Illinois
Department of
Natural Resources
One Natural Resources Way * Springfield, Illinois 62701-1787
http://dnr.state.il.us
Rod Blagojevich, Governor * Brent Manning, Director

Dear Educator,

Thank you for your interest in ***The Ecology of Volo Bog***, Volo Bog State Natural Area's curriculum for 10th - 12th grade students.

The Ecology of Volo Bog is an in-depth study of Volo Bog that is guided by this ***24 page activity guide*** especially for secondary level students. We provide an original copy from which you will need to make sufficient copies for each student in your class. We recommend placing the booklets in a stiff-backed binder.

The booklet is an interdisciplinary tool that involves the students beginning in the classroom with one class period followed by a portion of a second class period. The students then bring their partially completed study guide on their visit to Volo Bog where they will add to it from their observatons. Optional follow-up extensions take the students back again to their classroom and community. If you choose, you may involve the parents and others at home by assigning portions of the booklet as homework before the visit and by inviting some of the parents to get involved as chaperones.

We require at least one responsible adult chaperone for every 15 students but prefer one for every 8, especially for guided tours. This adult number includes the teacher. See also the enclosed materials for other rules and suggestions for a successful visit.

On the back of this letter is a sample agenda, from preliminary studies to concluding activities. If you should have any questions or suggestions regarding the activity guide, your visit, or any other aspect of the environmental education opportunities at Volo Bog, please call us at (815) 344-1294. We wish to do everything possible to make your student's visit to Volo Bog a fun and memorable learning experience. And thank you for all your work in helping us to reach more students with the wonders of Volo Bog!

Sincerely yours,

Stacy Iwanicki
Naturalist Program Coordinator

VOLO BOG: A WETLAND TO DISCOVER
SUGGESTED AGENDA

IN SCHOOL (Normal Type in the booklet):

The IN SCHOOL portions of *Volo Bog: A Wetland To Discover* should take two 45-minute class periods to complete.

DAY ONE:
The first class session should be completed about a week before the scheduled visit and take the class through the completion of page 17 (*Animals Of Bogs And Other Wetlands*). Homework assignments should also be ascertained during the first class period. (Homework = gathering "acid-testing" substances, researching poison sumac and tamarack trees, etc.)

DAY TWO:
The second class session is best done the day before the scheduled visit. Test the pH of the familiar substances (gathered by the students during the days prior). Review poison sumac and tamarack homework. Complete page 18 - 22. Discuss the Nature Preserve Ethic and expectations of behavior on the visit. Stress that a field trip is an extension of their learning experience in an outdoor classroom setting; a time to focus, not a time to goof around.

WHEN YOU VISIT (Bold Face Type in the booklet):

You should allow 4 hours for your visit. The Visitor Center activities in the book (page 1 - 6) and the Visitor Center Hunt together take approximately 45 minutes. A light snack may be appropriate after the Visitor Center and before the trip into the bog. Please use the picnic area or front lawn of visitor center for food, NO FOOD in the center or on the trails, please.

The walk through Volo Bog should take about 2 hours and should cover pages 7 - 20. Returning to the picnic area for concluding discussions on page 21 - 23 will allow for a change of setting. Allow 15 - 30 minutes for the discussion, depending on the attention level and the depth the class shares. (Some classes will be about spent by then, others will want to carry the discussion home on the bus!)

Suggested Trip Schedule
9:30 a.m. - 1:30 p.m.

