Mark Your Calendar:
August 10-11, 2019

by Jason Valcourt, conference coordinator

Time to mark your 2019 calendars for the 45th Annual NOFA Summer Conference! We return again to Hampshire College the weekend of August 10-11th for our annual late summer gathering, to enjoy a weekend with the fun and informative organic community of the Northeast.

At the 2019 conference we are highlighting once again the role of food quality in maximizing our health, preventing illness and supporting our immune systems. We are excited to revisit the ancient wisdom of understanding food as medicine. Presenters will provide guidance on all aspects of maximizing the medicinal qualities of our food, from growing food in a flourishing, remineralized soil microbiome to fermenting food as a way of preserving it while, at the same time, enhancing its nutritional and medicinal value.

Our 2019 keynote speaker is a familiar face to many—the New York Times called him “one of the unlikely rock stars of the American food scene.” Sandor Katz, author of Wild Fermentation (2001) & The Art of Fermentation (2012) will deliver a keynote address as well as an advanced fermentation workshop.

Sandor has set out on a path of “demystifying fermentation” and breaking open the field of “live-culture foods”. He is a self-taught experimentalist and “a fermentation revivalist” with the hopes of unlocking the rich nutritional value of fermentation for kitchens and ambitions of all sizes. He has supported the promulgation of ferments of all types across the U.S. and in dozens of countries abroad. From the simple sauerkraut recipes that started him on his journey he has explored and expanded into beer, wine, cheese, meats and a multitude of vegetables, some unique to certain cultures on earth and unknown by westerners.

Sandor’s emphasis on understanding and creating a lifestyle and diet that provides favorable conditions to our microbiome is based on the fact that the human body contains trillions of bacteria that far outnumber the human cells of our bodies. As Sandor states in a TED talk from early 2018, “Typically, people think about biodiversity as a phenomenon that affects the forests and the oceans, and certainly that is important. But we have to recognize that biodiversity also exists within us, and our health and our well-being are related to the health and diversity of our intestinal bacterial population.”

Sandor’s own journey to explore the culinary traditions of all human cultures has taken him all over the world. His tireless work has inspired both the preservation and celebration of food traditions as well as experimentation and bold evolution in fermentation culture -- and may also be responsible for diversifying gut microbiomes to support a healthy microbiome.

In addition to our deep dive into food as medicine, we will of course bring a lively trade show of farming and gardening methods, amazing exhibitors, enjoy live music, delicious foods, breakout sessions, a vibrant children’s conference and more. Stay tuned for more conference details in the new year!
Hi Jack,

Thank you so very much for your article on Lynn Margulis! (Book review section, Fall 2018 issue.) I tell everyone who will listen about her! Barely anyone knows about her or the importance of her many discoveries! Your application of her work to agriculture is timely as well. Thanks to you sharing your film review, I’m working with a team to show the movie here in Essex County in the winter! I would have never heard about this film if it wasn’t for your article, and I very much appreciate you bringing this subject to light!

Thank you again,
Carly Summers, Ph.D.
Agriculture Resource Educator
Cornell Cooperative Extension
Essex County, NY

Thanks Carly,
I meant every word of it and hope the review encourages others to read and watch documentaries about her brilliant insights. One of the great privileges I get by editing this paper is advance word of such interesting material coming out, and I try to pick things that I think will appeal to our readers. I’m glad this one did! – Jack

Jack -- Thank you! I loved the review of Lynn Margulis…am getting the local university to feature the film! Yeah! – Leah Tewksbury, Muncy, PA

Glad I could contribute to publicizing her and her work, Leah. That spreading to such a receptive community of the knowledge of the good work being done is exactly what makes this bully pulpit so rewarding! -- Jack

Dear Jack,

In one summer, you have somehow managed to read and write excellent reviews of more books and a film than most of us can find time for all winter! Taken together, your reviews in the latest issue of TNF add up to a fascinating essay on the important issues to think and learn about for our organic community. I especially appreciate your piece on the film about Lynn Margulis.

For years, I tried to get her to speak at a NOFA conference, but either she was not available or her scheduler priced her appearances above what I thought we could afford. I regret that we never connected - I wanted her to speak on what a microbiologist has to say to organic farmers. It would have been fascinating - and probably stimulatingly irritating too. I heard her speak once and managed to ask one question - what do you think about the chances of humans surviving climate change. All she would say was – ‘The algae say: “Next time, no brains!”’ Thank you!

