

Lesson Three

The Natural Divisions of Wisconsin

CONCEPTS

- There are six major natural divisions of forested areas in Wisconsin, each with distinct forest types.
- The distribution of forest types in Wisconsin is directly related to glacial history, topography, climate, soil types, human activity, and other disturbance factors.
- Humans have dramatically altered the location, extent, and composition of our forests.

OBJECTIVES

Students will be able to:

- Recognize Wisconsin's major forest types and list two tree species from each.
- Differentiate the six natural divisions in Wisconsin and describe the major forest types present.
- Describe the influence that the tension zone and landscape have on Wisconsin's natural divisions and resultant vegetative types.

TEACHING SITE

Indoor classroom with overhead projector and chalkboard.

MATERIALS

Copies for each student of the:

- Natural Divisions Information Chart Handout
- Landforms of Wisconsin Map

Transparencies of the:

- Natural Divisions of Wisconsin Map
- Wisconsin Tension Zone Map
- Landforms of Wisconsin Map
- Wisconsin Glaciation Map
- Wisconsin Continental Divide Map
- Current Land Use Map
- Forest Type Pictures

LESSON TIME

One 50-minute class period

NUTSHELL

Students will be introduced to the major forest types of Wisconsin and the trees that compose them. They will transpose features from glacial history and climatic maps onto a map of Wisconsin. They will compare these features with the boundaries of Wisconsin's forest types. Upon completion, they will compare the natural divisions of the Wisconsin map to a current land-use map.

TEACHER PREPARATION

Copy all handouts and transparencies listed in the Materials section. Read the background information and review the background information from the last lesson.

BACKGROUND INFORMATION

Natural Divisions in Wisconsin

Forests progress through different successional stages as they grow older. Each stage differs in forest composition and structure. The forest game in the last lesson gave a simplified view of the possible successional pathway that a particular forest undergoes through time. There are many different forest types in Wisconsin, each having different trees, disturbances, and site conditions. In the competition game, the forest type used is found in the Northern Highlands Area of Wisconsin. The Northern Highlands Area represents one of six natural divisions in Wisconsin, including the Superior Lowland, Lake Michigan Shoreland, Central Sand Plains, Southeastern Ridge and Lowlands, and the Southwestern Upland. Each of these divisions is separated from the others based on differences in climate, past glaciation, resultant topography, and soils.

Forest Classification

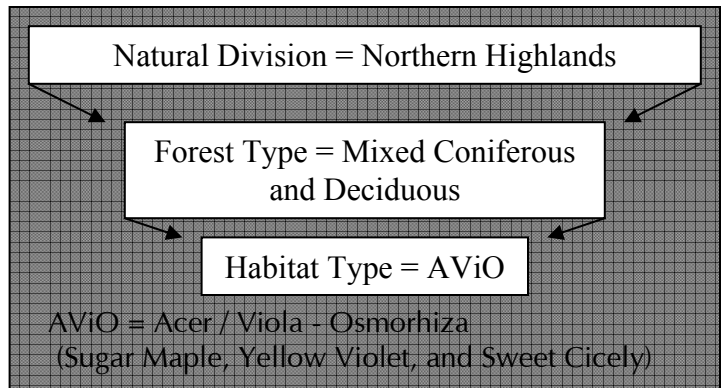
Forest classification throughout Wisconsin can be visualized as a hierarchy, with the natural division being the broadest category, then the forest type (coniferous, deciduous, etc.), and lastly the forest habitat type (usually labeled with the first initials of the scientific names of the dominant trees and plants present). For example, the site for our competition can be seen as having the hierarchy that is shown on the next page.

This hierarchy suggests that on a forest type map of Wisconsin you would initially see very large generalized forested divisions in Wisconsin (the natural divisions). Within these large divisions it would then be possible to see the different forest types that occur throughout the regions (coniferous, deciduous, etc.). The forest types would then also be divided into smaller forested areas based on the dominant trees that are there or the potential dominant trees that will occur there. These smallest divisions are the habitat types.

Potential habitat types are determined by the plant communities that exist in the forest at that particular point in time. More recently the Department of Natural Resources and the U.S. Forest Service have been working on a system of forest classification known as the National Hierarchy of Ecological Units. This method of dividing the landscape is proving to be the foundation of sound ecosystem management. The system is much more complex than the hierarchy presented here, but is based on the same general principles. As computer technology advances and more is known about our natural landscapes, systems such as these will be in use for much of Wisconsin and the United States.

