Chapter 12

THE SWEETGUM

StandingNation-Human Alliance Bulletin

Heartwood

- **TREES lower human blood sugar levels**. In one scientific study, 87 non-insulin-dependent patients, divided into two groups participated by performing *Shinrin-yoku*—the Japanese practice of "forest-bathing" or experiencing the forest atmosphere—nine times over a period of six years. They two groups walked in the forest for three or six kilometers according to their physical ability and/or the existence of diabetic complications. The mean blood glucose level after forest walking was reduced from 179 mg.100ml-1 to 108 mg.100ml-1. Blood glucose values declined by 74 mg.100 ml-1 and 70 mg100-ml after short- and long-distance walks respectively.

  > Since the forest environment causes changes in hormonal secretion and autonomic nervous functions, it is presumed that, in addition to the increased calorie consumption and improved insulin sensitivity, walking in a forest environment has other beneficial effects in decreasing blood glucose levels.[1]

- **TREES reduce human blood pressure levels.** A review of scientific studies published in English and Japanese were reviewed, considering all published, randomized, controlled trials, cohort studies, and comparative studies, that evaluated the effects of the forest environment on changes in systolic blood

[1] Y. Ohtsuka, N. Yabunaka, S. Takayama, "Shinrin-yoku (forest-air bathing and walking) effectively decreases blood glucose levels in diabetic patients" in *International Journal of Biometriology* 1998 Feb; 41(3), 125-7 on pubmed.ncbi.nim.nih.gov/9531856 (Accessed 2-16-21).

pressure. A subsequent meta-analysis was performed, and twenty trials involving 732 participants were reviewed. Systolic blood pressure of the participants in the forest environment was found to be significantly lower than those in the non-forest environment. Additionally, diastolic blood pressure of participants in the forest environment was significantly lower than that of those in the non-forest environment.[2]

- **TREES improve human cardiovascular health.** A review of 364 articles yielded 14 studies which met the criteria for inclusion in this scientific review. When synthesized, the researchers concluded:

> . . . . forest bathing interventions were effective at reducing blood pressure, lowering pulse rate, increasing the power of heart rate variability (HRV), improving cardiac-pulmonary parameters, and metabolic function . . .[3]

Scientists have shown that forest-bathing—sitting in or walking through a forest—lowers human blood pressure, pulse, and heart rate variability.

Is this a result of us breathing the oxygen-rich air of the forest into our bodies? Is it our pleasing experience of visual scanning the fractal patterns found in the forest--the repeating of the branching of trees, for instance? Is it the essential oils—the phytoncides—we're smelling? Or, is it the combination of all these things, perhaps along with other forest factors we've yet to discover, that makes our hearts happy—both the human heart beating in our body and the

[2] Yuki Ideno, Kunihiko Hayashi, Yukina Abe, Kayo Ueda, Hiroyasu Iso, Mitsuhiko Noda Jung-Su Lee, Shosuke Suzuki, "Blood pressure-lowering effect of Shinrin-yoku (Forest bathing): a systematic review and meta-analysis" in *BMC Complementary and Alternative Medicine 2017 Aug. 16;17(1): 409* at pubmed.ncbi.nim.nih.gov/28814305 (Accessed 2/16/21).
[3] Katherine Ka-Yin Yau and Alice Yuen Loke, "Effects of forest bathing on pre-hypertensive and hypertensive adults: a review of the literature" in *Environmental Health and Preventative Medicine 2020 June 22;25(1):23* (Accessed 2/16/21).

heart of who we are as human in communion with the environment that trees represent—our first home—singing in our soul?