Many hugs of gratitude,
Liz

Thanks, Liz! I have been looking forward to partial retirement (from my NOFA/Mass job) for a while. I definitely wanted to spend more time on reading and staying in touch with ideas. I felt like this issue I should do as many reviews that touched on microbes as possible, and fortunately there were a lot of books I had picked up and not had time for before, and the Margulis film came across my screen at the same time. What a fun experience it would have been to talk with her, I think. Definitely, no brains! (But I’m willing to put it to a vote).-- Jack

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Winter, 2018-19

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Longtime NOFA-VT Leader Enid Wonnacott Steps Down

by Melissa Pasanen

story originally appeared in Seven Days and is reprinted with permission

Enid Wonnacott has tallied many accomplishments over 30-plus years as executive director of the Northeast Organic Farming Association of Vermont. In 1987, her 10-hour-per-week job came with one filing cabinet and a milk crate filled with paperwork. Since then, Wonnacott has built the nonprofit into a 20-person team supported by a $2.8 million budget. NOFA-VT has had an impact not only on Vermont agriculture but nationwide.

Wonnacott started at the association the same year that Sen. Patrick Leahy (D-Vt.) became chair of the Senate agriculture committee. The two worked closely on developing the National Organic Program, which eventually led to the creation of the U.S. Department of Agriculture organic seal in 2002.

“Enid has been one of the most effective advocates for organic agriculture in the entire country,” Leahy told Seven Days via email, acknowledging that the road was long and that challenges continue. “Through all of this, as a leader, Enid has been patient but persistent and always a clear-eyed problem solver. I have often looked for Enid’s help on difficult policy challenges,” Leahy added, “and she has never been reluctant to let me know exactly what needs doing to support and strengthen organic agriculture.”

This summer Wonnacott, now 57, was inducted into the Vermont Agricultural Hall of Fame. In early October, she announced that she was stepping down from her position earlier than planned due to cancer.

The hall of fame acknowledgment is notable, said Chuck Ross, director of University of Vermont Extension and Vermont’s former agriculture secretary, who cohosted the awards event. While a few previous honorees contributed to the organic movement, Wonnacott is the first to be exclusively affiliated with organic agriculture.

“This is recognition of her role as guardian and voice of the organic movement,” Ross said. “It also recognizes the evolution of organic as a significant and meaningful part of our economy in Vermont and the economy nationally.”

Under Wonnacott’s guidance, NOFA-VT has become the go-to resource for organic farmers and gardeners, agricultural advocates, and locavores for everything from technical production assistance to comprehensive lists of farmers markets and CSAs. There were fewer than 50 organic producers in 1987; now NOFA-VT certifies more than 700. Its robust farm-to-school partnership, subsidized farm shares and other efforts work to broaden access to local and organic food.

The nonprofit’s mobile pizza oven, though, is probably the most vivid symbol of Wonnacott’s unique contributions: She embodies the warm heart of Vermont’s organic agriculture movement, pulling community together around organic food and the farmers who produce it.

“I love that whole program and initiative as much as anything we do,” Wonnacott said, after smoothly maneuvering the oven into Burlington’s Intervale on a September afternoon. Later that day, she headed up a team of volunteers and Intervale Center employees to bake pizzas for an event, hands in the dough, laughing and hugging longtime friends who stopped by.

Launched in 2006, the portable pizza oven fulfilled a vision Wonnacott had for gathering people around food in a way that fostered connection and conversation. “I’m passionate about community building,” she explained. “I think people need and seek community.”

Particularly in the early days, freshly baked pizza helped raise NOFA-VT’s profile with consumers and farmers. The copper-domed, wood-fired oven on a trailer has logged thousands of miles and produced thousands of pizzas at events such as farmers markets and young-farmer socials.

Since Wonnacott’s cancer diagnosis in 2014, working the oven has also provided a personal benefit. “It’s such a physical, present thing to do, especially when you have chemo brain,” she said. “To get out and see people is a really healthy thing for me.”

People who have worked with Wonnacott say her positive energy and balanced approach have been both anchor and beacon through the hard work of building a movement.

Mara Hearst, now a sheep farmer in Dorset, was 19 when she first met Wonnacott, who invited her to become a student representative on the NOFA-VT board. Hearst said Wonnacott’s consistent message as a leader and mentor has been: “We need to take time to be a community together.”

“After hours, she’s the first one to turn on the music and get everyone dancing,” said NOFA-NY board member Elizabeth Henderson. When she was founding president of NOFA/Mass., Henderson was on the committee that originally hired Wonnacott for the Vermont chapter. “It’s one of the things I’m proudest of,” she said.