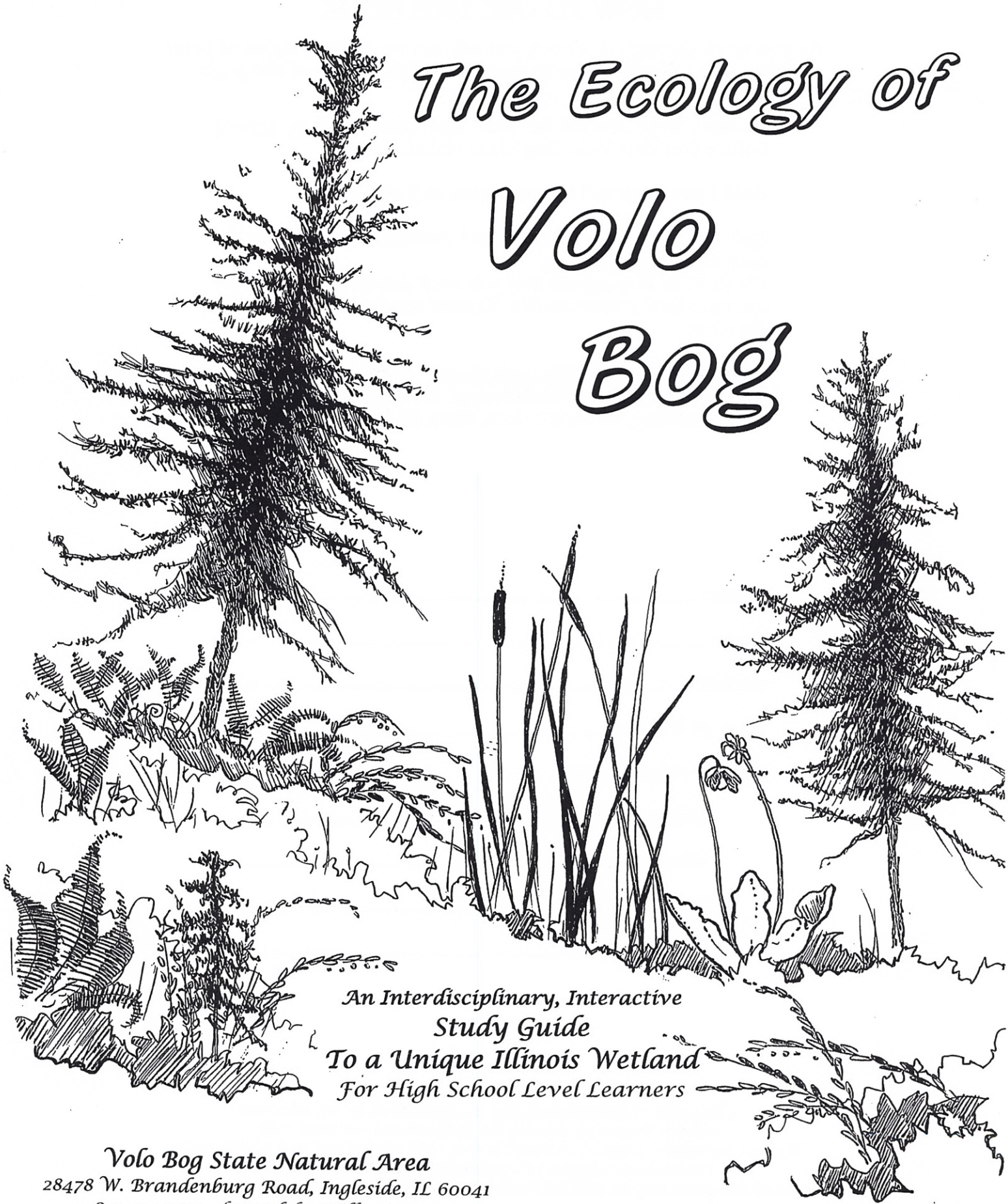
9:30 - 9:40 a.m.	Overview orientation and page 1
9:40 - 10:15 a.m.	Complete pages 2 - 6 (from Visitor Center Displays or supplementary handouts) and Visitor Center Hunt
10:15 - 10:25 a.m.	Review Hunt answers
10:25 - 10:30 p.m.	Review Nature Preserve Ethic and prepare for Bog visit
10:30 - 12:30 p.m.	Tour Volo Bog (pages 7 - 20)
12:30 - 1:00 p.m.	Concluding discussion (pages 21 -23)
1:00 - 1:30 p.m.	LUNCH!

EXTENSIONS (BACK AT SCHOOL/HOME - Italic Type in the booklet)

The extensions tie the student's experience with Volo Bog to ideas beyond their visit, often connecting to their own lives and even involving the family or community. They vary in complexity, allowing something for every aptitude and interest. Our intent is to have each student choose one extension that they feel they would enjoy pursuing. Finally, we'd enjoy hearing from the students. They could write to us at Volo Bog about their visit and their experiences with their chosen extension.

Thanks again and HAVE FUN!

The Ecology of Volo Bog



An Interdisciplinary, Interactive
Study Guide
To a Unique Illinois Wetland
For High School Level Learners

Volo Bog State Natural Area
28478 W. Brandenburg Road, Ingleside, IL 60041
815-344-1294 *dnr.volobog@illinois.gov*
http://www.dnr.illinois.gov/Parks/Pages/VoloBog.aspx

By Stacy Iwanicki
Natural Resources Coordinator

HOW TO USE THIS BOOK

As you work through this book you will notice *different* **styles** of print. The style tells you when to complete each section of the page.

Normal Type should be read and completed in school before you visit Volo Bog State Natural Area.