Diplomatic Relationships

- Sweetgum balls start out green and plump, drying as they mature. The spines open up to reveal seeds inside the balls. The seeds provide food for approximately 25 species of birds, including: wood ducks, wild turkeys, mallards, mourning doves, quails, red-winged blackbirds, Carolina chickadees, dark-eyed juncos, Carolina wrens, chipping sparrows, northern cardinals, and goldfinches, as well as chipmunks, and squirrels.[4]
- In the spring, nectar from the sweetgum tree's flowers provides nectar for ruby-throated hummingbirds and other nectar feeders.
- The sweetgum tree is a host plant for more than 30 species of butterflies and moths, including two of the largest and most stunning moths, the luna and promethean.
- Cherokee made a tea out of Sweetgum bark as an herbal treatment for the flu.
- The infertile seeds (in the green balls, the infertile sees are yellow w/no wings; brown seeds with wings are fertile) found in each of the sweetgum's compound seed capsules in 2008 were discovered to be a good alternate source of shikimic acid, one of the main ingredients in Tamiflu, which prevents and curtails the influenza virus. Before sweetgum seeds, the primary source of shikimic acid was

[4] Terry W. Johnson, "Out My Backdoor: In Defense of the Sweetgum Tree" *Georgia Department of Natural Resources Wildlife Resources Division,* https://georgiawildlife.com/out-my-backdoor-defense-sweetgum-tree (accessed 10/11/20)

the star anise tree of China where it was found in limited concentrations. (Today, genetically modified bacteria grown in labs produces the shikimic acid used in the drug.)

- The first Westerners to describe the sweetgum were “Spanish conquistadors who recorded its uses by Montezuma and the formidable Aztec empire in the 16th century. A primary use involved the sweet gum’s fragrant resinous sap—found just under the bark and which seeps out when the tree is wounded—was used to flavor a pipe full of the unfamiliar New World plant called tobacco.”[5] Sweetgum resin is occasionally used to flavor tobacco today.
- The dried sap—the “gum” of the sweetgum—which is bitter, despite its name[6], was chewed by American colonists and is sometimes still chewed by children.
- At one time, the twigs of the sweetgum tree were used as toothbrushes.
- Medicinally, today, sweetgum is known as the "copalm balsam" and the sweet-smelling resinous sap, is used extensively in Mexico and Europe as a substitute for storax, a liquid balsam obtained from the wood and inner bark of related *Liquidambar orientalis* of western Asia, used as an ingredient in the antiseptic compound tincture of benzoin, by itself as a mild antiseptic for skin sores and, when added to steam, for coughs.
- Various ointments and syrups are prepared from the resinous gum and are used in the treatment of dysentery and diarrhea.

[5] Dave Taft “The Mean Seed of the Sweet Gum” *The New York Times,* Feb., 7, 2018, https://www.nytimes.com/2018/02/07/nyregion/sweet-gum-tree-tamiflu.html (accessed 2/25/20).
[6] The sap of the “blackgum” tree (*Nyssa sylvaticano* or the Black Tupelo of the dogwood family and no relation to the sweetgum tree) is very bitter; the sweetgum’s sap is sweet in comparison with that of the blackgum tree.

- The fragrant sap is also used as a perfuming agent in soap.
- The sweetgum tree's dried seed pods—also called "gumballs," "spike balls," "Witches Burrs," "Witches Balls," and "Porcupine Eggs"—are used by current-day pagan witches as a powerful protection amulet, on altars, in witch bottles, and in spirit bags, ascribing the properties of protection, power, and prosperity to them.
- The sweetgum's "gumballs" are sometimes gathered to craft holiday wreaths and other decorations.

A Tourist's Testimonial

> *A sweet gum tree is the chameleon of wood, its corky exterior hiding its inner ability to imitate anything from cherry to mahogany. But its real value, one unrealized by most people, is its deep red heart, steady and strong.*[7]
>
> —Katherine Allred

Tree-Tripping

The sweetgum's dried seedpods can be used in many decorative crafts to celebrate the seasons and holidays of fall and winter. With a quick perusal of pinterest.com and a glue gun, paint, glitter, and other minimal craft supplies, you, too, can celebrate several seasons with a lot of spikey style. The "gum balls" can be used to construct both autumn harvest and Christmas wreathes, as well as a plethora of winter holiday decorations, both natural and not so much.

[7] Katherine Allred, *The Sweet Gum Tree* (Amazon: CreateSpace Independent Publishing Platform, 2005), p. 1.

If crafting is not a sweetgum tree caretaker's thing, some sell the sweetgum balls on eBay, Etsy, or Amazon. One seller on Amazon advertises them as a "great hiding spot and food source for baby isopods[8], but primarily crafters and practitioners of Hoodoo[9] are targeted as potential buyers. Other commercial ventures related to sweetgum balls have involved designing—for the most part, very expensive—devices by which to collect them from the ground--without using one's fingers to pick up the spiny balls.

