Teacher's Guide to "PEOPLE & FORESTS:
A Prehistoric and Historic Evolution of Forest Management in Northern Minnesota"

- **Recommended Grade Levels:** Middle School— High School
- **Subject Areas:** Science, Social Studies
- **Video time:** 47 minutes
- **Suggested minimal time frame**: 10 minute introduction + 2 class periods
- **Optional activities included**

CONCEPTS

- Change is nature's only constant; healthy forests are complex, living systems subject to and dependent on periodic processes of destruction, rebirth, and change.
- Human interaction with the forest has occurred for thousands of years.
- To affect positive changes for the future, we can learn from the past; decisions that promote balance between the needs of people and forests can be made by understanding and working within the framework of time and transformation.

GOALS

- To understand the forces through time that have created our present forest condition
- To realize there are multiple uses of a forest
- To understand that compromise between resource use and preservation is possible
- To be aware of considerations involved in designing a realistic forest management plan where humans have a positive impact on the landscape

OUTCOMES

- Describe the major changes forests of Northern Minnesota have undergone throughout the last ten thousand years.
- Identify multiple uses of a forest and find a compromise between resource use and preservation
- Choose ways to manage personal consumption in order to maintain forest sustainability

The Following will be included:

- **Pre and Post – Discussion Activities**
- **Lesson Activities**
- **Glossary**
- **MN Graduation Standards that could compliment objectives of the video:**

H.S. Sciences: *Environmental Systems* (A,E,G)
H.S. Inquiry 4.6: *Issue Analysis* (A-F)
H.S. Sciences: *Biological Concepts* (A, D)

Introduction to Teacher

This Teacher's Guide was created to facilitate discussion on the St. Louis County Land Department's video, "People and Forests" which is a documentary that describes the northern forest from the glacial period to the present. This video connects the present condition to modern forest management.

The instructor's role is to serve as a guide by facilitating discussion. This teacher's guide helps teachers by providing a teaching framework, which includes activities to ensure a personal learning experience. In addition to activities, there are probing questions to help teachers encourage discussion. One way to prepare students for discussion is to encourage them to collect articles on forest issues at least one month before showing the video. The articles will be especially useful if you choose to do the H.S. Inquiry 4.6: Issue Analysis (A-F) Grad. Standard.

Throughout the guide you will notice some words are in italics. This indicates that a definition or a more in-depth explanation of the word can be found in the glossary, which is located in the back of the guide.

Students and teachers can assess the impacts of the video by comparing their responses from the Pre and Post-Video questions, which are indicated on page 2 and 6.

Because class time is limited and the video is 47 minutes long, you may want to show the video in two segments. We suggest you introduce the video during the last 10 minutes of class the day before you begin showing it. On the first day you present the video, show 25 minutes. This segment provides an overview and demonstrates that change is nature's only constant. It describes what the major changes in Minnesota forests are since the last glaciation. The second day has 22 minutes of video time. This segment begins with the *European Settlement* and introduces *forest management*.

DAY BEFORE SHOWING: (10 minutes at end of class period)

Introduce the video to students:

The next two days we will be watching a video entitled, "People and Forests." This video will be about major changes that Minnesota forests have undergone since the last glaciation, the impacts of *European Settlement*, and how that history affects *forest management* today.

Pre-Video Questions:

Here are some questions to think about before we begin:

- What comes to your mind when you hear the words, *preservation* and *forest management*? (Ask students write down their response to this question. Collect students' comments. Students' responses will be used as a way to assess the video's impact.)

- How do you use products from the forest? (Hand out "A Home Inventory Worksheet")

- What other activities do you like to do in the woods? (This brings in economic and social needs).