Bold Face Type will be completed at Volo Bog.

Italicized Sections are suggested extension activities to be completed after your trip.
We at Volo Bog suggest that you each choose one extension apiece to further your studies. Reports can then be shared with the class.

Some words are double underlined. These are vocabulary words that you should understand. If you are unclear about their meaning, be sure to look them up in a dictionary.

Name: _____

Class: _____

Period: _____

Date of Visit: _____

Weather Conditions

Temperature: _____

Wind: _____

Sky Conditions: _____

Other: _____

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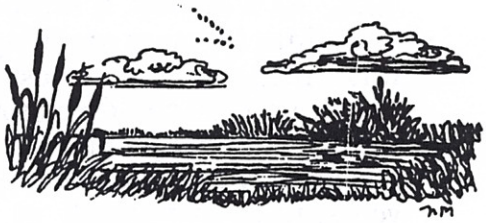
WHAT IS A WETLAND?

In School:

Volo Bog is a wetland. Wetlands are just what their name implies: Wet Lands. They are areas where water is at or near the surface of the soil for at least part of the year. During times of drought, the soil may appear very dry. When water is present it is usually shallow enough to support plants although some areas may be deeper. If most of a wet area is too deep to support plants, it is not a wet LAND but rather a lake, pond river or other type of aquatic environment.

You probably have a wetland near your home or school. Illinois once had over 10 million acres of wetlands. Experts estimate between 95% and 99% of those original wetlands are gone. What happened to these wetlands? Many of them have been converted to farmland as wetland soils are among the most fertile in the world. Many of the wetlands that remain in the Chicagoland area face a newer threat: development.



How many different types of wetlands have you heard of? Name as many as you can here.

_____ _____

_____ _____

_____ _____

When You Visit:

When you meet with your leader at Volo Bog, you will hear about three main kinds of wetlands. Write them down here along with their definitions.

_____ _____

_____

_____ _____

_____

_____ _____

_____

Extension:
Find out what wetlands are in your community. Go to the town/village hall to find out who owns them. Are they in public or private ownership?

VOLO BOG: A GIFT OF THE GLACIER

Bog Development and Structure

In School:

Bogs such as Volo are wetlands born of the glaciers. Their soils actually float on top of the water. In order to understand how this can be, we must understand how it happened. It all began over 50,000 years ago when the Wisconsin Glacier covered much of what is now Illinois with up to a mile of ice. The great weight of this ice caused it to flow over the land. As it moved, it scraped the land, gathering into its mass anything that stood in its way: trees, boulders, rocks, gravel and sand. Anything that couldn't move out of the way was "scooped up" and carried along. The glacier covered our area for about 40,000 years, until as recently as 12,000 years ago. When it finally melted with the warming climate, it dropped all the rocks, sand and gravel (collectively called glacial till) in place. The hilly topography of northeastern Illinois is made up of piles of this glacial till.

As the ice melted, chunks broke off and got buried in the till. These giant "ice cubes" were the last to melt, leaving depressions in the land where water collected and formed lakes. Many of the lakes were interconnected and water flowed from one to the other. A few, however, were isolated. It was in these lakes (known as kettle holes) where the water became stagnant and bogs began to develop.

The stagnancy of water is one key to the development of bogs. Oxygen is usually dissolved in water. However, if the water is stagnant, the oxygen eventually escapes, much like a soda left sitting out will lose its carbonation. Without any water movement, new oxygen is not mixed in. Without oxygen, fish can't survive; nor can bacteria. Without bacteria, one of nature's decomposers, nothing decays. Plants that grow around the edges of the glacial lake die and fall into the water. Without bacteria, they don't break down but rather just float around on top of the water. New plants grow out of the old. Thus, a floating mat has begun.

One of the key plants to begin forming the floating mat is sphagnum moss. When dry, it can absorb about twice as much water as cotton. Its buoyancy allows it to float. When the moss dies, it does not decompose. New moss just grows on the old. As the dead moss accumulates, it turns into soil known as peat. Eventually the peat mat gets thick enough to support other plants, even trees!

Because the soils of Volo Bog are floating, visitors explore the wetland from a boardwalk. This keeps everyone safe from falling through the mat!

When You Visit:

There are many different types of wetlands in the world. There are even different kinds of bogs.

Look in the visitor center for the sign that shows words for BOG in other languages. Did your ancestors have a name for bogs?

If so, what is the name?_____

If not, why not?_____

_____

Extension:

The floating soils of bogs have been compared to a sponge. Try to grow some seeds on a sponge in a bowl of water. You may want to use some fertilizer.

