The Ecology and History of Onondaga Lake: Exploring Haudenosaunee and Scientific Perspectives

HS Curriculum – Supporting Documents and further reading

Lesson 1: Before all Else: The Thanksgiving Address

a) Questionnaire
b) Article on Ley Creek from syracuse.com
c) Home Water Audit

Other resources:

- Freida Jacques on the Thanksgiving Address (Still to come)
- Wallace L. Chafe, *Seneca Thanksgiving Rituals* (Washington: U.S. Government Printing Office, 1961) – excerpt of detailed translation.
- Robin Wall Kimmerer, "Allegiance to Gratitude," in *Braiding Sweetgrass* (Milkweed Press, 2014)

Lesson 2: Meet the Plants

a) Plants of the Skä·noñh -- Great Law of Peace Center (also included in Middle School curriculum)
b) Onondaga Lake Plant sampling activity
c) Onondaga Lake vegetation sampling sheet

Other resources:

- Robin Wall Kimmerer, "The Honorable Harvest," *Yes Magazine*, Nov. 26, 2015.
- Anthony Wonderley, "The Eldest Medicine: Red osier dogwood in Iroquois folklore and mythology," in Christine Sternberg Patrick, *Preserving tradition and understanding the past: Papers from the Conference on Iroquois Research,* 2001 – 2005 (New York State Museum Record 1, 2010, www.nysm.nysed.gov/file/2163/download?token=rxjO8p42)
- Onondaga Lake plant bioblitz – plant list

Lesson 3: The Waters

Supplied separately:
--Map of Onondaga Lake watershed showing land use or cover type in the watershed. (A simpler map of tributaries and sub-watersheds is here: oei2.org/olp/ppdf/watershed%20map.pdf.)
--Map of Skaneateles Lake watershed

Other resources:

- James Ransom, "The Waters" in Haudenosaunee Environmental Task Force, *Words that Come Before All Else, pp.* 25-29.
- Robin Wall Kimmerer", The Sacred and the Superfund" in *Braiding Sweetgrass* (Milkweed Press, 2014), pp. 310-340.
- Onondaga County, 2015. Onondaga Lake Ambient Water Monitoring Program (236 pp., In Google Drive)
- Lesson plan for "Mother Earth: Rocks, Minerals, and Onondaga Lake" (available online)

Lesson 4: The Food Plants

a) Food miles exercise

b) Catherine Landis. “Berries, Nuts, Tubers (oh my!): Food Plants of the Onondaga Lake Watershed.”

Other resources

- Green Deane, Eat the Weeds blog (eattheweeds.com)

Lesson 5: The Birds

--Scavenger Hunt worksheet (to be developed)

Other resources (available on the website)

- Checklist of the Birds of Onondaga Lake and Vicinity
- Point Count Data Sheet for Birds
- Point Counts for Birds: Instructions

Questionnaire: The Haudenosaunee Thanksgiving Address as a pathway to stewardship education in the Onondaga Lake Watershed

Part A. For each question, please place a check mark where it best expresses your feelings about the statement.

	Very true	Kind of true	Not sure	Not very true	Not at all true
1. I have so much in life to be thankful for.	Very true	Kind of true	Not sure	Not very true	Not at all true
2. I can go a whole week without feeling grateful for anything or anyone	Very true	Kind of true	Not sure	Not very true	Not at all true
3. There are people I really appreciate.	Very true	Kind of true	Not sure	Not very true	Not at all true
4. When I look at the world, I don't see much to be thankful for.	Very true	Kind of true	Not sure	Not very true	Not at all true
5. When I talk with my friends, we mostly talk about things that make us angry or frustrated.	Very true	Kind of true	Not sure	Not very true	Not at all true
6. There are a lot of good things in the world.	Very true	Kind of true	Not sure	Not very true	Not at all true
7. If I feel grateful, I try to show it with words or actions.	Very true	Kind of true	Not sure	Not very true	Not at all true

Part B. What are some of the things you are thankful for? (List at least 3 and up to 9)

* _____ * _____ * _____

* _____ * _____ * _____

* _____ * _____ * _____

Part C. Try to remember the last time you felt grateful.