DAY ONE of SHOWING:

Reintroduce the video to students: (10 minutes)

"Today we will begin the video, 'People and Forests.' As I mentioned yesterday, the video covers the major changes Minnesota forests have undergone since the last glaciation, the impacts of *European Settlement*, and how that history affects *forest management* today.
Before we begin, I would like to hear some of your ideas on how you use the forest. What products do you use (list responses on the board)? What do you think the forest provided for people in the past? Here is something to think about before we watch the video:

- What do you think the forest was like in the past? (100 years ago, pre-settlement, 1,000 years ago, 5,000 years ago?)"

SHOW VIDEO (25 minutes)

After the video ask students to: (10 minutes)

- Review the major forest changes over time.

- Describe the causes and effects of those changes.

Remind students to complete the "Home Inventory" worksheet. Have students complete it by next class period.

Homework: **"A Home Inventory"**

How do you use the forest? What do you get out of the forest? Take a home inventory. Make a list of at least 20 products derived from trees. For example, list things such as toilet paper, tables, and paper.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____

- Looking at all you use, circle any products that you do not really need.
- What activities do you like to do in the forest?

_____
_____
_____
_____

- Do you think you could meet your daily needs without the forest? Explain your answer.

_____
_____
_____
_____

DAY TWO SHOWING

Briefly review major landscape changes described in the video and what caused those changes (5 min.).

Show the second half of the video (22 minutes)

- After the video, discuss the White Pine issue. Since pre-settlement, logging and fires have eliminated most of the white pine stands, only remnant stands exist in Minnesota. Many people believe we should manage for more white pine in northern Minnesota to reflect what was here pre-European settlement. However, after the logging and catastrophic fires that occurred in Northern Minnesota, the landscape has become conducive to deer which feed on white pine tips. Such feeding destroys young white pines. There are competing interests between desires to increase the deer population for hunting and to increase white pine populations. What do you think we should do and why? (15 min.)

Extension:

MN Graduation Standard: H.S. Sciences: *Biological Concepts* (A) Understand biological change over time, interdependence of organisms, and material cycles and energy flow in living systems.

- Take out your "Home Inventory" sheets. List or discuss *environmenta*l, *social*, and *economic* needs students came up with while watching the movie and while doing their home inventory assignments (15 min.)

- Notice that we consume forest products. Harvesting to produce these products can be beneficial to the forest. Harvest is a manageable disturbance factor that replaces some components of fire, which is necessary for a healthy forest. In essence, harvesting takes the place of fire. Harvesting renews the forest by stimulating regeneration. With this in mind, think about how we can manage the forest for future generations. (5 min.)

Extension:

MN Graduation Standard: H.S. *Environmental Systems* (A)
Understand interactions between social and natural systems. Understand implications of changes in the environment at short-term, long-term, local, regional and/or global levels. (E) Develop a conceptual understanding of the local issue and identify related scientific concepts and ecological systems, social systems, interest groups, their points of view, and possible solutions. Analyze how humans and natural systems affect and are affected by the local issue. (G) Develop and evaluate a personal action plan.

Post Questions: (back to pre-video discussion on *preservation* vs. *forest management*)

- Describe your views of forest *management*? (One paragraph)
- Describe your views of forest *preservation*? (One paragraph)
- Compare your thoughts before the video with your thoughts after the video. (One paragraph)

For Grad Standard: Gather newspaper articles that have been cut out for one month. Collect classmates' impressions on *forest management* and *preservation*. Identify areas of conflict. Divide into groups to evaluate multiple positions, identify areas of conflict, come up with possible compromises, and propose a solution.

Extension:
H.S. Inquiry 4.6: *Issue Analysis* (A-F) Gather information, identify relevant questions and points of view, summarize background information, examine information for bias, identify areas of conflict, compromise, and agreement, evaluate multiple positions and proposed solutions.

DAY THREE: (Optional Activities)

Expand group discussion in more detail on *economic, social*, and *ecological* needs.

Break your class into 3 groups. Each group should represent either the economic, social, or ecological perspective. Have each group present and discuss their needs and how they compete with each other. Facilitate discussion by asking students, "What do you think about the needs you came up with? Is one category more important than another? How can we reach a compromise?" (The compromise which balances social, economic, and ecological needs is considered *sustainability)* (20 min.)