The agricultural landscape has changed dramatically since Wonnacott became the nonprofit’s third executive director at age 26, fresh out of graduate school.

According to the Organic Trade Association, organic food sales in the U.S. hit $45.2 billion in 2017 and accounted for 5.5 percent of all food sold. Twenty years ago, OTA’s first published sales figure was $3.4 billion.

The USDA National Organic Program helped propel growth. However, its integrity has been questioned over the past couple of years based on media coverage of probable standards noncompliance by large organic dairy and egg operations. Investigation also revealed that some organic imports were receiving fraudulent certifications. Then the USDA withdrew approved, strengthened organic animal-welfare standards, though they had not yet been enforced.

After her initial diagnosis but before her cancer spread, Wonnacott had planned to retire in 2021, when NOFA-VT will turn 50. “But it’s also a good time now,” she said. “I recognize there are a lot of changes to the organic industry, challenges to organic integrity. I think there’s a need for really strong leadership, someone who has the energy I had when I started.”

After a pause she added, “I don’t have the fight anymore, just my love and appreciation for this move-
Wonnacott’s deep passion for agriculture was seeded while growing up on her family’s Weybridge homestead. Her mother was dean of students at Middlebury College. Her father died of cancer when Wonnacott, the youngest of three sisters, was 16. She spent a lot of time on a neighboring dairy farm, showed livestock at the fair and worked with a large-animal veterinarian.

At St. Lawrence University in New York State, Wonnacott studied biology and chemistry and first learned about organic agriculture. She relief-milked for a nearby organic dairy and read Wendell Berry’s 1977 classic, The Unsettling of America: Culture & Agriculture. “You know when you read a book and you’re like, Oh, my God. This is what’s in my head,” she recalled.

During a semester in Kenya, Wonnacott learned how to treat cobra bites and handle milk a 70-cow herd. Kenyan agriculture was organic “by default,” she said. “There was money to supply inputs, but no one knew what to do with them. I saw huge piles of imported chemical fertilizer next to broken-down tractors.”

As graduation neared, Wonnacott applied to veterinary school. Her mother suggested, for a yearlong Thomas J. Watson Fellowship to study alternative agriculture. “My mom was a really strong role model as far as ‘women can do anything,’” Wonnacott said. “She supported what was in my heart.”

She won the fellowship and worked on organic farms in New Zealand, Nepal, Norway and England: the experience was pivotal. “It was an agricultural system that made common sense to me, a culture of preventative management and health for the soil, the plants and the animals,” Wonnacott said. “I wanted to know, Why does the world not farm this way?”

Back in the U.S., she taught biology and environmental education and became an organic certification inspector before pursuing graduate studies at UVM. “I had to figure out why the world works the way it does,” she said. “How does our policy influence other countries? How do supply, demand and financial systems work?”

For her thesis, Wonnacott interviewed organic farmers about the role of policy in effecting change. “In the end, I felt like it’s all about grassroots — that was where change was going to come from,” she said.

When Wonnacott landed the job at NOFA-VT shortly after finishing school, she built on her thesis contacts to launch that grassroots effort.

In the mid-’80s, Wonnacott recalled, “organic was really the underground.” Farmers told her they didn’t label produce organic because customers would assume it had worms. “People thought it was just hippies playing around,” she said. “It wasn’t respected.”

Her goal, Wonnacott said, was to raise the status of the movement and provide support to farmers in the pre-internet age. She also prioritized developing a farmer-driven organic certification program with lengthy discussions to hash out standards. “For me, fascinated by movement building, by how groups make decisions, these were really amazing meetings,” Wonnacott said.

Jack Lazor of Butterworks Farm in Westfield met Wonnacott when she was a graduate student and worked helping to deliver the farm’s yogurt to stores. He was part of the first community forum she staffed the NOFA-VT traveling pizza oven, a job she loves.

Enid staffing the NOFA-VT traveling pizza oven, a job she loves.
Monsanto’s Global Weedkiller Harms Honeybees

Glyphosate—the most used pesticide ever—damages the good bacteria in honeybee guts, making them more prone to deadly infections. Previous studies have shown that pesticides such as neonicotinoids cause harm to bees, whose pollination is vital to about three-quarters of all food crops. Glyphosate, manufactured by Monsanto, targets an enzyme only found in plants and bacteria. The new study shows, however, that glyphosate damages the microbiota that honeybees need to grow and to fight off pathogens.