1. What made you feel that way? _____

2. Did you express your gratitude? If so, how? _____

_____

Lesson 1 document (b)

Toxic waste found in back yards of homes along Ley Creek in Salina

By Mark Weiner | mweiner@syracuse.com
Follow on Twitter
on April 27, 2016 at 11:52 AM, updated April 27, 2016 at 4:28 PM
syracuse.com/news/index.ssf/2016/04/toxic_waste_found_in_back_yards_of_homes_along_ley_creek_in_salina.html

Ley Creek, viewed as it flows from Salina to Onondaga Lake, was polluted by toxic waste from the defunct General Motors Inland Fisher Guide plant in Salina. Now some of the plant's toxic PCBs have been found buried in the back yards of 19 homes in Salina. The yards and creek will be cleaned up using assets of the former General Motors Corp. (Frank Ordonez / The Post-Standard) (Frank Ordonez / The Post-Standard)

WASHINGTON, D.C. – Toxic chemicals have been discovered in the back yards of 19 homes along Ley Creek in Salina, according to state and federal environmental officials who have ordered an immediate cleanup.

The polychlorinated biphenyls, or PCBs, are buried in the soil behind the homes, and do not pose an imminent health risk, state health officials said today.

The chemicals have been traced to the former General Motors Inland Fisher Guide plant in Salina, which closed in 1993, leaving a legacy of toxic pollution along the length of Ley Creek as its flows into Onondaga Lake in Syracuse.

A federal trust fund set up in 2010 after GM declared bankruptcy will be responsible for paying all of the cleanup costs at the 19 homes, according to the state Department of Environmental Conservation.

State health and environmental officials said they immediately notified the 19 affected

homeowners by phone or in person after the PCBs were discovered several weeks ago. Investigators said they do not know how the chemicals ended up in the back yards.

State officials declined to identify the street location of the homes today, citing concerns of affected homeowners who do not want the issue discussed in a public forum. The state disclosed information about the pollution only in response to an inquiry from Syracuse.com.

"Out of concern for privacy of residents, we historically do not release contamination information specific to individual residents," said Sean Mahar, a DEC spokesman in Albany. "In this particular case, each impacted resident has been directly notified by DEC and DOH (Department of Health)."

Salina Town Supervisor Mark Nicotra confirmed this afternoon that the houses are along Brookline Road. It is the only area in the town with a large cluster of houses that back up to Ley Creek.

The state is still determining the extent of the contamination, but officials said most of the PCBs were found buried 1 to 2 feet below the surface.

Still, the advice officials gave the homeowners is unsettling.

Residents living in the 19 homes have been advised to discourage children from playing or digging in the dirt, and from playing in Ley Creek or along its banks.

The state Health Department also told homeowners to limit unnecessary digging in their yards, avoid gardening, limit direct contact with soil beneath the surface, cover bare soil with mulch or grass, prevent the tracking of dirt into homes and discourage pets from digging into the soil.

State environmental officials have known since the early 1980s that the soil along Ley Creek is contaminated with PCBs from the former GM Inland Fisher Guide plant on Factory Avenue in Salina.

A March 1986 investigation by the Syracuse Herald-Journal found hazardous waste with PCBs from GM had also been dumped illegally in the Tripoli, Salina, Brighton Avenue and Clay landfills in Onondaga County.

The chemicals were banned in the United States in 1979 after tests showed they cause cancer in laboratory animals and may cause cancer in humans. Until then, PCBs had been widely used as an insulator in electrical equipment.

The affected Salina residents have been advised that blood tests are unnecessary because it's not unusual to find trace levels of PCBs in a person's blood, and the information would not help identify the source of contamination, according to the state Health Department.

Contractors conducting a state-supervised cleanup of the upper portion of Ley Creek detected the latest PCB contamination in the back yards while performing routine tests in the area, state officials.

