Vol. 13, No. 2

sagatagan Seasons



Spring 2010

The Story of Cane and Maple

Jenny Kutter

eet Cane (*Saccharum* officinarum L.). A member of the grass family, sugarcane can grow from eight to twenty feet tall. Widely cultivated, but completely intolerant to frost, sugarcane is grown only in tropical regions where it can flourish in perpetual summer. Introduced in the United States during colonization, U.S. sugarcane is now mainly grown in Florida and Louisiana.

Meet Maple (*Acer saccharum*). Sugar maple trees are native to the eastern half of North America and can grow up to 100 feet tall. Common in forests of the northeastern United States, sugar maple trees are well adapted to the long, cold winters we Minnesotans love. Though not botanically related, Cane and Maple are kin in other ways. Their differences are obvious: warm vs. cold, grass vs. tree, cultivated agricultural crop vs. native forest species. But their similarities, at least in the process of sugar production, are also obvious.

Sugarcane, along with sugar beets, is one of the main sources of table sugar in the United States (although more than half now comes from the beet). Sugarcane stalks cannot be easily harvested by machine, so it is most often harvested by the work of many hands. The canes are cut with machetes and sent to factories to be chopped, shredded, and pressed by machines to release the juice, which contains

iny Perouth



Arboretum student naturalist, Erica Manternach, helps visitors tap a maple tree at the Maple Syrup Festivals. Join us March 27 and April 10 for your chance to experience the joys of maple syruping!

"I admire Maple for connecting me to place, for rooting me in my habitat, for providing an avenue for community celebration, and for helping me know what the sweetness of my home tastes like."

an average of 10-20% sucrose.

Cane juice is evaporated until the sugar is too concentrated to be held in liquid form. The wet crystals are spun in a centrifuge (think clothes dryer or salad spinner) that flings the remaining syrup (molasses) out, leaving behind a wet, brown sugar that must be further refined before it can be consumed. The cane sugar is washed, re-dissolved, re-crystallized, and re-centrifuged multiple times. This leaves behind progressively purer sugar and progressively darker and more concentrated molasses. The final white granulated sugar sold in stores, whether cane or beet in origin, is 99% pure sucrose with everything else removed.

The process of maple syruping begins in the sugar bush, or an area of forest with many sugar maple trees. Rather than harvest trees for sap, mature trees are "tapped" in the spring of the year when daytime temperatures are above freezing and nighttime temperatures are below freezing. Maple sap is also not easily harvested by machine, and many hands are often needed to tap trees and collect the sap. The collected maple sap contains 2-3% sucrose. Maple sap is evaporated



www.csbsju.edu/arboretum/ arb_highlights/buscampaign

Sugar, continued from page 1

into syrup with a sugar (sucrose) concentration of 66.7%. Although not commonly done, maple syrup can be further evaporated to produce maple sugar (like brown sugar), and if further refined to 99% sucrose, would likely look and taste quite similar to table sugar.

While the process is interesting, this is a story not meant to simply distinguish between Cane and Maple, but also to reflect on their competition for our affection. Cane and Maple are both members of the same "family" of species that are deeply intertwined with the human attraction to the sweetest things.

Recent history has given us humans a somewhat fickle relationship with carbohydrates (sugars and starches), but in the end it all boils down to one word: energy. Our bodies break all carbohydrates down to the simplest sugar, glucose, which provides our bodies the energy we need. And today, we can get our daily dose of sweetness



Steve Saupe explains the operations of the sugar shack and evaporator at Saint John's. Tours and lectures give visitors a chance to learn about maple syrup production every spring. Maple syrup season is a time to celebrate the joys of community, habitat, culture, and place.

from more places than ever: maple trees, sugarcane, sugar beets, corn, palm trees, sorghum, honey, agave plants, and more.

We may be attracted to Cane for our ability to structure its growth and harvest, the ease of large-scale production and transport, and the great variety of uses for it in cooking and baking.

We may be attracted to Maple for its reminder of our cultural past, for helping us to live and move with the seasons, for its local and regional scale production, or for its unique flavor in our favorite recipes.

Cane is cultivated and coaxed from the earth year-round. Maple is freely given only on nature's time.

We all have our preferred sweeteners, for one reason or another, be they cultural, geographical, social, political, nutritional, or otherwise (although any of us arguing the nutritional qualities of one sugar over another should be warned: if you're eating sugars for their nutritional values, you're eating too much sugar!).

2

I don't fault Cane for what it is and what, in this story, it may represent. But I know the sights and sounds of the sugar bush and the community joy of making maple syrup in a way that, as a Minnesotan, I can't know about the sugarcane fields. I admire Maple for connecting me to place, for rooting me in my habitat, for providing an avenue for community celebration, and for helping me know what the sweetness of my home tastes like.