“We demonstrated that the abundances of dominant gut microbiota species are decreased in bees exposed to glyphosate at concentrations documented in the environment,” said Erick Motta and colleagues from University of Texas at Austin in their new paper. They found that young worker bees exposed to glyphosate exposure died more often when later exposed to a common bacterium. Other research, from China and published in July, showed that honeybee larvae grew more slowly and died more often when exposed to glyphosate. Prof Dave Goulson, at the University of Sussex, said: “It now seems that we have to add glyphosate to the list of problems that bees face. This study is also further evidence that the landscape-scale application of large quantities of pesticides has negative consequences that are often hard to predict.”

source: The Organic and Non-GMO Report, Sep–Oct, 2018

Federal Court Orders FDA to Ban Chlorpyrifos

The Ninth Circuit Court of Appeals has nullified the decision by past EPA Administrator Scott Pruitt to cancel a proposed ban on the pesticide chlorpyrifos, which has been linked to brain damage in children even in small doses. Pruitt’s action came just weeks after meeting with the CEO of Dow Chemical company, the largest maker of chlorpyrifos. In the decision the court cited the FDA as being “in direct contravention” of federal food and pesticide laws.

source: Acres, USA, October, 2018
Study: Dairy Fats Not Linked to Heart Disease, Strokes
A study by a University of Texas Health Science Center at Houston team, published in the American Journal of Clinical Nutrition, has found that; "...dairy fat, contrary to popular belief, does not increase risk of heart disease or overall mortality in older adults. In addition to not contributing to death, the results suggest that one fatty acid present in dairy may lower risk of death from cardiovascular disease, particularly from stroke."
source: Acres, USA, October, 2018

Chinese Ag Tariffs Not Likely to Directly Hit Organic Farmers
The 25% tariffs on US agricultural products, including soy, corn, wheat, sorghum, beef, pork, poultry, fish, dairy products, nuts and vegetables, that China has applied in response to the Trump tariffs are unlikely to harm organic farmers because little organic product goes to China. Only 1% of the Chinese market is organic and while that is a large amount of consumption, Chinese organic crop production in 2014 comprised 1.9 million hectares, compared to US production of 2.2 million hectares that same year. There is a good chance of an indirect effect if the tariffs stay in place, however, as some conventional growers are already looking to the domestic organic market as an alternative to export.
source: The Germinator, Fall, 2018

Congress Eyes Preempting Local Pesticide Bans
A provision tucked away (Section 9101) in the version of the Farm Bill passed by the US House of Representatives in June would preempt local governments from adopting their own pesticide regulations that would conflict with the federal Clean Water Act. The rest are following state regulations, which are far laxer.

At least 110 of the hog manure lagoons associated with confined animal feeding operations (CAFOs) in North Carolina now at least 155 local ordinances regulate use of toxic chemicals in parks and playgrounds (including 58 glyphosate bans) and could be preempted by the bill.
source: Acres, USA, November, 2018

Strawberries Linked to Inflammation Reduction
Researchers at the University of Massachusetts Amherst studying inflammatory bowel disease (IBD), a set of painful conditions that can cause severe diarrhea and fatigue, have found that consumption of whole strawberries at a level as low as ¼ cup per day suppresses symptoms of IBD and diminishes inflammation in colonic tissue. The condition may be caused by lifestyle factors such as diet and lifestyle habits of many people in this country – high sugar, high animal fats, but low fiber diets” according to Hang Xiao, Ph.D., who led the study.
source: Acres, USA, November, 2018

Smart Greenhouses?
The hard choice some farmers face choosing between using sunshine for crop production or for power generation has been somewhat eased by a new magenta translucent photovoltaic film that can sustainably produce electricity while still allowing enough light to pass through for plants to grow. It is called the Wavelength-Selective Solar Photovoltaic System and was invented by researchers at the University of California, Santa Cruz. Although the magenta panels transmit only some of the blue and green light waves, 80 percent of the plant varieties tested grew regardless of the panel color. The other 20% (including some tomatoes, lettuces, peppers, cucumbers, basil, limes, lemons and strawberries) had an even higher photosynthetic rate than normal.
source: Acres, USA, November, 2018

Daikonns for Coronary Protection?
A study printed in the Journal of Agriculture and Food Chemistry reports that compounds in the Sakurajima (or ‘monster’) Daikon radish are good for blood vessels and can potentially prevent heart attacks and strokes. Radishes are known to be good sources of antioxidants, but no previous studies had compared Sakurajima to other varieties with respect to heart-health benefits. It turns out the monster variety produces more nitric oxide, a key regulator of blood vessel function, as well as trigonelline, a plant hormone that seems to promote a cascade of beneficial changes in coronary blood vessels.
source: Acres, USA, November, 2018