Forest Sustainability

Considering our discussion yesterday when we talked about what we get from forests and your findings from your home inventory, how can we manage the forest to satisfy our needs and the needs of future generations? In other words, how can we achieve *sustainability*? (15 min.)

Back to the Future worksheet

This exercise makes the point that forests are always changing, and that we cannot manage back to a past forest condition. In order to do this, challenge the students to preserve a particular landscape in Minnesota's history. Divide the class into 4 groups. Assign each group a forest landscape from the "Back to the Future" worksheet. It will not take long for students to discover the challenges of preservation. Your role is to facilitate thinking and discussion. Ask your students questions such as: Is preservation possible? What are the competing interests? How do humans impact the forest landscape? What is the compromise? (20 min.)

CLASS PRESENTATION: Each group will be invited to present its forest type. Once each group has presented, the class may discuss which forest type to preserve. After each perspective has been discussed strive to design a plan that satisfies everyone. Is it possible to reach a consensus? What are barriers? (deer, human development, forest fires, inevitable change in forests) (25 min.)

Back to the Future—Managing Past Forest Landscapes

Background-
Minnesota forests have undergone major changes over time. Your teacher will assign you to one of the four past forest landscapes. Decide whether it is possible to re-create that landscape. What are the competing interests? How would you solve them?

Boreal Forest	**Mixed Hardwood Forests**	**Mixed Pine/Hardwood Forest**	**Oak Savannah**
The boreal forest existed for a brief period as the climate continued to warm about 11,000 years ago. The main tree species were spruce, jack pine, balsam fir, and birch. This forest type was maintained by periodic fires. The dominant mammal species was probably woodland caribou. <u>Issues</u> Cool, dryer climate White/red pine not here yet Few hardwood species Frequent fire dependent landscape	This forest occurred at about 10,000 years ago as the climatic warming continued. The main hardwood species were elm, ash, oak, and birch. This was a brief transitional forest between boreal and the mixed pine/hardwood forest. <u>Issues</u> Only lasted 500 years Warmer, wetter climate Current Elm population decimated by Dutch elm disease Ash production limited by current climate Birch declining due to climatic warming No pine component	Over the last 3,000 years, pine actually declined somewhat as the climate has transitioned to more cooler conditions. The forest was dominated by hardwoods, primarily quaking aspen, paper birch, red oak, and sugar maple. Major stands of red jack, and white pine still existed up to the European Settlement Period. Dominant mammals were still moose and woodland caribou. <u>Issues</u> Closest to our climate Fire needed to maintain the pine forests Negative deer impact on white pine Deer impact on woodland caribou – the two species cannot coexist on the same landscape due to a brain worm tolerated by deer but deadly to caribou	This scattered oak woodland/prairie type has existed in Minnesota from about 9,000 years ago to the European settlement period. Frequent fires maintained this oak woodland as a transition zone between prairie and forest in Minnesota. Oak Savannah has shifted about 100 miles east and then west during the climatic shifts of warming and then cooling. Major mammal species were elk, with some bison and white-tailed deer. <u>Issues</u> This is a very fire dependent landscape No fire allows the invasion of other tree species such as maple and basswood Bison and elk incompatible with current farming practices

My landscape is:_____

Given this landscape, could it be managed today? Why or why not?

How has the human population impacted the ability to preserve this landscape.

GLOSSARY:

Blister Rust—A disease introduced in about 1905 that has caused major mortality in White Pines. Pruning lower branches can reduce blister rust.

Bio-Diversity—An ecologically diverse forest includes a variety of tree species, animals, and plants. Such an abundance of unique life forms is called "biodiversity." Forest diversity has three levels: the composition of tree species; the structure – the age and size class of trees; and the distribution across the landscape including the size and shape of patches. Such diversity in trees buffers forest ecosystems against disturbance. With biodiversity, a forest is more prepared to withstand stresses by pathogens, insects, and climate changes than a forest with just one species and one age-class.

