

A HISTORY OF CHANGE
STUDYING LOCAL ECOLOGY
IN NEW ENGLAND

Brian C. Dempsey
Thoreau Institute
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“Is it not a maimed and imperfect nature that I am conversant with?”

- Henry David Thoreau, *Journal*

“With fences had come the weeds: dandelion and rat alike joined alien grasses as they made their way across the landscape.”

- William Cronon, *Changes in the Land*

Introduction:

If a Native American from the year 1600 A.D. were magically transported to the present day, s/he would be astonished. Immediately, the Indian would recognize the changes by observing the composition of life in the forest. Strange plants, foreign animals and other alien life settled into the Indian's home and redecorated the landscape. Other than highways, malls and subdivisions, European and other immigrants have left their mark in New England by adding and mixing to the ecological pot.

Students can study the history of their backyard community by collecting common plants in their lawn or woods. By researching what type of plants they found, where they originally came from, and how they have been used in the past, a person can reconstruct a story of their environment.

Purpose:

This curriculum is designed to give high school students in New England an opportunity to study the history of their local ecology.

Time:

Three full class periods are required to complete this unit. Additional time outside of school, on the part of the student, is necessary to create a project.

Materials:

Pencils, crayons, and any place with grass, weeds and trees

Outline of unit:

Day before: • homework assignment using the Internet to research indigenous, alien, and invader plants.

Day 1: • Read story, "Awakening to a Foreign Land" with class.

- Four groups of students assemble time line using "Pictures of a New England Landscape," historical quotes from "Witness to a Changing Land," and cards with dates from the years 1600-2000. One person from each group answers questions from "A History of Change."

- Day 1 - continued
- Class discussion of answers from “A History of Change.”
- Day 2:
- Students refer to graphs & work individually to complete “Taking a Closer Look at Ecological Change.”
 - Make overhead transparency of “Mystery of the Forest” and review with the class.
- Day 3:
- Students hand-in homework from Internet search on indigenous, alien, and invader plants.
 - Assign project, “Natives, Aliens & Invaders.” Project is due in one week.
 - Go outside to woods and/or a field to show students some examples of indigenous, alien and invader plants.

Assessment:

Students can individually earn credit points by correctly answering the riddles to the overhead transparency, “Mystery of the Forest.” In addition, students are graded on their Internet homework assignment and “Natives, Aliens & Invaders” project.

Follow-up:

Throughout the school year, other topics can be connected to this unit. Food webs, ecological succession, human impact on the environment, interpreting and making graphs, and even genetics, since a mutation produces a “four-leafed clover” in the Red Clover originally introduced from Europe.

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Homework Assignment on local plants

Name: _____

Due: _____

Directions: Using the Internet at home or school, use a search engine (ex. Infoseek) and the key words "alien plants" to look up the the following web site:

1) Indigenous, Alien and Invasive

or look directly at the site by typing

http://www.panda.org/research/facts/South_Africa_Facts/35indig.htm

Assignment:

A. Read the web stie listed above and in one brief sentence, define:

1) Indigenous -

2) Alien -

3) Invaders -

B. Next, explain why some aliens become invaders.

C. Use the Internet or books from a library to list 3 common indigenous plants which you can probably find nearby and 3 common alien or alien invaders that also live near you. Bring this assignment with you the day it is due.

Awakening to a Foreign Land

This is a story about an Algonkian Indian man who was hunting in the woods in the year 1600 A.D. in an area which would later become Eastern Massachusetts. He mysteriously awakens to the transformed world of the present day, and discovers that plants and animals which he interacted with daily have become strangely altered. Other creatures are completely new.

While reading this story, look for clues that can help you explain what has happened to this Native American's home.

All day I have traveled searching for my home and my people. There is no sign that an Algonkian tribe has visited these parts for a very long time. I am lost in a strange new land.

My last memory was of pursuing a wily deer through miles of hilly forest. Above in the canopy of hickories, chestnuts and pitch pines I could here the cooing of passenger pigeons. I ran swiftly around the trunks of great trees, whose bark had been charred by the last fire. I paused at the top of a hill. Far below, I could see the deer, who had stopped to rest and feed on lush grass growing in a stand of oaks. I reached back to pull out an arrow and silently ran toward my prey, camouflaged by the shadows of the forest. Unexpectedly the breeze shifted in favor of the deer. It jerked its head upward, recognizing my scent, and desperately leapt for the safety of a swamp ahead. Just as the tip of my arrow ripped into its neck, I fell head-first into a hidden cavern which collapsed around me. A cool, eternal darkness covered me with blankets of earth as I slipped into a deep sleep.

I awoke to the thundering sound of a giant rolling beast, which plowed a heavy shovel down into the ground. I lay entombed and helpless while the creaking, roaring shovel scooped me from the earth and lifted me high into the brightness of the air. My body was stiff and sore, yet I managed to raise my head and shoulders from the rubble that engulfed me. Inside a clear box, I could see the blue eyes of a pale-skinned man shifting levers, controlling the yellow beast's movement. His eyes met mine and widened with a look of astonishment. He began yelling in a foreign language to other men hammering on a large building nearby. A surge of panic shot through my body. I twisted sideways out of the giant shovel that cradled me and fell hard onto a mound of gravel below. I limped toward the safety of the nearby swamp.