BOGS: ACID SOIL AND WATER

In School:

You've probably heard of acids: battery acid, acid rain, sulfuric acid. Most people think of nasty things and scenes from horror movies when they think of acids. These "nasty" acids are strong acids. Acids come in all sorts of strengths from the highly acidic sulfuric acid to the mild acid in corn.

The strength of an acid is written as a "scale" of pH which is the measure of a chemical property. Its a little too complicated to go into here but we can understand how acidic one substance is compared to another. Let's look at the pH scale. The scale ranges from 0 - 14 with zero being the most acidic and 7 being neutral. The smaller the number, the more acidic something is. The numbers ranging from 7.1 - 14 are basic or alkaline. Bases are kind of like the opposite of acids. They are usually slimy. Bleach is a base.

Just how much more or less acidic is one thing compared to another? You can figure this out by adding a number of zero's after a "1" equal to the difference between the two pH values. Sound complicated? Its not too hard, really! Try this:

pH of 6 is 10X more acidic than 7. (because 7 -6 = 1. Add one zero: 10)

pH of 5 is 100X more acidic than 7. (because 7 - 5 = 2. Add two zeros: 100)

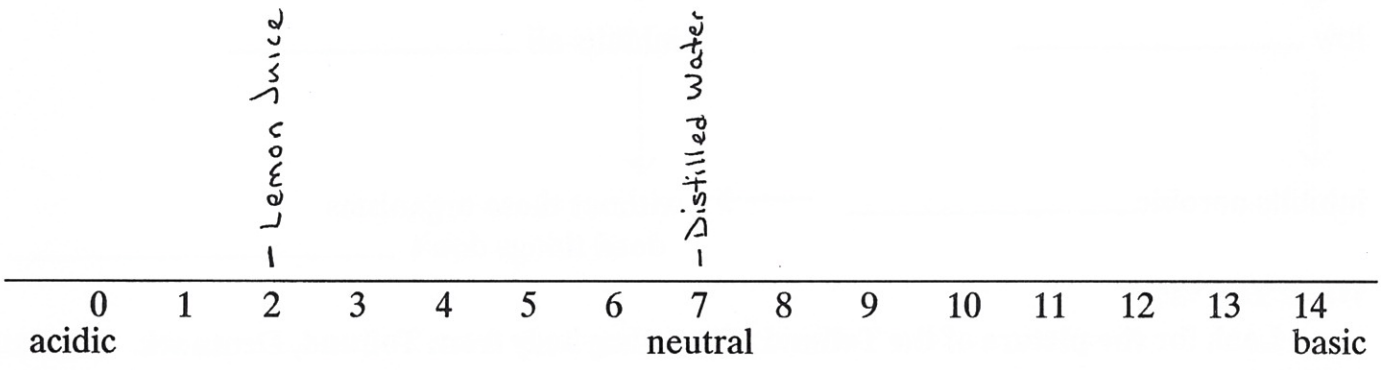
pH of 4 is _____X more acidic than 7? (because 7 - 4 = 3. Add three zeros = _____)

pH of 3 is _____X more acidic than 6? (6 - 3 = ___. Add _____zeros = _____)

pH of 5 is _____X less acidic than 1?

The acidity (pH) of a substance is tested using litmus paper which turns a different shade of yellow, pink or blue depending on the pH. Get some pH paper from a science teacher. Bring the following common substances to class before you visit Volo Bog and measure their acidity. Record your findings below and on the chart.

Lemon juice____	Corn____	Potato____	Tomato____
Bleach____	Vinegar____	Borax____	Milk____
Ammonia____	Orange juice____	Baking soda____	Distilled water____
Saliva____	Soda Pop____	Coffee____	Rain____



When You Visit:

Bog water is acidic. When you visit Volo Bog you'll use pH paper to measure the bog water's acidity and record it on upcoming pages. Compare the bog water to these more familiar things.

THINGS ARE PRESERVED IN BOGS...