Forest Types

The natural divisions of Wisconsin contain one or more forest types. The major forest types found throughout Wisconsin are deciduous, coniferous, boreal, pine and oak barrens, oak woodland, and oak savanna. **Deciduous** forests are composed of trees that survive winter by having a dormant period, losing their leaves in the fall and regaining them once again in the spring. **Coniferous** forests are composed of trees that have cones and needles. Most coniferous trees in Wisconsin, with the exception of tamarack, keep their needles throughout the winter season. Many forests in Wisconsin are **mixed coniferous and deciduous** forests meaning that both coniferous and deciduous trees are present. A **boreal forest** is made up of mostly cold-tolerant coniferous trees. A boreal forest



occurs when cold temperatures stop the growth of most or all deciduous trees, leaving only coniferous trees. An **oak woodland** is a dense stand of trees very similar to a deciduous forest, but contains mainly oak tree species. An **oak savanna** is a shaded mixture of oak trees and grasses. It can be visualized as intermediate to a prairie and an oak woodland. Today in Wisconsin, oak savannas make up less than 0.1% of their original distribution. **Oak-pine barrens** are composed of jack pine and/or oak trees usually of a similar age and height (even-aged). These barrens are dependent on fire disturbances and particularly sandy soils to maintain the oak and jack pine composition and the even-aged structure.

Factors That Define Natural Divisions and Resulting Forest Types

The Natural Divisions of Wisconsin and their specific forest types are caused predominantly by differences in climate and topography. *The natural divisions may be best understood by using the maps provided within the activity in order to visualize the relationships.*

Climatic Zones

The state is divided climatically into a Northern and Southern Climatic Zones. The Tension Zone, shown as a band on the map, divides these two zones. North of the tension zone, the climate is characterized by a high frequency of cool, dry arctic air from Canada. Winters are longer with more snow and colder temperatures. South of the tension zone, climate is controlled by air from the

Pacific Ocean meeting with tropical air from the Gulf of Mexico. These interactions produce warmer winters with less snow and longer summers with more rainfall. The Wisconsin Tension Zone forms the division line between the northern forests of the state and the southern forests, savannas, and prairies. The zone is represented as a band. The northern line of the band represents the farthest extent that southern forest types are found. The southern line of the band similarly represents the farthest south that the northern forest types are found. Within the Tension Zone, both types may be found interspersed.

An additional climatic zone exists in northern Wisconsin in the **Lake Superior Lowland**. This area in the northwest corner of the State is subject to the cold winds that blow over Lake Superior. This “lake effect” lowers the temperature, increases snowfall, and as a result influences the vegetation that grows there. The climate throughout the lowland creates the boreal forest that characterizes the vegetation within this natural division.

Glaciation

The glacial history of Wisconsin has also helped to form the natural divisions of the state. Glaciation has created three natural dividing features within the state. Those features are: 1) the division between the driftless area (unglaciated) and the rest of the state, 2) the sand deposits that distinguish the central portion of the state, and 3) the continental divide.

The **Southwestern Upland** division, otherwise known as the “driftless area”, was never subject to glaciation and remains rugged with old, well-formed river valleys. This older landscape hosts a unique pattern of vegetation. As the glaciers moved across the rest of the State, the old surface features of the State were smoothed over and a new young soil began to form. These younger soils host the trees and plants of the rest of the state.

The southern movement of the glaciers across the state formed elevated ridges known as moraines. These moraines work to divide the state into different regions. One major moraine forms a natural division in Wisconsin’s forested land. The north-south ridge divides the state into an eastern 1/3 and a western 2/3. Another ridge in the northern part of the state is also a result of Wisconsin’s historic topography and most recent ice-age. This ridge separates the **Lake Superior Lowland** from the rest of the state.

Each of these ridges acts as a continental divide that separates the state into three distinct water basins. Water north of the east-west ridge drain to Lake Superior. Water south of this ridge is divided by the north-south ridge. Water east of this divide drains to Lake Michigan; water west of the divide drains to the Mississippi River. This separation creates differences in climate patterns and soil types.

The continental divide separates the **Northern Highland** from the **Lake Michigan Shoreland** and also helps to separate the **Southeastern Ridge and Lowland** from the **Central Sand Plain** and **Southwestern Upland**. The divide that borders the **Lake Superior Lowland** confines the lake effect climate of that area.

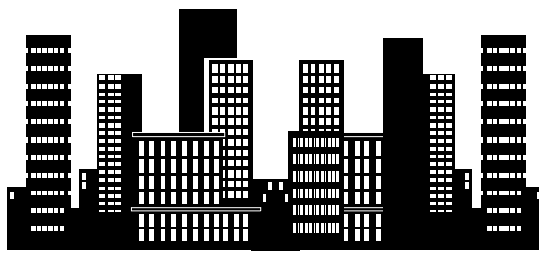
The glaciers that moved over the state also deposited different materials on the landscape. One major deposit lies in the middle of the state. As the glaciers melted and retreated northward, large amounts of sand and water washed into the central area of Wisconsin. This outwash created what geologists call Glacial Lake Wisconsin. The action of the water and sand in the lake deposited the sands and created the flat, sandy area known as the **Central Sand Plain**. The soils throughout this area have high amounts of sand and create a unique environment for trees and plants.

