad, gently sloping hillsides known as drumlins, landforms created as the glaciers receded and left glacial deposits behind. Because of their location in the landscape, these soils are very deep by New Hampshire standards, with the depth to bedrock typically being greater than five feet. This characteristic, along with their loamy texture, make these soils well drained. These soils belong to a group of soils referred to as Forest Soil Group IA, soils that have higher fertility and more favorable soil moisture relationships compared to other soils in the state. That is, they have both good nutrient and water holding capacity, as well as good drainage.

For those of you who are avid hikers in the White Mountain National Forest, you will undoubtedly have noticed that in many areas, the soils are much thinner than the soils in valleys or on drumlins and that there is a patchwork of soils, with some being able to support good tree growth and others not. While soils vary widely in most landscapes, this is especially true in a mountainous area where parent material (bedrock versus glacial deposits for example), climate, and topography (slope and aspect) all vary over short distances. The type of soil that develops in turn impacts the health as well of the species of trees found there (Leak and Riddle, 2007). For example, in rocky habitats where bedrock is exposed at or near the soil surface, the soil will be thin, dry, and low in nutrients. These areas, often found at higher elevations, favor shrubs such as blueberry bushes. Growth will be slow for both softwoods and hardwoods. In outwash habitats, typically found at medium to lower elevations, the soil developed from sorted glacial deposits that tend to develop into coarse textured (i.e., sandy) soils. Tree growth in these soils will be moderate for both softwoods and hardwoods, and while many tree species will grow and be found in these areas, white pine are the most productive on this type of soil. Glacial till habitats, one of the most common habitats found in New Hampshire's mountains, are often steep and it is here that the glaciers dumped material with little sorting, so rocks of various sizes are found. These areas are very good for hardwoods (beech, sugar maple, yellow birch), with few softwoods found.

To learn more about the soils on your property or at your favorite hiking spot, visit the Web Soil Survey on the Natural Resource Conservation Service website (http://nrcs.usda.gov). Here you will find information on the various soil series found at your location of interest, along with general soil properties, including parent material, texture, depth, and characteristics related to soil fertility. If forest management is your goal, you can use soil survey information to evaluate a variety of factors, including the "site index"—the potential productivity of common trees on a particular soil type; drainage class—the frequency and duration of wet periods; erosion hazard--the likelihood that soil erosion will occur as a result of site preparation and harvest; susceptibility for compaction; and harvest equipment operability—soil conditions (e.g., slope, surface stoniness, soil wetness) that may restrict equipment use. Use this invaluable resource to "see the soil", not just the trees, and base your activities on the soil's inherent properties and suitabilities.

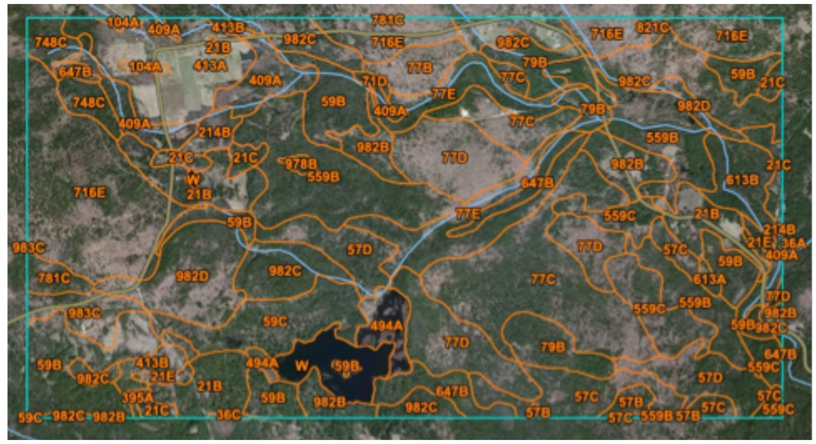
References:

Leak, W.B. and J.R. Riddle. 2007. Why Trees Grow Where they do in NH Forests. U.S. Department of Agriculture Forest Service, Northeastern Forest Experiment Station, NE-INF-37-79.