Separately, the U.S. Environmental Protection Agency is overseeing a cleanup of lower Ley Creek, a 2-mile stretch of the waterway near Onondaga Lake, a project expected to cost $17 million to $25 million. Studies have found the lower portion of the creek is polluted with PCBs, mercury and dioxin.

The cleanup will be paid for by the RACER Trust, a federal trust fund set up in 2010 as part of GM's bankruptcy case.

Residents with questions about the pollution are asked to contact Richard Mustico, the DEC's project manager, by email at Richard.Mustico@dec.ny.gov or at (518) 402-9676.

Update: Salina Town Supervisor Mark Nicotra confirms the 19 homes are along Brookline Rd

Name_____

School_____

Home Water Audit

This home water audit will give your family an idea of how much water your household uses daily. Your family will need to help you gather some of the answers for this audit.
Answer only the questions that apply to your house. (This home water audit had been adapted from St. Johns River Water Management District's Family Water Use Survey).

Household Information:

Type of Dwelling

- ❑ Detached single family residence
- ❑ Town house residence
- ❑ Condominium residence
- ❑ Apartment residence

Does your dwelling have an individual water meter?

- ❑ Yes
- ❑ No

Number of adults living in home:_____

Number of children living in home:_____

Number of toilets:_____

Number of showers:_____

Dishwasher? ⁻Yes ⊓No

Clothes washer? _Yes ⊔No

Water Use:

1. **Showers**: How many showers does your family take a day? About how long is each one? Add the figures and fill in your answer.

_____ X _____= Total shower time per day

number of showers Number of Minutes

2. **Baths**: How many baths does your family take a day? A half-full tub is about 18 gallon, a full tub is about 36 gallons. Add the figures and fill in your answer.

_____ X _____= Total baths per day

number in family Number of baths

Lesson 2: Meet the Plants

a) Plants of the Skä·noñh -- Great Law of Peace Center

Here are some key points on the biology or significance of these species in terms of "who" they are, and their relationship with people and other life forms. Compiled by Catherine Landis and Rachel May.

sycamore

- important floodplain/riparian species
- can reach 600 years in age. After 200 or 300 years the trunk hollows out but the tree continues to grow. People have sought shelter in very large hollow trunks; bears sometimes use them as dens; owls, swifts, and wood ducks roost in them.
- has the largest leaf of any native North American tree.
- the sap is drinkable and can be boiled down to syrup; hummingbirds like the sap, and Sapsuckers bore holes to release the sap so that they can catch insects that come to feed on it.
- the bark can serve as a coffee substitute
- the wood is hard to split and tends to twist when drying, but it is good for butcher blocks and for carving into boxes, utensils, and handles.
- the seeds are food for birds (purple finch, goldfinch, junco, chickadee) and mammals (squirrel, muskrat, beaver).
- its European cousin is also called the plane tree. "[A]ccording to Herodotus, the Greeks owed some of their success to the charm of the plane tree. In 480 BC, invading Persian King Xerxes camped his army in a grove of those trees. The king was so enamored by them that he put off his march for a few days. This delay helped lose Xerxes the war, and Greece went on to build the Athenian Empire."

Source: Green Deane, "Sycamores get no respect," Eat the Weeds blog [eattheweeds.com/sycamores-not-just-another-plane-tree-2/]. Some info also from www-pub.naz.edu/~treewalk/platanus/sycamore2.htm)

ash (white or green).

- ash splint baskets were used by the salt industry to drain freshly exposed salt crystals (see photos at Liverpool Library);
- black ash, a wetland tree once common around the lakeshore, important for native basketry (see video: "Black Ash Baskets" https://www.youtube.com/watch?v=rOWc9ZokBYY)
- ash preferred wood for baseball bats
- emerald ash borer (EAB; a metallic wood-boring beetle) and the devastating effect it is having on ash species in this country. Why should students care about ash? EAB is an example of an invasive insect, so it could be folded into the discussion on plant invasives.

northern white-cedar

- northern white-cedar swamps were one of the most important habitats around Onondaga Lake before they were destroyed for salt production, commerce, and urban development (see http://onondagalakehistoricalecology.weebly.com/northern-white-cedar-swamp.html for information on the cedar swamps)
- this species should not be confused with eastern red cedar, famous for its reddish fragrant wood and oil
- long-lived; up to 1500 years!