Classic Herb Publication Updated
The ATTRA publication Herbs: Organic Greenhouse Production has been updated from its 2005 version and is available free as a pdf on the Internet. It looks at marketing channels for organic herbs and makes assessments of the environmental factors to consider for small-scale greenhouse production of fresh-cut herbs.
source: Acres, USA, November, 2018

Family Farmer Group Opposes New North American Trade Deal
The National Family Farm Coalition (NFFC) is disappointed that the renegotiation of the trilateral North American trade deal now known as the US-Mexico-Canada Agreement (USMCA) has put the financial interests of multi-national corporations ahead of family farmers, workers, and the environment. Canada’s supply management dairy protections have enabled small farms to survive by producing dairy, eggs and poultry on a family scale. Under the new deal, US farmers will gain access to the Canadian market for these products. Canada’s entire dairy market is smaller than that of Wisconsin and the result of U.S. entry will be many Canadian farmers going out of business.

“While the slightly expanded market will offer small benefits to some US dairy farmers, it does nothing to reduce the overproduction at the heart of our dairy crisis – rather, it increases the false idea that exports will save us. We must solve the problem of our overproduction through common sense farmer-led supply management programs, not by dumping our excess milk into the Canadian farmers’ market,” said Wisconsin dairy farmer Jim Goodman, board president of NFFC.

According to the NFFC, the changes in the USMCA appear poised to shift Canada’s farmers (continued on page A-9)
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farming free-for-all like that of the US, with all of
its negative economic, social, and environmental
consequences.
source: popularresistance.org, Oct 4, 2018

Co-op Impact: More Than Good Food
In 2008, a study of 17 food co-ops in Vermont, Mas-
sachusetts, New Hampshire and Connecticut found
they had a combined membership of 64,000 people
and aggregate annual sales exceeding $161 million.
Further, these co-ops made local purchases of more
than $30 million and had over 1,200 employees. The
Vermont co-ops were among the top 25 employers
in the state!
A decade later, the Neighboring Food Co-op
Association (NFCA) surveyed the co-ops that partic-
ipated in the original study to see what has changed
over the past 10 years. One of the 17 co-ops had
closed its doors, but in the remaining 16 co-ops:
• Shared Revenue grew 39%, from $161 million
to over $224 million;
• Sales of Local Products grew 23%, from an
estimated $92 million in 2008 to $119 million in 2018;
• Membership grew by 38%, from 64,000 to
more than 88,000;
• Employment grew 20% from 1,240 to 1,485;
• Staff Wages grew 69%, from $28.6 million to
almost $48.3 million.
source: press release, October 31, 2018, NFCA

California Passes Farm Animal Protections
California Proposition 12, which passed this fall with
more than 61% of the vote, sets specific space
requirements for confined animals raised for food.
Building on a popular but flawed 2008 measure, the
updated rules specify square footage for each animal.
The new guidelines are unambiguous and ban sales from producers who don’t comply— even if they are from outside of the state. The proposition also adds an enforcement mechanism, giving the initiative teeth its predecessor lacked. The state’s department of food and agriculture, alongside its department of public health, will now be charged with overseeing the regulations and violators could face misdemeanor charges and fines.
“California voters have sent a loud and clear message that they reject cruel cage confinement in the meat and egg industries,” said Kitty Block, CEO of the Humane Society of the United States, after the election results were announced.

The Humane Society was one of several animal rights organizations that backed the ballot, collectively financing more than $13m in support. They came up against other animal activists from People for the Ethical Treatment of Animals (Peta), the Association of Egg Farmers and the National Pork Producers Council were also in opposition, emphasizing that the new rules would cause food prices to spike.
Beginning in 2020, the law will require that veal sold in the state come only from calves who have more than 43 sq ft of space, and hens (including chickens, turkeys, ducks, geese and guinea fowl) will have to have at least one sq ft. Two years later, in 2022, the law will expand to include breeding pigs and their babies, banning the sale of pork unless it comes from pigs given at least 24 sq ft of space, and will require all eggs sold to come from “cage-free” hens, defined by the United Egg Association.