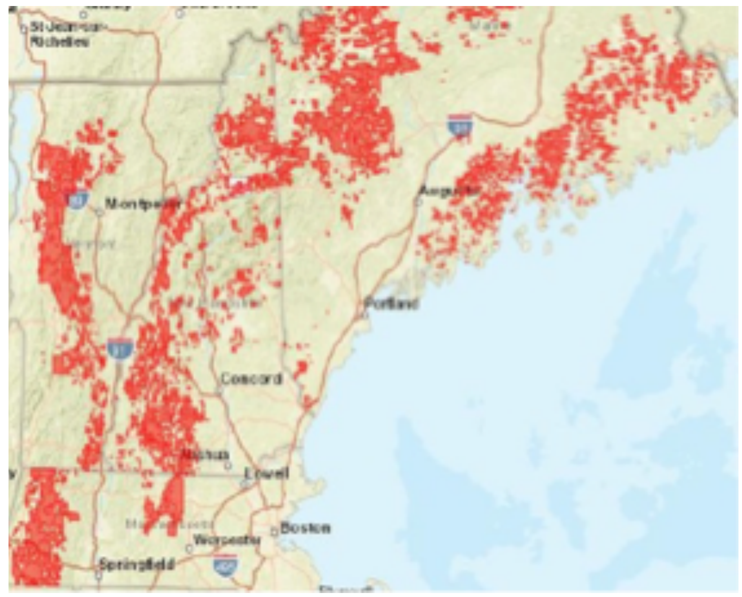
Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at the following link: https://websoilsurvey.sc.egov.usda.gov/.

Serita Frey is Professor of Soil Microbial Ecology in the Department of Natural Resources and the Environment at the University of New Hampshire where she teaches courses in soil science and ecology. Her research examines how environmental change is altering forest ecosystems, with an emphasis on soil organisms and fertility. Her research team maintains three long-term global change experiments at the Harvard Forest Long-term Ecological Research (LTER) site in Petersham, MA and a state-wide, distributed soil sensor network in NH. Her email is: Serita.Frey@unh.edu and if you have problems accessing the maps, she invites you to contact her.

Serita at work below:



Soil Map of White Mountains, above
Extent of Marlow Soils in New England, below



A WORD TO THE WISE: it's worth going on to the WODC website (www.wodc.org) to see illustrations in full color!

COMING ATTRACTIONS in your favorite Newsletter:

For those of you waiting eagerly for Part II of Dave Govatski's article on the history (and future) of the WMNF, we will print that in next spring's issue of this newsletter, to coincide with the WMNF Centennial.

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HOT NEWS: Much of that spring issue will be devoted to mapmaking and WODC's very own mapmaker: Mike Bromberg. But we don't want to wait that long to tell you that a September news release informed us that **Mike had become the first person on record to climb all of the 200 highest peaks in the contiguous U.S.!**
With his well known sense of the dramatic, he celebrated the completion of his list on 13,745' Fremont Peak (WY) at the time of the total eclipse on August 21st. As for the 4,000 footers, not content with completing them in every month of the year, he also summited all at midnight and (unsatisfied with that), then summited all of them at midnight in winter. A full report on Mike's climbing and mapmaking adventures will reward you in spring for having survived the winter.

Management of Forest Diseases

by **Isabel Munck**
USFS Forest Pathologist

I would like to begin this article by introducing Forest Health Protection, the Program I work in, which is part of the State and Private Forestry Deputy Area of the U.S. Department of Agriculture (USDA) Forest Service (https://www.fs.fed.us/foresthealth/). I belong to a group of 250 specialists in the areas of forest entomology, forest pathology, invasive plants, pesticide use, survey and monitoring, suppression and control, assessment and applied sciences, and other forest health-related services. Forest Health Protection provides technical and financial assistance on forest health-related matters establishing partnership across lands of all ownerships. We work across lands of all ownerships because forest pests do not respect political boundaries. The general policy of the U.S. Forest Service is to protect forest-related values from damaging insect and pathogen outbreaks. We help to maintain, enhance, and restore healthy forest conditions and look for links between changing climate and pest conditions. I work out of the Durham Field Office that services New England and New York. As a forest pathologist, my field of expertise are forest diseases. Most forest tree diseases are caused by fungi. Forest diseases can affect tree species composition, forest structure, and create habitat for wildlife such as snags and coarse woody debris.

Forest diseases and insect pests are very difficult to control once they become widely established in the landscape; therefore, much effort is spent in monitoring forest health conditions and early detection of insect and pathogens. For example, aerial surveys are conducted every year in cooperation with Forest Health State Agencies such as the New Hampshire Division of Forests and Lands to detect tree mortality, defoliation, and crown discoloration. Remote sensing technologies are also used to map changes in tree health and mortality. The entire State of New Hampshire in flown including the White Mountain National Forest (WMNF). Results of these surveys can be viewed in the Forest Health Enterprise Team Mapping and Reporting website: https://foresthealth.fs.usda.gov/portal/. Pest conditions by State can be viewed in the Forest Health Highlights: https://www.fs.fed.us/foresthealth/protecting-forest/forest-health-monitoring/monitoring-forest-highlights.shtml. New Hampshire also has their own Forest Health Program web page: https://www.nhdfl.org/forest-health/.