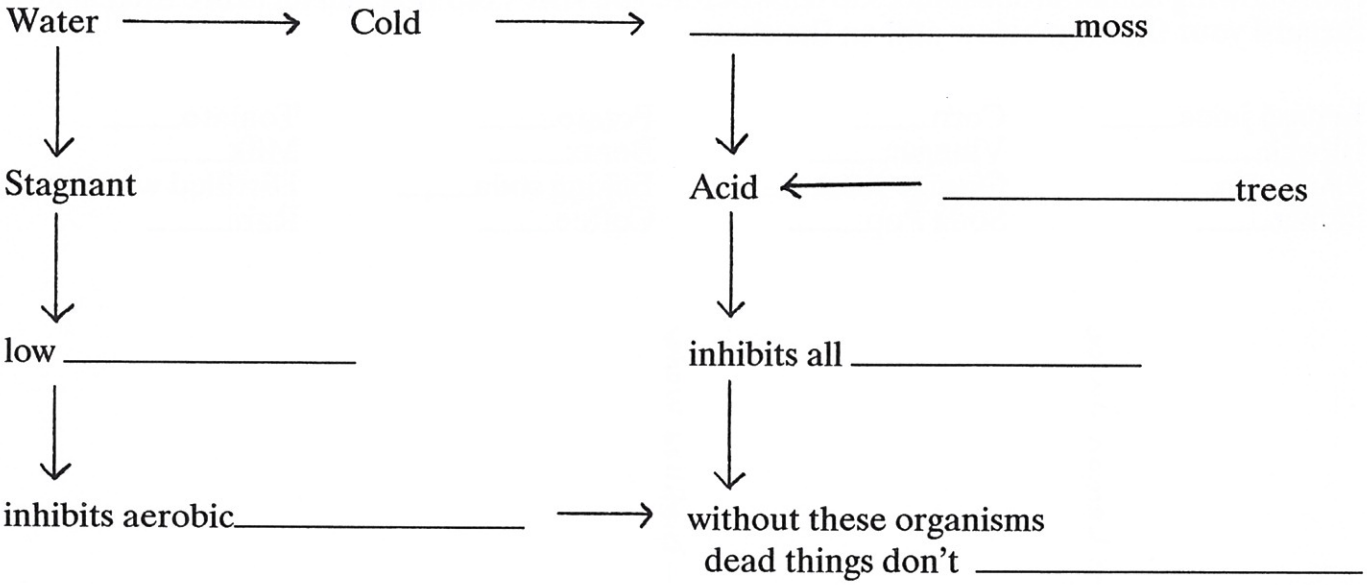
In School:

The acid in bogs comes from two plants: 1. Sphagnum Moss which splits water to form acid; and 2. The leaves of the Tamarack Trees which have tannic acid in them. Tannic acid is the same acid that makes tea brown. We'll learn more about tamaracks later.

In northern Europe, people harvest the organic soils (peat) of their bogs. The water is drained from the bog and the peat is cut into bricks. When dried, the bricks are used as fuel for heating and generating electricity. Peat is an early stage in the development of coal. Occasionally, the peat cutters come across some real startling finds: preserved human bodies over 2,000 years old! Their skin has turned to leather. Their hair, eye lashes, and whiskers are still in tact. How did these iron-age people become preserved? Lets consider the bog water.

1. Bog water is cold and stagnant.
2. Stagnant water becomes low in oxygen (much like a stale soda looses it dissolved carbonation).
3. Without oxygen, aerobic (oxygen loving) bacteria cannot survive.
4. Cold water is a good environment for sphagnum moss, a buoyant, absorbant plant of the north country.
5. The moss makes the water acidic.
6. Tamarack trees contribute tannic acid to the bog water.
7. These acids inhibit all kinds of bacteria (aerobic and anaerobic - anaerobic means living without oxygen)
8. A combination of the stagnant, low oxygen water and the acidity inhibits most the bacteria.
9. Without bacteria, things cannot decompose.

Fill out this flow chart to better understand the overall picture of how things are preserved in bogs. (Hint: use the information above)



When You Visit:

Look for the picture of the Tollund Man, a bog body from Tollund, Denmark. In what cultural age did he live?_____ How did he die?_____

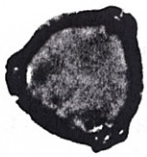
POLLEN ANALYSIS SHOWS SECRETS TO PAST CLIMATES

In School:

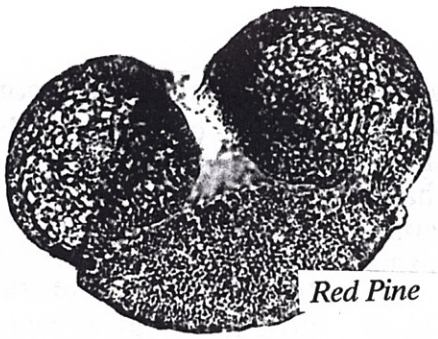
Human remains are not the only things preserved in bog soils. In 1977, Dr. James King studied pollen grains preserved in Volo Bog's peat. Different species of pollen were found at different depths. The deeper the pollen was found, the longer ago it was deposited.