The world is filled with many stories, but there is none sweeter than the story of Cane and Maple.

Jenny Kutter is the department coordinator for the Arboretum. Her joy of all things maple notwithstanding, it is a good, rich dark chocolate that satisfies her soul. She wonders if there could ever be such a perfection as a maple dark chocolate.

A Question of Energy

Theo Eggermont

This winter I was charged with the task of helping the Abbey and Arboretum develop educational tours for the newly installed Saint John's Abbey solar farm. Uncertain where to start, I turned to William McDonough, a brilliant architect who describes an imaginary and impossible design task of replicating a tree. His starting question: what do trees do? My starting question: what does our solar farm do?

The solar cells produce electricity when the sun shines, displace carbon emissions, provide a variety of educational and research opportunities, can help demonstrate that solar is viable in cold climates, are almost completely recyclable, support a market with great potential for efficiency improvements, and eighty percent of the land beneath the panels can be planted to native prairie.

How does that compare to other ways of producing electricity? On campus, we also have a coal burning power plant. So, what does coal

Theo

do?

When burned, coal releases stored carbon from thousands of years ago, and sends particulate matter, compounds of nitrogen, sulfur and mercury, and high amounts of carbon dioxide into the air that we breathe. Mining coal clears mountains, causes 30,000 premature deaths a year, and can have great impacts on water quality.

But, coal produces a highly reliable and consistent source of electricity and heat (in the form of steam, on campus), which is essential to meeting our demand for energy, and large deposits of coal are present in the U.S. rather than imported from other countries.

Perhaps it's not even about which questions we ask, but that we learn to ask the questions and teach others how to do the same. How do we get electricity? What other ways can we get electricity? What are the inputs, and where do they come from? What are the outputs, and where do they go? What is wasted? How can we use or minimize that waste? What are the costs and why? What about efficiency and conservation?

These questions will lead us to answers that can sometimes be as clear as, well, mud. But by learning about the issues from a variety of angles and choosing our priorities, we can start to form a picture that will be our guide. That is the task we've set forth to accomplish with educational tours of the solar farm at Saint John's.

And that's not so bad, considering the task Mr. McDonough set up for himself when answering his own question about trees: a tree "makes oxygen, sequesters carbon, fixes nitrogen, distills water, accrues solar energy as food, makes complex sugars in food, creates microclimates, changes color with the seasons, and self replicates." Good luck, my friend.

Theo Eggermont is the CSB/SJU sustainability fellow. The real energy question is: what does Theo do? All answers welcome.

Saint John's Abbey Solar Farm

- 1,820 solar modules installed on 3.9 acres of abbey farmland
- 575,000 kWh annual production, or the equivalent of approximately 65 homes
- Will produce 4% of Saint John's annual needs, but will produce up to 20% of real-time needs in perfect conditions
- The largest solar system in the Upper Midwest—four times larger than the previous largest system
- Made possible by a 2 million dollar grant from Xcel Energy and Westwood Renewables
- 80% of the land is undisturbed and will be planted to native prairie



Saint John's Abbey's 4-acre solar farm was installed in the fall of 2009. The panels are mounted in rows that can track the sun from east to west, which can increase the panels' efficiency by 15%.

Energetics of Maple Syrup Production

Steve Saupe

E ach maple syrup season, we keep track of a number of statistics: number of taps, number of loads of sap, number of gallons of syrup, even the number of hours of volunteer help. But how much energy does it take to make maple syrup?

Did you know that Saint John's maple syrup is solar-powered? No, we don't have any solar panels on the sugar shack, but our evaporator is ultimately solar-powered – we heat with wood. When wood is burned, it releases heat energy. That energy was captured from the sunlight during many summers of photosynthesis and stored in the fibers of the tree. In order to boil off roughly 40 gallons of sap for every gallon of maple syrup, we use a lot of stored solar energy, or wood.

As a rule of thumb, syrup makers know that you need about one cord of wood for every 100 taps. Or, since each tap typically yields enough sap to make about one quart of syrup, one cord of wood will make about 100 quarts, or 25 gallons, of syrup.

To move the wood from the wood shed to the evaporator we use a modified wheelbarrow that has a platform which is 2 feet wide x 3 feet long. Assuming that we stack the wood in the wheelbarrow about 2 feet high and that the logs overlap the sides of the platform by about a foot, we can carry about 18 cubic feet or 0.14 cords of wood per trip. Thus, it takes a little more than 7 trips to the wood shed for each cord. This may not seem like much, but it means that the Saint John's sugar makers and volunteers needed to make no fewer than 88 trips to the woodshed last spring!

