

Lesson 1: Discovering Wisconsin's Forests

NUTSHELL

In this lesson, students compare temperature and precipitation data from three forest biomes of the world — tropical rainforests, temperate forests, and boreal forests. They discover which biome Wisconsin is in and learn about six types of forests found in that biome by watching a short video. Through a mapping activity, students explore the factors that influence the location of the different types of forests. As a conclusion, students present their findings in a travel brochure.

ENDURING UNDERSTANDINGS

- Different forest biomes exist around the world. Examples of forests that grow in some of the biomes include tropical forests, temperate forests, and boreal forests. Wisconsin is in the temperate forest biome.
- Different types of forests exist within a biome. Some of the types of forests in Wisconsin include coniferous, deciduous, and deciduous and coniferous mixes.
- Regions in Wisconsin differ in climate (e.g., precipitation, temperature) and the results of glaciation (e.g., soil, topography). These variations lead to different forest communities with differing species, thereby contributing to biodiversity.

ESSENTIAL QUESTIONS

- How do climate, soils, and topography affect the location of types of forests in Wisconsin?
- What factors can be used to compare Wisconsin's forests to each other?

OBJECTIVES

Upon completion of this lesson, students will be able to:

- Differentiate between biomes of the world and distinguish which forest biome Wisconsin is in.
- Compare and contrast different types of forests within Wisconsin.
- Summarize how climate, soils, and topography affect the location of different types of forests in Wisconsin.

SUBJECT AREAS

Arts, Language Arts, Mathematics, Science

LESSON/ACTIVITY TIME

Total Lesson Time: 115 minutes + Concluding Activity

- Introduction15 minutes
- Activity 140 minutes
- Activity 230 minutes
- Activity 330 minutes
- Concluding project can be done as homework or in class. If in class, allow one 50-minute period.

STANDARDS CONNECTIONS

Standards for this lesson can be viewed online at the LEAF website (www.leafprogram.org).

FIELD ENHANCEMENT CONNECTIONS

This lesson ties closely with **Field Enhancement 1, Tree Identification**.

MATERIALS LIST

For Each Student

- Copy of Student Page  **1, Biome Data**
- Calculator
- Graph paper (optional)
- Copy of Student Page  **2, Wisconsin's Forest Communities**
- Copy of Student Page  **4, Wisconsin's Forest Communities Travel Brochure Rubric**
- Supplies for creating a travel brochure

For the Teacher

- Copy of Teacher Page  **3A-B, Wisconsin's Forest Communities Video Script**
- Student Pages  **3B, Forests in Wisconsin Aspen/Birch** and  **3E, Forests in Wisconsin Oak/Hickory**, to project
- Color versions of Student Pages  **3A-F, Forests in Wisconsin**, from the LEAF website (www.leafprogram.org) to project

NOTE: Electronic versions of projected images are available on the LEAF website at www.leafprogram.org.

For the Class

- Four meters of adding machine tape (or any paper that can be cut into long strips)
- Ruler with centimeters
- Teacher Page  **1, Biome Precipitation Graphs**, to project
- Teacher Page  **2, Biome Temperature Graph**, to project
- [Wisconsin's Forest Communities](http://www.leafprogram.org) video from the LEAF website (www.leafprogram.org)
- Copy of Student Pages  **3A-F, Forests in Wisconsin**
- Container (9"x13" clear if possible) (optional)
- Sand or sand/gravel mixture (optional)
- Large chunk of ice (one per class period) (optional)
- Teacher Page  **4, Landforms of Wisconsin**, to project
- Teacher Page  **5, Wisconsin Glaciation**, to project
- Teacher Page  **6, Wisconsin Tension Zone**, to project
- Teacher Page  **7, Wisconsin Climate, Soil and Topography**, to project

BACKGROUND INFORMATION

Biomes

Biomes are large areas with similar climates and ecological communities. This classification system helps describe the natural world, but is not necessarily agreed upon by all scientists. Generally, terrestrial biomes are grouped into six major types: tundra, taiga/boreal forests, temperate forests, tropical forests, grasslands (including prairies and savannahs), and deserts.

There are also both freshwater and marine aquatic biomes. Climatic conditions play a major role in where biomes are located. Temperature and **precipitation** determine what kind of plants can live in an area. The vegetation, in turn, influences what other types of organisms

can live there. No matter where a biome exists throughout the world, it will have similar organisms. In this lesson, the focus is on three of the world's forest biomes — boreal forest, temperate forest, and tropical rainforest.

TEACHER PREPARATION

For Extensions

- Freeze water in ½ pint milk cartons. Peel the cardboard off when it's time to use the ice. Add pebbles to the water in the cardboard ice trays if desired.
- Fill 9"x13" container ⅓ to ½ full of damp sand or a sand/gravel mixture.

Forest Biomes

Taiga/boreal forest is found in sub-arctic northern latitudes across North America, Asia, and Europe. Winters are severe, and summers are relatively short but feature long days. Precipitation is generally in the 45-125 cm range annually. Soils tend to be acidic and are often waterlogged during the summer. Relatively few trees are adapted to these conditions. Those that are (fir, spruce, hemlock, cedar, and pine) have needles with a waxy coating to prevent water loss. This is an important adaptation since water is frozen much of the year. Many of the smaller boreal animals (e.g., squirrels, insects, birds) rely on seeds from the cones of these trees for food. Larger herbivores (e.g., deer, moose, elk) eat bark and young shoots. There are also some larger omnivores and carnivores (e.g., bear, wolves).

In Wisconsin, there are small amounts of forest that have similar characteristics to boreal forest. These forests are not necessarily in the boreal biome, but exist due to the cooling effect created by the Great Lakes. High lake-effect snowfall and low temperatures, due to winds from the north along Lake Superior, create conditions for boreal forest in northern Wisconsin. Cool, moist air moving across Lake Michigan in the summer and moist soils create conditions in Door County for boreal forest to grow in certain pockets. Due to local conditions, the boreal forests in Wisconsin are not typical of boreal forests in more northern regions of the world. (There are higher precipitation levels in Wisconsin.) These forests account for only about two percent of the original vegetation cover of the state.

Temperate forests grow in the mid-latitudes of North America, Europe, eastern Asia, and Australia. These include both temperate dry forests and temperate rainforests. Wisconsin is dominated by temperate dry forests. These forests have moderate average temperatures and precipitation (75-200 cm annually) and four distinct seasons. While broadleaf trees (oak, hickory, beech, maple, poplar, etc.) dominate,

some conifers can also be found here. Losing leaves in the fall is one way that broadleaf trees are adapted for the temperate climate because they become relatively inactive after doing so. Decaying leaves help create a richer soil than is found in boreal forests. The lack of leaves on the trees in early spring also allows sunlight to penetrate to the forest floor so many smaller herbaceous plants have a chance to grow. This contributes to species diversity.

VOCABULARY TERMS

Biome: A regional ecosystem of the world characterized by distinct seasonal climatic differences, vegetation, and animals.

Climatic Zones: Regions of different temperature and moisture conditions.

Glaciation: To be covered by large masses of slow-moving ice formed by accumulated snow.

Precipitation: All forms of moisture that fall from the sky, including rain, snow, hail, etc.

Taiga/boreal Forest: Type of forest found in the circumpolar regions of the northern hemisphere.

Temperate Forest: Type of forest found in regions with an average temperature of $\pm 10^{\circ}\text{C}$ (50°F) for two to four months of the year.

Topography: The relative elevations and configuration of features in a landscape.

Tropical Forest: A forest that grows in "winterless" tropical climates with high temperatures and generally high annual rainfall.

Tropical Rainforest: Type of forest found in regions with high temperature, humidity, and rainfall with an average temperature of 18°C (65°F) for the coolest month.

These forests have many layers, each with its own characteristic organisms. Many insects, spiders, and worms live in the soil or just at the forest floor. The forb layer (non-woody plants) is fed on by many animals (e.g., mice, rabbits) and the shrub layer provides another food source (including berries) and shelter (especially for birds). The understory and canopy trees add additional habitat. A few common animals in temperate forests include white-tailed deer, gray squirrels, woodpeckers, raccoons, skunks, and black bear.

Tropical forests exist near the equator and have warm average temperatures. There are two primary types of tropical forests: tropical rainforests and tropical dry forests.

Tropical rainforests exist near the equator in places such as Brazil, Costa Rica, the Congo, Indonesia, and Malaysia. Tropical rainforests have warm temperatures that don't vary much daily or seasonally. Humidity is high and rain falls nearly every day, averaging 240 cm or more each year. This relatively unchanging climate means that plants here don't need to have adaptations for changing seasons as in the boreal and temperate forests. This allows for a tremendous diversity of plants and animals, including millions of insect species, more than 40,000 plant species, and a similar variety in other organisms. Most of the nutrients in a tropical rainforest are tied up in the vegetation as opposed to the upper layer of soil. When vegetation is cleared, the few nutrients remaining in the soil are used up or leached away rapidly and topsoil is subject to erosion. Therefore, these forests don't regenerate well and can go from extremely productive to desert-like in a very short time.

Layers in tropical rainforests are distinctly different from one another. Light barely reaches the forest floor, while the canopy grows extremely high (35 meters or more above the ground). Some of the many animals found in tropical rainforests include parrots, toucans, boa constrictors, jaguars, monkeys, and ocelots.

There are tropical dry forests in India, Australia, Central and South America, the Caribbean, Mexico, and Africa. Tropical dry forests receive low rainfall amounts, as little as 50 cm per year, and are characterized by species well-adapted to drought. Trees of dry tropical forests are usually smaller than those in rainforests, and many lose their leaves during the dry season.

Types of Forests In Wisconsin

Different types of forests are found throughout Wisconsin. Like biomes, the location of these forests depends on a variety of factors, including climate, soil, and topography. Patterns of forest location have also changed over time due to human influences such as logging, agriculture, and settlement. Although there are many different types of forests throughout Wisconsin, this lesson focuses on six general types: pine, aspen/birch, spruce/fir, maple/basswood, oak/hickory, and urban. Descriptions of these six types of Wisconsin forests can be found in the *Wisconsin's Forest Communities Video Script* on pages 29 and 30. When two tree species are listed together, it means these species are generally found growing together. There is not an absolute rule, though; many variations of these general types exist. For example, the oak/hickory description is a generalization of the plant and animal species and climate that are expected to accompany this type of forest. There are also oak/maple/white pine forests in Wisconsin that have their own characteristics but some similar plant and animal species.