- Rot resistant, and therefore used for longhouse posts and (later), fence posts; also canoe ribs, medicine

eastern white pine.

- "The primary national symbol of the Haudenosaunee is the Great White Pine (the Great Tree of Peace), which serves throughout the Great Law of Peace as a metaphor for the confederacy. Its branches are said to shelter the people of the confederated nations, and its roots spread to the four directions, inviting other peoples, regardless of race or nationality, to take shelter under the tree" (from Dictionary of Haudenosaunee, need correct name of this text)
- bundles (fascicles) of 5 needles represent the Five Nations when they first united for peace;
- pine needle tea high in vitamin C; prevented scurvy historically (no oranges from Florida back then)
- white pines up to 12' in circumference once grew in the Syracuse area

staghorn sumac

- early successional species; clonal
- male and female flowers on separate plants; only female flowers produce fruits
- wood used for spiles to tap maple trees for sap;
- berries feed birds; can make beverage with antioxidant properties
- note differences with poison sumac—how would you tell them apart?

red oak

- wide ranging oak species; found further north than any other oak (except bur oak)
- tall, graceful form, spine tipped lobes on leaves
- produces relatively large acorns (look for them on the ground) & abundant crops; good for wildlife and people

red osier dogwood

- sprawling shrub of wetlands and moist ground
- new growth in spring & summer is green, but stems turn deep red by winter
- favored deer browse, and birds eat berries
- for cultural values/stories, see "The Eldest Medicine: Red Osier Dogwood in Iroquois Folklore and Mythology" by Anthony Wonderley (See Other Resources)

black raspberry

- important berry plant for native people
- first year canes do not produce flowers or fruit
- leaves in threes, green on tip and whitish on the underside of leaves
- canes can bend over and produce new shoots at the tip
- seeds spread by birds, people; establishment favored by disturbance, long-lived seed bank

red/Austrian pine

the Austrian pine is often confused with red pine because they look similar. Its furrowed bark shows patches of brown, white, and gray. It has flexible needles, 3-8" long, that grow in pairs. Austrian pine is native to Europe. It is ornamental and does well in urban conditions
Source: Ohio Public Library Information Network: "What Tree is it?"
http://www.oplin.org/tree/fact%20pages/pine_austrian/pine_austrian.html

boxelder "is native to portions of the southern tier and Susquehana Valley, but has become more broadly established throughout many parts of the state. Boxelder grows commonly along the banks of streams and rivers, and may occur as a weedy species in urban areas where its seeds are able to germinate. Boxelder has a soft wood that has no commercial value, but is important for wildlife and the stabilization of stream banks where it grows. Boxelder is not recommended for horticultural plantings."
Source: Cornell sugar maple research and extension program, http://maple.dnr.cornell.edu/kids/tree_box.htm

sugar maple

- considered leader of the trees in Haudenosaunee culture
- NYS State Tree
- a "cultural keystone species"

European buckthorn

- Native to Eurasia; brought to North America as ornamental plant
- It spreads rapidly and suppresses other native plants in several ways:
  --leafs out early, drops leaves late, thereby shading many natives
  --it may produce chemicals that inhibit growth of other species
  --the high levels of nitrogen in its leaves feed invasive earthworms in the soil, which breaks down fungi in the soil that may be necessary for growth of native plants
  --it is a host for some plant pests, like soybean aphid, alfalfa mosaic virus, and crown fungus

Source: Michigan Department of Natural Resources Michigan Natural Features Inventory 2/2012 https://mnfi.anr.msu.edu/invasive-species/CommonBuckthornBCP.pdf

***Phragmites* (common reed)**

"Non-native Phragmites, also known as common reed, is a perennial, aggressive wetland grass that outcompetes native plants and displaces native animals. Because of its height and its distinctive, fluffy seedheads, Phragmites is easy to spot."