One of the forest health issues that was mapped during aerial surveys showing crown discoloration to trees in the WMNF are the fungal pathogens of eastern white pine collectively known as white pine needle damage (WPND). For example, 12,101 acres of white pine needle damage were mapped by aerial surveys of the WMNF during 2012. WPND is caused by a complex of fungi that cause pine needles to turn from green to yellow in mid-June and fall off by mid-July (Wyka *et al.* 2017). Normally, white pines shed older needles in October, but not during the summer. The untimely defoliation causes growth reductions (McIntyre et al 2014). The pathogens that cause WPND are native to North America. Native pathogens are an important part of a healthy forest ecosystem, but when environmental conditions or past management history can create epidemics that result in forest mortality. Although several pathogens are associated with white pine defoliation, the fungus *Lecanosticta acicola* is the main culprit. This pathogen was previously reported in the northeast affecting white pine (Stanosz et al. 1991), but damage was not widespread. The current epidemic is caused by a change in environmental conditions, warmer winters and wetter springs, which are more favorable to the survival, reproduction and dispersal of the pathogen (Wyka *et al.* 2017).

In addition to leading forest health monitoring efforts, Forest Health Protection is also responsible for providing technical advice. When information gaps exist, as was the case with white pine needle damage, experts in Forest Health Protection collaborate with scientists within the Forest Service, universities, and or Forest Health State Partners to gather the needed information. When the white pine needle damage epidemic was first reported in 2009, it was not clear which fungal pathogens were causing the damage, the conditions that lead to the outbreak were unknown, and its impact on tree health and potential mortality were undetermined. We set up monitoring plots to examine long-term effects on tree health with our State Forest Health Partners, established collaborations with University (Broders *et al.* 2015, McIntrire et al. 2017) and Canadian Forest Service (Laflamme *et al.* 2015) scientists to identify the fungal pathogens, environmental conditions favorable to disease outbreaks, and studied the effects of defoliation on tree physiology. Now we know that warmer and wetter environmental conditions have led to the proliferation of several foliar pathogens, which have not yet caused tree mortality but have caused reductions in growth (McIntire et al. 2017).

Among the greatest threats to forests in the Northeast are invasive diseases and insect pests (Liebhold *et al.* 2013). Invasive diseases and insect pests threaten forests and cost billions of dollars in prevention, control and restoration. For instance, oak wilt, caused by the fungus *Ceratocystis fagacearum*, has killed millions of oaks from Minnesota to Texas and recently as far east as New York, causing losses of billions of dollars (Kokotovich & Zeilinger 2011). These estimates include the costs of surveying and monitoring, regulation, outreach, timber loss, loss of residential property value, tree treatment, removal and replacement, as well as the value of lost ecosystem services such as biodiversity, soil and water retention and quality, carbon sequestration, or wildlife habitat, all of which, while very difficult to measure, can be extremely high. For example, American chestnut, once a common tree species, has been almost extirpated by chestnut blight, a disease caused by the fungus *Cryphonectria parasitica*, introduced in the late 1800s. Other tree species have grown to replace American chestnuts, restoring ecosystem services such as carbon sequestration and water quality, but other ecosystem services such as specific pre-invasion biodiversity and food for certain groups of wildlife may have been permanently lost (Boyd et al 2013).

Forest Health Protection provides financial assistance to prevent, suppress and control pest outbreaks threatening forest

resources. For example, in 2008 oak wilt was detected for the first time in New York, near Albany. Once the disease becomes established, it is very difficult to control and can affect a site for many years. When the disease was first found in New York in 2008, one management alternative, would be to do nothing. An opportunity to slow the spread of oak wilt in New York would have been missed. The result would be a perennial oak wilt problem in areas where disease is not yet present, such as New England, where oaks form an important component of the forest resource. Instead, the Forest Service collaborated with the New York Department of Conservation to eradicate the disease at this location by providing technical assistance and funding to remove infected trees and trenching to disrupt root connections that would enable the pathogen to spread from infected trees to healthy trees through connected roots. In 2016, oak wilt was detected in the Finger Lakes and Long Island. In addition to removal of infected trees at these new locations, current efforts are focusing on delineating the spread of the disease and outreach efforts to inform tree health care professionals and homeowners about the disease and its management.