ACTIVITIES

1. Begin the activity by asking your students why they live in their community. Have them share what reasons they have for living where they do. If needed, guide their answers with additional questions so they come up with most of the following answers:

My parents live here, my grandparents live here, my parent's jobs are here, this is a safe place for kids to grow up, the schools are great in this community, everything we need to live is within driving distance, etc.

Tell your students that each of these factors relate to why they live in their community.



Using another community in Wisconsin that would be very different than yours, ask them if they think it would be easy for them to live in the other community, *i.e. would it be easy for them to live in Milwaukee instead of Amherst Junction?* Ask them what differences there would be between these two communities. *Size, jobs, crime, goods and services, etc.*

Tell the students that just like these two communities are different, so too are our forest communities different in Wisconsin. Whether a person lives in either a rural community or a city community is dictated by many factors that occur before they arrive, such as the job market, family ties, or activities the individual enjoys. Tell the students that in their community it may be a parent's job or family ties that keep them in their particular community. Ask the students if they can think of reasons why different types of forest communities are found in different regions of the state. *Climate, soil type, topography, glaciation, disturbances, human activity.* Tell the students that today they will discover what factors influence the location of forest types in Wisconsin.

2. Pass out the **Natural Divisions Information Chart** and the **Landforms of Wisconsin Map**. Using an overhead of the **Forest Type Pictures** and referring to the **Natural Divisions Chart**, discuss with your students what forest types are found in the six natural divisions of Wisconsin. Highlight the specific tree species present in each forest type. Refer back to the previous lesson on succession. Ask students in which natural division they think the hemlock/sugar maple forest would have been found. *Northern Highland*. Ask them if they think that the entire Northern Highland area has only these species of trees. Tell them that the area is made up of many different trees, each competing with the other species present.

Tell them that although there may be many different kinds of forests throughout a natural division, the environmental conditions within the natural division are very similar. Again ask the students to brainstorm what factors or environmental conditions limit where certain trees may grow. *This list should include temperature and moisture (climate), soil characteristics (rocky, sandy, mucky, etc), the shape of the land (topography/landforms), and the types of disturbances that occur.*

3. Tell the students that climatic differences across the U.S. produce what's known as a tension zone in Wisconsin. Ask them if they have ever taken an ice cube out of the freezer and let it melt. Ask them why it melted. Tell the students that the climate inside the freezer is very different from the climate outside the freezer and as a result, an ice cube does not last outside of the freezer. Tell them that the freezer door separates the outside warmth from the inside cold. The thickness of the freezer door spans an area that separates two very distinct climates. In nature, we refer to an area that separates two distinct climates as a **tension zone**.

Put the map of the **Wisconsin Tension Zone** on the overhead. Explain to the students that the tension zone separates the cool northern climate brought by arctic air from the warm southern climate produced by Pacific and gulf air. Tell the students that the areas above the tension zone and below the tension zone represent two different climates. Ask the students what effects they think the difference in climate has on determining the species of trees present. Refer back to the ice cube. Tell them that just like the ice cube many tree species can only prosper and survive in the northern or southern climates. Referring to the overhead, tell them that the top line of the tension zone represents the maximum distance northward that many southern trees can survive and the bottom line represent the max distance southward for many northern trees. Tell them that in between the two lines is a mixing zone made up of both southern and northern tree species. Have the students draw the tension zone onto their **Landforms of Wisconsin Map**.

4. Put up an overhead of the **Landforms of Wisconsin Map**. Ask your students if they see different patterns. Help them discriminate between flat and rough areas. Brainstorm the reasons for why the landscape looks the way that it does. Tell them that glaciers have had the most significant influence on the shape of Wisconsin's land. Ask them to identify any major features on the map.



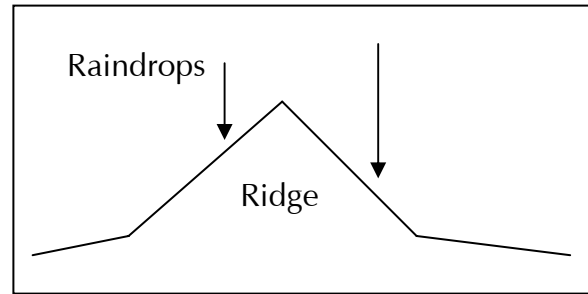
Put up the overhead of the **Wisconsin Glaciation Map**. Point out the driftless area of southwest Wisconsin and the sandy outwash area in the center of the state. Tell the students that glaciers never reached into these areas. Ask students how these areas differ from other regions of the state.

Ask students to identify the difference between the Central Sand Area and the Driftless Area. Point out the well-defined streambeds in the Driftless Area and the patterns that result. Ask the students if these valleys took a long period of time or a short period of time to form. Tell the students that this area of land was never scraped away by glaciers; therefore it is much older than the rest of the state.