- It probably came to North America in the early 19th century.
- It invades salt marshes and other wetlands and chokes out all other plant species, reducing habitat for fish and wildlife, and sometimes blocking natural water channels.
- It spreads by seed (borne by wind or animals) and most commonly by rhizomes.
- It grows as high as 18' and when it dries out it can be a fire hazard.
- "Is there anything good about Phragmites? Some birds, such as yellowthroat, marsh wren, salt marsh sparrow and least bittern roost in Phragmites. Red-winged blackbirds and some wading birds have been documented to nest in Phragmites. Other studies suggest that due to its high productivity, limited ability to export litter, and slow decay rates, Phragmites might offset problems that rapid sea level rise could pose to many coastal marshes."
- There is a native species of Phragmites that occurs in the Northeast, but it is rare and non-invasive.

Source: US Fish and Wildlife Serve, "Phragmites: Questions and Answers" https://www.fws.gov/gomcp/pdfs/phragmitesqa_factsheet.pdf

Lesson 2: Meet the Plants

b) **Onondaga Lake Plant Sampling Activity – Point Intercept Instructions Draft June 24, 2016**

In this activity, you'll conduct a more quantitative, SEK survey of plants at selected sites around Onondaga Lake, such as the Skanonh Center. The sampling method employed is called point intercept, and involves walking parallel transects through a site and recording the plants you see a 1 m intervals.

Plants, as we have learned, are critical to habitat. **Ecosystem structure** and **species composition** are both important. **Structure** relates to the arrangement and size of plant growth forms in the site. For example, do you see trees, shrubs, or grasses? Are there multiple layers or strata? Having a mixture of vertical layers (e.g. tree, shrub, herbaceous plants, and grasses) can add to structural diversity and thus add to habitat quality.

Species composition refers to the different kinds of plants in a community. You'll receive a page with names of common riparian plants, native and non-native. Native plants are preferred since they generally support a much richer fauna of insect, fungi, and vertebrate consumers and by extension insect feeders such as bats, birds, and shrews. Non-native plants can include invasive species that can reproduce and spread rapidly over an area. Invasive plants can provide benefits, but generally detract from overall habitat quality of a site. A quantitative study can shed light on plant community structure and function in a given area.

In this exercise, you'll focus on plant community structure, but you'll also have a chance to identify some of the more common plants.

Sampling

Figure 1 shows a couple of different ways you could sample vegetation in a certain area. Say the dark splotches are patches of milkweed in a field, and you want to know the percent cover of milkweed since you care about monarchs. You could sample using plots (A), line intercept (B), or point intercept (C). Point Intercept. This method uses a grid or a series of lines to determine sampling points. We will use point intercept in this study.