Forest Protection also participates in restoration efforts such as conserving the butternut resource. Butternuts (*Juglans cinerea*) are native trees once common in New England (Schultz 2003). Similar to chestnut blight, butter canker has almost wiped out butternuts and they are now listed as a "sensitive species" in many States. The "sensitive" species listing awards butternuts certain conservation status. The butternut resource is inventoried in National Forests, such as the White Mountain National Forest, in an effort to conserve the butternut resource. The state of Vermont is working closely with the US Forest Service Northern Research Station by providing graft material from healthy looking trees (Schultz 2003). Scions from these were grafted to black walnut root stock and maintained in an orchard in the Green Mountain National Forest for conservation purposes. Scientists such as Dr. Dale Bergdahl have located and mapped resistant butternut trees throughout New England. Many healthy looking butternuts are actually hybrids of Japanese walnuts. Butternuts hybridized naturally with the introduced Japanese walnuts (*Juglans ailantifolia*), and these hybrids are more disease resistant (Boraks & Broders 2014).

I hope that I have been able to convey the complexity involved in trying to manage forest diseases and insect pests. It involves multi-agency coordination and collaboration among researchers, forest health specialists, land managers, land owners, and National Forests. Many passionate individuals work on the protection and conservation of our natural forest resources. I feel very fortunate to be able to participate in these efforts.

Isabel's references and her photo of White Pine Needle Damage are on WODC's website as bonus material. Photo at upper left is Isabel on Mt. Chocorua.

and other ongoing tree disease research efforts,

Numerous attempts are being made around the country to battle the diseases that are devastating our native trees. Isabel mentions the natural hybridization that our butternuts are undergoing with their imported Asian cousins, and it's tempting to think that we should be importing and planting Asian congeners of other species. But this route is a double edged sword because of the fear that hybridization will narrow the natural genetic variability of our native species. (In some cases, where that species has been effectively wiped out, this argument seems as endangered as the trees.) Two iconic American trees that have disappeared from our streets and forests are elm and chestnut, and efforts to restore them show the different means currently pursued by researchers. Elms were largely urban trees, individually planted, and work on elms has concentrated on cultivars which have narrowed xylem vessels which slow and restrict the upward and tangential movement of the fungal infection to an extent where the tree's immune system can wall it off. (Plants can do everything animals can; they just do it more slowly.) In the case of chestnuts, which were a major forest species, research has focused on viruses which infect the fungal pathogen. These have worked in Michigan and (probably) in Ontario, but nowhere else, and the most promising current research is genetic modification of the fungal pathogen so that it becomes more capable of transmitting the virus which affects it.

plus a Marxist take on resource management,

"Let the fragile green breast of Siberia be dressed in the cement armour of cities, armed with the stone muzzles of factory chimneys, and girded with iron belts of railroads. Let the taiga be burned and felled, let the steppes be trampled. . . Only in cement and iron can the fraternal union of all peoples, the iron brotherhood of all mankind be forged."

From Vladimir Zazubrin, the first head of the Union of Siberian Writers, in 1926. Zazubrin was arrested and shot about a decade later, but it was not until 1988 that the Kremlin's chief ideologue, Vadim A. Medvedev, finally conceded that "universal values such as avoiding war and ecological catastrophe must outweigh the idea of a struggle between the classes." (Taken from *The Tiger* by John Vaillant)

Theories of Forest Management: Command & Control vs. Resiliency

"An essential paradox of wilderness conservation is that we seek to preserve what must change." Pickett & White, 1985

When I heard Klaus Puettmann (a prof. at OSU), speak on "Preparing Forests and Foresters for an Uncertain Future", I was impressed by his assertion that, "managing complex adaptive systems is like raising teenagers", in that one's goal should be to prepare them for future surprises and uncertainty. He's concerned that most foresters work to adapt to what's there now, when they need to worry about what's ahead. The problem, of course, is that it's easier to work with what's there now than to work towards an unknown future, and it's easier to work towards a clear present goal (prevent floods, stop forest fires, kill insect pests) than to work towards a goal as slippery as future ecosystem resilience.

If it's difficult to work towards the vague concept of "resilience" when the ground isn't slipping away under your feet due to climate change and a host of alien tree diseases; it's close to impossible, given these issues. It's frustrating that the very issues that increase its difficulty, also increase its urgency.