Biodiversity in forests provides wildlife habitat, which includes shelter, food, and water for wildlife. Since Northern Minnesota has an overlap of forest-types – both boreal, hardwood, and shrub forests, it ranks with Maine for having the greatest variety of bird species (150 species) in the North America. Dead trees left standing increase biodiversity by providing an excellent home and source of food for a variety of life including: wood-peckers, squirrels, and bark beetles. The red-backed vole, a mouse-sized rodent about 3-4.5 inches in length, relies on tree bark for food. They nest in trees of the boreal forest. Patches of young forest including patches generated by harvesting or fire provide habitat for animals such as deer and grouse.

Climate—This term is generally associated with variations of temperature and precipitation from one region to another. Climate has a major influence upon forest cover. Variations and extremes of temperature and precipitation from summer to winter seasons can have a dramatic effect. The occasional but normal development of severe storms is also a factor. Climate also influences ecological processes resulting in different vegetation cover. For example, fires will be more frequent in a colder, drier climate than a wetter, warmer climate.

Diversity—The variety and complexity of species, ages, and sizes present in an ecosystem and the relative abundance of each.

Dutch Elm Disease—A disease introduced in the 1950's that has eliminated nearly all of our forest and city Elms.

Ecological—Forests serve many ecological needs. One example is that forests provide clean water and clean air. Forests provide watersheds, which allow rainwater to be filtered through the earth before entering the ground water or other bodies of water. Trees have different capacities for holding water for photosynthesis. Some tree species such as the aspen are able to absorb water more quickly than others such as pines. Potentially a clear-cut or blow-down like in the Boundary Waters Canoe Area has a heavier water load into the ground water so there is not as much filtration taking place. Soils become flooded with water. A mature tree stand on the other hand, intercepts moisture through leaves

and roots. Some studies have shown that it takes fifteen years for water filtration to return to the original rate following a regenerating clear-cut harvest. Also, the forest purifies the air. Leaves transform carbon dioxide into oxygen through the process of photosynthesis.

Economic— Jobs, Timber products, recreation (eco-tourism, skiing, hunting, bird watching, biking, food, land value). Over 3.5 million people visit Duluth to experience the north woods each year. Their economic impact has been calculated as $400 million per year.

Ecosystem — An interacting system of living organisms (plants and/or animals) soil and climate factors.

Environmental — a description of the aggregate of all the external conditions and influences affecting the life and development of an organism.

European Contact — (Pre European Settlement)
This is the period of European exploration and fur trade. In northern Minnesota, it was generally from 1650 to 1850 A.D.

European Settlement –- Shortly after 1850 A.D., extractive activities resulted in major changes to the Northern Minnesota forested landscape. Permanent settlement occurred to support logging, agriculture, and mining. The greatest expansion of settlement occurred between 1880 and 1910.

Fire-Dependant Species — Each of the following species needs a disturbance such as fire that exposes mineral soil necessary for the species to sprout: Jack Pine, Red Oak, Red Pine, White Pine, Paper and Yellow Birch

Fire-Resistant Species –- Each of the following species has thick bark that resists damage from a moderate ground fire: Red Pine, White Pine, and generally Oaks.

Forest Fires — Fires that are caused by humans or lightning. There are two main fire types:

- Catastrophic (Crown) Fires caused by an abundant fuel load and strong winds burn an entire forest stand. A new stand must develop from regeneration. Catastrophic fires were probably more common during the historic period of logging and land clearing for farms.

- Low-Intensity (Ground) Fires burn only the lower portions of a forest stand, primarily the brush layer and ground "duff" layer and do not affect large trees. Tree regeneration occurs under the mature forest canopy. This type of fire generally burns with a moderate fuel load and light winds. Low-intensity fires were probably more common in the prehistoric period following de-glaciation but some crown fires certainly did occur.