Effects of Abiotic Factors on Forest Types

The location and extent of different types of forests in Wisconsin depend on climate and the results of glaciation. Climatic factors include moisture and temperature. Glaciation effects include soil type and **topography**.

Wisconsin is divided into two main **climatic zones**, northern and southern, with the tension zone dividing them. The northern zone receives cool, dry arctic air from Canada. Winters here are longer, with more snow and colder temperatures than in the southern zone. Climate in the southern zone is more influenced by air from the Pacific Ocean and Gulf of Mexico. Here, winters are warmer, with less snow, and summers are longer, with more rainfall than in the northern zone. The tension zone is a band that runs somewhat diagonally from north central Wisconsin to southeastern Wisconsin. Here the climate is intermediate between that of the northern and southern zones. Other climatic influences are latitude and geographic position (e.g., steepness, direction in which a slope faces, placement with regard to water and land formations).

Lake influence also plays a role in the location of different types of forests in Wisconsin. In general, the Great Lakes' influence leads to cooler summer temperatures, warmer winter temperatures, and higher precipitation in coastal areas than surrounding inland areas. There is a relatively small area in northwestern Wisconsin where the climate is influenced by Lake Superior. Arctic winds blow southeast across the lake and carry moisture and precipitation inland. This lake-effect leads to lower temperatures and increased snowfall. In eastern Wisconsin, the climate is influenced by Lake Michigan and Green Bay.

Glaciation has also played a major role in Wisconsin. Glaciers once covered much of the eastern and northern parts of Wisconsin. As glaciers moved across these parts of the state, they smoothed the landscape and left deposits of sand and gravel that changed the soils in some places. Glaciers also created “kettles” and left many lakes in their wake. The southwestern part of the state was not glaciated and has a more rugged topography featuring steep hillsides and river valleys. This part of Wisconsin is called the “driftless” area. Along the edges of glaciers and at the farthest point they reached, moraines formed from the sand, gravel, and rock material deposited as the ice melted. The same moraines formed ridges that act as a continental divide, determining which way water will flow.

Disturbances such as fire, wind, insects, etc., affect the location of forests on a small scale. Humans can influence natural disturbances and their effect on forests. For example, humans suppress fires and control insect infestations. These things can impact which forests grow where. Human resource need has also affected the location of forests in Wisconsin. Clearing for agriculture and logging in the 1800s and 1900s have altered and continue to alter the original distribution of forests in Wisconsin.

The effects from the combination of these factors (climate, glaciation) have led to the current distribution of forests in Wisconsin. Ecologists, foresters, and other scientists have studied this distribution and created maps showing ecological landscapes or natural divisions in the state. Each of these divisions is characterized by unique soil, topographical, temperature, and moisture conditions. Distinct vegetation and forest cover also characterize the divisions. The types of forests described in this lesson fall into those natural division categories.

PROCEDURE

Introduction - A Forest You've Seen

1. Ask students to reflect on time they've spent in a forest or anywhere else where they've been around trees. Have them take a few minutes to write down what they remember. What did you see, smell, hear, etc.? What were the trees and other plants like? What animals did you notice?
2. Ask students to share what they've written. *(Most likely, they will describe being in a temperate deciduous or coniferous forest.)* Then ask if that's what forests are like worldwide. *(No.)* Ask for examples and reasons for the differences. *(Other parts of the world have different climates and different plants and animals. For example, there are tropical rainforests with thick vegetation and large desert areas without much vegetation.)* Explain that in this lesson they are going to learn more about these large regions of land that have a distinct climate and types of plant and animal life called biomes. They will also learn which biome Wisconsin is in and compare different types of forests here.

Activity 1 - Biome Comparisons

1. Divide the class into groups of three, and provide each student with Student Page  **1, Biome Data**. Explain that it contains the average monthly precipitation (cm) and temperature (°C) data for a year from the three main forest biomes of the world — taiga/boreal forest, temperate forest, and tropical rainforest.
2. Each student in the group should take responsibility for one biome. Have students calculate the total yearly precipitation for each biome. (Taiga/boreal forest = 36 cm, temperate forest = 117 cm, tropical rainforest = 208 cm.) On a separate sheet of paper, have students graph the precipitation data. They should create a cumulative bar graph for each biome type. Place the month on the "X" axis and precipitation on the "Y" axis. Fill in the precipitation amount for each month and then add to that the cumulative total for all the previous months. Project Teacher Page  **1, Biome Precipitation Graphs**, so students can check their work.
3. Using adding machine tape (or any other long strips of paper) make a strip the length of each precipitation total (cm), and label the biome it represents. Hang them vertically in the classroom so that it's easy to compare the annual precipitation. Discuss how these differences in precipitation result in different forests. *(Areas with higher precipitation can support more growth and more species of plants and animals. Areas of lower precipitation have less diversity. Trees in higher precipitation areas tend to be larger, have more lush foliage, and grow an array of flowers and fruits. Trees in lower precipitation areas tend to be smaller, have needles, and have smaller or less showy flowers and fruits.)*
4. Each student should again take responsibility for one biome. Using the temperature data on Student Page  **1, Biome Data**, have students make a line graph with months along the "X" axis and temperature on the "Y" axis. Have each group graph the three sets of temperature data on one graph using a different color for each biome. Groups should make a key showing which color represents which biome. Allow students to check their graphs against Teacher Page  **2, Biome Temperature Graph**.

5. Lead a discussion of the results. Some possible discussion questions:
- Which biome comes close to having the same temperature all year?
(*Tropical rainforest.*)
 - How might that affect what lives there?
(*Both plants and animals can grow year-round. Things might tend to grow larger than plants in other biomes.*)
 - What pattern is evident in boreal/taiga temperatures?
(*Cold most of the year; five months have average temperatures below freezing.*)
 - Observe the temperate temperature patterns. Which three months are coldest? (December, January, February.) What do we call that time of year? (Winter.) Which are warmest? (June, July, August: Summer.) Make a similar connection with spring and fall, and point out that temperate forests are characterized by having four distinct seasons.

Help students come to the conclusion that Wisconsin is in the temperate forest biome.

NOTE: You may also want to mention that Wisconsin has a small amount of forest that has characteristics of boreal forest in the northwest along Lake Superior and in the northern portion of the Door County Peninsula. These forests are not necessarily in the boreal biome. Ask students what conditions might contribute to these forests in Wisconsin. (High lake-effect snowfall and low temperatures, due to winds from the north along Lake Superior, create conditions for the existence of boreal forests that may not otherwise be found in northern Wisconsin. Cool, moist air moving across Lake Michigan in the summer and moist soils create conditions in Door County for boreal forests to grow in certain pockets. Due to local conditions, the boreal forests in Wisconsin are not typical of boreal forests in more northern regions of the world. [There are higher precipitation levels in Wisconsin.]

Activity 2 - Forests In Wisconsin

1. Refer to the Introduction, where students described a forest in which they spent time. Ask if all the descriptions were the same. (*No. Some may have had pine trees, others broadleaf or mixes. Types of animals and other organisms may have varied.*) Obviously, there are different types of forests within Wisconsin. Now students will have an opportunity to learn about some of those different types of forests.
2. Distribute a copy of Student Page  **2, Wisconsin's Forest Communities**, to each student. Explain that the class will be watching a short video about six types of forests in Wisconsin. Assign each student one type of forest (pine, aspen/birch, spruce/fir, oak/hickory, maple/basswood, and urban). Divide the class so that an approximately equal number of students has each type of forest. Each student is responsible for gathering information on that forest and sharing it with the class after the video.
3. Watch the LEAF video found online at www.leafprogram.org titled Wisconsin's Forest Communities (7 min. 10 sec.), and have students take notes on what they hear and see about their type of forest. **NOTE:** Not all of the information for Student Page  **2, Wisconsin's Forest Communities**, is given for every type of forest on the video. Students should gather as much information as they can. You may want to show the video twice, since the tempo of the video moves quickly.

4. After the video, have students share what they learned about each type of forest. Assign one student with each type of forest to be a recorder and add any additional information gathered by class members to their worksheet. Show students the map of each type of forest from Student Pages  **3A-F, Forests in Wisconsin**, either printed or projected, as you go over the description of each forest from the video. Post the six completed Student Page  **2, Wisconsin's Forest Communities**, sheets with their accompanying maps (Student Pages  **3A-F, Forests in Wisconsin**) in a visible area. **NOTE:** Teacher Page  **3A-B, Wisconsin's Forest Communities Video Script**, is provided with this lesson. Key points for Student Page  **2, Wisconsin's Forest Communities**, are in bold.

Activity 3 - Abiotic Influences

1. Project Teacher Page  **4, Landforms of Wisconsin**. Ask a volunteer to point out features that he/she notices. (*Hills, valleys, waterways.*) Ask how these features might influence what grows there. (*Areas along water and in valleys would be likely to have more moisture. Hilltops are probably windier. On steep slopes, it might be difficult for some trees to take root. There could be many others.*) Ask students how they think the landforms in Wisconsin were created. (*Glaciers.*) Remind students of the beginning of the Wisconsin's Forest Communities video they watched. Have students point out which areas of the state were glaciated and which were not. (*The northeastern $\frac{2}{3}$ of the state was glaciated.*)

EXTENSION: Show the class a container filled with damp sand or a damp sand/gravel mix. Have students imagine that this is the land that makes up Wisconsin. Ask for student volunteers to create some landforms (hills, valleys, etc.). Now take a chunk of ice and push it through part of the "land" (or have a student do so). Ask what happens to the land the ice pushes over. (*It gets flatter.*) Ask what

happens to the areas the ice doesn't touch. (*They retain the landforms they had.*) Lift up the ice and have students look at the bottom. (*It should have picked up sand and/or gravel.*) Ask what would happen if you left the ice in one place. (*It would melt and leave its sand and a puddle behind.*) Relate these observations to what a glacier does when it passes over land. Allow the ice to melt and observe what happens to the water and pebbles left behind.

