How Do the Great Lakes Modify the Growing Season?

Using agricultural product and frost maps and an infrared satellite image, students develop a hypothesis about the effect of the lakes on growing seasons. They create a model to test it.

Grades: 4-8
Subject Areas: Science, Social Studies

If you've ever had the pleasure of going out to the back yard, plucking a fully ripe peach off a tree and sinking your teeth into its sweet succulent flesh, you probably lived in the south or in a few special areas of Michigan, Ohio or New York. Peaches are just one of several delicate, early-blooming southern fruits that can thrive in a narrow band of land (30 miles or 48 km wide) along the south and east shores of Lakes Michigan, Erie and Ontario. Michigan, for example, produces 60% (6 out of every 10 pounds or kilograms) of the cherries grown in the entire United States. That fruit belt also grows peaches, apples, pears, plums, grapes and berries in large quantities. A simmilar, much smaller cherry and apple growing belt is found in Wisconsin's Door County. Vineyards for wine grapes thrive in Ohio and Western New York state. How can these fragile "Southern Belles" survive the long cold northern winter? This exercise helps students answer that question.

Procedure

1. Copy and distribute table of first and last frost dates and the sketch maps of the Great Lakes basin showing types of farming areas and mean annual frost-free periods. Have students find the areas on the farming map which include fruit growing and color them with pencils. Have students find the areas with the longest frost-free period and color them with pencils as well (Use different colors to show 160, 180, and 200 days frost free). Show or distribute the infrared satellite image of the Great Lakes region attached to this activity. Explain that infrared energy can be detected with special sensors. The darker areas on the image are warmer, the lighter areas are colder. A few scattered clouds on the image are very cold and show pure white. (See Activity 17, "Astronaut's View of the Great Lakes," for an explanation of satellite mapping.)

2. Ask your students to propose reasins for the survival of fruit orchards in these narrow bands around the lakes. Work toward developing one or several hypotheses which would explain the information in these maps. Use the "If _____, then _____" formula. For example: If there are more days without frost over the lakes than inland, then the lakes must help keep the frost from forming. If the lakes are colder than the surrounding land in June, then the land must warm up faster than the lakes. If the last frost in the spring is about the same but the first frost in the fall is later in areas closer to the lake, the lake must delay the frost. If the lake is colder in June and warmer in September than the surrounding land, then the lake must change temperature more slowly than the surrounding land.

3. Ask students to develop a way of testing the hypotheses they have developed. Give students a list of available equipment and make sure they have access to the materials listed.

2 thermometers (that can be submerged in water)
2 plastic buckets
ice
water
soil
source of cold (like a refrigerator or outdoors in winter)

With this equipment students can construct experiments which show that water warms more slowly than air or that water cools more slowly than soil.
Examples: 1. Place one thermometer in a bucket with ice water. Suspend second thermometer in air above similar amouint of ice in bucket without water. Record temperatures at regular intervals.
2. Take equal amounts of room-temperature soil and water in plastic buckets. Place thermometers in them. Place in cool or cold location. Check temperature changes (Watch out for freezing and broken thermometers if outdoor temperature is extremely cold).

Help students to organize and evaluate their experi-

ments by asking questions such as:

-How will we know a change is taking place?
-What parts of the experiment vary (are different from one another)?
-If more than one part varies, how will we know what has caused the change?
-What can we do to make sure only one element is different?
-What should we do with the information as we collect it?
-How can we make it understandable?

Discuss the difference between an observation and an inference. For instance, you *observe* that a peach is green, and you *infer* that it's not ripe, so you *decide* not to eat it. When testing the validity of a hypothesis, separating what you observe from conclusions you make about your observation is important.

4. After the experiment is completed, ask the students if their hypothesis has been confirmed or refuted. Using the model and the information in the maps, images and chart, ask students to develop an explanation for why peaches can grow in a narrow band of Michigan and Ohio lake shore area and in northern Alabama and Georgia, but not in the area in between. You may wish to have them do this in a brief written report or in group discussion.

5. Following is a brief explanation of how the lakes modify the growing season near them:

The waters of the lake moderate the temperatures over the land along their edges. This means that in the winter the lakes are warmer than the air. As air passes over them it warms up and carries the warmth for about 30 miles (48 km). This warmer air keeps the fruit trees and plants from being frozen and killed by temperatures which drop far below zero. In spring the water stays cool longer than the air and land. Air passing over the lake cools off, and stays cool around the fruit area. This cooling slows the development of fruit blossoms. The trees and plants blossom later when there is less chance of damage by frost. In the late summer and early fall the warmed water of the lake again warms the air, protecting the mature fruit from damage by early frosts.