Forest Fire Suppression—The intentional reduction or elimination of fires. This form of management has been practiced on most of the Minnesota landscape for over 60 years and has changed the ecology of both grasslands and forests.

Forest Management—An intentional method of shaping our forests for timber values, wildlife habitat, watershed, aesthetics, and recreation. Suppressing forest fires is one form of management that has been practiced.

<u>Landscapes of Minnesota: Historical and Present</u>: (see diagram)

- **Prairie—**(South-West and Western Minnesota) This landscape is presently dominated by agriculture. Only about 1% of the (historical) native prairie is left. Frequent fires that occurred on the prairie have been eliminated.

- **Oak Savannah –-** (100 mile wide band running NW to SE in central Minnesota). Scattered woodlands of primarily Bur Oak dominate this area. Much of the area is now agricultural. Sugar Maple, Basswood, Elm, and Quaking Aspen have invaded this area due to the elimination of frequent fires.

- **Mixed Hardwoods/Pine** – (NE and North-Central Minnesota)**.**
  These forests are dominated by Quaking Aspen, Paper Birch, Red Oak, Elm, Sugar, and Red Maples, White and Red Pines. Associated species include Yellow Birch, Cedar, Balsam Fir, and White Spruce.

- **Boreal Forest—** The boreal forest consists of trees characteristically northern or Arctic. The boreal forest was the first forest type to appear in this area after the glacier receded 11,000 years ago. Key trees species are: Black Spruce, Balsam Fir, Jack Pine and Paper Birch. Common associates are: Aspen, Balsam Poplar, White Cedar, and Red Maple. This forest type was maintained by periodic fires. A true boreal forest does not exist in northern Minnesota. However, Balsam Fir and White Spruce are common north of Lake Superior. Also, some boreal-like patches of Jack Pine, upland Black Spruce and Paper Birch occur in very scattered areas of North East Minnesota, primarily within the Boundary Waters Canoe Area Wilderness.
  -NOTE- Present Pine cover (Red, White, Jack) in northern Minnesota is under 10%. Prior to European Settlement Pine cover was about 25-30%. The main reasons for this decline was logging of the pines followed by catastrophic fires and then fire suppression, allowing more hardwoods to dominate the landscape. Also, Elm is nearly non-existent in our present day hardwood forests due to Dutch Elm disease.

Landscapes of Minnesota; Prehistoric (see diagram)

The progression of landscape types in northern and central Minnesota 13,000 years ago to 1650 AD are as follows:

De-Glaciation→Tundra→Tundra-Parklands→Boreal Forest→Mixed Hardwood Forest→Mixed Pines/Hardwood Forest with some Oak Savannah and Prairie Grasslands→Mixed Hardwoods/Pine Forest

-NOTE- The peak of post-glacial warming occurred about 7,000 years ago. At this time Prairie Grasslands occupied nearly ¾ of Minnesota. Only NE Minnesota east of a line from about 40 miles west of Duluth to Hibbing to about International Falls remained forested. This was the Mixed Pine/Hardwood Forest. To the SW was a band of Oak Savannah bordering on the Prairie. In the last 4,000 years the climate has cooled and the forests of northern and central Minnesota gradually shifted to a Mixed Hardwood/Pine type. Here are some more details:

- Tundra –
  This landscape type existed soon after the glaciers receded and consisted primarily of grasses, sedges, and shrubs such as dwarf willow and birch. Climate was cold but was progressing to warmer conditions at this time. Large mammals (now extinct) such as mastodon, wooly mammoths and arctic bison (13,000 years ago).

- Tundra-Parkland –
  This landscape consisted of tundra with significant patches of woodlands. These woodlands contained spruce, willow, balsam poplar, and shrubs of dwarf birch and alder. Climate was relatively cool and wet but was progressing to warmer conditions. The large mammals of the tundra were probably still in existence with the addition of barren ground caribou (12,000 years ago)

- Boreal Forest –
  The boreal forest existed as the climate continued to warm for a brief period about 11,000 years ago. The main tree species were spruce, jack pine, balsam fir and birch. This forest type was maintained by periodic fires. The dominant mammal species was probably woodland caribou.