Probably the key publication in changing philosophies of forest management was published in 1996 by Holling & Meffe in Conservation Biology 10(2): 328. Entitled (provocatively) "Command and Control and the Pathology of Natural Resource Management", it presented a powerful argument for variability, flexibility and resiliency in both resources and their managers, in place of our society's deeply embedded belief in control. They write, ". . .a common theme of many resource-management efforts is to reduce natural bounds of variation in ecological systems to make them more predictable, and thus more reliable, for human needs." Over the long run, this has three devastating effects. First, agency priorities shift from research and monitoring to increasing the efficiency of the task: developing better ways to eliminate floods, rear hatchery fish, kill wolves, etc. Second, the shift away from research and monitoring, isolates agency personnel from the system being managed and to signs of public concern. And finally, since capital investment in agricultural production, pulp mills, suburban development, etc. follows the initial successful control of resources, economic interests press for continued and increased subsidies and further command and control. Finally, of course, the ecosystem which now lacks variability and resilience, encounters an unforeseen challenge and collapses.

We're lucky that our FS here in the Whites doesn't share in the Command and Control pathology. Plenty of other resource managers still do. The sticky point now is the question of whether, and in what ways, managers should intervene to reduce the effects of past management practices. This has reached a head in Oregon in old growth forest, where Jerry Franklin, an 80 year old, greatly respected forest scientist, who fought for decades to protect old-growth trees, is now arguing for logging some areas to create early seral habitats: open areas colonized by plants and shrubs. Protection of the forest has reduced this "forgotten stage" of forest development from 20% to 2%. You can imagine the uproar. Of course, some areas have been logged in the past but clearcutting, the damage caused by heavy equipment, and the trend towards replanting trees in clearcut areas has not resulted in viable seral habitat. (It's that damn control again.) Amazingly, the seral habitat that changed Franklin's mind resulted from an event most would consider even more damaging to the environment than clearcutting: the Mt. St. Helens eruption. It's taken a while (it's been 37 years), but the volcano's flanks are now a vibrant habitat, rich in plant and animal life. (Nature does it better.) It's a real dilemma. Do we try to control the damage created by our past control? Sometimes it seems to work: bringing wolves back to Yellowstone. And sometimes it doesn't: creating tree "plantations" to replace vanished forests. SG

WODC ORDER FORM

(SHAMELESS COMMERCE & STOCKING STUFFER DIVISION)

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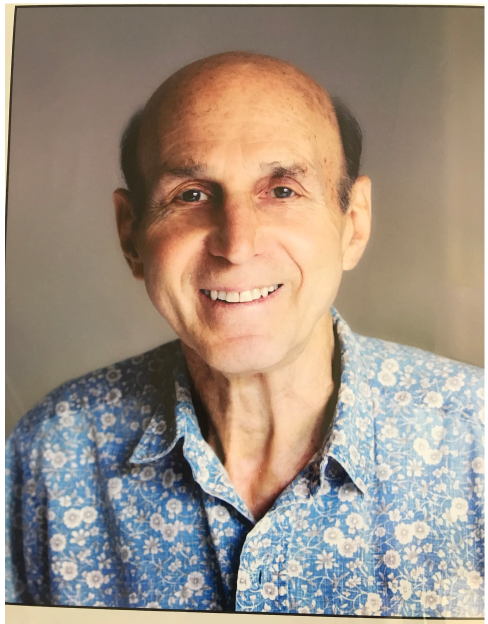
QTY	DESCRIPTION	PRICE	TOTAL
	WODC Patch	3	
	WODC Map & Guide (3rd edition) Members Non-Members	 6.00 8.00	
	Unfolded WODC Map & Guide	9	
	3 or more unfolded Maps - each	7	
	WODC Historical Collection (CD)	25	
	"Serene Green" Cotton T-shirt (Old Logo) Specify M. L or X-L _____	18	
	Synthetic (silky) Navy Blue T-shirt (New Logo - see design on website). Specify M, L or X-L ___________	18	
	New Memberships (not for renewals!) ☐ Pathfinder ☐ Steward ☐ Trail Blazer ☐ Five Year	 15.00 25.00 50.00 250.00	