Looking at energy use from a different perspective, a study in Wisconsin showed that, depending on the evaporator and the fuel source,



How much energy does it take to make maple syrup? Ask the volunteers. Gary Gillitzer hauls another load of firewood to the evaporator during the 2009 Maple Syrup Festival. This general scene was repeated no fewer than 88 times during the 2009 syrup season.

the wood fuel efficiency for producing one gallon of syrup ranged from 170,000 BTU (a unit of energy) with a state-of-the-art evaporator using reverse osmosis, to 5,343,000 BTU for a hobbyist.

To calculate the wood fuel efficiency at Saint John's we need to know the BTU content, or the potential to generate heat, of our wood. For example, basswood has 11.7 million BTU per cord compared to ironwood with 24.1 million BTU per cord and red oak with 21.3 million. At Saint John's we burn a mixture of wood including red oak, sugar maple, ironwood, and assorted scrap lumber. If we use a conservative estimate of 20 million BTU per cord, last year we used 250 million BTU's to produce our 268 gallons of syrup. In other words, our fuel efficiency was 932,835 BTU per gallon of syrup, which isn't too bad for an antique "solar-powered" evaporator.

This past summer our chief syrupmaker, Brother Walter Kieffer, OSB

and a crew of student employees completed a number of renovations on our wood shed including an addition. The remodeled wood shed is now more than double in size. When full it will hold 33.6 cords, enough wood to cook the sap from nearly 3400 taps and make about 840 gallons of syrup. Since we tap about 1000 trees per season, we can store enough wood for three seasons. I'm sure this is welcome news for Father Fintan Bromenshenkel, OSB, a nonagenarian, who working like the Energizer Bunny, cuts wood nearly every day for the maple syrup operation.

Steve Saupe is a CSB/SJU professor of biology. While he was busy calculating the energy of maple syrup, we were busy calculating the energy of Steve Saupe and how much should be set aside for the Arboretum. He'll be busy.

The Physics of the Arboretum

Sarah Gainey

hen I consider the energy the Arboretum staff puts into the goals and mission of our organization, I can't help but think of the first two laws of thermodynamics (who wouldn't think physics?).

Remembering that energy cannot be created from scratch (law #1) helps as we use the wisdom and experience of people to develop programs new to us. Keeping in mind that useable energy is lost any time you convert from one energy type to another (law #2) helps us to remain focused on our mission and longterm goals, and not lose energy by changing directions too often. In that spirit, here's where we've been putting some of our energy.

Energy Curriculum

After we hosted an Energy Educators Workshop last summer that educated twenty-one teachers on energy issues, and with the completion of the new Saint John's Abbey solar farm last fall, interest in energy education skyrocketed. We are currently writing curriculum for middle and high school students to help them understand the concept of energy and how alternative energy sources such as the solar farm play a role in the bigger picture.

One of our main goals of the curriculum is to encourage the students to be "full cycle thinkers" and to take into account the full ramifications of their energy choices. We are also developing experiences for CSB/SJU college students and other interested adults to use the presence of the photovoltaic panels to learn and think about their energy choices.

Advertising

As most organizations would agree, it does not make sense to plan, organize, and host events if nobody knows about them! While the Arboretum enjoys great success in our bigger events, such as the maple syrup festivals or the annual Avon Hills conference, we often have very low attendance at our other events. We're working to get the word out about events in new and unique ways, and learning from our students in the process!

To get CSB/SJU students more involved in maple syruping, Richelle Caya, one of our student naturalists, executed a clever campaign. All throughout February, CSB/SJU students were told: "It's Coming..." That simple message was broadcast in e-mails, posters, and (my personal favorite) written in snow sprayed with food coloring.

Throughout March we've been announcing: "It's Here!" We're advertising the season on campus with maple syrup at coffee Mondays at the library, over ice cream for dinner at the Reef, and as "shots" during happy hour at Brother Willie's pub. The student interest in maple syruping is abuzz with energy.

Collaboration

Looking for other groups with similar interests has proven to be a way to strengthen our efforts without increasing our staff workload. With Resource Training and Solutions, we brought over 100 middle school students to the Arboretum for the Project Earth Conference in October. We will continue that collaboration to host the Earth Partnership for Schools training this summer, which gives schools the skills and resources to restore native habitat on their property.

Additionally, the Minnesota Odonata Project is holding a dragonfly and damselfly workshop here this summer, and University of Minnesota Extension hosted a Forest Pest First Detector Training in early March. All these collaborations, plus others, allow the Arboretum to expand educational opportunities for members and the surrounding community in a way that combines our energy with that of others.