For example, ragweed pollen was found in the top 1/4 meter of the peat. This shows that this aggressive European plant appeared on the scene about the time European-descended settlers arrived in the area. An abundance of pine and fir pollen was found near the bottom of Volo Bog's basin. From the depth at which the pollen was found and a method called carbon dating, Dr. King concluded that these evergreens grew near Volo Bog between 10,000 and 11,000 years ago or **b**efore **p**resent (B.P.)

Because of this layering, bogs have been called history books with flexible covers. The results of Dr. King's work are displayed in the Volo Bog Visitor Center. A chart shows the relative abundance of about 50 different plants from 1977 to about 11,000 years B.P.



Bog Birch



Red Pine

Sunflower

Jack Pine

When You Visit:

Look at the pollen charts in the visitor center. From the graph and text:

What plant dominated the area 11,070 years B.P.? _____

For how many years did a mixed forest of pine, fir, birch and ash exist? _____

When did the number of oak trees begin to increase? _____

Why did oak, pine, elm and larch (tamarack) begin to decline about 140 years ago?

_____

_____

_____

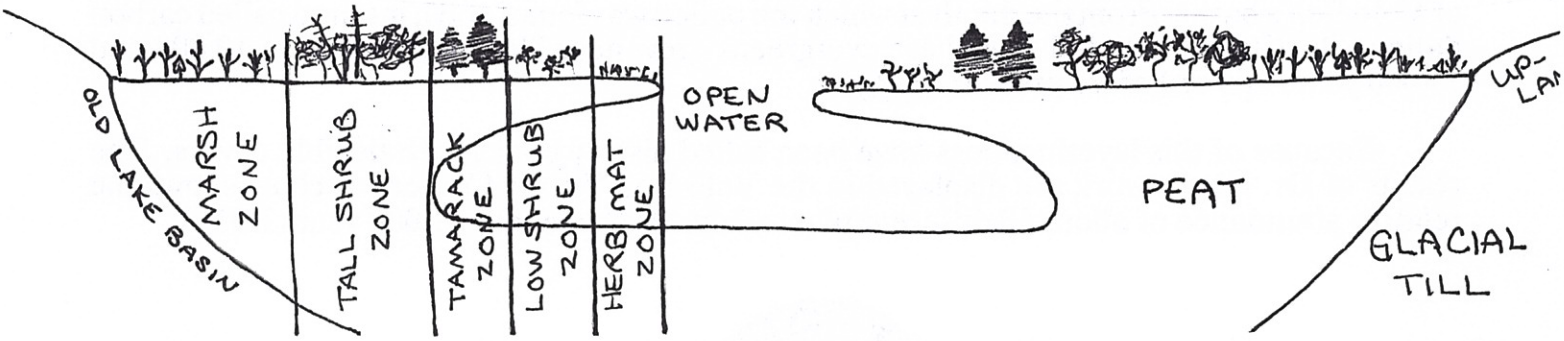
Extension:

A woman named May Theilgaard Watts wrote a book called Reading the Landscape of America. It has an excellent chapter about bogs titled "History Book With Flexible Cover"

COMMUNITIES OF VOLO BOG

In School:

Over the years, the floating mat of Volo Bog thickened and grew closer to the center of the old glacial lake. At the same time, some of the peat sank to the bottom and accumulated from the bottom up. Eventually the floating peat met up with the peat on the bottom. Here, the soil no longer floats. Because of the different soil structures (floating or not floating), different types of plant communities become established.



A community is a group of organisms which live in the same area. Just like a human community such as a city or town, ecological communities have organisms which have different roles. Some members of the community are called producers: these organisms convert the sun's energy to food.

Other organisms eat the producers. They are called primary consumers. Organisms which eat primary consumers are called secondary consumers. Finally there are organisms which break down dead material. These are called decomposers. Volo Bog is unique because much of the plant and animal material present in the soil is NOT being decomposed. This gives rise to some very interesting conditions. List one below: (See pgs 4 & 5)

When You Visit:

The movement of the sun's energy through the community is called a food chain. The interconnecting ways that all of the organisms are related is called a food web.

List an example of each of the following that you see depicted in the visitor center:

Producer _____ **Secondary Consumer** _____

Primary Consumer _____ **Decomposer** _____

Volo Bog has a unique set of communities. The communities are generally identified by the dominant types of plants found in that area. Why do you think plants, rather than animals, are used?

The following pages allow you to explore the different communities found in Volo Bog.