2. Now project Teacher Page  **5, Wisconsin Glaciation** and point out the main divisions. Explain that glaciers (or lack of them) affect both land forms (topography) and soils of an area. These in turn affect what can grow in an area.
3. Now lead a discussion about climate.
- Ask students what comes to mind when they hear the word "climate." (*Most will have an answer about temperature. Point out that moisture is part of climate too.*)
 - Ask students to describe the climate where they live. (*Answers will vary but should include information on average temperatures, rainfall, seasons, etc.*)
 - Ask if it would be the same for all parts of Wisconsin. (*No.*)
 - Have students think back to the *Wisconsin's Forest Communities* video. Ask if anyone can describe the major climate zones in Wisconsin. (*Due to arctic air from the north and gulf air from the south, Wisconsin has a northern and a southern climate zone with a tension zone between them.*)
 - Ask what the tension zone is. (*The tension zone separates the northern and southern climate zones, and its climate is a mix.*) Project Teacher Page  **6, Wisconsin Tension Zone**. Point out the two climates and the tension zone.
 - Project Teacher Page  **7, Wisconsin Climate, Soil, and Topography**. Remind students that the areas they outlined have different mixes of climate and soil and topography from the glaciers.

4. As a final step, have students study the six maps on Student Pages **3A-F, Forests in Wisconsin**. Ask if they can see a correlation between the locations of the forests and the areas created on the *Wisconsin Climate, Soil, and Topography* map by the tension zone line and the glacial lines. *(There is a correlation between the location of the forests and the areas of different soil, climate, and topography.)* This is most apparent on Student Page **3B, Forests in Wisconsin Aspen/Birch** and Student Page **3E, Forests in Wisconsin Oak/Hickory**. One at a time, project the *Aspen/Birch Forests* map and the *Oak/Hickory Forests* map and point out the correlation to the students between forest type locations, climate, soil, and topography. Go through the other forest maps and student observations of other correlations (e.g., pine forests are most prominent in the sandy outwash because they like sandy soil, spruce/fir forests are predominantly up north because they do well in cooler climates).

Conclusion - Travel Brochure

As a culminating project, have students make a travel brochure for any of the six types of forests in Wisconsin they learned about. They should include information gathered while doing Activities 1 through 3. Provide students with a copy of Student Page **4, Wisconsin's Forest Communities Travel Brochure Rubric**, before they begin, and discuss what should be included. This could be a homework assignment, or provide one class period as work time.

The activities in the Summative Assessment part of this lesson can also serve as a Conclusion.

CAREERS

The career profile in this lesson features Jon Harris, GIS Specialist Forester, Douglas County Forestry Department, and is found on page 26. A careers lesson that uses this information begins on page 170.

SUMMATIVE ASSESSMENT

1. Ask students to write a paragraph summarizing what they learned about the connection between annual precipitation and diversity in the boreal forest/taiga, temperate forest, and tropical rainforest. They should also include the effects of temperature in these biomes. *(Annual precipitation in the boreal forest is lowest and temperatures are coldest; it has the least diversity of species. Annual precipitation in the temperate forest is more than the boreal forest, but less than the tropical rainforest and temperatures are more moderate with four distinct seasons; diversity is intermediate too. Tropical rainforests have the greatest precipitation and warm temperatures all year; they have the greatest diversity.)*
2. Ask students to write a story from a particular type of forest's point of view. They should describe some of the natural (climate, glaciation, soils, etc.) influences that occurred over time and made it what it is today. *(Stories will vary, but should include fairly specific information learned from the mapping activity. For example, what's unique about temperature and precipitation through the seasons, if the area it is in was glaciated, if it is in a lake effect region, etc.)*

Career Profile

Jon Harris, GIS Specialist/Forester

Meet Jon Harris. He is a GIS Specialist and Forester with the Douglas County Forestry Department. Using Global Information Technology (GIS and GPS), Jon collects data to describe current forest conditions and model future forest conditions. This is important so others can make decisions about what to do with the forests. Jon creates forest maps that resource managers and recreationalists — including ATV enthusiasts, wildlife viewers, campers, and hunters — can use. As a forester, Jon also plans timber sales. This means he makes decisions about when to harvest, what tree species to cut, how much timber is available, where roads will go, and more. Jon does all this work on behalf of the residents of Douglas County, so they will have healthy forests today and in the future.

Jon has had a lot of education to get him where he is today. He has an Associate degree in Science and Mathematics, a Bachelor's degree in Environmental and Forest Ecosystems, and a Master's degree in Sustainable Natural Resource Management. Jon also studied paper science, is an instructor for ArcView computer software, and attends training every year on different topics. Several jobs have helped Jon prepare for this one. These include fisheries technician, information technology assistant, forest technician, GIS technician, and forest management assistant.

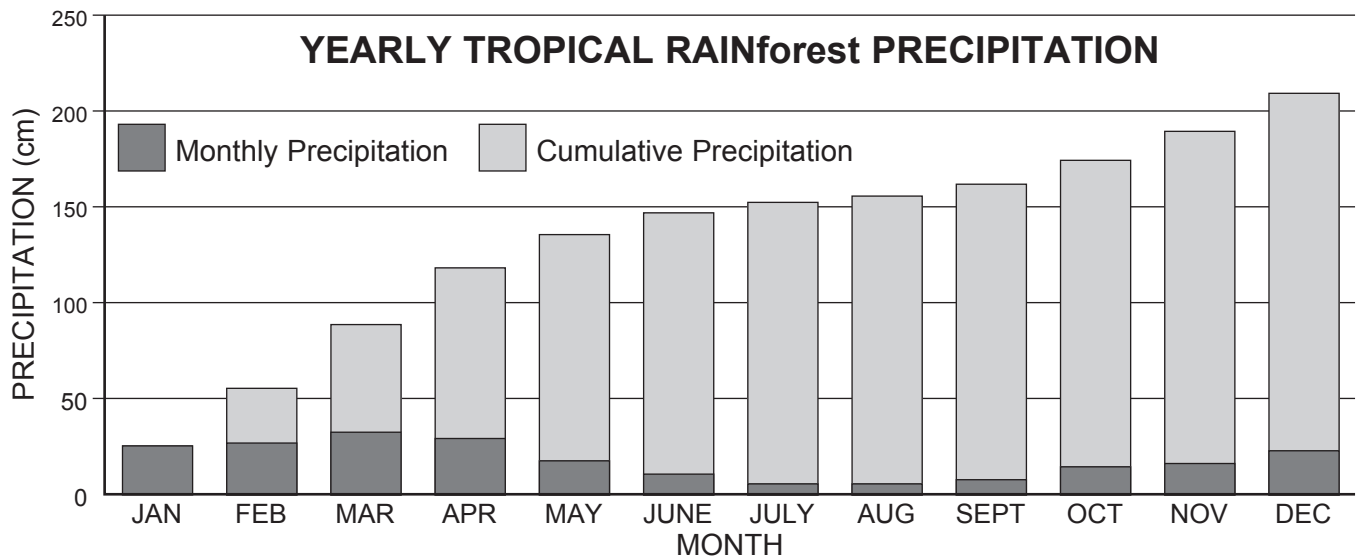
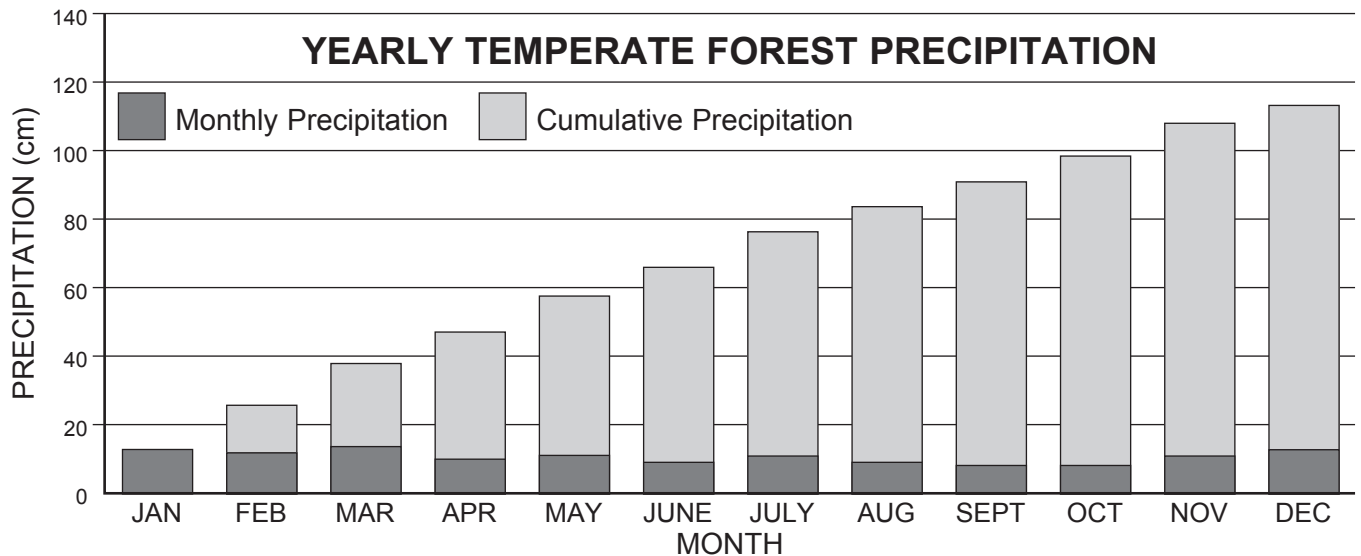
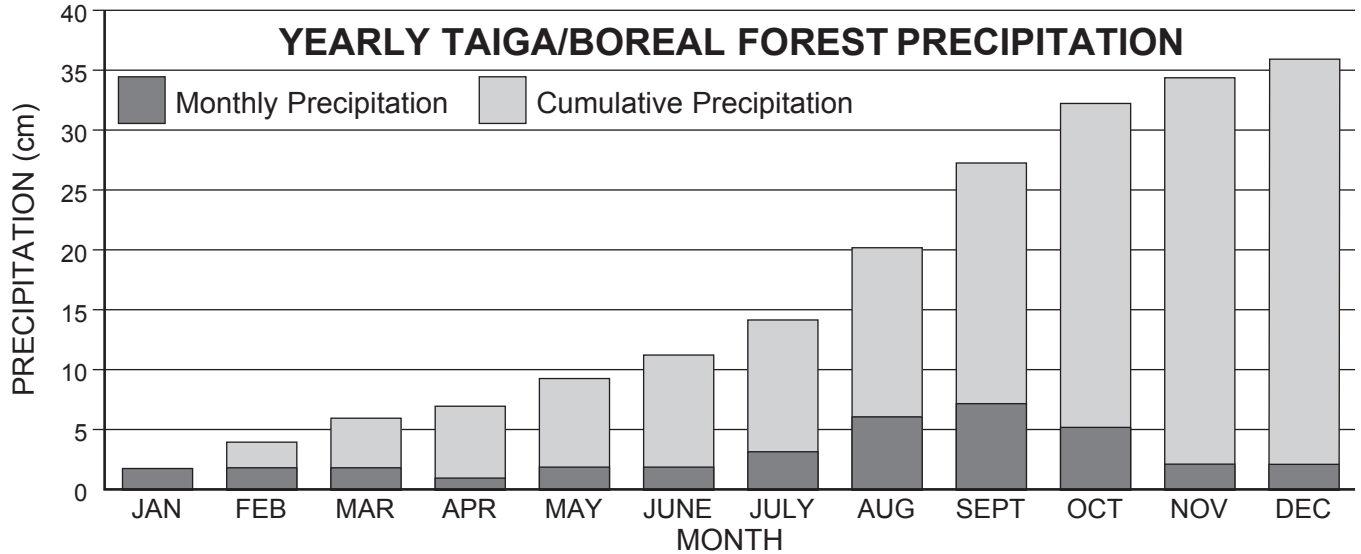
Jon's favorite part of his job is the diversity of things he does. He can be out in the forest marking timber one day or in the office working with state-of-the-art global information technologies the next day.