I did not slow down until the roar of the beast faded into a muffled silence. It is then when I realized that the forest had changed. I stopped to listen and smell the air. An unfamiliar scent of wildflowers drifted through the trees and the soothing song of passenger pigeons was absent. I looked behind me for familiar landmarks. I could make out the hill top which I ran down when pursuing the deer. However, a dense undergrowth of shrubs, young trees and strange herbs obstructed a clear view of it through the forest. Gone were the giant pitch pines, hickories and chestnuts. In their place grew smaller red maples, birch and white pine that had not yet reached maturity.

Ahead, a green carpet of poison ivy stretched over the ground, its hairy vines crawling up young saplings. Winding snake-like through the forest were several stone walls that crisscrossed a territorial path along the wooded floor. Vines of the poison ivy had wrapped themselves over some of the larger stones in the wall. Who built such strange monuments and when were they made, I wondered? A dull pain of hunger reminded me of the deer that I killed earlier. There were no large chestnut trees bearing tasty seeds which could be roasted as a quick snack. In their place were humble, young chestnuts which grew no larger than a shrub.

I sauntered parallel to a stone wall and examined the ground for signs of bear and turkey but could find none. I found no tree trunks clawed by mountain lion nor scat left by wolves. Instead, many squirrels scurried along the branches above, some shaking their fluffy tails and barking warnings for others to stay away from their tree. Stuck between the limbs of a young red maple, I pulled out a tuft of gray fur and smelled the strong odor of opossum.

While considering knocking down a squirrel for a meal, I noticed a broad, flat surface that shimmered through the forest like ice. It was situated where the swamp should be, so perhaps the water is frozen, I thought. However it was early fall, too early for the chill of winter. Curious, I set a faster pace down toward the swamp. The sparkling, narrow surface on the horizon expanded as I walked closer, and became blacker as I grew near. The ground was now soft and moist, filled with tall cinnamon fern.

Pausing cautiously behind a grove of red cedars, I witnessed an alien landscape. A flat blackness of tar smothered the ground, pushing to the edges of the forest. Puddles left by a passing rain polished the surface of the hard, smooth tar and reflected sharp rays of sunlight. Gone was the swamp, teeming with cattails, dragonflies, beaver and the great blue heron. In their place were rows of shiny blue, red, green and white beasts, similar

to the yellow creature that attacked me earlier. Each sat on four black wheels, placed between a set of geometric white lines on the ground. They all waited patiently, to be activated by one of the pale-skinned strangers.

Inching forward to the border of the tar lot, I found the remnants of the former swamp struggling along a ditch. A few plants and animals looked familiar; bull frog perched on Lilly pads, buzzing mosquito, a few dragonfly, and patches of cattail. But there were many odd plants. Tall herbs, topped by small, brilliant-purple flowers towered over the other plants, depriving them of sunlight. These colorful wildflowers dominated their marginal habitat and together formed a long band of purple stretching to the end of the black tar lot.

Huddled among the tall, purple flowers grew a cluster of cattail. I pulled one out vertically and exposed its shoots. It tasted tangy as it crunched in my mouth. I yanked out several more and ate them until I was somewhat satiated. The slope above me leading to the tar lot was carpeted by a swath of green grass, cut short. Strange, small, dark birds with iridescent necks hopped among the grass hunting for food. In the distance I could hear the familiar caw from a family of crows. I climbed out of the swampy ravine and crawled on all fours up the hill to the edge of the black lot. Piled in a strewn hump, trash lay deserted along the hill, disappearing into the swamp below. Poking out from among the garbage, I could see a beautiful crystal container. Gently, I tugged it from the mound of liter. A red label, faded by the sun, contained a raised inscription or design. Suddenly a giant mouse squeaked, jumping from a borrow next to where the crystal container had rested. The monstrous-looking mouse scurried for the safety of a better home.

What is this crazy place? - I wondered, gazing beyond the tar lot at a wide, rectangular building. The rolling landscape is the same, but what has happened to the the plants and animals of the forest? Where is my tribe, and who are these pale-skinned people?

Discussion questions:

- 1) What type of work do you think the “thundering yellow beast,” operated by a blue-eyed, pale-skinned man, was doing when he dug the Indian from the ground?
- 2) How was the forest different when the narrator awoke to the present day?

3) Why do you think some plants and animals remained the same while others were new?

4) What was the "tar lot" that the narrator described?

Witnesses to a Changing Land

The following reports by colonists, travelers, and native people describe New England's ecology over several hundred years.

"For Beasts, there are some Beares... Also here are severall sorts of Deere... Also Wolves, Foxes, Beavers, Otters, Martins, great wild Cats, and a great Beast called a Molke [moose] as bigge as an Oxe."

- Francis Higginson
1630

"The Salvages are accustomed to set fire of the Country in all places where they come, and to burne it twize a yeare, viz: at the Spring, and the fall of the leafe."

- Thomas Morton
1632

"Whereas it is generally conceived that the woods grow so thick there is no more cleared ground than is hewed out by labor of man, it is nothing so, in many places diverse acres being clear so that one may ride ahunting in most places."