- Mixed Hardwood Forests –
  This forest occurred at about 10,000 years ago as the climatic warming continued. The main hardwood species were elm, ash, oak, and birch. This was a brief transitional forest from boreal to the mixed pine/hardwood forest.

- Mixed Pine/Hardwood Forests –
  This forest existed in Northeastern Minnesota during the long period of climatic warming 9,000 – 3,000 years ago. Dominant tree species were Red and Jack Pines, Elm, Ash, and Oak Hardwoods. Occasional to frequent fires maintained the dominance of pine. At the peak of climatic warming about 7,000 years ago. White pine entered the state from the east and became part of the mixed pine/hardwood forest. Dominant mammals were moose and woodland caribou.

- Mixed Hardwood/Pine Forest— see diagram
  The composition of this forest was similar to historic and present forests. Over the last 3,000 years, Pine actually declined somewhat as the climate transitioned to cooler conditions. The forest became more dominated by hardwoods, primarily Quaking Aspen, Paper, Birch, Red Oak, and Sugar Maple. Dominant mammals were still moose and woodland caribou.

- Oak Savannah – se diagram
  This scattered oak woodland/prairie type has existed in Minnesota from about 9.000 years ago to the present. Frequent fires maintained this oak woodland as a transition zone between prairie and forest in Minnesota. Oak Savannah has shifted about 100 miles east then west during the climatic shifts of warming and then cooling. Major mammal species were elk, with some bison and white-tailed deer.

Mosaic – A patchwork or diverse forest types and age-class

Nutrient Cycle –
The natural cycle of a forest goes from birth to life to death to rebirth. In essence, destruction is necessary for life. When a tree dies, the nutrients break down into valuable organic material that enables new growth in the forest.

<u>Prehistoric Native Cultures</u>:

- **Paleo-Indian Tradition—**(12,000—8,000 years ago) Nomadic hunters who pursued now extinct large mammals, for example, the cold adapted, grassland-dwelling wooly mammoth and mastodon.

- **Archaic Tradition—**(8,000—2,800 years ago) peoples of this period were noted for increased tool-use including the use of stone projectile and copper. First evidence of fire used as a tool for manufacturing dugout canoes

- **Woodland Culture—**(2,800 to 300 years ago) Peoples of this period were noted for their greater dependence on fishing and later on wild rice harvesting. These people used more water-based transportation; developed use of pottery, built burial mounds, and in the later years used birch bark canoes. Base camps would be revisited seasonally.

Preservation –

To protect, maintain, or keep alive (Webster's). Note that it is difficult to preserve a forest, a living system that is dynamic and ever changing. It does not remain static.

Social –

Outside of the economy, there are social benefits of the forest that include quality of life, solitude, recreation, beauty and shelter.

Sustainability –

A plan, which strives to meet the needs of the present without compromising those of the future. An example of a sustainable forest management plan is that the volume of wood removed from a given area is equal to growth within the total forest minus loss from natural causes i.e., wind, fire, insects, and disease.

Tree Species of Minnesota, a Summary:

- Northern Minnesota: Quaking Aspen, Balsam Poplar, Paper & Yellow Birch, Sugar Maple, Red Maple, Red Oak, Basswood, Black (swamp) Ash, Elm, Cedar, White Spruce, Black (bog) Spruce, Balsam Fir, Red Pine, White Pine, and Jack Pine.

- Southern Minnesota: Sugar Maple, Basswood, White Oak, Elm, Shagbark Hickory, and Butternut.

- Central Minnesota: (Oak Savannah) principally Bur Oak, with some Basswood, Sugar Maple, Elm, and Quaking Aspen.