6. Students may have personal experience of another way lakes modify the temperatures near them: going to the beach in the summer. Temperatures are usually several degrees cooler at the edge of a lake than even a few hundred feet inland. Ask if any student noticed how much cooler than inland the lake shore is sometimes.

Taking It Further

1. Orchards are often placed in river basins or along chains of lakes. Locate any orchards in your area and discover if they are protected by being near water. Are they protected in any other way?

2. Check local nurseries for types of fruit trees available for your area. Study zone maps of the U.S. Department of Agriculture to see how temperatures vary from place to place in your state and region (These maps are often printed in seed and nursery catalogs). Plant a fruit tree at your school that is hardy for your area.

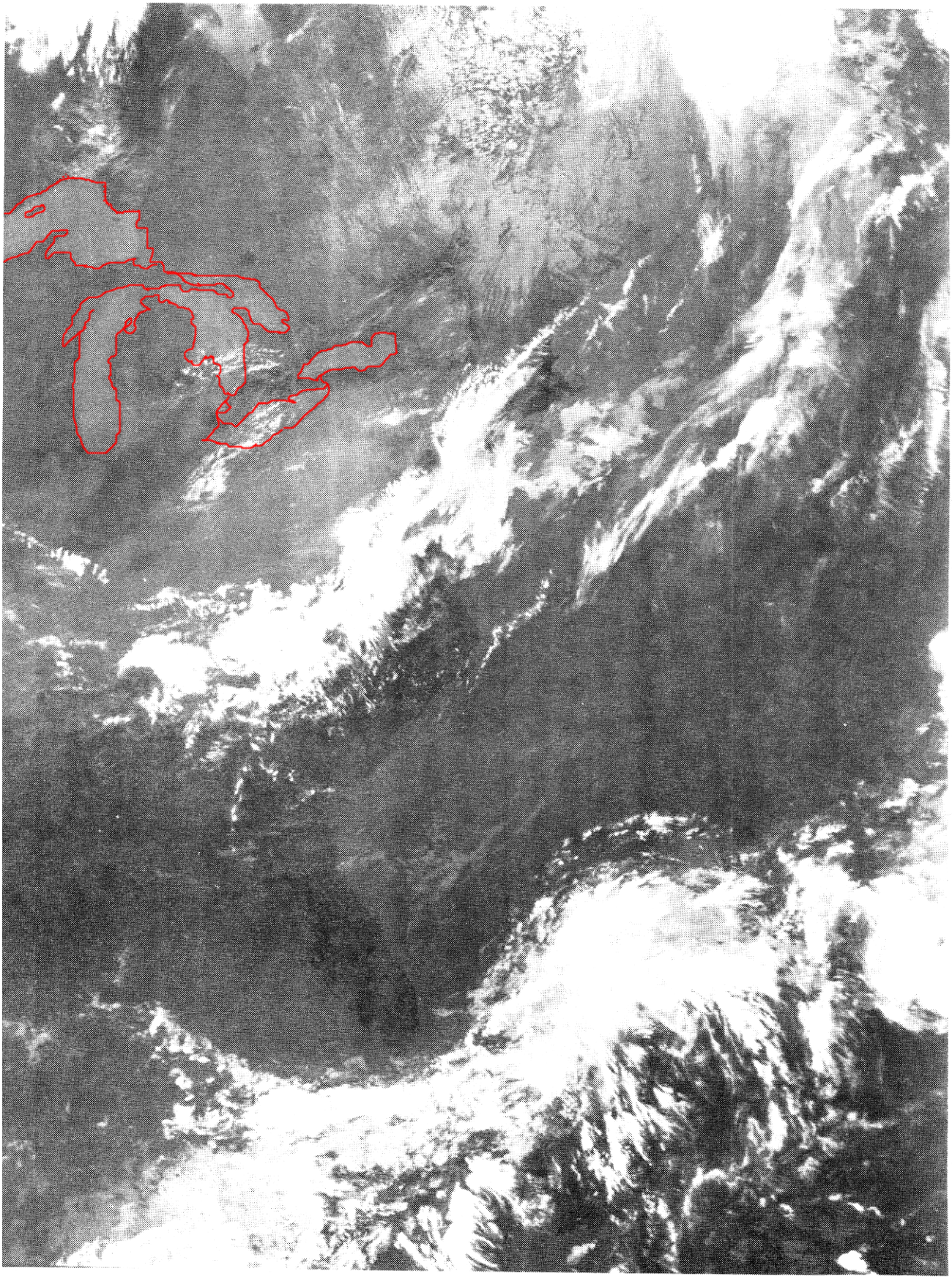
3. Check among family and friends. Does anybody know of a fruit tree surviving and/or bearing fruit outside of "its zone?" What elements can you discover that help protect it? Review the infrared map. Do cities show a darker color than surrounding areas? What does this indicate? How can that help fruit trees?