- William Wood
1634

The fire "consumes all the underwood and rubbish which otherwise would overgrow the country, making it unpassable, and spoil their much affected hunting."

- William Wood
1634

"You know our fathers had plenty of deer and skins, our plains were full of deer, as also our woods, and of turkies, and our coves full of fish and fowl. But these English having gotten our land, they with scythes cut down the grass, and with axes fell the trees; their cows and horses eat the grass, and their hogs spoil our clam banks, and we shall all be starved."

- Narragansett Indian leader Miantonomo
1642

Passenger pigeons flew in great flocks "that to my thinking had neither beginning nor ending, length of breadth, and so thick that I could see no Sun."

- John Josselyn
1672

"The times are Exceedingly Alter'd, Yea the times have turn'd everything upside down, or rather we have Chang'd the good Times, Chiefly by the help of the White People, for in Times past, our Fore-Fathers lived in Peace, Love, and great harmony, and had everything in Great plenty. ...But alas, it is not so now, all our Fishing, Hunting and Fowling is entirely gone."

- Mohegan Indians of Connecticut
1789

"Our timber trees are greatly reduced, and quite gone in many parts. In towns near and bordering on the sea shore, little can now be found within the distance of twenty miles, and it is not uncommon for the builder to send at this day from thirty to forty miles for timber and planks, and the stock is fast decreasing, not only from the demand of timber and planks, but from scarcity of other fuel."

- Benjamin Lincoln
1814

“the forests are not only cut down, but there appears little reason to hope that they will ever grow again.”

- Timothy Dwight
1821

“When I consider that the nobler animals have been exterminated here,- the cougar, the panther, lynx, wolverine, wolf, bear, moose, deer, the beaver, the turkey, etc., - I cannot but feel as if I lived in a tamed, and, as it were, emasculated country.”

- Henry David Thoreau
1856

“The establishment of even-aged white pine in former fields initiated a lumber industry in the 1870’s that operated through the use of portable sawmills and a practice of clear-cutting. Advanced regeneration hardwoods below pines was generally cut or damaged during logging or was burned with the slash. Thus, an even-aged forest of hardwood sprout generally followed the pines.”

- David Foster
1993

Cut out the dates below for use as a time line with the historical accounts above and photos showing ecological change (included on following pages):