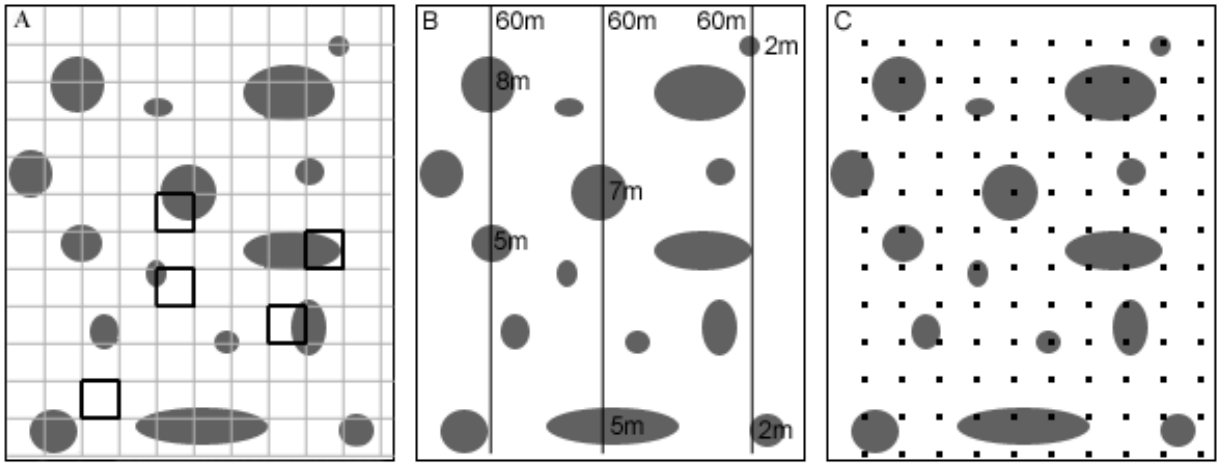

Figure 1. Three spatial sampling methods used to assess the area of cover of milkweed patches (dark areas) in a 50m x 60m field. A) Plot method with 5 randomly placed plots. B) Line intercept method with three randomly placed transects. C) Point intercept method with systematic placement of equally spaced points (black dots) with the first point randomly placed.

Point intercept instructions
The sampling takes place either at randomly chosen points or at points spaced at equal intervals, as in Figure 1-C. We will use regular intervals, for simplicity.

Materials:

- Compass
- Measuring tape – ideally metric, at least 20 m in length
- Clipboard, pencil, data sheets
- Pole or stick to use to define the points
- Plant field guide, bug protection

1. Use a Google Earth image or even a schematic drawing of the area to be surveyed to lay out transects. They should be about 30 m apart, and perpendicular to the roads so they cut through the property. At Skanonh Center, you could start on the service road and head in the direction of the Parkway.

2. Use a compass to set a consistent bearing, so all the lines are parallel.

3. Lay the tape along the transect at the established bearing. Stop every 1 m and record the vegetation touched by the pole (or use a stick) at that point. If tree limbs overhang the point, you could have multiple layers (e.g. tree, grass).

4. Complete at least 30 points/ transect.

5. The cover estimate is the number of points (i.e., “hits”) touching) each plant growth form (grass, shrub, tree, etc.)) divided by the total points measured.

Example: For the milkweed study, (Figure 1-C), out of 120 points sampled you find milkweed at 20 points for an approximate cover of 20/120 or 16.7%.

Layer Definitions:

Grass - plants with long, narrow leaves, jointed stems, flowers in spikelets, and grain-like fruit. Grasses have dense fibrous roots which help stabilize the soil in and along streams.

Herbaceous - plants lacking woody stems; above-ground growth usually dies back in winter. Herbaceous plants include wildflowers such as asters, milkweed, goldenrod. They can filter pollutants, and help slow water during high flows.

Shrub - woody plants, usually with multiple stems and less that 5 m tall when fully grown. They provide habitat and food for wildlife as well as water filtration functions.

Trees – woody plants, usually single stems and greater than 5 m tall when fully grown. Trees can grow over the stream and help cool the water. Fallen limbs from streamside trees add structure to aquatic habitat. Autumn leaf fall provides a major nutrient input, and the tree canopy "architecture" adds to roosting and nesting sites for wildlife.

Materials:

- Tape measure (at least 20 meters is best)
- Sampling Pole
- Native/Non-native Plant Guide
- Clipboard

Methods:

We will sample the vegetation structure using a modified point intercept method.
Steps:
1. Using the measuring tape, lay out a transect (a long line) approximately parallel to the stream and 1 m from the water's edge.

2. To take a sample, place your sampling pole straight up and down at 50 cm (0.5 m) intervals along the transect line.

3. At each sampling point, note whether vegetation is present for each of the four layers (grass, herbaceous, shrub, and tree). You may have to sight along the pole in order to determine if the tree layer is present directly above the sampling point.

Move to the next point. Be sure to note the presence of any of the 5 common native and non-native riparian plants at your site. (These are listed on the plant ID page that accompanies this lesson.)

If time allows, repeat the methods for transects at distances of 5 m and 10 m from the water's edge.