Extension:

Succession is the process where one plant community replaces another over time. Do a succession survey. Set up a 10-meter string on two posts from the edge of a pond and running up hill away from the pond. Every couple of feet along the string, record observations on soil type, soil moisture, kinds of plants and animals present and other information. You may want to make a photographic report on your findings.

THE MARSH ZONE

In School:

The Marsh zone is the first of five plant communities in Volo Bog. It is the outer most zone, closest to the edge of the old glacial lake. Like in all marshes, it is dominated by soft-stemmed (herbaceous) plants. It does not have floating soil but is solid peat from the surface to the bottom of the old glacial lake. The water depth varies depending on the time of year and past weather conditions. It has been as deep as 1/2 meter. During dry times, no water is visible; one may have to dig down several centimeters before reaching moisture.

When You Visit:

As you enter the boardwalk leading through Volo Bog, the first zone you come to is the marsh zone. Notice the plant community here. One plant is very dominant (the most common). Be sure to include it in the list below.

Record the following:

Three Plants:

_____

_____

_____

Two Invertebrates:

_____

_____

Two Vertebrates or signs of their presence:

_____

_____

What uses did the Native American Indians have for cattails?

_____

_____

What mammal builds a lodge out of cattails and uses them for food?_____

How do muskrats help preserve the diversity of plant and animal life in the marsh?

_____

_____

Water temperature_____ **Water Depth**_____

pH_____ **To what substance does this compare?**_____

Extension:

Make some useful items out of cattails. Go to the library to obtain some ideas. (Be sure to get permission before collecting!)

THE TALL (OUTER) SHRUB ZONE

In School:

One of the first things you want to be sure to be aware of when you enter the tall shrub zone is poison sumac. It is a shrub or small tree that has poisonous plant oils in its stems and leaves. Touching any part of the plant at any time may cause a real nasty rash - worse than poison ivy according to some folks.

Poison sumac is recognized by its heavy grey branches and compound leaves. The leaflets on each compound leaf are opposite each other and there is usually a single leader leaf.

Look up poison sumac in a book and draw a branch with leaves:

When You Visit:

Describe how this zone differs from the marsh zone.

_____

_____

_____

Record the following:

Three Plants:

_____

_____

_____

Two Invertebrates:

_____

_____

Two Vertebrates or signs of their presence:

_____

_____

How many different ferns can you find? _____ **Name one:** _____

Which plant is poisonous to the touch and will give you a rash? _____

Extension:

Draw examples of a compound leaf compared to a simple leaf.

What other species of sumac are there? Are they poisonous? How can you tell them from poison sumac? Where do they grow? Do they have any useful purpose? Does poison sumac have any useful qualities? What other poisonous plants grow in Illinois? Do they have any useful qualities?

THE TALL SHRUB ZONE (CONTINUED)

When You Visit:

Which shrub is alien to North America, indicating the influence of European settlers to this continent? _____

Listen quietly with your eyes closed for two minutes. How many different kinds of bird calls can you distinguish? _____

Notice the dead trees in the tall shrub zone. How might they have died? What evidence do you see?