The birds crafted of sweetgum balls you can find online are particularly appealing. But my favorite are the reindeer, made of 4 sweetgum balls and decorated with an acorn nose, bright berry eyes, twig antlers, and pinecone ears and tail)[10]. Sweet Avery Grace may be getting a sweetgum reindeer for Christmas this year.

Tree Dreams

- Is there a tree that in some way deeply connects you to another person who was or is in your life today?
- Is there a tree or a species of tree that means something special to your family?
- Have you had planted a tree in honor of your or of another couple's wedding?
- Have you planted a tree over your baby's buried placenta? Or in honor of a birth?

[8] "Isopods are "an order of marine invertebrates (animals without backbones) that belong to the greater crustacean group of animals, which includes crabs and shrimp. . . . Scientists estimate that there are around 10,000 species of isopods . . ranging from micrometers to a half meter in length." from the National Oceanic and Atmospheric Administration (NOAA) website: oceanexplore.noaa.gov/facts/isopod.html (accessed 10/11/20).
[9] "African Americans' experience and practice of the herbal, healing folk belief tradition [is] known as Hoodoo." Definition from *Mojo Workin': The Old African American Hoodoo System* by Katrina Hazzard-Donald (University of Illinois Press, 2013).
[10] For directions, see "In the Garden" blog at http://tinaramsey.blogspot.com/2009/01/gum-ball-art.html (accessed 10/11/20).

- Is there a tree that has witnessed your family's growth at a regular vacation spot?
- Is there a gravesite you visit marked or shaded by a tree?
- Have you planted a memorial tree to remember someone by after they have died?

Tree's Big Idea: **MYCORRHIZAL FUNGAL MYCELIUM NETWORKING**

What we didn't realize about trees until less than the last century and a half is that a tree's reach does not end at its root tips. For millions of years, trees have had underground partners that have helped them thrive. The reach of a tree is extended by a network of mycorrhizal fungal mycelium.

Let's unpack this scientific phrase—which was created to express a surprising discovery—beginning with the noun and working back:

- **mycelium**—a mass of branching, loosely interwoven, filaments, known as hyphae, that makes up the body of a fungus.
- **fungi**—A group of **eukaryotic** organisms (i.e, organisms made up of cells with a nucleus containing genetic material, a list which includes animals, plants, fungi), a group which contains at least 50,000 recognized species (and possibly as many as between 100,000 and 250,000 species).

  Fungi are distinct from green plants, animals, and bacteria. They differ from green plants, as we do, in not possessing chlorophyll. Because they are without chlorophyll, they are heterotrophic, meaning they are organisms that cannot produce their own food and, instead, depend on the bodies of other organisms for nourishment. While herbivores, like cattle and vegetarians, eat

plants, and carnivores, like lions and meat-eating humans, eat the flesh of other animals, fungi usually obtain food by absorption. The way that a fungus obtains what it needs in the way of nourishment is accomplished in one of three different ways, depending on the species of fungi:

  - parasitically
  - saprotrophically (the process of obtaining nutrients from non-living organic matter, e.g., mushrooms' role in decomposing forests)
  - symbiotically (i.e., through a mutually beneficial relationship).

- **mycorrhiza**—This word, coined in 1885, literally, means "fungus-root" and defines the symbiotic relationship between a fungus and the roots of a plant, a relationship first studied between 1879 and 1882. In the mycorrhizal relationship, the fungus facilitates water and essential nutrient uptake (e.g., phosphorus, copper, calcium, magnesium, zinc, and iron) in the plant, and the plant provides carbon and energy in the form of carbohydrates created by photosynthesis to the fungus.