Ask the students why the Central Sand Plain and the Driftless Area look so different if both of them remained unglaciated. Explain that as the glaciers melted they created large streams and rivers. The large amounts of water eventually formed Glacial Lake Wisconsin. The actions of these water bodies deposited sand throughout the region. Tell the students that this sand filled up all of the valleys and features in central Wisconsin creating this flat featureless area. Tell them that even today all of the soil in this area is made up mostly of sand. Have them draw both of these areas on their **Landforms of Wisconsin Map**.

Referring to your copy of the **Wisconsin Continental Divide Map** (don't put this overhead up yet), show your students the distinct wavy line that runs east to west in the most northern part of the state and the ridge that runs north to south in the eastern part of the state (it begins just east of the Central Sand Plain and runs northward). Explain to them that these are high points or ridges left behind by the glaciers. Draw a cross section of a ridge on the chalkboard that looks like the diagram below.

Tell the students that this drawing represents the end-view of a ridge. The arrows represent raindrops falling from the sky. Draw just one arrow at a time and ask the students which way they think the raindrop is going to flow after it hits the ridge. Tell them that all of the water that hits on the left of the peak will flow left and all of the water that lands on the right of the peak will flow right. Tell them that the top of the ridge is called a divide because it divides the way in which the water flows. Put up the **Wisconsin Continental Divide Map**.



Ask the students why it might be called the continental divide. Tell the students that all of the water that lands to the north and east of the continental divides will flow into streams and rivers that eventually flow into the Great Lakes. Likewise, all of the water that lands to the south and to the west of the continental divides will flow into streams and rivers that eventually flow into the Mississippi River.

Have them draw the continental divide onto their **Wisconsin Landforms Map**. Explain that the divide creates differences in temperatures and weather patterns. Tell the students that the colder temperatures and higher snowfall in the Lake Superior Lowland provides the conditions needed for the boreal forest. These cold temperatures are a result of the cold air coming off of Lake Superior. This "lake effect" cold air and snowfall is stopped by the ridge.

- Put up the overhead of the **Natural Divisions of Wisconsin**. Ask your students if they see any similarities between the **Natural Divisions of Wisconsin** and their **Wisconsin Landform Maps** on which they have drawn boundaries of glaciation and climate. Invite students up to the overhead to show where these lines correlate. Have your students use their map to fill in the **Natural Divisions Information Chart**.

After the chart is filled in, overview the differences between each of the areas. Explain that the factors outlined on the map create differences in environmental conditions and affect the types of trees that grow within each area.

CONCLUSION

Tell your students that they have just looked at how the physical environment of Wisconsin has affected where and what types of forests grow in our state. Ask them if they can think of any other factors that we have not talked about today that might affect where and what types of forests are present. *Human impact*. Put up the overhead of the **Current Land Use Map**. Have your students compare the **Current Land Use Map** to their **Wisconsin Landforms Map**. Ask if any similarities exist.

Have the students look at their **Natural Divisions Landform Chart**. Tell the students that before Wisconsin was settled, the forest types shown on their chart covered the landscape. Ask the students if they think that human use of the land over time has affected the distribution of forests in each of the natural divisions. Ask the students where on the map they think humans have changed the forest. They will most likely recognize the area listed as agriculture, but may not recognize the forested Northwoods. Tell them that in fact, all of our forests have been altered over time. Tell the students that they will be introduced to our land-use history in the next class.



Student Log Book

Ask students to write a paragraph describing the natural influences on Wisconsin's forest types. Students should incorporate their knowledge of the tension zone, glacial history, and general landscape of Wisconsin in their discussion.

Web Links

Wisconsin Department of Natural Resources— <http://www.dnr.state.wi.us>

US Forest Service—<http://www.fs.fed.us>

The Department of Botany at the University of Wisconsin-Madison—
<http://www.wisc.edu/botit/links.html>

References

Hole, Francis D. 1980. Soil Guide for Wisconsin Land Lookers. Geological and Natural History Survey and University of Wisconsin Extension. Bulletin 88. Soil Series 63.

Hole, Francis D. and Germain, Clifford E. 1994. Natural Divisions of Wisconsin. WDNR Publication. Madison, Wisconsin.



Wisconsin Forest Types



1) **Prairie** – notice the absence of trees



2) **Deciduous Forest** – mixture of broadleaf trees with no evergreen trees



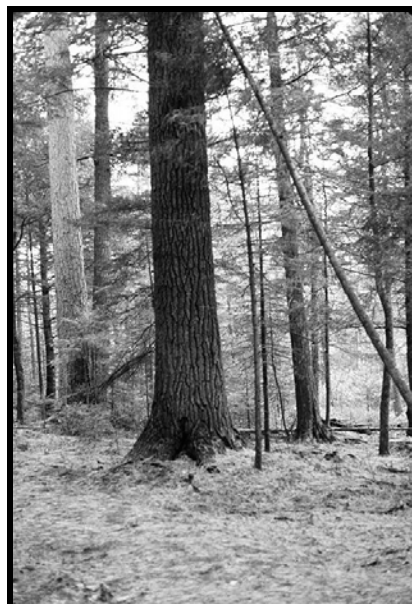
3) **Boreal Forest** – all northern evergreen trees