1600

1700

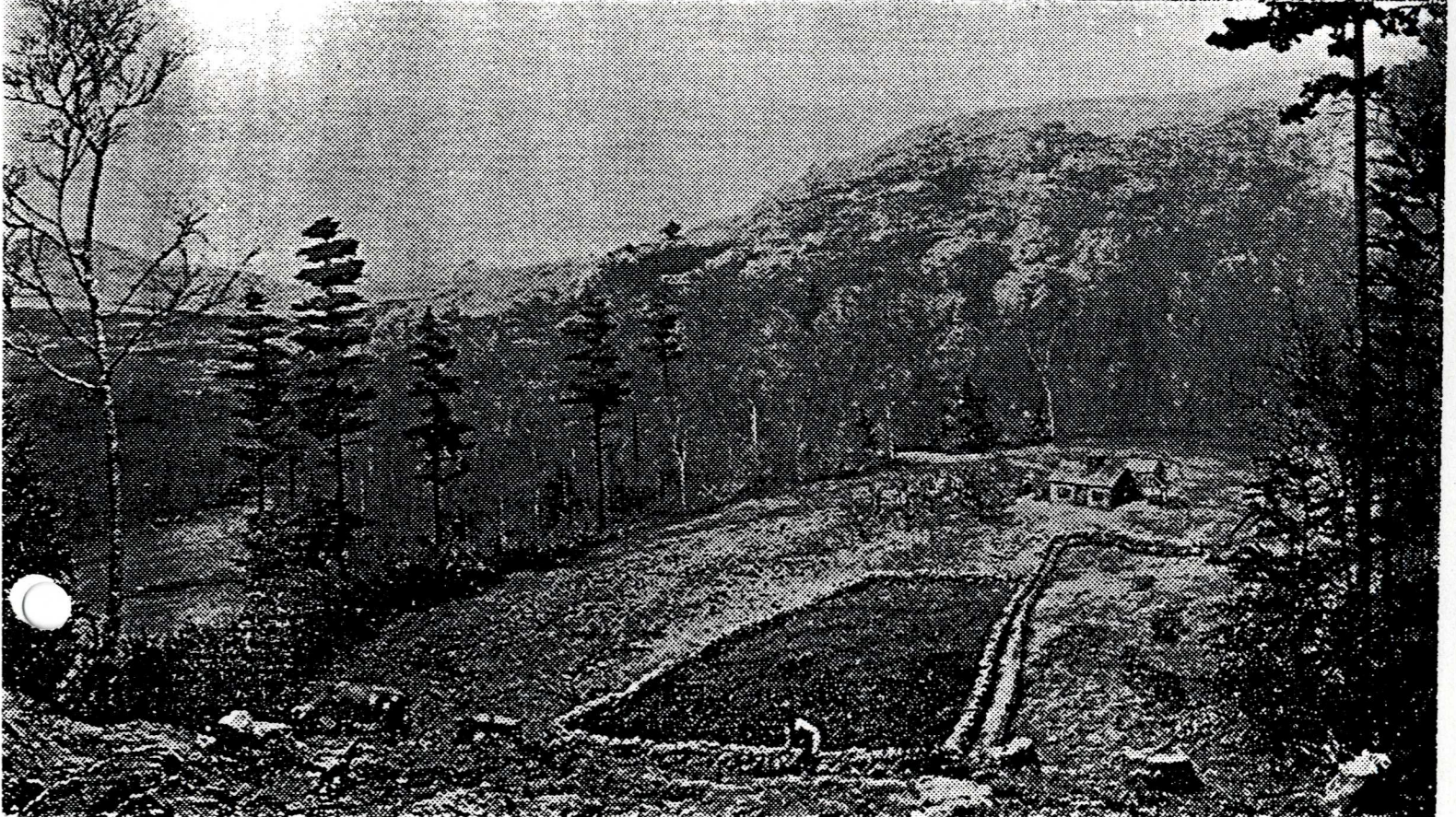
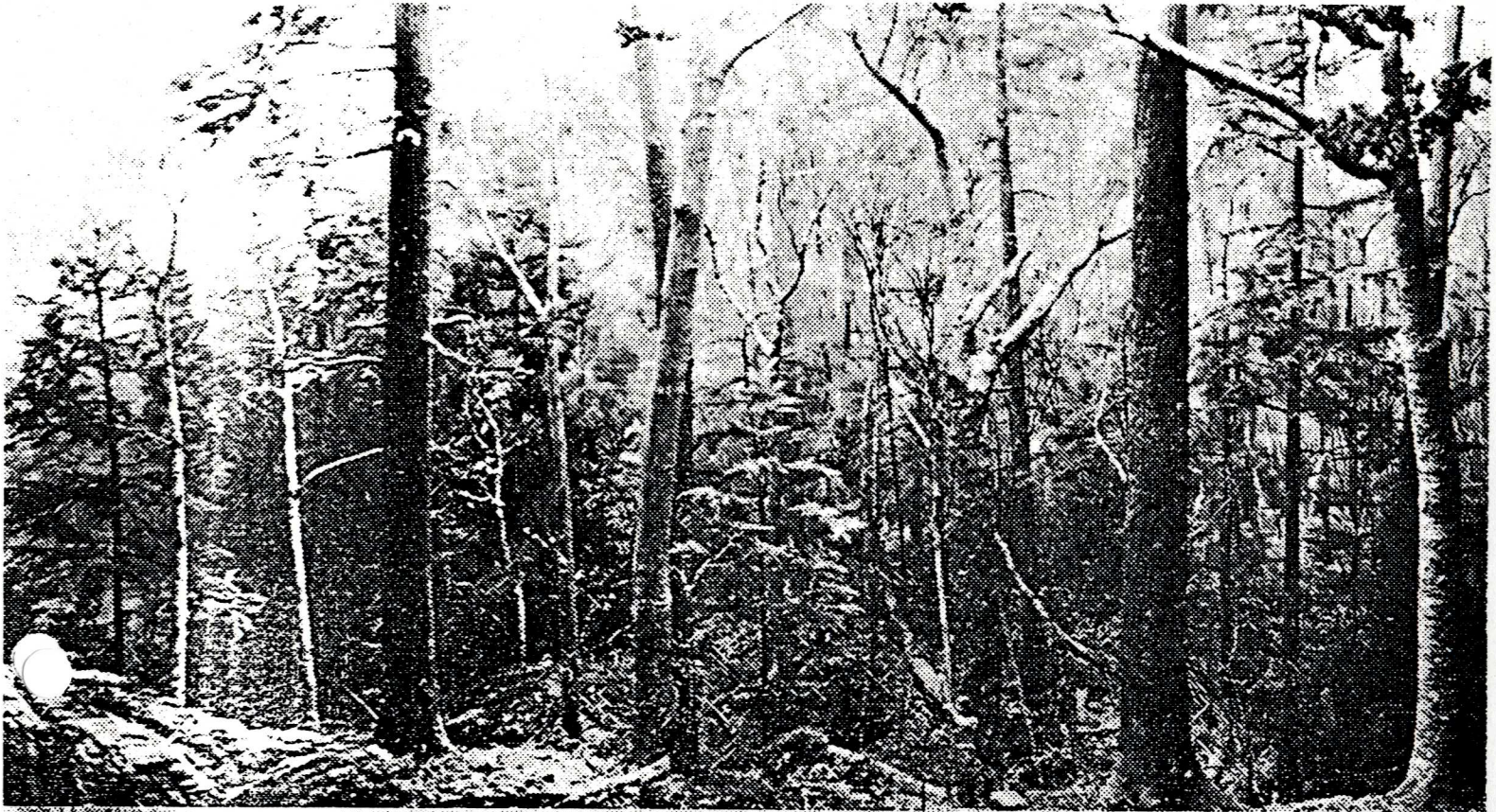
1800