Harvard’s billion-dollar farmland fiasco
One of the world’s major buyers of farmland, under fire for their involvement in land conflicts, environmental destruction and risky investments, is none other than Harvard University. A new report by GRAIN and Rede Social de Justiça e Direitos Humanos presents, for the first time, a comprehensive analysis of Harvard University’s controversial investments in global farmland. The report finds that:
• Harvard’s endowment fund has spent around $1 billion to acquire control of an estimated 850,000 hectares of farmland around the world, making the University one of the world’s largest and most geographically diverse farmland investors.
• Harvard’s farmland acquisitions were undertaken without proper due diligence and have contributed to the displacement and harassment of traditional communities, environmental destruction and con-
flicts over water. The consequences of these deals are particularly dire in Brazil, where Harvard’s en-
dowment fund has acquired nearly 300,000 hectares of land in the Cerrado, the world’s largest biodiverse savannah.
• Harvard’s opaque farmland investments resulted in windfall remunerations for its fund managers and business partners but have failed as an investment strategy for the university.
• Other U.S. Universities, including the University of Texas, Princeton, Stanford and Yale, have invested over a billion dollars in “natural resources” and farmland.
source: Graing.org, Sep. 6, 2018

Comparison of Animal Welfare Certifications

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<tr>
<th>Standards</th>
<th>American Humane Certified</th>
<th>Animal Welfare Approved</th>
<th>Certified Humane</th>
<th>Global Animal Partnership (GAP)</th>
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<tr>
<td><strong>Air Quality</strong></td>
<td>Ammonia must be ≤ 25 ppm</td>
<td>Ammonia must be ≤ 5 ppm</td>
<td>Ammonia must be ≤ 5 ppm</td>
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<tr>
<td><strong>Outdoor Access</strong></td>
<td>Not required before processing</td>
<td>Required at all times</td>
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<td><strong>Stocking Density Minimum</strong></td>
<td>1.6 ft² per chicken</td>
<td>4 ft² per chicken</td>
<td>6 lb/ft² for chickens</td>
<td>5 lb/ft² for chickens</td>
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<td><strong>Permitted Physical Alterations</strong></td>
<td>Castration</td>
<td>Branding in compliance with state laws</td>
<td>Branding only in accordance with state laws</td>
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<td><strong>Natural Light</strong></td>
<td>Not required</td>
<td>Not required</td>
<td>Not required</td>
<td>Disbudding allowed with pain control</td>
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<td><strong>Forging Opportunities</strong></td>
<td>Not required</td>
<td>No more than 20%</td>
<td>Required</td>
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<tr>
<td><strong>Weaning</strong></td>
<td>≥ 3 months for beef calves ≤ 5 weeks for dairy calves</td>
<td>≥ 8 months for beef calves</td>
<td>≥ 8 months for beef calves</td>
<td>Natural weaning only</td>
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<tr>
<td><strong>Antibiotics</strong></td>
<td>Only to treat bacterial infection</td>
<td>Only to treat diseased animals</td>
<td>Only to treat diseased animals</td>
<td>Only to treat disease in non-bark market animals</td>
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While on an afternoon hike last fall, I sat down at the base of a large tree to take in what might be going unnoticed. Within seconds, a chipmunk appeared from behind a pile of large rocks. Based on its behavior, I suspected this chipmunk had had the good fortune of a past encounter with a hiker willing to share a snack. When it realized that I had nothing to offer, the chipmunk turned and began searching the area. It quickly stopped and began digging. Lucky guy, I thought, assuming that the chipmunk had located a cached acorn buried by a hard-working gray squirrel. It came as a surprise, then, when in less than a minute, the chipmunk unearthed an acorn sized truffle!

Most of us have heard of truffles, though we often associate them with fancy European restaurants; black and white truffles, in particular, are prized ingredients. But truffles exist here, as well, and while our Northeastern chipmunks probably don’t have gourmet tastes, they’re certainly gourmand in their taste for truffles.

Truffle terminology
A wide variety of fungi are found in most forests, and loosely speaking, they obtain nutrients in one of three ways. Saprotrophic fungi are decomposers. They release acids and enzymes that break down dead tissue into smaller molecules that they can absorb. Decaying wood, plants, and even some animals can become food for a saprotroph. Examples of these include oyster and shiitake mushrooms. Parasitic fungi infect a living host and sometimes kill it. The distinction between parasitic and saprotrophic fungi isn’t always clear; for example, some bracket fungi that produce conks on the exterior of a tree trunk can be both. Mycorrhizal fungi form symbiotic relationships with the root systems of forest plants. Common examples include porcini, chanterelle mushrooms, and almost all truffles.