We asked Jon what he thought you should do now if you are interested in this career. He said, "Furthering your education should take priority over all else." More education is being required, and it makes getting a job easier. Jon also recommends gaining experience in a variety of areas so you have a diverse background.



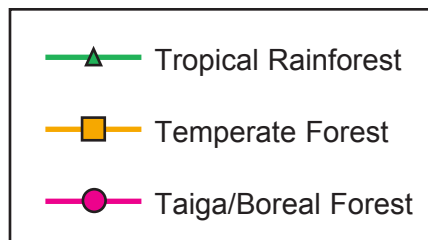
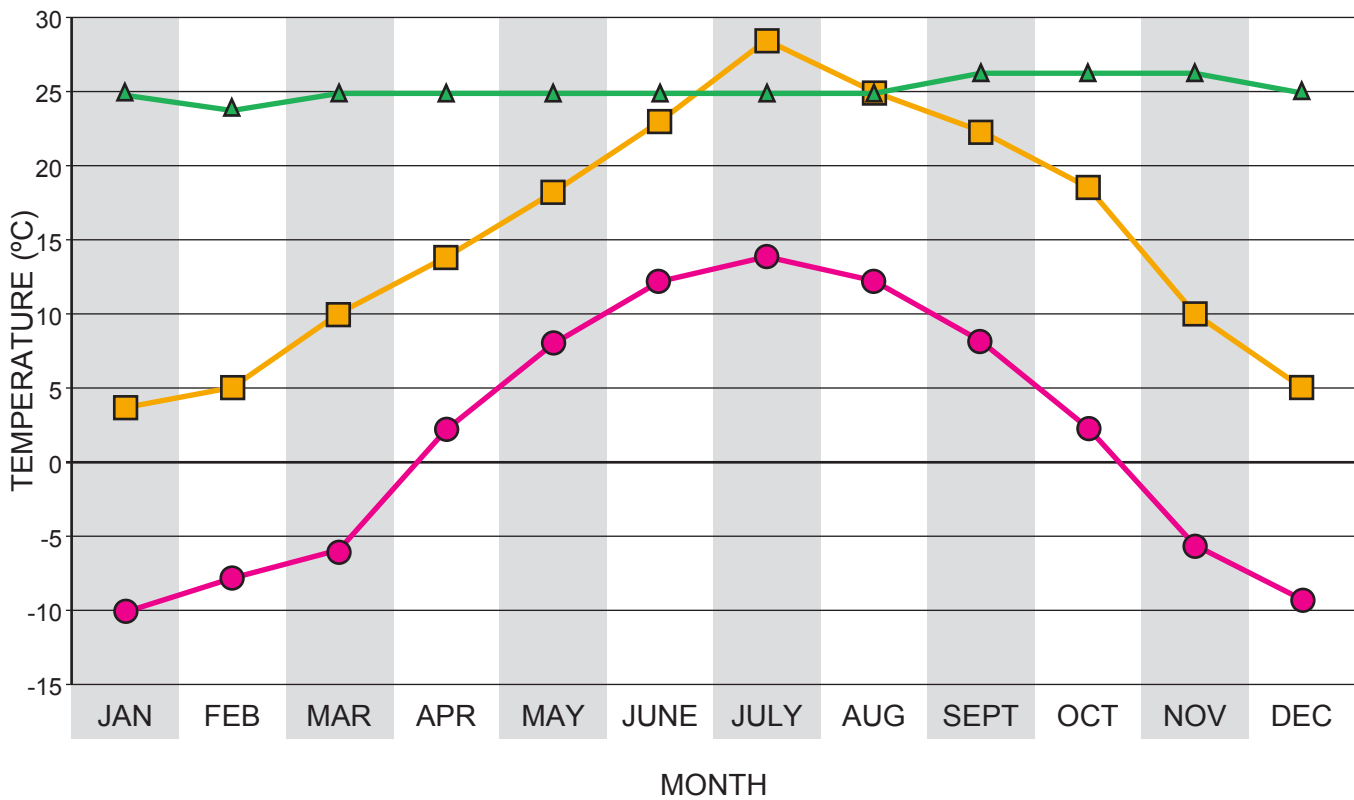
Jon spends time in Wisconsin's forests gathering data to create maps.

BIOME PRECIPITATION GRAPHS



BIOME TEMPERATURE GRAPH

YEARLY TEMPERATURE (°C) DATA FOR 3 BIOMES



WISCONSIN'S FOREST COMMUNITIES VIDEO SCRIPT

- **HOST:** When you think about forests, do you just think about trees? Forests are covered by trees and a whole lot more! A forest is a community with many different living things.

Travel across Wisconsin and you'll see a variety of forests. Why are there different types of forests in Wisconsin? Their locations depend on three things: climate, soils, and topography.

Climate refers to the weather conditions in a certain location. These conditions include wind, temperature, precipitation, and cloud cover. In Wisconsin, the Northern Climate Zone has cooler temperatures and snowier winters. The Southern Zone gets less snow, and the summers are longer and moister. The Tension Zone separates the two, and its climate is a mix.

The topography and soils of Wisconsin have been largely shaped by glaciers. Thousands of years ago, glaciers covered much of the eastern and northern parts of the state. As they moved across the land, the glaciers shaped the landscape, creating smooth plains and rolling hills. Deposits of clay, sand, and gravel were left behind, changing the soil in these areas. Glaciers never got to the southwestern part of the state, so the topography of the southwest has rugged, steep hillsides and valleys.

All of these variations in climate, soils, and topography led to different forest communities. Patterns of forest location have also changed over time because of human influences like settlement, agriculture, and logging.

Let's take a tour of Wisconsin and visit some forest communities.

- **PINE:** Welcome to the Northwoods! White and red pines grow well here on the dry, sandy soils. If you visit long enough, you might see white-tailed deer, timber wolves, black bears, and red squirrels.

Of course, all pine forests don't look alike. Some forests contain towering white pines, while others, like jack pine barrens, are mostly grasses with a few scattered trees. Some pine forests grow in rows like this red pine plantation. Someone planted this forest. Many pine forests are economically important to the paper and lumber industries.

- **ASPEN/BIRCH:** This aspen forest feels airy and sunny because aspen trees love the sun. To keep an aspen forest an aspen forest, you'll need to harvest all the trees so the sun warms the soil and new trees can grow. Did you know that young aspen trees can grow three to four feet per year?

Young aspens provide food and shelter for animals like white-tailed deer, ruffed grouse, and beaver. These forests grow on a wide range of soil conditions and grow on sites following disturbances like fire. Look around an aspen forest and you'll find paper birch, hazelnut, and the heart-shaped large-leafed aster.

Aspen and birch trees are susceptible to many diseases and insects. They tend to be short-lived, but are very important trees for Wisconsin's pulp and paper industries.

- **SPRUCE/FIR:** Here in the spruce/fir forest, it's always green. Take a deep breath and smell the spruce, fir, cedar, and tamarack trees. Watch your step, though, these forests are usually wet and swampy.

If you see a tree without its needles in winter, it's probably not dead. It's a tamarack tree. They shed all of their needles every fall. Many birds and animals live in the spruce/fir forest. (Hawk, squirrel) Look for plants like bunchberry, starflower, wild sarsaparilla, and clubmosses. Economically, spruce/fir forests provide pulpwood and lumber.

WISCONSIN'S FOREST COMMUNITIES VIDEO SCRIPT

- **MAPLE/BASSWOOD:** The maple/basswood forest is Wisconsin's most common forest community. Maples have the ability to grow in a fair amount of shade. Because of this, maples can enter the forest understory and eventually become the most common species. Maples grow on moist, nutrient-rich sites.

In the spring, trilliums can be found here blanketing the hillsides with their white blossoms. Wood violets grow here too — they're Wisconsin's state flower. And talk about state stuff, the sugar maple is our state tree.

Chipmunks, deer, and many birds feed on the plant seeds and berries of the maple/basswood forest. Moisture-loving insects, reptiles, and amphibians hide among the leaves and fallen logs on the forest floor.

Maples are an important source of lumber, but are also prized for their sap used in maple syrup.

- **OAK/HICKORY:** Hope you brought your hiking boots! To visit this forest, you'll have to climb the hills and ridges of southern Wisconsin. Here, you'll see oaks, walnuts, hickories, and black locusts.

About half of the forests in southern Wisconsin are oak forests. Before settlers arrived, these forests were maintained by fire. Today, without periodic fires to remove shrubs and other competing trees, it is difficult for new oak trees to grow. One unique community, the oak savanna, is especially affected by the absence of fire. This transition area between forests and prairie is considered an endangered ecosystem.

What do oaks produce? You guessed it — acorns. Nut-loving wildlife like wild turkeys, deer, and squirrels are abundant here. These forests provide high-quality timber for furniture and cabinets.

- **URBAN FOREST:** Your last stop on this tour is the forest in a city or town near you. This forest is made up of the city's green spaces — parklands, backyards, playgrounds, and vacant lots.

Trees not only make our urban areas more beautiful, but they also provide shade that cools the surrounding area by almost ten degrees. Their leaves filter out air pollution, and their root systems help stop soil erosion. Trees take in the carbon dioxide that we exhale and produce oxygen — the clean air that we all need to breathe.

Many animals like deer, songbirds, bats, chipmunks, and squirrels depend on city trees for food and shelter.

From the street trees chosen to survive salt and air pollution — to the landscape trees planted to beautify and shelter buildings — to the native trees in park woodlands — each tree is a valuable part of the urban forest. Just imagine what a city would be like without trees!