Duration of frost-free season and the average date of last and first frost, 1931-1960 for Walkerton and Southampton, Ontario

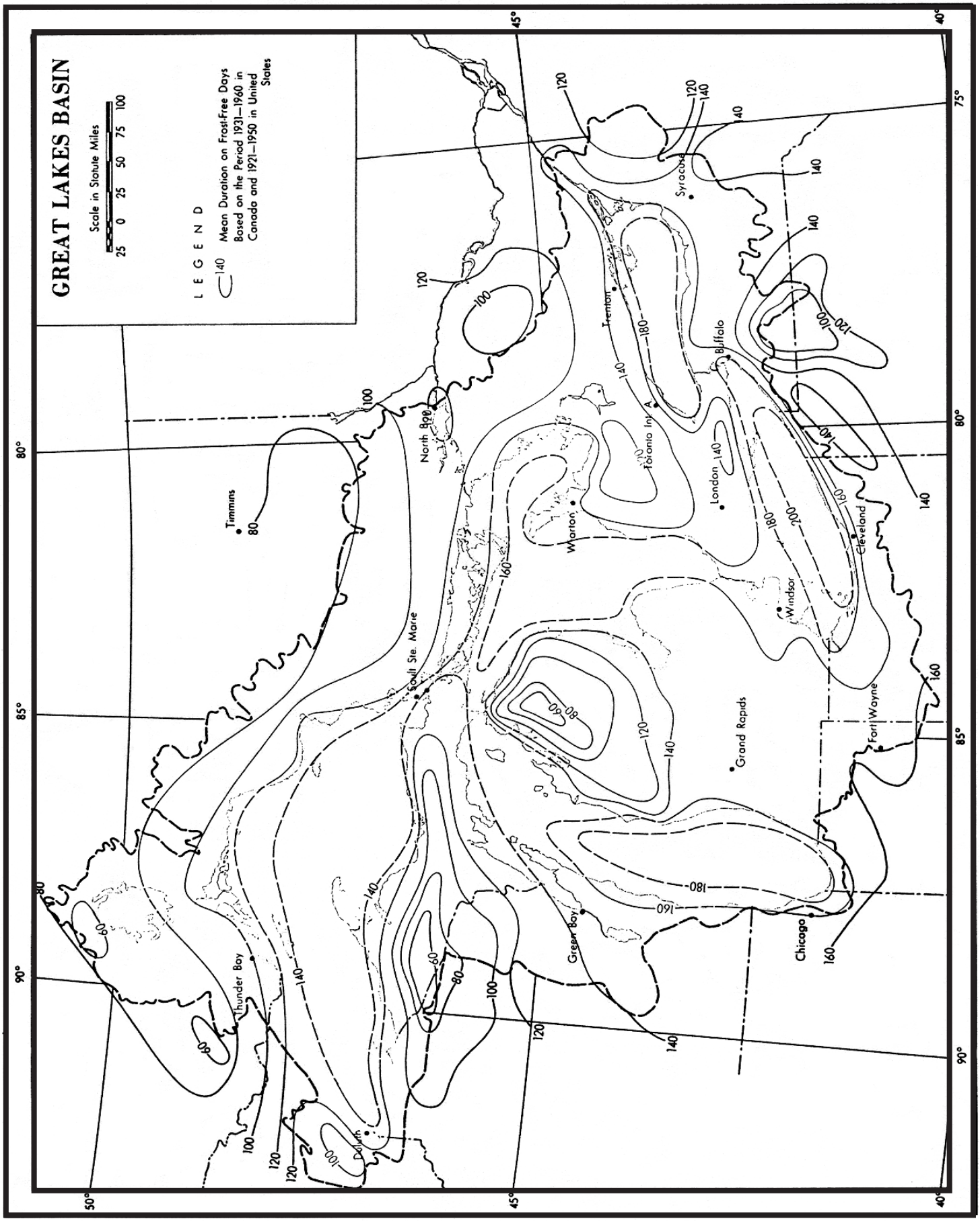
Station	Elevation (feet)	Distance from Lake Huron (miles)	Duration/days of frost-free season	Average date last frost	Average date first frost
Walkerton	800	30	129	May 19	Sept 26
Southampton	670	1	145	May 16	Oct 10