IN MEMORIAM: IAN McLEAN COOKE

Ian Cooke, a 5th generation Hawaiian and his wife Janet (an Australian) became their family's first generation in Wonalancet when they bought the house that sits at the foot of Dicey's Mill Trail up Passaconaway. If you're wondering how Ian and Janet managed to meet, it was a shared interest in music; while both were studying German in Austria, both asked to use the classroom's piano. And if it seems odd for a Hawaiian-Australian couple to buy a house in NH, it happened while Ian was on the Harvard faculty, and the house was a three hour ride away. That they continued to come to Wonalancet after Ian had joined the faculty of the University of Hawaii, and it was fifteen grueling hours away by air, is a sign of true love. The house came complete with furniture, linens, tableware and about a hundred acres of land, now greatly reduced because Ian and Janet donated more than 90 of those acres to the WMNF. If you've hiked the Blueberry Ledge Cutoff; you've hiked across some of those acres. And, if you've crossed the elegant bridge that joins their sections of the Dicey's Mill and BLC trails, that's a contribution from them as well — put in after they'd fallen into the brook a few times. In a way, these gifts represented just one aspect of Ian and Janet's lifelong generosity; the most dramatic of which was their adoption on short notice of two Korean daughters, adding them to their existing three sons, and being loving parents to all five.



Having been lucky enough to have known Ian for years, I can't imagine that anyone could have resisted his gentle charm. He loved music (he played cello and piano his entire life; was an enthusiastic quartet member, and supporter of young musicians); he loved hiking and knew each turn of our trails; was an internationally acclaimed neurophysiologist; was interested in food and wine, and had the rare but desirable trait of always assuming that anyone he was talking to was equally admirable. He was adventurous. I admired his two week raft trip down a tributary of the Urubamba to study Amazonian wildlife; but I'm not so sure about his tendency to eat foraged mushrooms without expert identification. But this was just one aspect of his resistance to authority, which may have reached its pinnacle when, needing more lab space, and lacking official approval, he and his lab mates spent a weekend building a mini-lab, knocked a hole in the *real* lab, cemented in their construction, finished by Monday morning and subsequently claimed to the outraged authorities that such a little thing shouldn't need a permit.

Ian lived fully for his 84 years among us; was generous in his loves and actions, and was greatly loved in return. Can any of us ask for more?

The Fall Trails Report

Our 2017 trails season is winding down. We did not undertake a major project this year but did complete our annual maintenance. Once again we hired Jed Talbot's Off the Beaten Path crew to assist with annual maintenance. Jed's crew spent 200 hours clearing blowdowns, cleaning drainages, and brushing out trails. We combined that effort with contributions from adopters and 4 volunteer trailwork days. In May we cleared blowdowns on Pasture Path, Red Path, Tilton Spring Path, and the old section of McCrillis Path. On our June trailwork day volunteers cleaned drainages on the Cabin Trail. In July we cleared blowdowns and did annual maintenance on both Blueberry Ledge Cutoff and the new section of McCrillis Path. In September we cleaned the drainages on Dicey's Mill Trail for a second time.

Overall, volunteers provided 290 hours of trailwork. When combined with the 200 hours from Off the Beaten Path we logged approximately 500 hours maintaining WODC trails this season. WODC also participated in the Legislative Study Committee on NH Hiking Trails. Many of the usual trail issues were discussed but two issues are becoming increasingly critical. First, hiker parking is out of control throughout the WMNF. At times the demand for parking is 3 to 4 times the size of existing parking lots. Hikers are parking cars in inappropriate places which both endanger public safety and create congestion in rural neighborhoods. Second, the increased frequency of intense rain storms is having a disproportionately negative impact on legacy trails, the trails that go straight up the mountain. Both issues will require attention and some creative solutions in the next few years.

We have had a mild Fall but experienced two late October storms that dropped a combined 7.8 inches of rain in 6 days. We'll deal with that impact on the trails next season. Thanks to all who contributed either directly or indirectly this season. I look forward to working together again next year to keep our trails in great shape.

Jack Waldron, Trails Chair (and, although he's too modest to say it himself, President)

Santa Claus (Deconstructed)
(with special attention to birch trees, mushrooms and reindeer)
by **Susan Goldhor**

My guess is that by the time you read this, It will be more or less Christmas time. So let's talk about Santa Claus. Surely you've wondered about this bizarre figure. We know that Christmas is really a palimpsest over the real celebration which is that of the winter solstice. I'm ignoring Chanukah, whose candle-lighting is another winter solstice solace, but which was originally a very minor holiday that got inflated into a major one so that Jewish kids wouldn't be too jealous of their Christian neighbors. It doesn't really work, of course, because seven candles can hardly compete with a whole lit up tree and, no matter how many presents you get, you don't have the thrill of their arriving via a flying sleigh, pulled through the night sky by reindeer. Somehow, the Christians get it all. Not just the baby in the barn, and the three kings, and the shepherds, and the stars and the angels, but the fir tree, and the reindeer, and the thrilling ride through the night sky, and the delivery of presents to every home via the chimney by a fat man in a red suit with white trim. Wow! Unfair to all other religions! What could possibly match this panoply of thrills? Nothing. That's what.