Onondaga Lake Vegetation Sampling Data Sheet

Location:_____

Date: _____

School: _____

Group Members:

Transect number:

Compass bearing:

Native Plants
Circle all that are
cottonwood
staghorn sumac
milkweed
red oak
black raspberry

Sampling Point	Grass	Herbaceous	Shrub
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
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14			
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30			

Lesson 4: The Food Plants

a) **Food Miles and Carbon Emissions***

Food miles are the distance that food travels from the farm to your plate. By sketching your foodshed, you may have been surprised to learn where your food actually comes from. In this exercise, you'll begin to quantify some of the environmental impacts of this long-distance transport of foods you eat each day. We will also explore ways in which we can make reduce these impacts.

Carbon dioxide emissions (g/Tonne-km) for different modes of freight transport:

Road **207** – most common method of transport in North America
Sea **30** – most common international (other than NA) method of transport
Air 1,260 – used rarely to ship very perishable items
Rail 41 – also used for North American transport

In other words, for every tonne of food item shipped by road one km, 207 g of CO_2 is emitted (Pirog, *et.al*, 2001).

Assumptions used for our calculations:

- Each food item was shipped in one tonne allotments.
- If the food was grown in North America (includes Canada and Mexico) use **road** emissions.
- If the food is from South America, Europe, Asia or Africa, use **sea**.
- We will use NYC as the final destination. Our calculations will therefore be conservative.

Sample calculation:

Kiwi fruit from New Zealand travels 14,198 km by sea
Food miles (km) x CO_2 emissions (see above)
14,198 km x 30 g/Tonne-km = **425,940 g/Tonne-km**

Class calculations:

Choose two plant foods from the list below that you enjoy and make the calculation.

_____ x _____ = _____g/Tonne-km CO_2
_____ x _____ = _____g/Tonne-km CO_2

Food Item	**Country of Origin**	**km to NYC**	**Transport emissions factor**	**g/Tonne-km CO_2**
cabbage	Phelps, NY	*88		
orange	Australia	15,992		
lettuce	California, US	4,038		
coconut	Mexico	3,641		
pineapple	Ecuador	4,560		
avocado	Chile	8,219		

*km to Syracuse, NY

*Worksheet adapted from "Food Miles: What a Long, Strange Trip it's Been," lesson by Nicole Wiener.

For reflection and discussion

Which foods are associated with the least amount of CO_2 emissions during transport to NYC?

Which foods are associated with the most CO_2 emissions during transport to NYC?

In what ways can you reduce your impact of CO_2 emissions? Give specific examples.

Would the impact of your food choices be different in the winter versus the summer?

What other factors involved in food production and distribution may contribute to greenhouse gas emissions that we have we not discussed? (For example, was the food grown sustainably?)

Lesson 4: The Food Plants

b) **Berries, Nuts, Tubers (oh my!): Historical Food plants in the Onondaga Lake watershed**

by Catherine Landis DRAFT

The Onondaga Lake watershed contained, and still contains, a great diversity of food plants. People have been attracted here for millennia, in fact, due to the plant, wildlife, fish, and mineral resources. Soils were excellent for growing corn (maize), beans, squash and other crops. The Lake shared in an abundant fishery as part of the Seneca-Oswego Rivers watershed. Due to this abundance, native people could rely largely on local foods within the watershed and the larger territory of the Onondaga people. The food plants collectively are known in Haudenosaunee languages as XXXX or "our sustainers."

From upland forests, people collected nuts, berries, cherries, wild leeks, and mayapple. From forest openings and meadows, they harvested strawberries, raspberries, blackberries, wild plum, hazelnuts, and grapes. Pawpaw, groundnut, and gooseberries grew along rivers and streams. In wetlands you could find cattails, wild rice, arrowhead, spatterdock, blueberries, cranberries, elderberries, serviceberries, and nannyberry. In addition to plants, wetlands provided muskrat, beaver, turtles, frogs, turtle eggs, fish, deer, shellfish (mussels) and other foods. Salt marshes yielded samphire or glasswort, a "tasty morsel" of a succulent & salty annual plant, later sold on the streets of Syracuse.