- **HOST:** Well we've only just begun to explore Wisconsin's many forest communities. As you travel around our state, remember how differences in climate, soils, and topography determine the location of our forests. Discover the special plants and animals that make these forests their home. Wisconsin's forests are all around you — make sure and visit one real soon.

LANDFORMS OF WISCONSIN

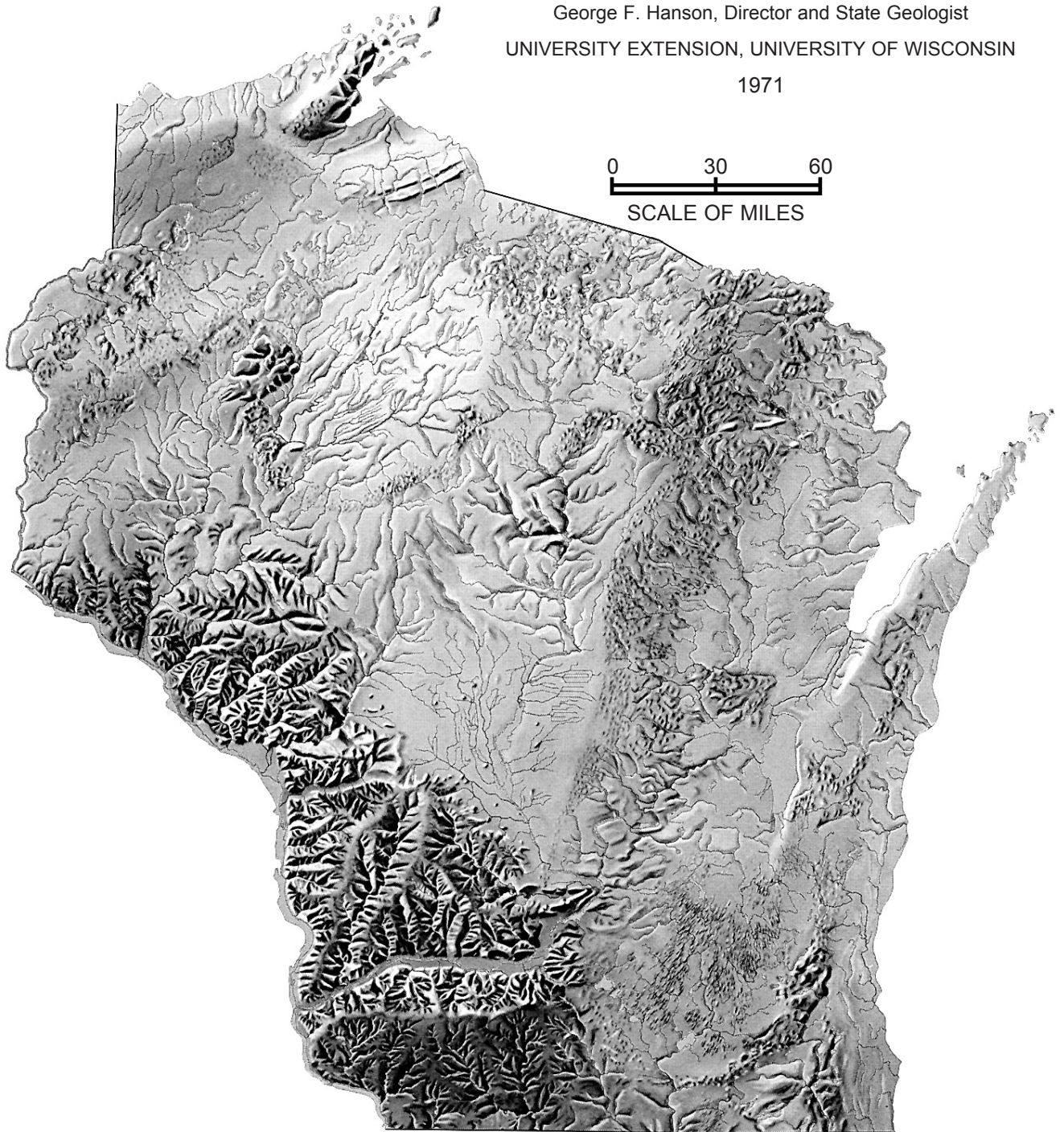
Geological and Natural History Survey

George F. Hanson, Director and State Geologist

UNIVERSITY EXTENSION, UNIVERSITY OF WISCONSIN

1971

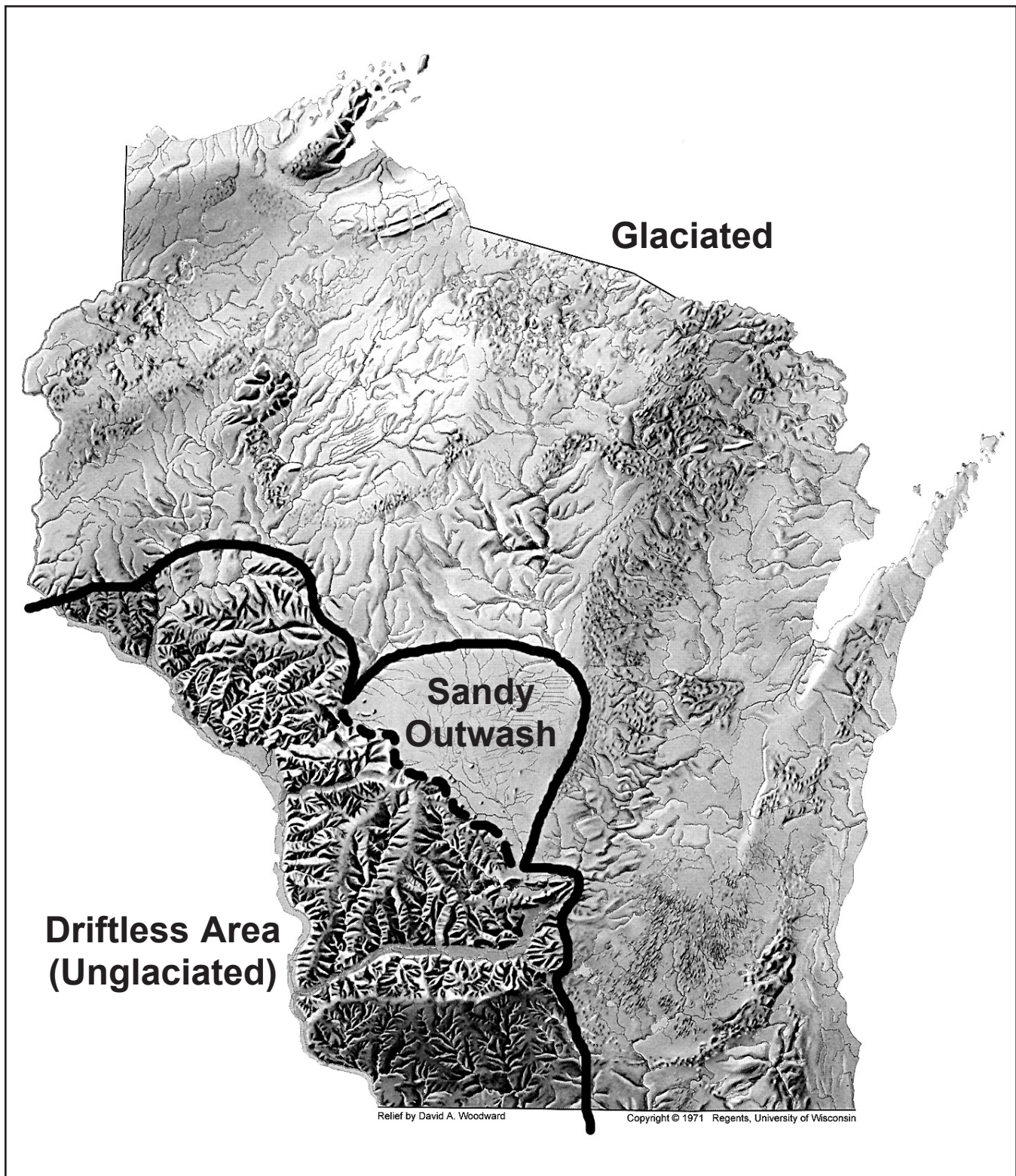
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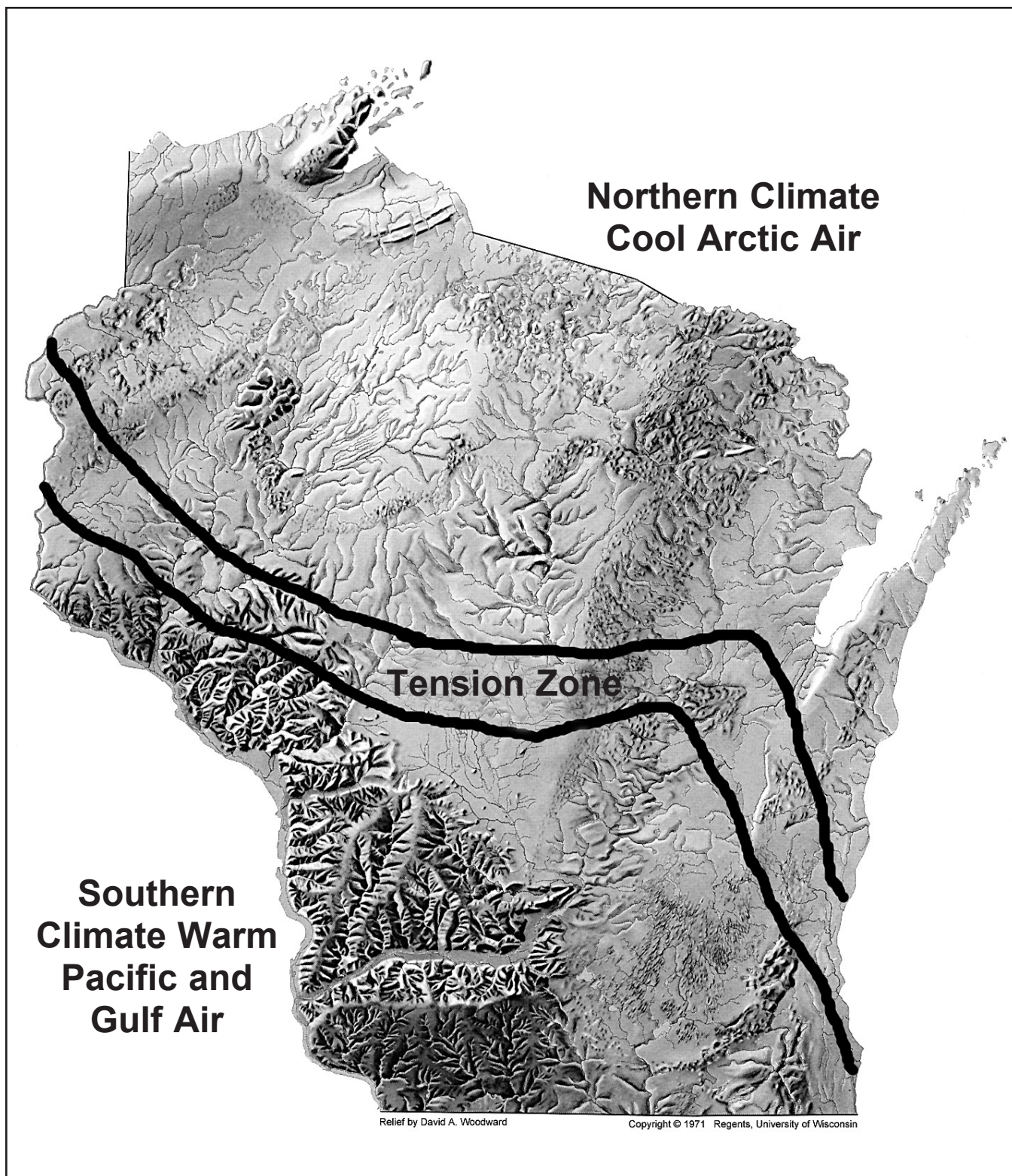
Relief by David A. Woodward