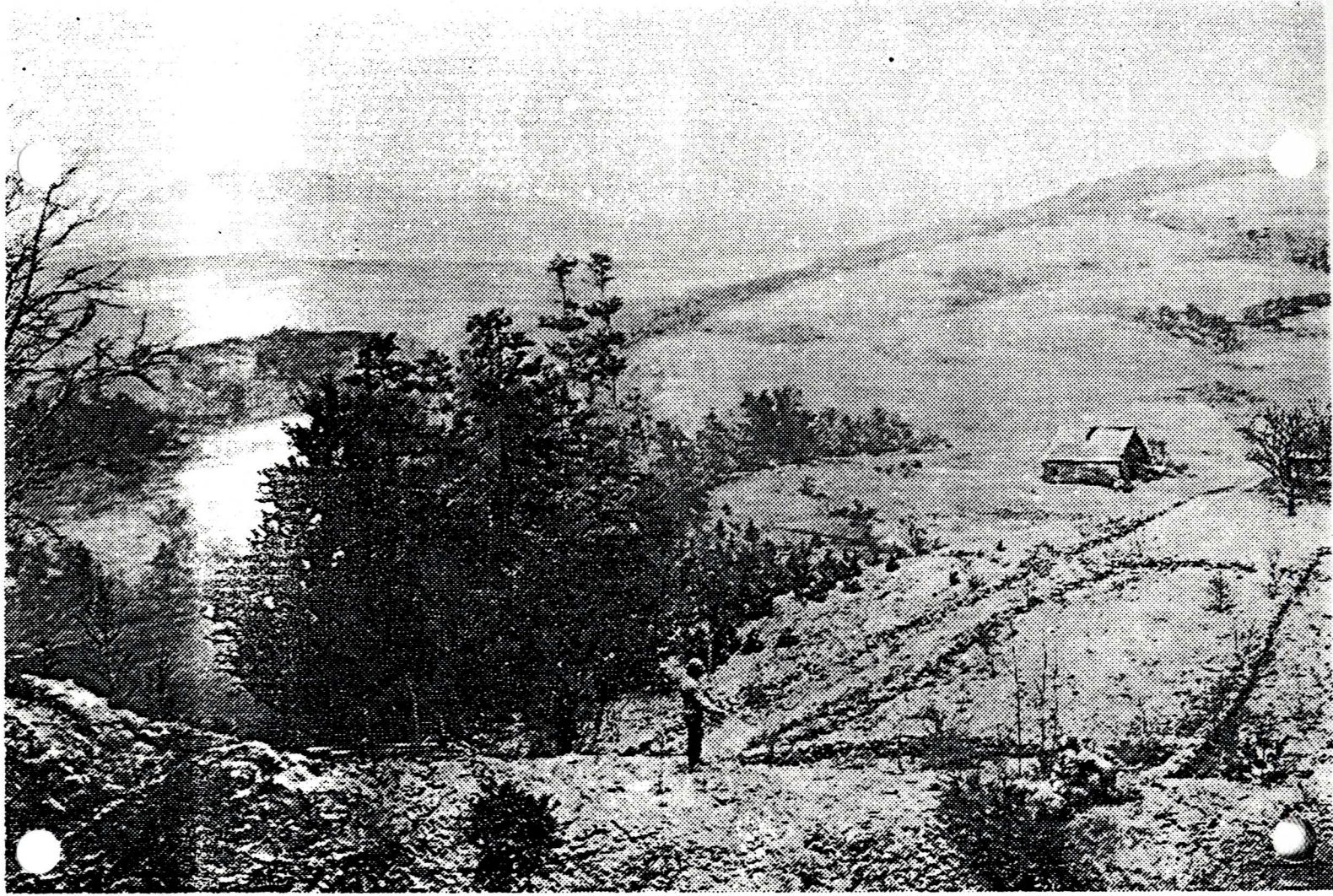
1900

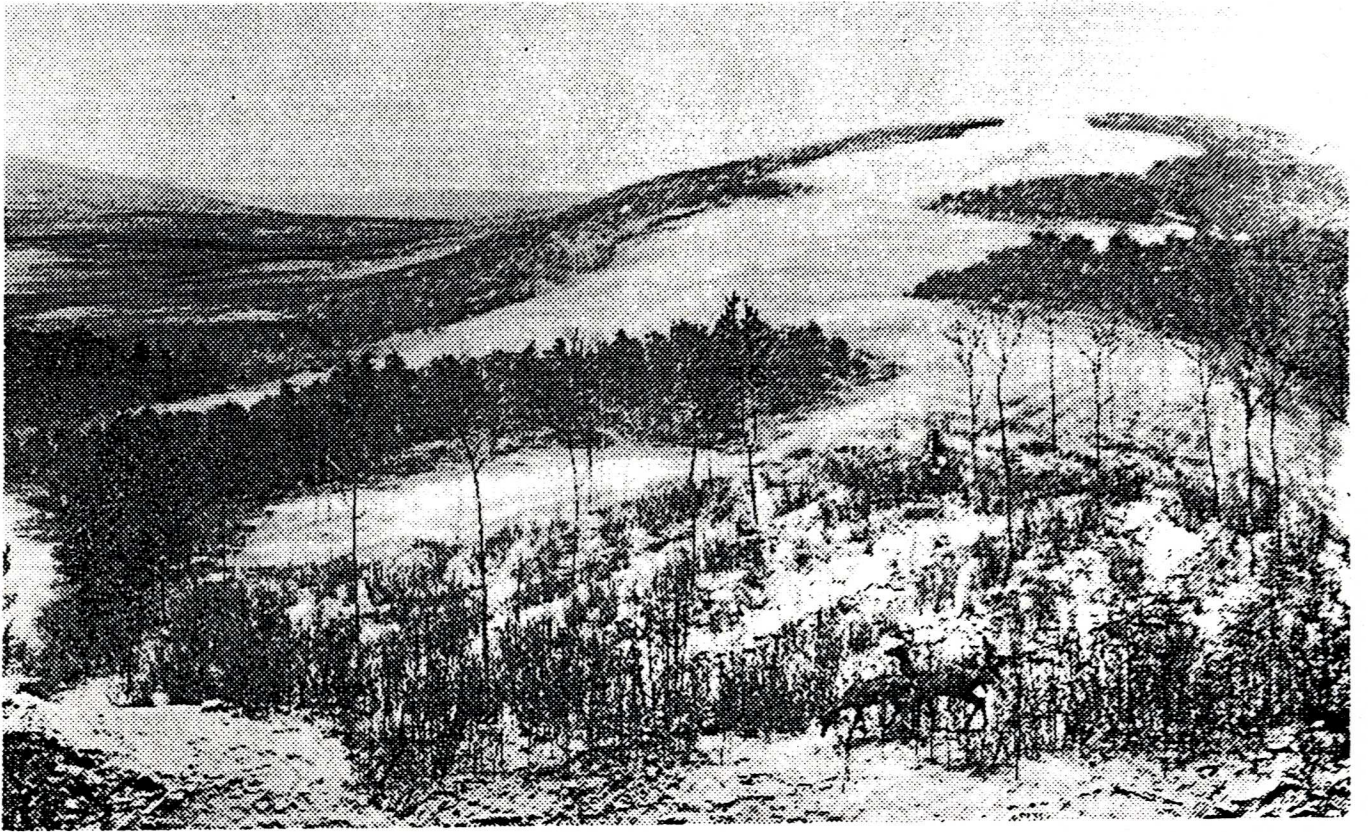
2000

Pictures of a New England Landscape

Photographs by Martin Zimmerman, Harvard Forest, Harvard University







A History of Change

The Transformation of New England's Ecology

Names of members in group: _____

Directions: Use your story "*Awakening to a Foreign Land*" to reconstruct the changes in New England's landscape by chronologically laying out the pictures under the dates 1600, 1700, etc. Place each quote sequentially under the pictures and answer the questions below.

1) Compare Francis Higginson's description of the wildlife he described in 1630 to what the Algonkian Indian man observed in the story after he said, "I sauntered parallel to a stone wall..." Which of the animals live in this area of New England today? Which do not?

2) Compare Thomas Morton & William Woods' reports of cleared woods and fire setting to the Native's descriptions of the forest where he hunted deer. Write down clues you can find in the story that confirm the statements made by Morton & Woods.

3) After the woods were no longer burned routinely by local Indians, how had the forest changed? Refer to the story for evidence. Were the types of trees the same? Give examples.

4) The Narragansett Indian leader Miantonomo & Benjamin Lincoln described the effects of clear cutting the forests, and how it impacted the lives of people in New England. Look carefully at the sequence of pictures and write down your conclusions as to what European and other immigrants did to the land which caused later hardships.

5) Look for evidence in the pictures supporting David Foster's statement of the modern forest's regrowth. Carefully look at the last picture and write down your observations which show evidence that the woods were previously occupied by humans.