4) **Oak Savanna** – widely spaced, mixed oak trees with no understory



5) **Pine Barren** – even aged stand of jack pine trees



7) **Coniferous Forest** – mixed evergreen trees



6) **Mixed Forest** – a mixture of deciduous and coniferous trees



8) **Oak Woodlands** – forested area with mixed oak trees

NATURAL DIVISIONS INFORMATION CHART

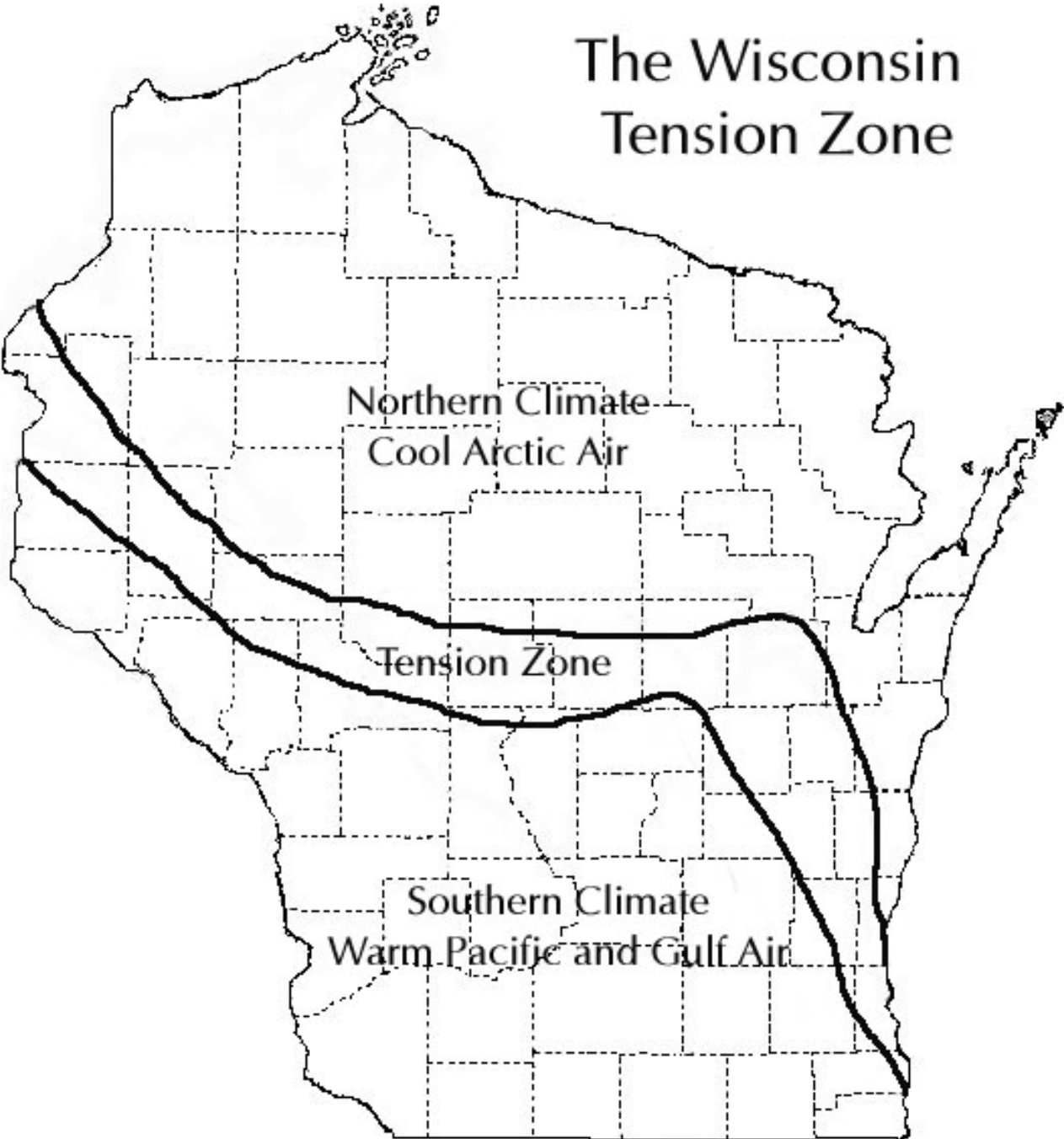
Natural Divisions	Superior Lowland	Northern Highlands	Lake Michigan Shoreland	Central Sand Plains	Southeastern Ridge and Lowlands	Southwestern Highlands
Forest Types with Examples of Tree Composition	Boreal – Balsam Fir White Spruce Black Spruce White Cedar White Pine Tamarack	Coniferous – White Pine Red Pine Hemlock Balsam Fir	Coniferous – White Pine Hemlock White Cedar White Spruce	Oak/Pine Barrens – Jack Pine Hill's Oak Black Oak	Oak Savanna – White Oak Bur Oak Black Oak Red Oak	Oak Savanna – Bur Oak White Oak Hill's Oak
Climate Zone (Southern, Northern or Lake Effect)		Deciduous – Sugar Maple White Birch Yellow Birch White Ash Basswood	Deciduous – Beech Sugar Maple Yellow Birch	Oak Woodland – Hill's Oak Black Oak White Oak Bur Oak Pin Oak	Deciduous – Sugar Maple Basswood Elm Hickory Red Oak	Deciduous – Sugar Maple Silver Maple Basswood Willow
Glacial History (Glaciated, Sandy Outwash or Unglaciated)						
Continental Divide (North, Northeast or Southwest)						