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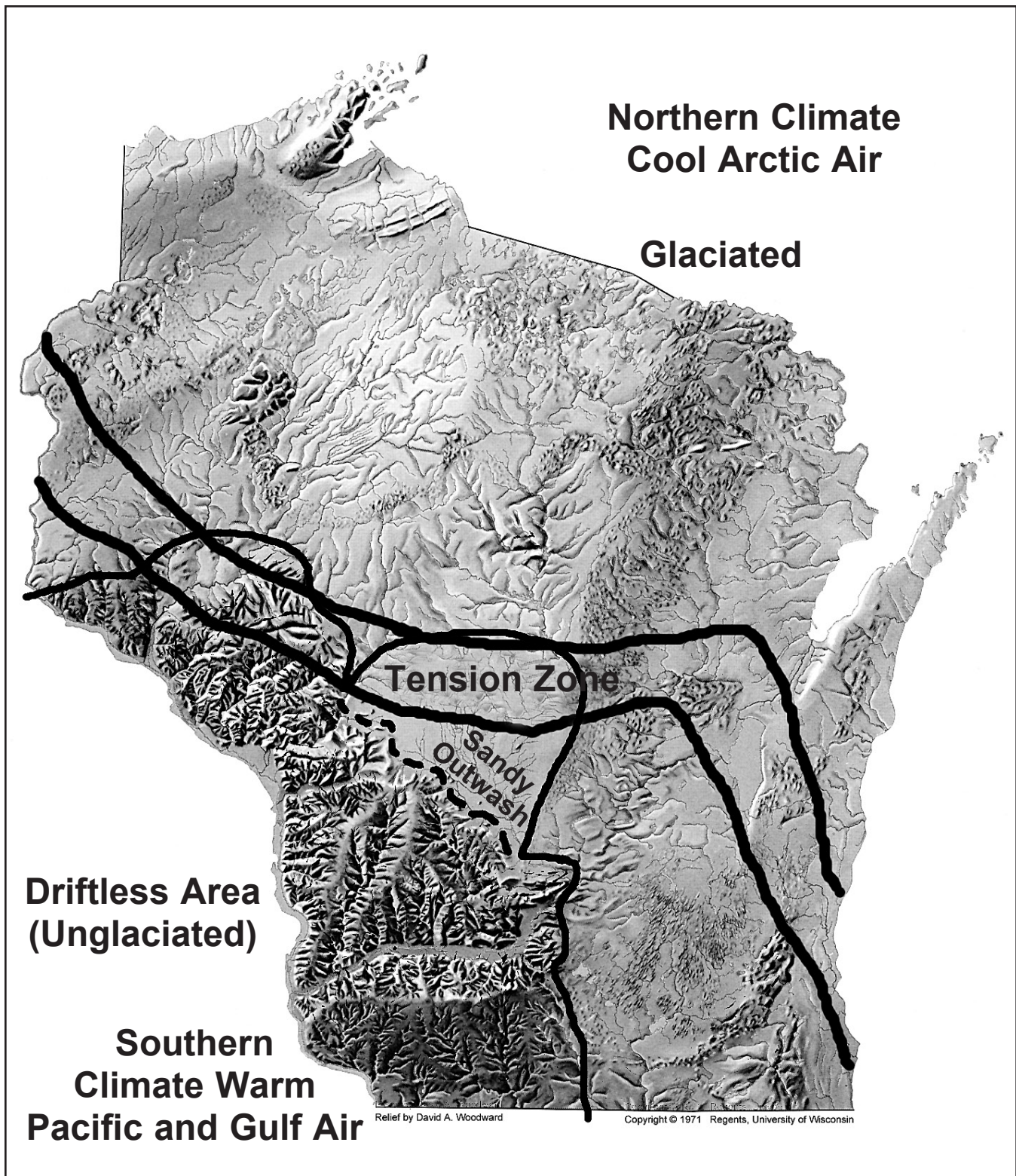
WISCONSIN GLACIATION



WISCONSIN TENSION ZONE



WISCONSIN CLIMATE, SOIL, AND TOPOGRAPHY



BIOME DATA

PRECIPITATION (cm)			
Month	Taiga/Boreal Forest Biome	Temperate Forest Biome	Tropical Rainforest Biome
January	2	13	28
February	2	12	28
March	2	13	33
April	1	9	29
May	2	10	18
June	2	8	10
July	3	10	5
August	6	8	4
September	7	7	6
October	5	7	12
November	2	9	15
December	2	11	20
TOTAL			

TEMPERATURE (°C)			
Month	Taiga/Boreal Forest Biome	Temperate Forest Biome	Tropical Rainforest Biome
January	-10	4	25
February	-8	5	24
March	-6	10	25
April	2	14	25
May	8	18	25
June	12	23	25
July	14	28	25
August	12	25	25
September	8	22	26
October	2	18	26
November	-6	10	26
December	-10	5	25

WISCONSIN'S FOREST COMMUNITIES

1. Type of Forest: _____
2. Found Mainly in What Region of the State? _____
(based on the map)
3. General Description: _____