The laws of thermodynamics tell us we can't create energy. But we can direct it, and in doing so we can energize our members, our programs, and the community.

Sarah Gainey is the environmental education coordinator for the Arboretum. She wishes she understood physics better, but figures the laws of thermodynamics are a good place to start.



Volunteer, Doug Stucki, leads a group of students on a birding walk during the Project Earth Conference last fall. Co-hosting events with other organizations helps us expand and strengthen programs.

Froggie Went A Frozen?

Rosalie Leiner

S pring has a way of making us feel like we're coming back to life after a long, cold winter. But what if spring brought us back to life *- literally*?

This may seem a little extreme, but imagine for a moment that when winter comes, our bodies freeze solid, our hearts stop beating, and our nervous system comes to a dead halt. As intense (and impossible) as the prospect of being alive *and* frozen solid sounds, it is actually the way some critters survive winter in Minnesota.

Wood frogs, spring peepers, gray treefrogs, and western chorus frogs have adapted to living a frozen life. The key? Ice management: control *where* and *how* ice forms in the body.

Ice crystals are very obtrusive and

are very destructive if formed inside the cell. Cell dehydration and ice expansion can damage cell structure beyond repair. Frogs overwintering in Minnesota have adapted to allow ice to form only in the spaces between the cells, and only in spaces where ice expansion would do the least amount of tissue damage.

The frogs are able to designate particular spaces in their bodies for ice formation to help maintain cell and tissue structure. These include places that allow adequate room for expansion, like the abdominal cavity, bladder, and even the brain ventricles. This mitigates the risk to vital organs by controlling how much ice can form within the organs.

Finally, the frog uses antifreeze proteins to prevent small ice crystals from grouping into larger ice crystals, and cryoprotectants to prevent



Does spring remind you of how cold you've felt all winter? Imagine having been frozen—literally all winter long. The gray treefrog is one of several critters that can truly appreciate a spring thaw.

cell dehydration.

One of the biggest problems faced by an animal when it begins to freeze is the dehydration of its cells, which can lead to the cell's membrane collapsing. This is one of the main concerns when people get frostbite. The cells dehydrate to the point where they can no longer function or be restored, which is why severely frostbitten tissue generally has to be removed.

Frogs adapt to this dehydration problem with cryoprotectants ("cryo" = cold). Cryoprotectant compounds are usually made up of carbohydrates such as sugars. When the frogs begin to freeze, their body is stimulated to produce high levels of glucose that is distributed to the cells and organs through circulation. A high level of glucose in the frog's cells prevents too much water from leaving them as ice forms. The glucose helps keep the cells hydrated enough to keep the cell membranes from collapsing. Cryoprotectants are key in the survival of a frozen frog.

As the days get warmer, the frogs will begin to thaw. First their little hearts will start beating, next they'll begin to breathe, and from there these little frogs will start to move again. Perhaps a few of us would gladly take the opportunity to shut down and skip the winter if we knew that we could come back to life every spring. For now we can head outside to blink into the bright sun and listen for a sure sign of the spring thaw. The frogs will begin to proclaim it in April.

Rosalie Leiner is an environmental education fellow at the Arboretum. She figures maple syrup ought to make a good cryoprotectant and will focus on getting the syrup distributed throughout her bloodstream by next winter.

UPCOMING EVENTS

Minnesota Natural History3rd Tuesday each monthLecture SeriesSeptember-May

Free – Students (any age) & Arb members 6:30-8:00 p.m. \$5 – Nonmembers, nonstudents

April 20 Climate Change and its Effect on MN Trees Δ **May 18** Purple Martins

Interested in learning more about Minnesota's natural world? Join us each month during the school year for a lecture and discussion on a variety of natural history topics. Lectures will take place indoors.

All ages are welcome to all of our lectures; however, we have designated some lectures as \P kid-friendly when the topics/ presentation styles are more suitable for kids. Lectures that are designated as Δ teacher-friendly indicate that there will be classroom resources available for teachers at the lecture.

Project WILD Training\$35 per personScholarships availableMefor pre-service teachers

Saturday, March 20 9:00 a.m. – 3:00 p.m. Meet in the New Science Center Pre-registration required

This is an interdisciplinary conservation and environmental education program emphasizing wildlife. Designed for educators of K-12th grade, WILD capitalizes on the natural interest that kids have in wildlife by providing hands-on activities and curriculum for the classroom. More information and registration materials are available on the Arboretum Web site.