Taking a Closer Look at
Ecological Change

Name: _____

Part I - Data Table & Bar Graph

A. Directions: A table of information on the next page summarizes the percentages of trees documented for land surveys from 1676-1981. Use these numbers to make a bar graph below the data table. You will need colors of crayons to represent each type of tree.

B. Questions: - *(answer after completing your bar graph)*

1) Oak and Hickory trees have the ability to regenerate themselves by sprouting from their roots after a devastating forest fire. Red maples are not able to do this. After the arrival of colonists in the 1600's, Indians ceased to burn the woods as a method of hunting. Over time, how did this effect the populations of White Oaks, Hickories and Red Maples?

2) Why do you think people bother to make a bar graph from a table of numbers? - (i.e. how is it useful?)

Part II - Pollen Analysis

Directions: Answer the following questions by comparing the percentages of pollen recorded from the years 12,700 to the present (0).

1) Since European settlement, approximately when did Pines, Oaks and Chestnut trees experience their first major decline? What were Europeans doing to the land which reduced the population of these trees?

2) Ragweed, a weedy plant that causes hay fever, often grows in fields. Approximately when did Ragweed reach its peak population, based on its percentage of pollen? How can this information be used to explain how the land was being developed at that time?

Bar Graph & Pollen Analysis Comparison

1) Compare your bar graph & pollen graph. In the last one hundred years Chestnut trees suddenly became very scarce. List some possible causes which would explain this sudden decrease.