No doubt you can tell that I've given a great deal of thought to and made a serious study of Christmas. The bottom line is that Christmas, at least as celebrated in America, simply doesn't make sense. Theoretically, it celebrates the birth of Christ. This gives us the creche, the angels, the kings, etc. So far, so good. Now we come to the tree, which is invariably a type of evergreen which does not grow in the holy land, and which is often decorated with fake snow. This is usually explained by its being a pagan holdover, especially beloved by Germans and other northern peoples, who were into celebrating the solstice. I can appreciate this, being pretty much pagan myself. Who wouldn't appreciate the greenery, the lights, and the wonderful smell during the darkest, most indoor time of the year? But Santa? The attempts to explain him are pathetic. A third century Greek or Anatolian saint named Nicholas who is said to have given some gifts to poor people? Sorry. You'll have to do better than that. It's true that the name of Santa Claus is derived from Nicholas' Dutch name (Sinterklaas), and it's also true that Sinterklaas gives gifts to good children. Let us not forget, however, that he also comes from Spain by boat (switching to horseback when he reaches land), and taking bad children back to Spain with him, which makes sense when you think of the bloody works of the Spanish Inquisition in the Lowlands a few centuries ago and the dread they inspired. But where do we get the red and white costume, the round tummy (unsuited to a serious and probably gaunt saint and martyr), the North Pole locale, the flying reindeer, and the descent down the chimney? Where do we get the total non-Christian *weirdness* of this character? Where did he originate? And the answer that I find most compelling is that Santa comes from Lapland, with forays into Siberia, and the shamanic use of *Amanita muscaria*, a widely used hallucinogenic and entheogenic (enabling the consumer to experience god) mushroom.

It's a safe bet that *A. muscaria* is the most recognizable mushroom in the fungal pantheon. With its brilliant red cap (apologies for the fact that it's often orange or yellow in our region), decorated with white warts, it has been called one of the most photogenic mushrooms in the world. And, it is probably the most painted mushroom in the world, appearing in children's books as different as *Alice in Wonderland* and *Babar*, to say nothing of infinite depictions of evil or enchantment or rituals -- although not rituals affiliated with religions commonly practiced here. If you were asked to illustrate a fairy tale toadstool, it's a safe bet that you'd use *A. muscaria* as your model. Found under birches and evergreens, it has a wide distribution -- not only in the circumpolar regions, but much further south. However, given Santa's North Pole habitat, let us concentrate on the northern habitats and particularly on Lapland and Siberia. Why Lapland along with Siberia? Well, for one thing, this is the home of reindeer herding as opposed to caribou hunting. We should note here that if reindeer have any passion outside of rutting season, it's for *A.m.*, either the whole thing or those fractions remaining after it has passed through a set of human kidneys. Deer generally love human urine, which is a source of salt, and urine from an *A.m.* consumer must be absolute manna for reindeer.

Richard Platt writes from England, "Lapp shamans used to eat the mushroom during the midwinter pagan ceremonies of Annual Renewal. The first effect of eating it was a deep coma-like slumber. When the shamans woke the drug stimulated their muscular systems, so that a small effort produced spectacular results -- the intoxicated person perhaps making a gigantic leap to clear the smallest obstacle. The effect on animals was generally the same and a mushroom-maddened super-reindeer traditionally guarded each shaman. When missionaries first reached Santa's native Lapland, they found a thriving pagan myth of reindeer flight. Rather than oppose it, they shrewdly assimilated the stories into the folklore of Christmas and Saint Nicholas. . .The colour scheme of his outfit is taken from the unmistakable red and white cap of the fungus. Lapps still scatter the mushroom in the snow to round up reindeer."

But wait! There's more! The Siberian winter dwelling or yurt, had a smoke hole in the roof, supported by a birch pole. At mid-winter festivals, the shaman would enter the yurt through the smoke hole, perform his ceremonies and then ascend the birch pole and leave. There's your chimney connection. (Note: Siberians revere the birch tree and a sacred serpent is said to dwell at its roots. This is not a casual connection -- the mycorrhizae of A. muscaria also dwell at the birch trees' roots. There has been a fascinating conflation over time of the Tree of Life and the Tree of Knowledge, and at least one authority says that *A. muscaria* is the apple of that tree. In Kamchatka, one birch in particular, the endemic *Betula ermanii*, is believed to be the pathway between the world we know, the upper world, and the underworld: a ladder is sometimes made of birch wood to give the shaman a visual means by which to ascend or descend in the shaman's journey to effect a cure, offer protection from evil spirits, or secure a successful hunt.)