4. Soil Conditions: _____

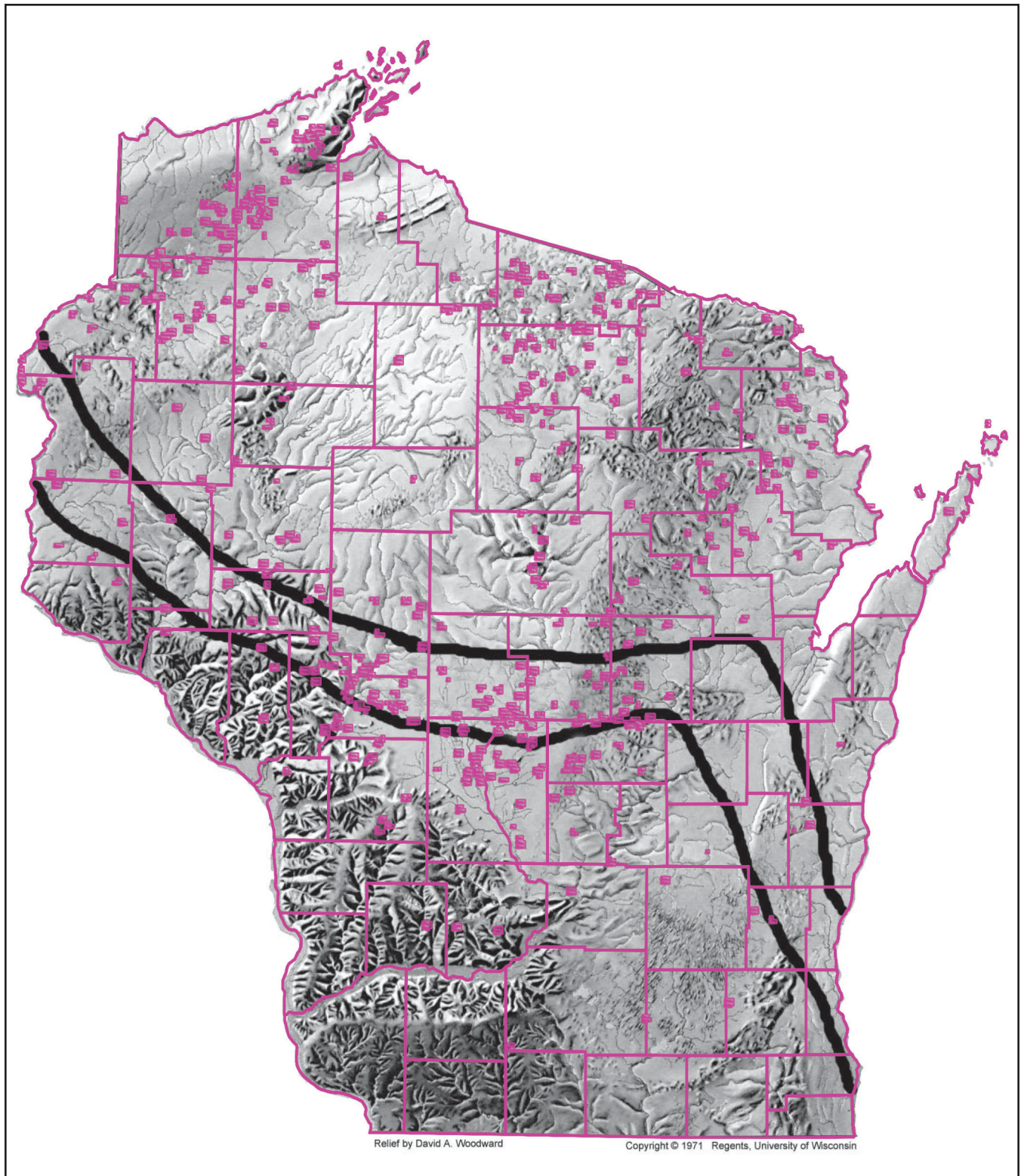
5. Common Plants Present: _____

6. Common Animals Present: _____

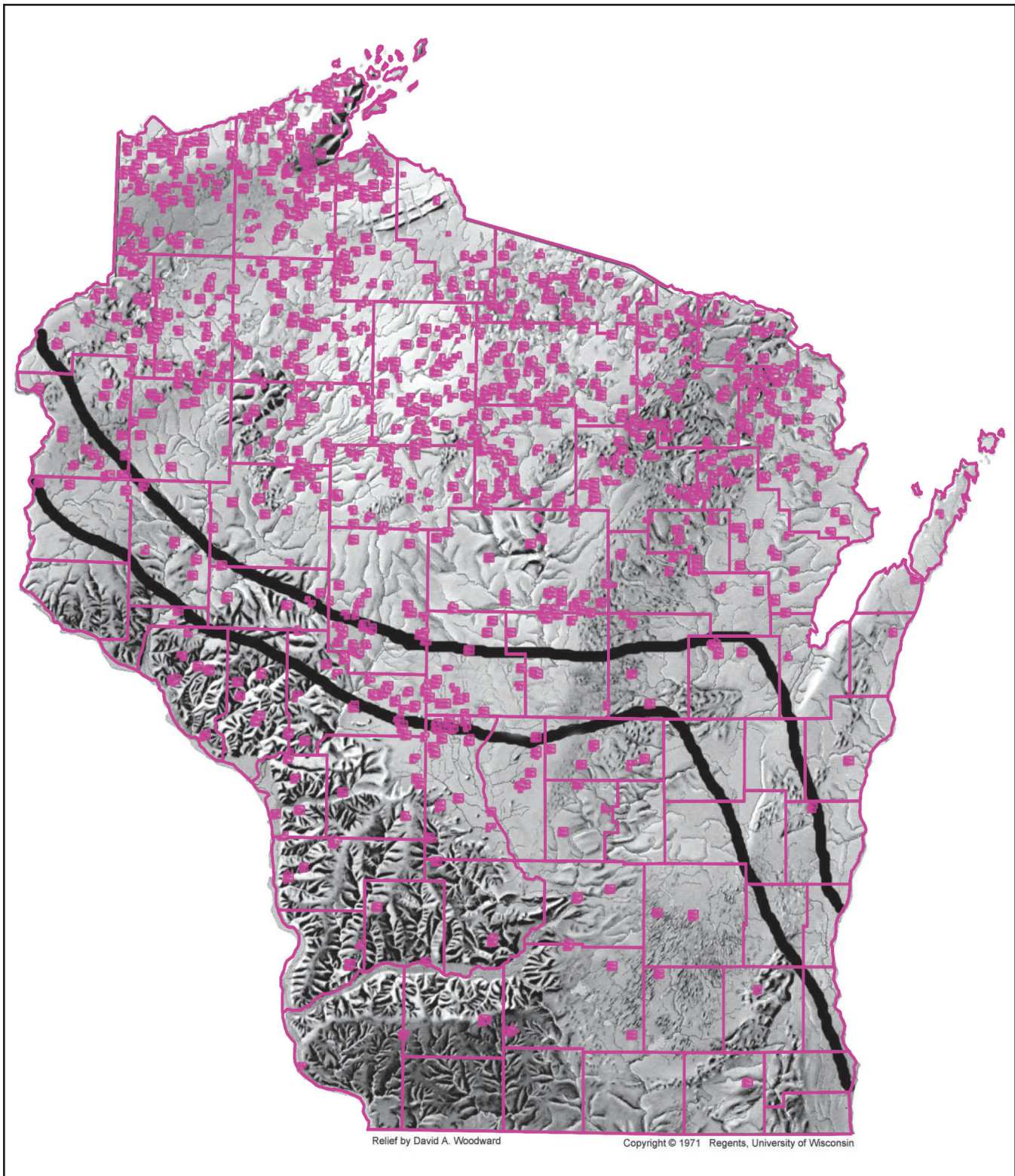
7. Trees are Economically Valuable for: _____