Mycorrhizal fungi, partnering with the roots systems of "approximately 95 percent of the plants on earth,"[11] may stimulate the growth of fine roots, speed a plant's growth, and lengthen the life of the root system "while sequestering carbon in much more meaningful ways than human 'carbon offsets' will ever achieve."[12]

> "These fungi live in symbiosis with plant roots and transport carbon from plant photosynthesis directly into the soil," Clemmensen wrote. 'The prevailing dogma had been that aboveground plant litter (dead needles and wood) is the principal source of carbon storage in boreal forest soils,' she explained. But her results show that "a large proportion of the carbon

[11] Michael Phillips, *Mycorrhizal Planet: How Symbiotic Fungi Work with Roots to Support Plant Health and Build Soil Fertility* (White River Junction, VT: Chelsea Green Publishing, 2017)
[12] Ibid.

> stored in boreal forests instead enters the soil from beneath, via roots and their associated mycorrhizal fungi."[13]

Ten to 20% of the sugars a plant produces through photosynthesis are absorbed by the mycorrhizae.

Depending on the species of tree, a tree's roots are commonly engaged in a relationship with one of two types of mycorrhiza fungi, either ectomycorrhiza or endomycorrhiza (aka arbuscular mycorrihaza).

Ectomycorrhizal fungi, which forms forming on only 2% of plants, tends to form relationships with woody plants, including many forest trees: pines, spruce, hemlock, firs, oak, hickory, alder beech, birch and willow. Ectomycorrhizal fungi live on the outside of the short feeder roots, forming a thick mantle, visible to the naked eye. A Hartig net, which is constructed of highly branched hyphae, form a latticework structure between the epidermis (the cells on the roots surface) and the cortex (the cells between the epidermis and the vascular cells responsible for conducting water and nutrients).

Endomycorrhizal fungi, which is in relationship with about 85% of the world's plants species, penetrates the cortex of the root, forming arbuscules, which serve as the sites of exchange for phosphorus, carbon, water, and other nutrients. Forest tree species that partner with endomycorrhiza include cedars, cypress, junipers, redwoods, maple, ash, dogwoods, sycamore, tulip tree, and sweetgum.

Regardless of the type mutually beneficial partnership,

> [t]he fungus not only penetrates [or] envelops the tree's roots, but also allows its web to roam through the surrounding forest floor. In so doing it

[13] Mark Fishetti, "Root Fungus Stores a Surprising Amount of the Carbon Sequestered in Soil," *Scientific American,* March 28, 2013, https://www.scientificamerican.com/article/root-fungus-stores-a-surprising/ referencing: Clemmensen KE, Bahr A, Ovaskainen O, Dahlberg A, Ekblad A, Wallander H, Stenlid J, Finlay RD, Wardle DA, Lindahl BD, "Roots and associated fungi drive long-term carbon sequestration in boreal forest," *Science*, 339: 1615-1618. (The former accessed 9/20/20).

> extends the reach of the tree's own roots as the web grows out toward other trees. Here, it connects with other trees' fungal partners and roots.[14]

Peter Wohlleben, in *The Hidden Life of Trees: What They Feel, How They Communicate,* suggests that while accomplishing all of what we've understood roots' basic tasks to be, aided, as we've come to understand, by its mycorrhiza fungal mycelium partner, the roots perform another critical role for the tree providing the means by which trees communicate with one another. He attributes the fungi, in relationship with tree's roots, to serving as a "the forest Internet." ". . . And so a network is created, and now it's easy for the trees to exchange vital nutrients and even information—such as an impending insect attack."[15]

Wohlleben cites Dr. Suzanne Simard of the University of British Columbia, who has discovered that one of the ways in which trees warn each other of the danger of a browsing giraffe or a particular species of caterpillar or swarm of marauding insects in the vicinity is via:

> . . . chemical signals sent through the fungal networks around their root tips. . . . News bulletins are sent via the roots not only by means of chemical compounds but also by means of electrical impulses that travel at the speed of a third of an inch per second.[16]

Nature, the world's leading multidisciplinary science journal, coined the phrase "the wood-wide web" in response to Simard's research. Scientists have more to explore and understand with respect to the messages being sent between trees—both relations and neighbors—in this wonderfully rich underground realm between the surface of the ground and bedrock.

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[14] Peter Wohlleben, *The Hidden Life of Trees: What They Feel, How They Communicate* (Vancouver/Berkeley: Greystone Books, 2015), p. 51.
[15] Ibid.
[16] Ibid., p.10-11.