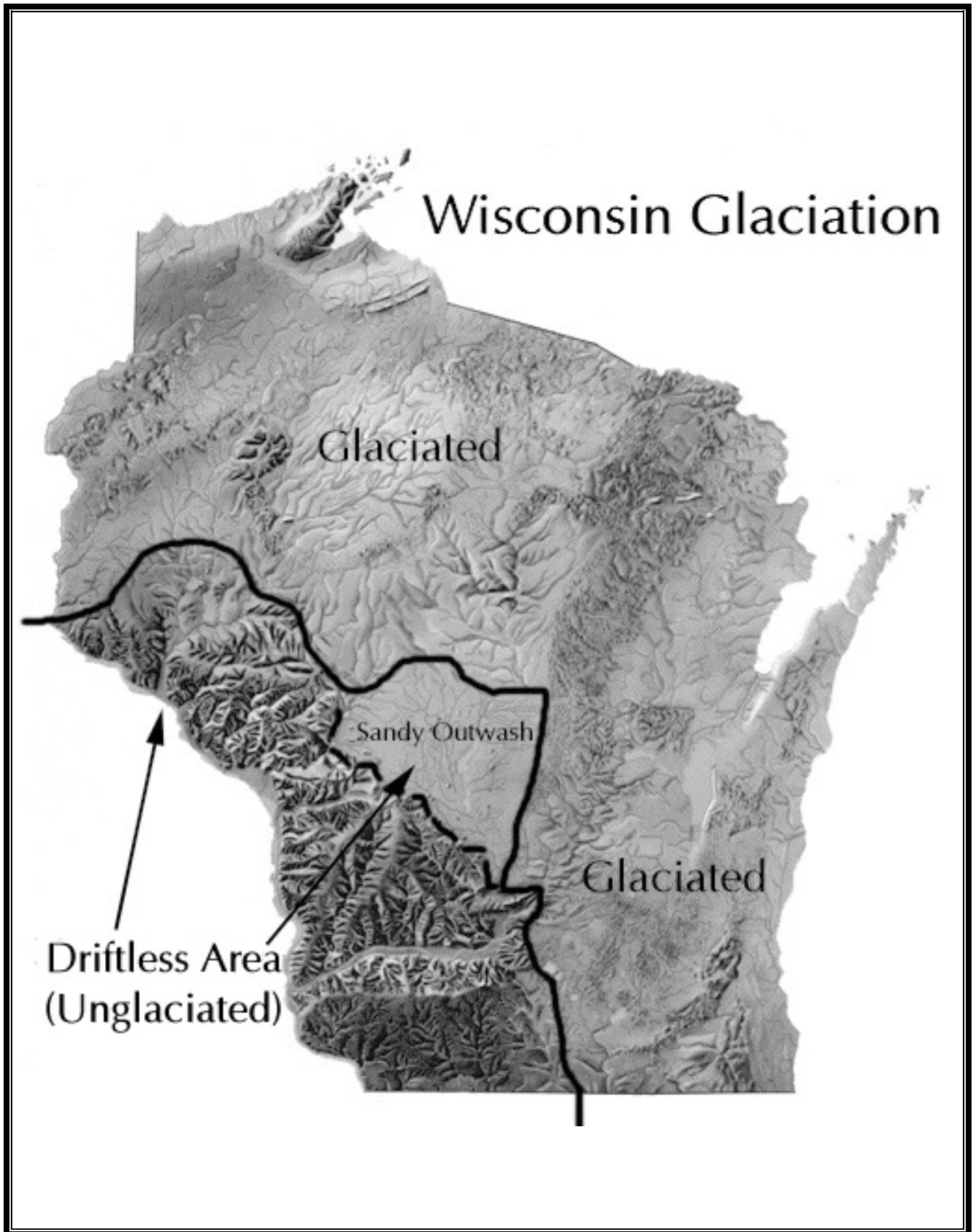
Landforms of Wisconsin



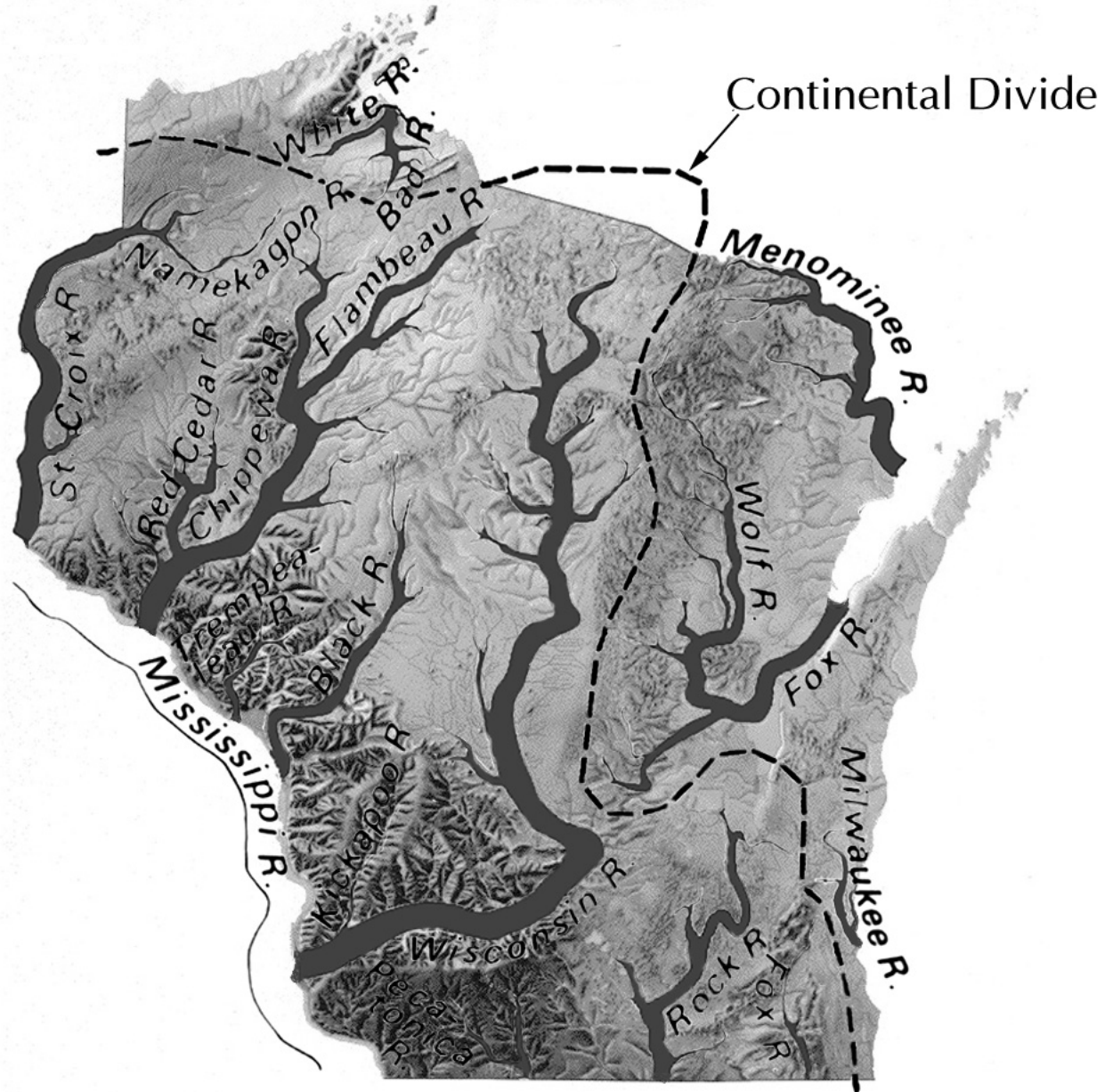


The Wisconsin Tension Zone

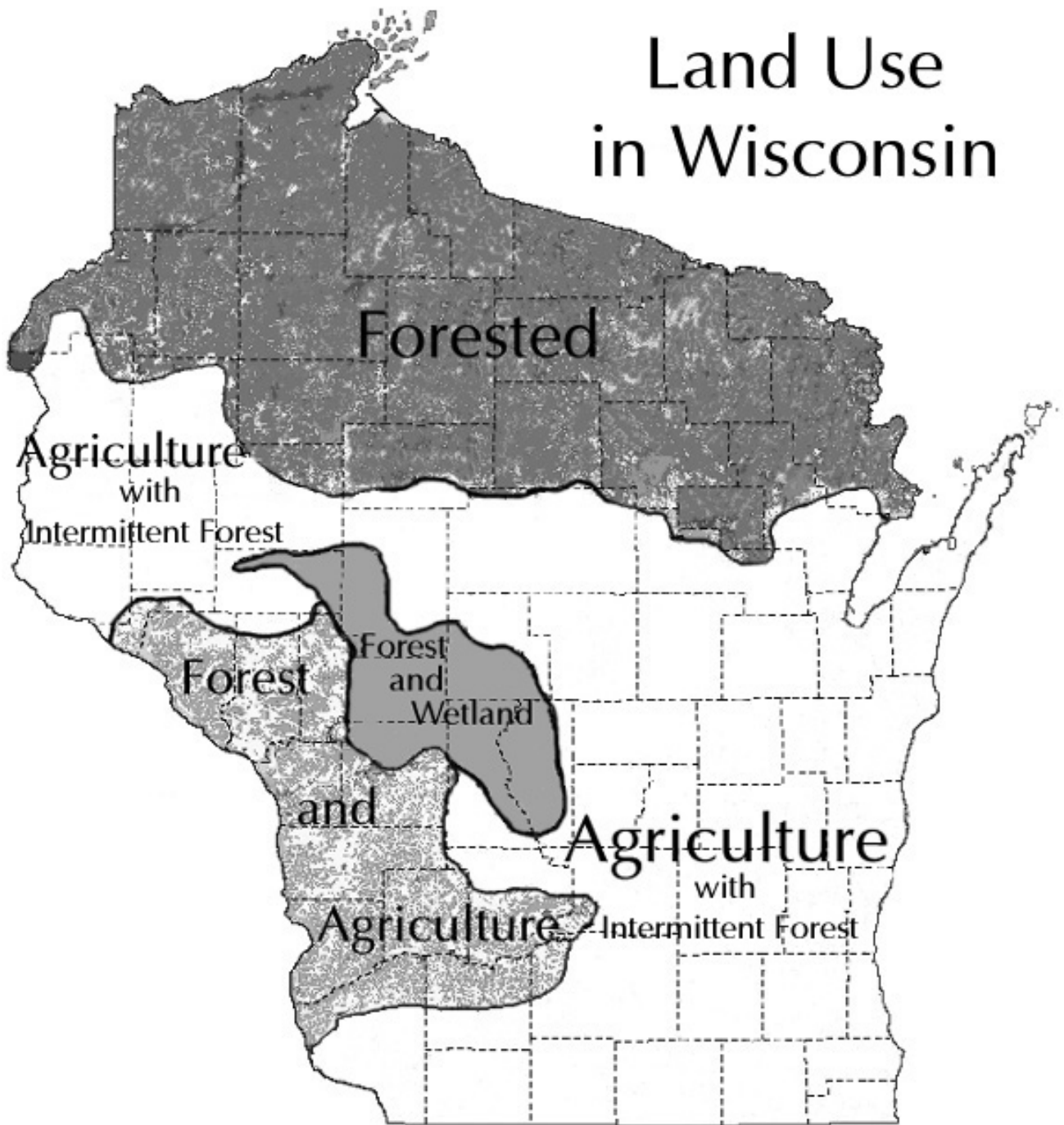




Wisconsin Continental Divide Map



Land Use in Wisconsin



NATURAL DIVISIONS INFORMATION CHART (ANSWER KEY)

Natural Divisions	Superior Lowland	Northern Highlands	Lake Michigan Shoreland	Central Sand Plains	Southeastern Ridge and Lowlands	Southwestern Highlands
Forest Types with Examples of Tree Composition	<p>Boreal –</p> <p>Balsam Fir White Spruce Black Spruce White Cedar