8. Other Unique Information: _____

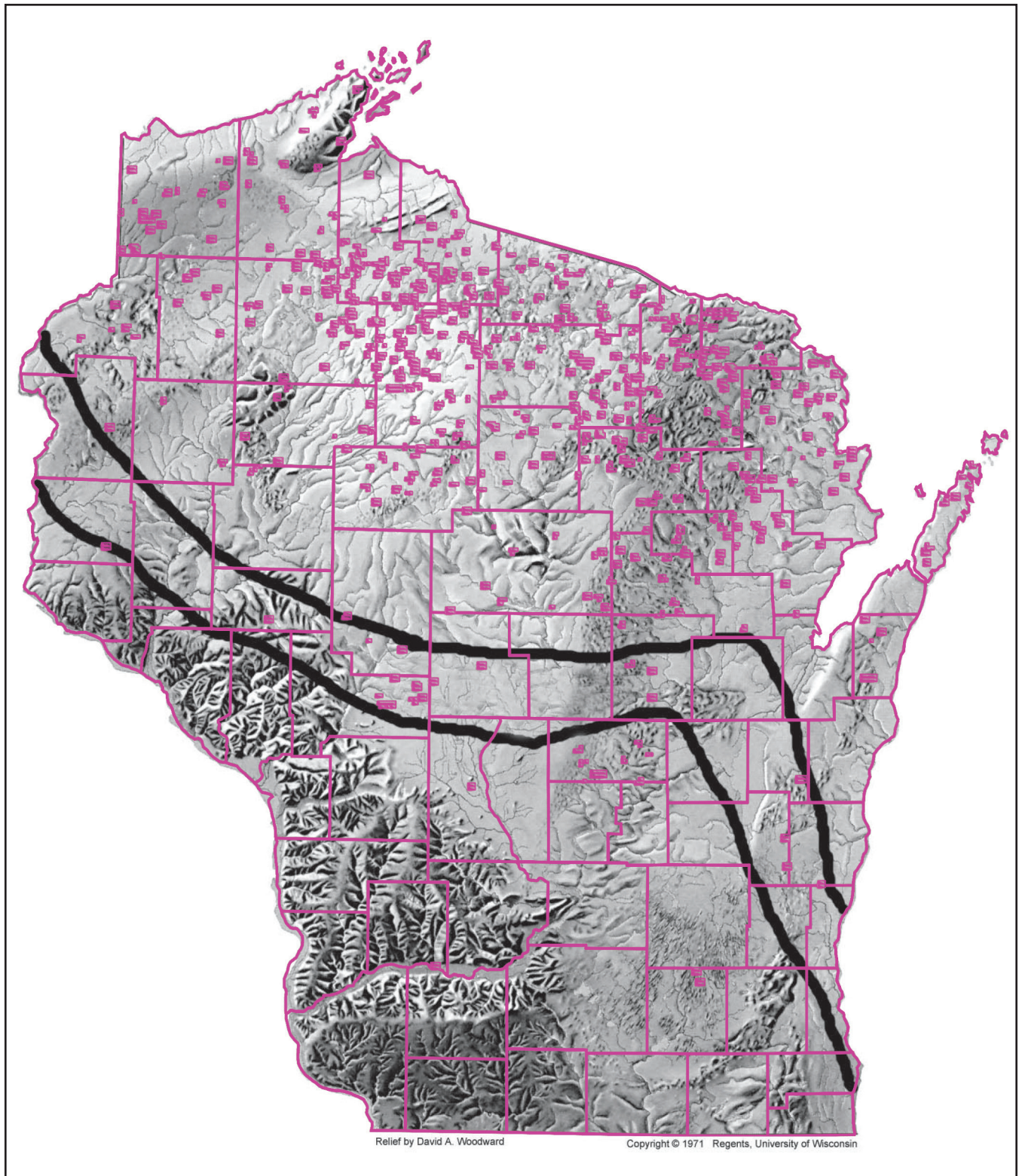
FORESTS IN WISCONSIN - PINE



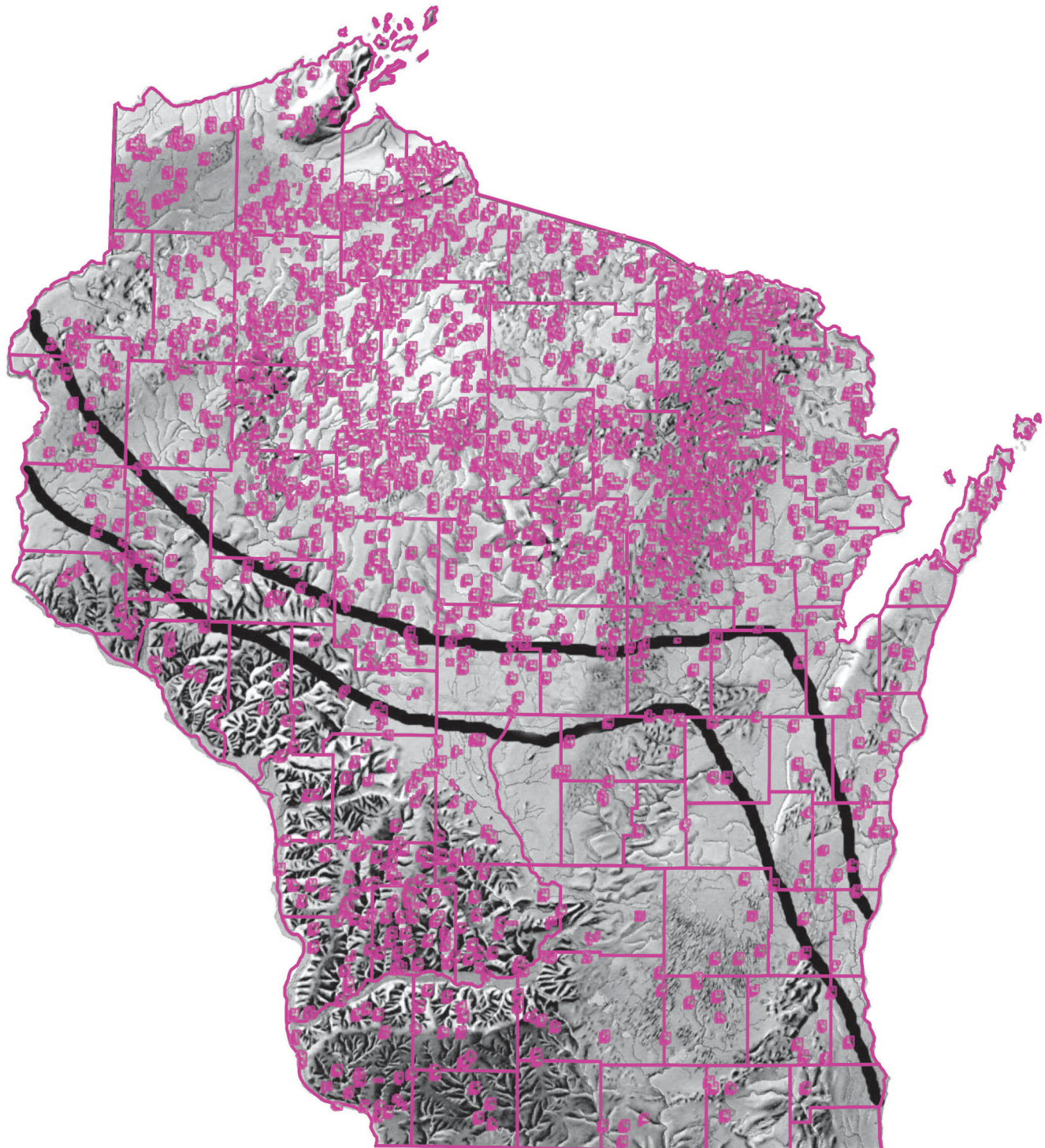
FORESTS IN WISCONSIN - ASPEN/BIRCH



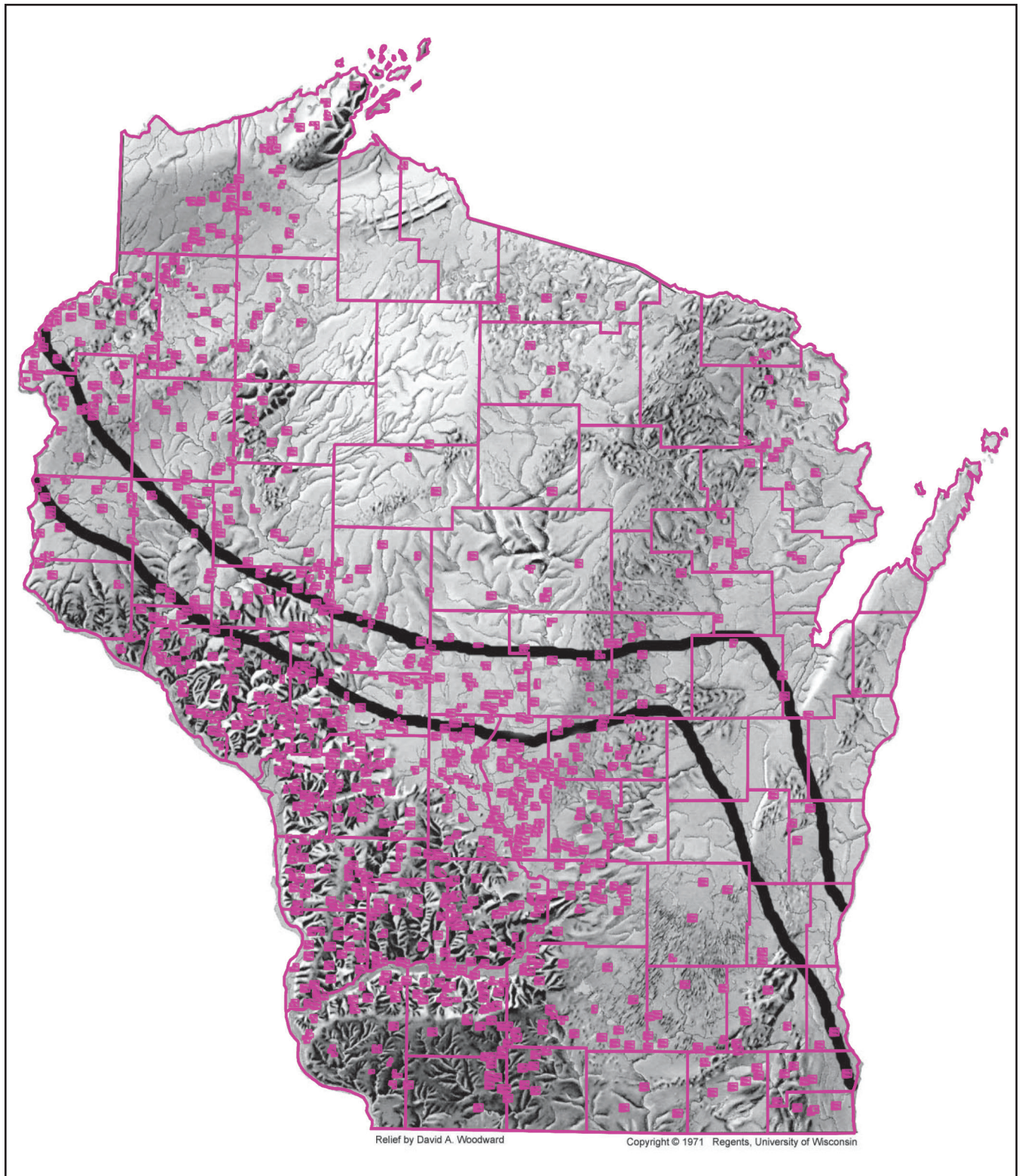
FORESTS IN WISCONSIN - SPRUCE/FIR



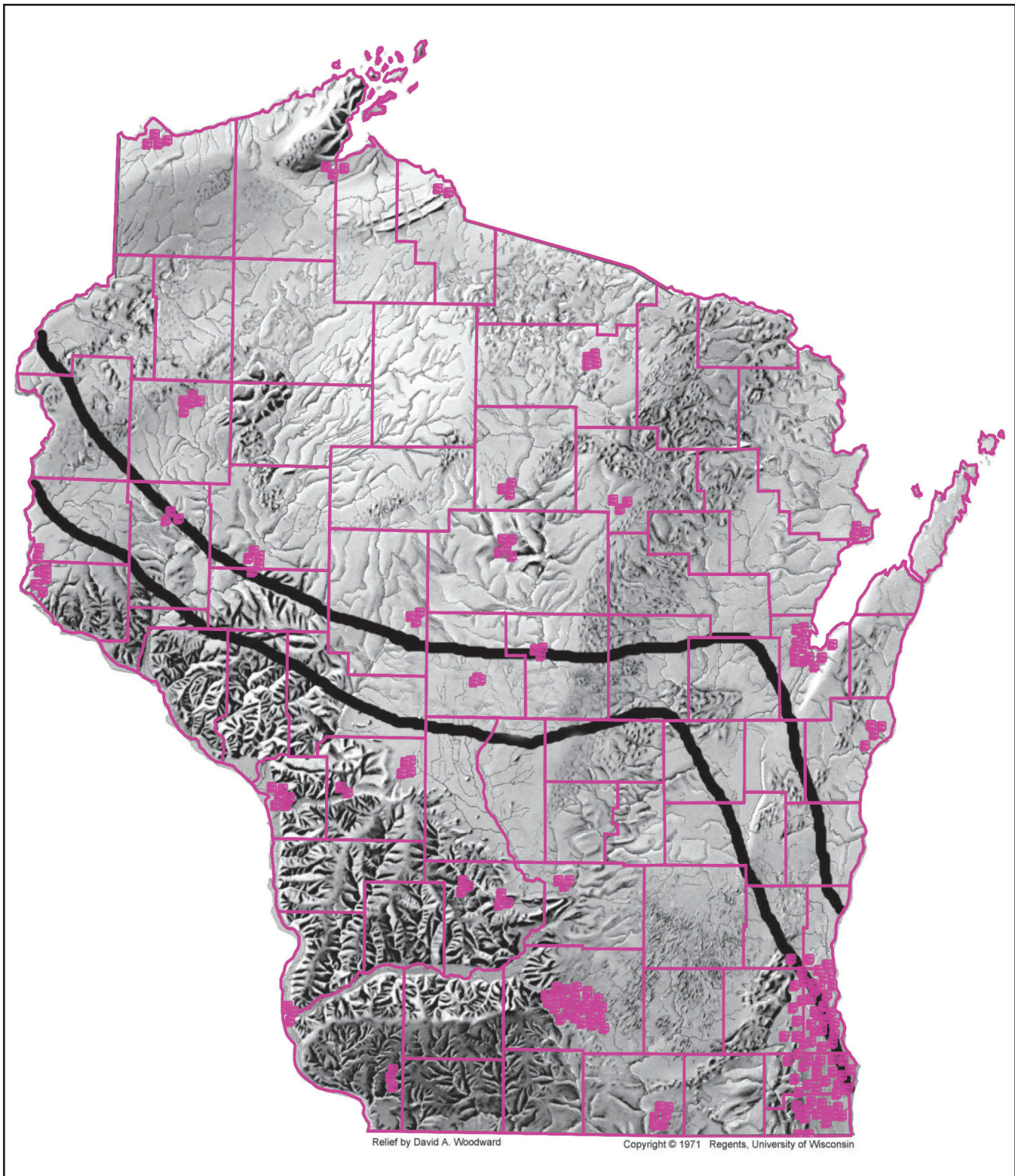
FORESTS IN WISCONSIN - MAPLE/BASSWOOD



FORESTS IN WISCONSIN - HICKORY/OAK



FORESTS IN WISCONSIN - URBAN



WISCONSIN'S FOREST COMMUNITIES TRAVEL BROCHURE RUBRIC

OBJECTIVE	POOR	FAIR	GOOD
Use of Research and Work Time	Needs frequent reminders to stay on task; little accomplished in class.	Organizes time well; needs some direction from teacher.	Organizes time well with little direction from teacher; makes good use of resources.
Content (includes basic description, location in Wisconsin, typical plants and animals, climate, topography and unique features)	Missing two or more of the required elements or contains inaccurate information.	Missing one required element or some information is very basic.	Includes all required elements. Information is complete and accurate.
Attractiveness and Organization	Organization of material is confusing.	Brochure is well-organized.	Brochure is especially well-organized and attractive.
Writing (spelling and grammar)	There are more than four spelling and/or grammatical mistakes.	There are up to four spelling and/or grammatical mistakes.	There are no spelling and/or grammatical mistakes.
Sources	Sources not cited or documented incompletely.	Most sources cited accurately.	All sources cited accurately and completely.
Graphics/Pictures	Graphics are missing or do not go with accompanying text.	Graphics go well with text, but there are too few.	Graphics go well with text and there is a good mix of text and graphics.