_____

_____

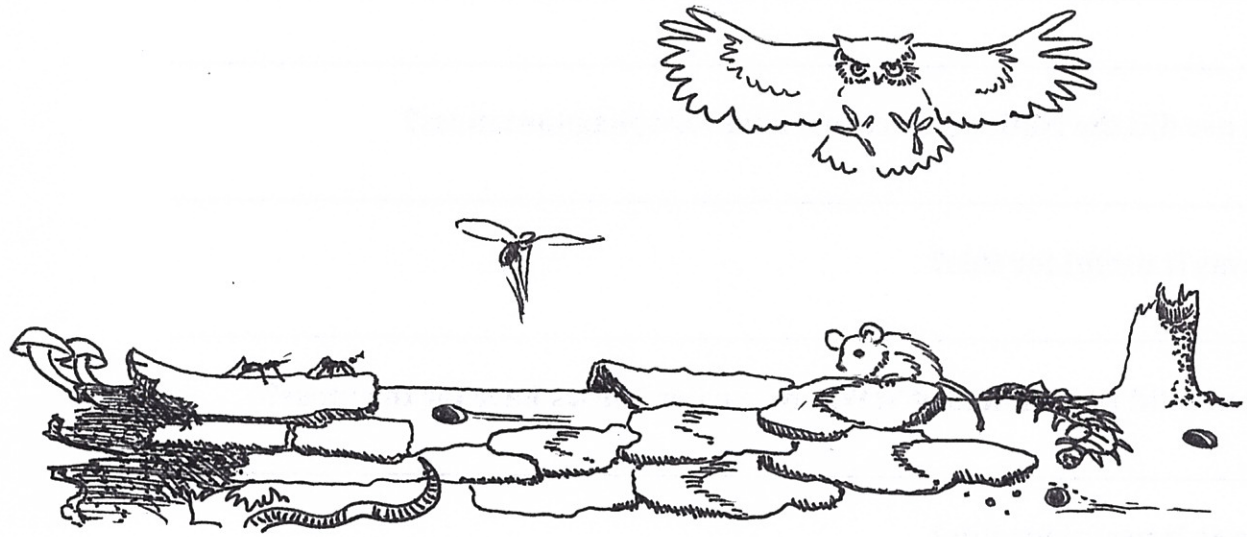
_____

What good is a dead tree? What evidence can you find to the usefulness of the dead tamaracks?

_____

_____

_____



Water temperature_____ **Water Depth**_____

pH_____ **To what substance does this compare?**_____

Extension:

Make a poster demonstrating the usefulness of a dead tree.

THE TAMARACK ZONE

In School:

This zone was named for the tamarack, an unusual tree. It has pine cones which puts it into the family of trees called Pinaceae or pine trees. However, unlike most pines, the tamarack is deciduous - it looses *all* its needles each fall. This helps the tamarack to conserve water in the winter because there is less surface area exposed to the drying winds. It may seem strange that a plant in a wetland needs to conserve water. We'll look at why this is necessary a little later.

The needles of the Tamarack have tannic acid in them. When it looses its needles, it releases the tannic acid to the soil and water of the bog. It is this acid that helps to turn the water brown. Tannic acid is used to tan leather hides.

The tamarack is also known as the eastern larch tree. See if you can find out what uses it has or has had in the past.

_____

_____

_____

_____

When You Visit:

Notice the hummocks, or hills of moss, out of which the tamaracks and shrubs are growing. This is the sphagnum moss: Feel and describe it:

_____

_____

What use did the Native Americans have for sphagnum moss?

_____

Why was it useful for this?

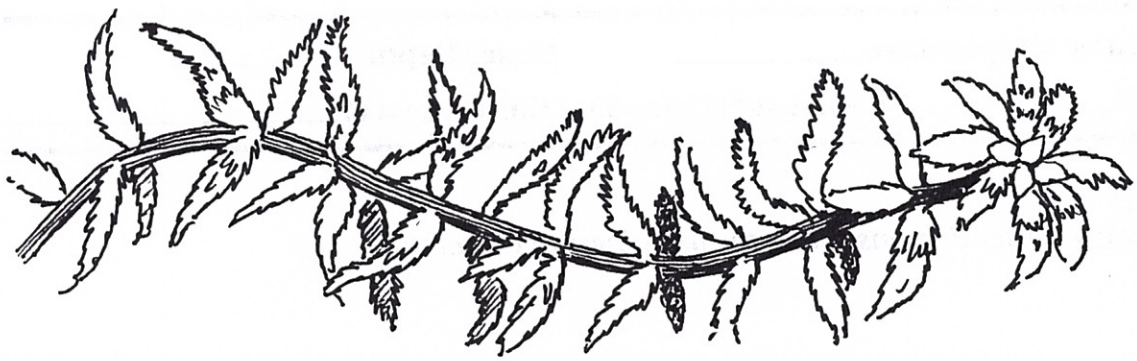
_____

What use did the soldiers of WWI and earlier battles have for the moss?

_____

Why was it useful for this?

_____



THE TAMARACK ZONE (CONTINUED)

In School:

Our first encounter with sphagnum moss is in the tamarack zone. When it dies, it decomposes very slowly and incompletely. This is because of the acids and lack of oxygen which keep bacteria from growing. Remember, without bacteria, things don't decompose. Each year new moss grows on top of the old dead plants. Over the years, it builds up and becomes soil we call peat. Peat is an early stage in the formation of coal; left long enough, it will turn into this useful fuel.

Record the following:

Three Plants:

_____

_____

_____

Two Invertebrates:

_____

_____

Two Vertebrates or signs of their presence:

_____

_____

Find some sap leaking from a tamarack tree. Describe its aroma:

_____

Feel the needles of the tamaracks. Describe the feel:

_____

_____

Water temperature_____ **Water Depth**_____

pH_____ **To what substance does this compare?**_____

Extension:

What are the three "fossil" fuels? From what did each form? What do bogs have in common with fossil fuels?