The fungal “mycelium” – a mass of branching, thread-like fibers – encapsulate the roots of a tree and extend out into the soil where they capture water, nitrogen, phosphorus, and other nutrients that are then transported to the tree’s roots. In return, the mycelium fibers obtain carbohydrates (sugars) from the roots.

A number of field and laboratory experiments have
demonstrated that removing the fungus substantially reduces the growth rate of a tree and can result in its death. So, healthy trees need their fungi and fungi need their trees.

The term “truffle” is commonly used in reference to the belowground fruiting body, or sporocarp, that enables reproduction. An above-ground mushroom’s fruiting body grows up and out of the ground on a stem and then develops a cap that contains spores. Once the cap dries out, it releases the spores into the wind as a means of reproduction. But because truffles fruit in the soil, this wind-blow spore dispersal mechanism isn’t possible. The truffles’ cap has evolved into an underground mass that resembles a small potato; within that mass are millions of spores and each can develop into a new truffle-bearing fungus. So, how do truffle spores disperse if they are below ground?

It’s important to be eaten

Let’s return to the chipmunk I encountered on my hike. As it handled what seemed to be a stag or deer truffle (genus Elaphomyces), the chipmunk seemed most intent on eating the outer rind, or peridium. No doubt it also swallowed a number of spores found inside. In addition to chipmunks, flying squirrels, red squirrels, various voles and mice, deer, bears, and even fishers are known to consume truffles. Truffles provide these animals with nutrients, essential minerals, amino acids, and vitamins. Vitamin D in some truffles occurs in higher concentrations than most other foods available in the forest, and for nocturnal rodents, truffles may be an important source of this “sunshine vitamin.” In New Brunswick, Canada, red squirrels and northern flying squirrels are major truffle consumers. Truffle researcher Karl Vernes found that red squirrels cache truffles as they do spruce cones, often in a central location or midden. Near the town of Moncton, for example, a suburban red squirrel was found to be using an abandoned robin’s nest to store more than 50 deer truffles. Truffles preserve well simply by air drying, so having a cupboard well stocked with truffles is a wise strategy for a snowbound squirrel.

Similar to berry-eating birds, chipmunks and other animals that eat truffles disperse the undigested spores, helping to establish new populations of the fungus. Additionally, researchers found that fungal spores collected from flying squirrel droppings had a higher germination rate than spores collected directly from the truffle. This suggests that, in addition to aiding in spore dispersal, the success of spores may be enhanced by passing through the

An abandoned robin’s nest near Moncton, New Brunswick, was a convenient place for a red squirrel to store deer truffles.
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As truffles mature, they produce strong, chemically complex odors that attract many small mammals. The scent of a truffle may contain compounds similar to certain animal pheromones, meaning that a little goes a long way. And like pheromones, they are often species-specific. The truffles I’ve handled range from mildly foul, like something rotting, to a very pleasant citrus-like odor. Responding to these olfactory cues, small mammals are adept at uncovering mature fruit bodies of truffle fungi. This clue to finding truffles has also been used by human foragers seeking prized white and black truffles in southern Europe. Historically, human-truffle hunters relied on the sensitive snout of a domestic pig that was tethered on a leash. Pigs are efficient in rooting out truffles; however, a major drawback to this approach is that they often eat the truffles before their handler can scoop them up. As a result, dogs have replaced pigs because they are more interested in a reward than eating the truffles they sniff out.

How widespread is the truffle connection?

In their comprehensive book Trees, Truffles, and Beasts – How Forests Function, authors Chris Maser, Andrew Claridge, and James Trappe summarize decades of their research on truffles in the Pacific Northwest and Australia. They trace the long evolutionary history of truffles and show that the relationships among trees, fungus, and fungus-eating (mycophagous) animals have existed for a very long time and likely occur throughout the forests of the world.

In northern Minnesota, forest ecologists John Terwilliger and John Pastor were puzzled as to why black spruce trees were rare in abandoned, drained beaver meadows, yet very common in surrounding forests. Using information on the diet and distribution patterns of red-backed voles, a major consumer of truffles in that region, these researchers were able to demonstrate that it was the reluctance of voles to enter the meadows and the lack of their spore-filled droppings that limited black spruce from colonizing the meadows. Fungal spores and the mycorrhizal network that eventually develops are essential for seedling spruces to thrive.