White Pine Tamarack</p>	<p>Coniferous –</p> <p>White Pine Red Pine Hemlock Balsam Fir</p>	<p>Coniferous –</p> <p>White Pine Hemlock White Cedar White Spruce</p>	<p>Oak/ Pine Barrens</p> <p>–</p> <p>Jack Pine Hill's Oak Black Oak</p>	<p>Oak Savanna –</p> <p>White Oak Bur Oak Black Oak Red Oak</p>	<p>Oak Savanna –</p> <p>Bur Oak White Oak Hill's Oak</p>
Climate Zone (Southern, Northern or Lake Effect)	<p>Lake effect or northern (lake effect is not on the map but the concept is in the background information so students may have either answer)</p>	<p>Deciduous –</p> <p>Sugar Maple White Birch Yellow Birch White Ash Basswood</p>	<p>Deciduous –</p> <p>Beech Sugar Maple Yellow Birch</p>	<p>Oak Woodland –</p> <p>Hill's Oak Black Oak White Oak Bur Oak Pin Oak</p>	<p>Deciduous –</p> <p>Sugar Maple Basswood Elm Hickory Red Oak</p>	<p>Deciduous –</p> <p>Sugar Maple Silver Maple Basswood Willow</p>
Glacial History (Glaciated, Sandy Outwash or Unglaciated)	Glaciated	Glaciated	Glaciated	Sandy outwash	Glaciated	Unglaciated
Continental Divide (North, Northeast or Southwest)	North	Southwest	Northeast	Southwest	Southwest	Southwest