2) Look at your bar graph and it appears that Pitch Pines and White Pines were uncommon from 1676 - 1750 but unspecified pines were abundant. This is because early English settlers did not always distinguish one type of pine tree from another, so they lumped all pines in the same group. Therefore, written historical records may not be very accurate. Why is it therefore important to also use scientific data when investigating environmental change?

Part I - Table & Bar Graph

Representation of Trees in Early & Recent Land Surveys of Concord, MA
(as percentages of trees mentioned). - adapted from Whitney & Davis, 1986

	Ancient Records of Concord 1676-1750	Thoreau's survey 1849-1860	Recent survey 1981
<u>Hardwoods:</u>			
White Oak	27.3	14.4	8.9
Hickory	9.4	3.6	0.8
Chestnut	3.8	5.0	0
Red Maple	2.8	13.0	16.0
<u>Pines:</u>			
Unspecified pines*	18.2	0.7	0
Pitch Pine	0	8.6	0.2
White Pine	0.3	5.0	23.1

*Note: historical records are not specific as to which type of pine

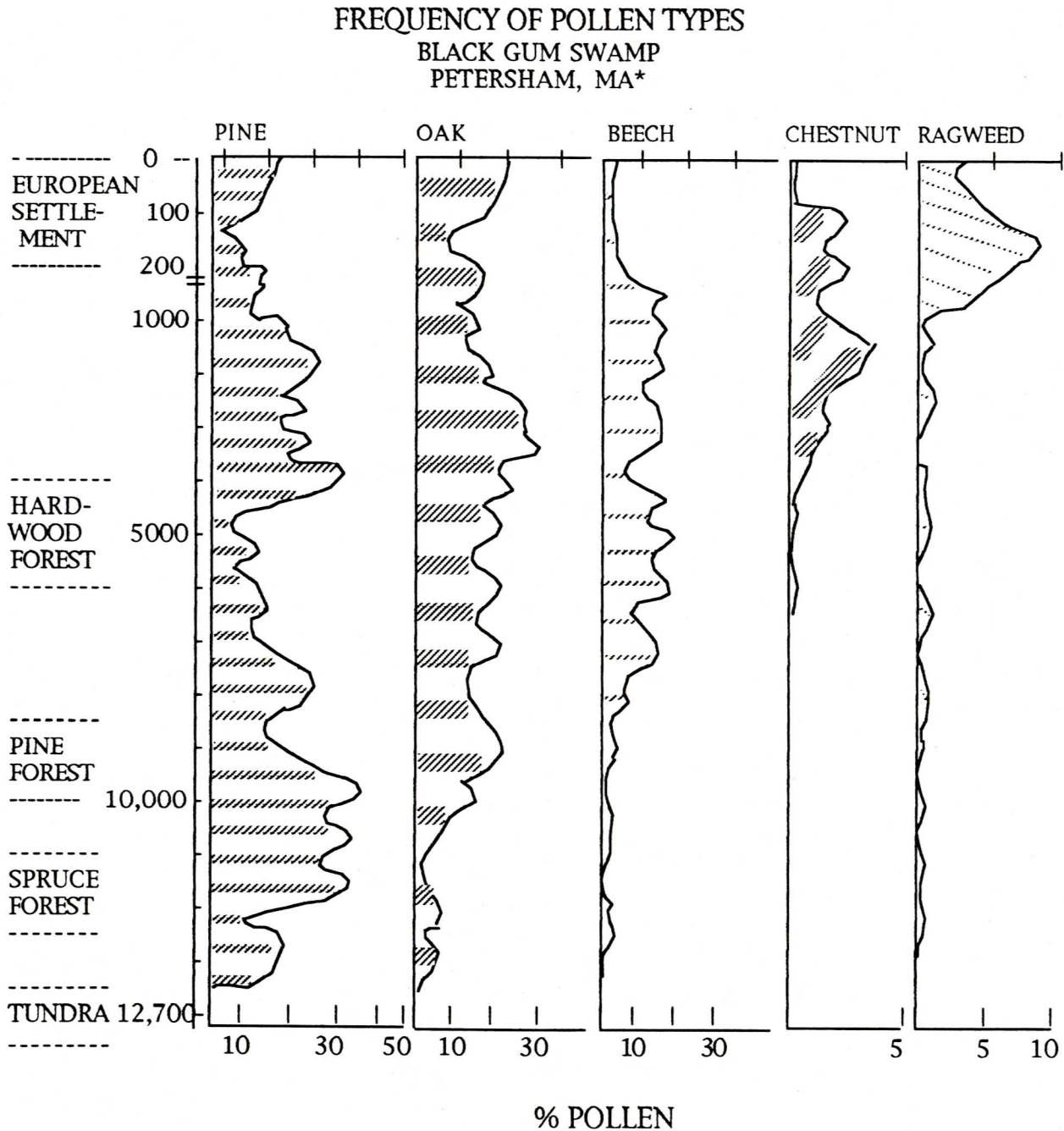
		Ancient Records of Concord, 1676-1750	Thoreau's survey 1849-1860	Recent survey 1981
%	t	28		
	r	26		
	e	24		
	e	22		
	s	20		
		18		
	i	16		
	n	14		
		12		
	r	10		
	e	8		
c	6			
o	4			
r	2			
d	0			

color key:

White Oak = uncolored	Red Maple = red	Pitch Pine = green
Hickory = yellow	Unspec. pines = brown	White Pine = blue
Chestnut = black		

Part II - Pollen Analysis

Lakes, swamps & other environments containing a steady body of water can record their own history. Pollen settles on the bottom of a swamp & preserves a record of the pollen producing plants of an area. This graph shows the relative abundance of five types of plants in one location of Massachusetts from 12,700 years ago to the present.