Maple Syrup Festival

Saturday, March 27 Saturday, April 10

\$1 off per person if you

\$7 – Adult nonmembers
\$3 – Child nonmembers (ages 4-17)
\$3 – Adult Members
Free – Child Members

pre-register by the Friday before the festival you attend (Up to \$10).

Join us for what has become our most popular event of the year! Sap collecting, syrup cooking, horse-drawn rides, demonstrations, and hot maple syrup sundaes await the whole family during this fun-filled event! Preregistration for families is preferred but not required. Preregistration for scout groups is required.

To volunteer, register, or get more information about Arboretum events, please call (320) 363-3163 or e-mail arboretum@csbsju.edu. Find us on the Web at www.csbsju.edu/arboretum

Arboretum Staff: Thomas Kroll, Director/Land Manager Sarah Gainey, Assistant Director/ Environmental Education Coordinator Jenny Kutter, Department Coordinator Andrew Elton, Environmental Education Fellow Rosalie Leiner, Environmental Education Fellow Dan Vogel, Forest Technician

Student Staff: Melissa Bach Richelle Caya Lief Davisson Marion Gondringer Brett Jacobs Bobby Mandell Erica Manternach

Scout Days at the Maple

Syrup Festivals \$7 – Adults Saturday, March 27 Saturday, April 10 Pre-registration for scouts is required

\$3 – Scouts and children (ages 4-17)

Bring your scouts to the Maple Syrup Festivals and they can receive a "Saint John's Maple Syrup" patch! Participate in activities including sap collecting, syrup cooking, demonstrations, and hot maple syrup sundaes to earn your patch! Did your troop come last year? Join us again to get the new 2010 patch!

Earth Week 2010

S

\$1

\$1

Ir

April 18–24 Earth Day, April 21

May 8

.m., OR

00 p.m.

eferred.

Celebrate Earth Week with Saint John's Arboretum! We'll have a variety of events throughout the week, so watch your e-mail and check our Web site for your opportunities to celebrate!

pring Birding Day	Saturday,
12 – Arboretum members	5:00 a.m. — 1:00 p
16 – Nonmembers	8:00 a.m.−1
cludes meals.	Pre-registration pr

Spend a morning hiking through the Arboretum woods with birders during peak migration. Early risers will be stunned by the abundance of birds active early in the day. Coffee and rolls will be served at 8:00 a.m., lunch and compilation of the bird lists at 12:00 p.m.

7th Annual Plant & Garden Tool Sale **Saturday, May 8** 8:30 a.m. – 12:00 p.m. Or until sold out!

Welcome spring by stocking up at our annual plant and garden tool sale. Arboretum members receive 50% off on all items. Memberships are available for purchase on the day of the sale.

MN Master Naturalist	Tuesdays & Thursdays
Volunteer Training:	July 6 – August 10
Prairies & Potholes	6:00-8:30 p.m.
5200 per person	Field trips July 24 & Aug 7

The MN Master Naturalist program is akin to the Master Gardener program and is geared toward adults who are curious and enjoy learning about the natural world and sharing their knowledge with others. Complete a 40-hour course over 6 weeks this summer, studying natural history, environmental interpretation, and conservation stewardship. For more information, visit the Arboretum Web site.

Arboretum Advisory Council:

- Terri Barreiro Mike Connolly Scott Daninger Kari Dombrovski John Geissler Tom Haeg Glenn Miller
- Greg Miller, OSB Janette Monear Bob Russell Steve Saupe Larry Schwietz Tom Wicks

Saint John's University PAID O.S. Postage Non-Profit Org.



Collegeville, MN 56321 Saint John's University

SAGATAGAN

beasons

THE NEWSLETTER OF SAINT JOHN'S

Published quarterly

Arborelum

Spring 2010

Contains 30% Post-Consumer Recycled and FSC Certified Paper

education, and environmental tradition of land stewardship, and richness of God's creation

respect.

in central Minnesota and

fosters the Benedictine

Our Mission

- Preserve native plant and wildlife communities of the Arboretum lands
- education and research Provide opportunities for
- Model practices of sustain-
- Make accessible a natural able land use
- environment that invites
- spiritual renewal
- Arboretum Plant & Garden Tool Sale Saturday, May 8 **7th Annual**

Put a "Spring" in your step... and in your garden!

• Energetics of Maple Syrup.....

 Froggie Went A Frozen..... • The **Physics** of the Arboretum...... A Question of Energy.....

p. 3

p. 4

p. 1-2

p. 6 p. 5 The Story of Cane and Maple.....

In this Issue...



surrounding Saint John's woodland in the 2,740 acres prairie, oak savannah, and encompasses the lakes, Saint John's Arboretum

Our Vision Abbey and University.

Saint John's Arboretum

celebrates the unique beauty