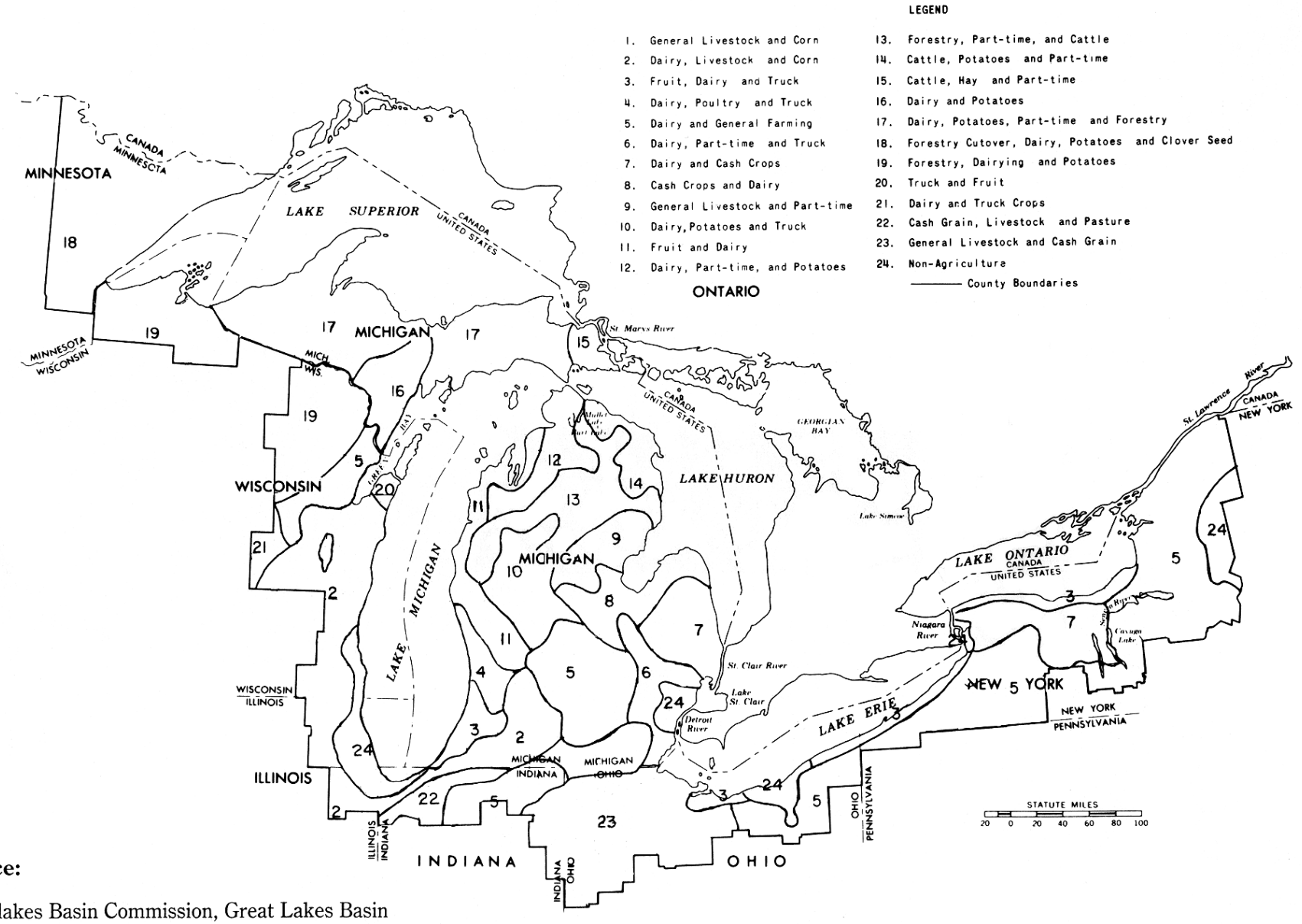
Source:

D.W. Phillips and J. A. W. McCulloch, *The Climate of the Great Lakes Basin*, Climatological Studies, Number 20, Environment Canada, Atmospheric Environment, Toronto, Canada, 1972, [U.D.C. 551.582 (713)], p. 13.



Infrared images show warmer areas as darker, colder areas as lighter. Notice the high clouds which appear as bright white patches. In June the lakes are colder than the land and so appear lighter in the infrared image.





TYPES OF FARMING

Source:

Great lakes Basin Commission, Great Lakes Basin Framework Study, Appendix 13, Land Use and Management, Public Information Office of the Great Lakes Basin Commission, Ann Arbor, Michigan, 1974, p. 27.