To me, one of the most powerful arguments for a strong linkage between Santa and *A.muscaria* is the introduction of flying into the legend. Although I draw the line at believing that those who consume *A.m.* can fly, I do believe that they experience a surge of strength and may feel as if they are flying. Mycologist Gary Lincoff has reported his own experiences swallowing 5 grams of dried *A.m.* after visiting Siberian Koryak shamans. Some extracts: "A reindeer herd manager we interviewed told us that some of his herders ate the *Amanita muscaria* when they had to chase after runaway reindeer: the mushroom allowed them to go for long periods of time without stopping to eat or rest. . . . At dinner, I rose to make a toast to our Russian guides. As I stood up, I pushed my chair behind me. It hit the wall and broke in several pieces. . . . On leaving Kamchatka the next day by plane, I tried to attach my seat belt and pulled it out of the seat. . . . Two weeks after returning home I was still feeling the effects of the relatively small amount of the fly-agaric mushroom I had consumed. The primary effect was a sense of power, an upwelling rising from my stomach. . ."

The number of stories about flying, from cultures that use *A.m.*, are impressive. A single example: the Norse deity, Wotan, flies through the sky in a vehicle pulled by animals, and drops of blood from his steeds are said to be the origin of *A.m*. And so on and so forth. But please don't try to achieve flight on your own by consuming our local *Amanita muscaria* variant. All contain a mix of hallucinogenic and toxic elements. Alas, the European mushroom contains more hallucinogens; ours contains more toxins. (Gary Lincoff got his from Siberia.) You won't die, but you might wish to.

Yes, Virginia, there *is* a Santa Claus. But he's a Lapp/Siberian shaman who's high as a kite. Deal with it.

Editor's Ramble: Climate is changing, species of animals and plants are going extinct, sea level is rising — but if anything can be counted upon in this changing world, it's the elements. Mendeleev's chart has always seemed to be something to hang my hat on and lean against, secure forever. Happy in my ignorance, I pictured the elements forming at the start of creation: unchanging, basic, fixed. Reader, I was wrong. But how could I possibly have guessed right?

To begin at the beginning, the big bang occurred almost 14 billion years ago. At that moment, there were no elements; there were *no atoms*; there were not even any sub-atomic particles. But it took less than half an hour (give or take a few minutes) for protons, neutrons and electrons to form. As Wallace Arthur puts it in *Life Through Time and Space,* "When the universe was thirty minutes old, atomic nuclei were everywhere." Although this phase of primordial nucleosynthesis was incredibly productive in terms of number of atomic nuclei (Arthur suggests "gazillions" as an estimate), only two types existed: hydrogen and helium, the two lightest elements. But they weren't elements yet; in fact, they weren't even atoms yet, because although they contained protons and neutrons, the electrons were not sticking; just bouncing around in space. Real atoms, complete with electrons, didn't appear until about half a million years later. (The big bang was a kind of hurry up and wait phenomenon.)

So where did all the other elements come from? At one level, there's a (more or less) simple answer: all the elements -- with the exception of those early hydrogen and helium atoms -- have been and continue to be created in the furnaces in the hearts of stars. (which gives the expression, "thank your lucky stars" a whole new meaning.) There were no stars in our universe until a few hundred million years after the Big Bang, and when the first stars emerged out of giant clouds of gas, they were huge but not dense; composed almost entirely of hydrogen and helium. They burned only for a few million years, generating energy by fusing hydrogen and helium into heavier elements such as carbon and oxygen in their cores. Then they exploded as supernovae, spewing out these heavier elements which enabled the formation of smaller, denser, longer lived stars. These denser stars forged still heavier elements up to and including iron. But the elements heavier than iron require a truly extraordinary event for formation. The November 24 issue of *Science* announced, "Last month, astronomers wowed the world when they announced that they had seen two neutron stars merge, apparently creating heavy elements such as gold and platinum and spewing them out into space." We are made of stardust. But that gold ring on your finger is the product of a spectacularly violent collision, whose gravitational waves were strong enough to be detected here on earth, and whose afterglow lasted for days. I'll never look at the periodic table again without thinking of the hundreds of millions of years; the births and deaths of stars; the beauty and violence and unimaginable variety of elemental genesis. **Susan Goldhor**

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