*Adapted from an exhibit at the Fisher Museum at Harvard Forest, Harvard University, 1997

Mystery of the Forest

“What is this crazy place,... what has happened to the plants and animals of the forest?” the Algonkian Indian man asked us.

Directions: use your copy of “Awakening to a Foreign Land” and “Taking a Closer Look at Ecological Change” to solve the following riddles:

Riddle:

1) “unfamiliar scent of wildflowers”

2) “song of passenger pigeon was absent”

3) “Gone... giant pitch pines, hickories & red maples.” Instead, “smaller red maples, birch & white pine.”

4) “chestnuts... grew no larger than a shrub.”

5) “Who built [stone walls] & when were they made?”

6) No “mountain lion” nor “wolves.”

7) Many “squirrels,” “crow” & signs of opossum

Answer:

1)

2)

3)

4)

5)

6)

7)

Riddle:

8) "colorful [purple] wild-
flowers dominated their
marginal habitat."

9) "small, dark birds with
iridescent necks"

10) "crystal container..."
with a "red label, faded by
the sun, contained a raised
inscription or design."

11) "giant... monstrous-
looking mouse"

Answer:

8)

9)

10)

11)

Natives, Aliens & Invaders

studying plants to understand the history of the land

Introduction:

When you step out bare foot onto the soft, green grass of your lawn, you touch the leaves of history. If you take a short trip on the highway or venture briefly into the woods, you also come into contact with an ancient saga full of natives, aliens and invaders. No, this is not a story about alien abductions or Viking invaders. It is about the living history of local plants, and by studying them, you will understand your biological roots.

Assignment:

Using your homework regarding indigenous, alien and invader plants, locate areas around your home or school which contain the species you listed in that assignment. Your job is to 1) write a 1-2 page summary of New England's ecology, 2) collect three indigenous plants, 3) collect three alien and/or invader plants, and 4) write a research paper about the plants you collected.

If you had trouble coming up with some plants to collect and study, here is a suggested list:

indigenous:

Cattail
Goldenrod
Poison Ivy
Corn
American Chestnut tree
Sugar maple tree

aliens:

Red Clover
Common Plantain
Timothy
Apple tree
Ginkgo tree
Chestnut blight (fungus)

invaders:

Dandelion
Purple Loosestrife
Water Chestnut
European Buckthorn

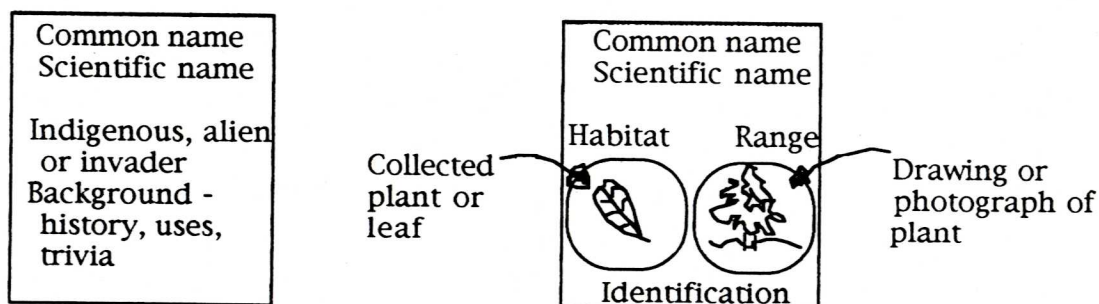
A) Collecting plants

Unmowed lawns, roadsides, parks and woodlots are all great places to search for your plants. If the plant is small, remove as much of the intact plant as you can (leaves, stem roots and flowers - if blooming). If it is a tree you are after, take off a leaf and then make a bark rubbing, by laying a piece of paper against the bark of the tree and rubbing a crayon over it. This will give you a pattern of the bark (each species of tree has a unique bark pattern). And remember, DON'T COLLECT POISON IVY - only draw it please.

After you have your leaves and small plants, they should be dried and flattened by putting them between newspaper and placing a heavy book on top for a few days. Later, remove the flat, dry leaves and neatly glue each to a piece of paper.

B) Presentation

Below is the format you should follow for researching and presenting each species of plant you collect:



C) Research

Begin your research paper with a 1-2 page summary describing how the landscape of New England has changed since 1600 A.D. Use the handouts from class to help you. Next, go to the school and town library to research the six plants you have collected. Describe the background of each plant - its history, medicinal use, and any interesting trivial facts. Is it indigenous, alien or an invader? What is its scientific name, habitat, geographic range, and how can it be identified?