In New England, the role of truffles in forest ecosystems had largely gone unexamined until researchers from the University of New Hampshire recently took on the topic. Associate Professor Rebecca Rowe and doctoral student Ryan Stephens are leading the investigation in the White Mountain National Forest. Among the questions they are addressing: What conditions affect the distribution and abundance of truffles in northern forests? Although fundamental to our knowledge of forest ecology, such information can also aid in...
The abundance of truffles, especially in softwood or conifer stands, provides a reliable food source for many animals. Understanding how disturbances, natural or human-caused, can affect mycorrhizal fungi, thereby aiding in the development of approaches that might help offset such disruptions to this co-dependent system. To answer this question, Stephens and Rowe inventoried the abundance and variety of truffles in different parts of the forest, divided by dominant tree groupings. Hardwood stands included American beech, red maple, sugar maple, yellow birch, white birch, and white ash. Softwood stands were dominated by eastern hemlock, red spruce, balsam fir, and an occasional white pine. Finally, mixed-wood stands included a combination of both hardwoods and softwoods. Within each forest type, Stephens and his field assistants used garden cultivators to rake up samples of the forest floor and then carefully filtered through the rotting leaves, needles, branches, and soil in search of truffles.

Suspecting that this method might miss some truffles, Stephens also used chipmunks as an additional source of information. Small, baited box traps were set to capture chipmunks in the same forest stands that were sampled by digging. When captured, small mammals usually defecate in the trap. So it’s quite easy to get several samples from an animal and then release it. The more challenging part of this approach is identifying the specific truffles eaten by chipmunks from the fungal spores found in their droppings. Size and shape of spores are often unique for a variety of truffle, and there are standardized keys that lead a biologist to a correct identification. But spores are quite small – some just a fraction of the width of a human hair – and as a result, extreme care and the use of a powerful microscope is required when preparing and identifying samples.

While the research is not yet complete, Stephens and his colleagues have found some interesting patterns. Truffles were most abundant in softwood stands, with an average of roughly 60 pounds growing per acre, and least abundant in hardwoods, with less than 7 pounds per acre. Not surprisingly, chipmunk droppings yielded a greater variety of truffles than the researchers were able to locate on their own. Chipmunks are capable of finding truffles that are no larger than a plump grain of rice. Among individual trees, eastern hemlocks were consistently associated with sites containing the most truffles. Even in hardwood stands, clusters of truffles were located at the base of a lone hemlock. This pattern suggests a tight relationship between hemlocks and several of the most common truffles that Stephens found in the White Mountains. That relationship makes sense because hemlocks are...
abundant in northern forests and they are among the longest-lived trees, which must be an attractive trait to a symbiotic fungi.

The human connection
The researchers also found that the vitality of truffle-producing fungi is clearly linked to its host trees. When trees are removed or the composition of a forest changes over time, the diversity and abundance of truffles in the forest will also change. As a result, wildfires and timber harvests can have a large effect on truffles. Removal of host trees eliminates the supply of energy to the fungus and that prevents it from producing truffles. In addition to removing host trees, soil temperature, moisture content, and compaction can limit truffles. Based on that information, foresters and loggers might be encouraged to leave small groups of trees that include at least one dominant tree to ensure that important fungi remain on a site where most trees are removed. In northern New England, it may be especially appropriate to leave groups of hemlock.

The association of truffles with eastern hemlocks raises greater concerns because of the recent invasion into the Northeast of the hemlock woolly adelgid, an insect that threatens the hemlock’s very existence. At the Harvard Forest in western Massachusetts, forest ecologists are attempting to understand the changes that will occur to

The relationships among trees, truffles, and small mammals illustrate the interconnectedness of organisms in this ecosystem.
Deer truffles are among the most common variety found in northern forests. Forest composition if hemlocks die out. Using experimental removals (where hemlocks are cut) and computer simulations, they predict that white pine, black birch, and beech trees may become more abundant. Their results also indicate that changes in forest composition will vary with local conditions, such as soil fertility and rainfall patterns. Regardless of which species replace them, there’s no doubt that with a loss of hemlocks, the diversity and perhaps abundance of truffles will change.

Understanding the role of small mammals and truffles in maintaining the vitality of our forests highlights the interdependence of organisms and how those connections may be disrupted. Chipmunks and truffles may be small, but it is quite impressive to see how important they are to a healthy forest.

John Litvaitis has worked as a wildlife ecologist for county, state, and federal natural resource agencies in New Jersey, Florida, and Oklahoma. After 31 years as a professor at the University of New Hampshire, he is “re-wiring” his career as a full-time advocate for wildlife. John lives in Madbury, New Hampshire.

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