Whether salmon, venison, pigeon, or berry, the honorable harvest governed collection of foods. People took from the Earth but also gave back in a system of reciprocity. Wild as well as cultivated foods made up the diet, the proportions of each changing over the centuries that people have lived here. For example, corn became a major part of the diet sometime after 1000 A.D. Although corn was present for roughly 1000 years before this date, it played a lesser dietary role during this time. The system of mixed foraging and crop cultivation has been called a "liminal" one, neither entirely horticultural nor foraging (hunter-gatherer).

We may imagine people going into the forest and simply collecting whatever nuts and berries they could find. However, foraging cultures are often proactive in engaging with the land and the plants that sustain them. Plants receiving more sunlight will generally produce more nuts and berries, for example. An open grown hickory can produce 8x as many nuts as one growing in a shaded forest. In fact, many nut trees have intermediate to low shade tolerance, meaning they need lots of sunlight, first to survive, and then to produce fruit. People therefore planted nut trees around village sites in open spaces where they could develop copious amounts of fruit in a good year.

Many native nut trees do not produce large nut crops every year, but rather in masting cycles of 3-5 years. (The nuts that fall to the forest floor are called mast, and the production of nuts referred to as "masting.") Remarkably, many tree species synchronize nut production over large geographic areas, so nut crops are high or low in

a given year for all of the nut trees at once (see “The Council of the Pecans” in *Braiding Sweetgrass* by Robin Kimmerer, for more about nut trees and mast behavior).

In addition, people worked with the forest to promote plants for food, dye, medicine, fiber. We call these practices *tending*, since they involve working with existing plant communities, rather than ripping them out for crop monocultures. Planting, weeding, burning, and coppice systems are some of the ways people tended plants locally. Native people created “food forests” using trees, shrubs, and herbs. They also brought food and other plants to the Onondaga Lake watershed from other parts of the country, including pawpaw, black walnut, and possibly red mulberry.

Table 1. Wild and cultivated food plants of the Onondaga Lake watershed (used historically, but many are still present).

Type of food	**Examples from Onondaga Lake watershed**
Tree sap	sugar maple, birch, black walnut
Fruits	strawberry, blueberry, raspberry, blackberry, wild plums, cherries, grapes, bunchberry, cranberry, currants
Nuts	black walnut, butternut, oaks (acorns), hickories, chestnut, beechnut, hazelnut
Roots and tubers	wild leeks, arrowhead, cattail, ground nut, Jerusalem artichoke
Greens	marsh marigold, purslane, lamb’s quarters, milkweed, Virginia waterleaf, fiddleheads
Grains	wild rice; *Chenopodium, Amaranth*
Cultivated	corn, beans, squash, sunflower

Corn has long played a dominant role in Haudenosaunee culture and diet. Corn, beans, and squash were grown together in polyculture starting about 1300 AD. Known as “The Three Sisters,” these crops are deeply rooted in Haudenosaunee culture. The intercropping system reduces the need for pesticides and fertilizers. The bean plants add nitrogen to the soil and, over time, can help corn grow well. Women controlled the raising of crops and were the “farmers” in this culture (while men hunted and fished). The women used hand tools, rather than the plow, thus conserving soil organic matter and reducing erosion. Sustained crop yields also occurred over longer time periods compared to plow-based systems.

Other plants appeared on the edges of Haudenosaunee fields and some were welcomed, rather than being removed as weeds. There is actually not a word in the Onondaga language for weeds. Such species as purslane, sunflower, milkweed, and dogbane were valued for food, medicine or fiber.

Native people and others continue to use many of these same food plants today, with additions from species brought in by Europeans and Americans. Apples, peaches, pears, turnips, beets, carrots, kale, and other orchard and garden plants arrived with European settlers. Due to this mix of species, many food plants grow in the Onondaga Lake watershed today.