The Geography of Tornadoes OR "Auntie Em, Auntie Em"

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Purpose: In order to assist students in comprehending natural disasters native to the state of Indiana, research and mapping projects focusing on tornadoes will be practiced.

Teaching Levels: This particular lesson plan was designed for students in grades 6-9.

Geography Standards: The Geographically informed person knows and understands: **#1** - how to use maps and other geographic representations, tools and technologies to acquire, process and report information from a spatial perspective, **#4** - the physical and human characteristics of places, **#5** - that people create regions to interpret Earth's complexity, **#7** - the physical processes that shape the patterns of Earth's surface and **#18** - how to apply geography to interpret the present and plan for the future.

Objectives: As a result of completing this activity, students will
1. learn some basic facts about tornadoes
2. map two selected tornado statistics by state, and
3. observe, analyze and speculate about the pattern(s) created by the completed map.

Materials Required
- overhead projector
- Data Sheet "Average Yearly Number of Deaths by state
- Tornado Quiz (one per student) Tornadoes & Tornado Deaths by state
- overhead transparency of the Answers to the Tornado Quiz State 1950-1994 (one per student)
- U.S. Map (one per student)
- one colored pencil per student
- Map instructions (one per student)

Background
This background is based on updated statistics provided by Dave Tucek of the National Weather Service in Indianapolis. The original lesson came from Building Skills in Geography, Boehm, Bybee & Peterson, Glencoe Publishing Company, 1990, p. 123. By mapping tornado frequency and tornado deaths by state, patterns emerge to show areas of the U.S. affected greatly by tornadoes (dubbed "Tornado Alley") and also those areas of the U.S. that are relatively safe from tornado activity. Other sources consulted for this lesson were The Earth: A Physical and Human Geography by Harm J. deBlij, John Wiley and Sons, 1987, p. 114 and two recent articles from the March 10, 1996 Indianapolis Star, "The Tornado Warning" and "Birth of a Killer". I like to use this lesson in conjunction with the annual statewide tornado preparedness drill, usually conducted in mid-March.

Procedure
1. Pose the following question to the class: "How many of you have ever seen a tornado?"

Discuss, briefly, responses with the students. Continue by asking: "How many of you might consider yourself to be an expert on tornadoes?" Discuss any responses. Then, distribute the Tornado Quiz; each student should take the quiz independently. Then, have each student grade their own quiz as the teacher reviews the answers on an overhead.
2. Now that the students know a little more about tornadoes, explain to them that they will create a U.S. map based on tornado statistics provided by the National Weather Service. Ask: "What kinds of tornado statistics in the U.S. could be mapped, over a period of time?" Discuss the answers (possibly, number of tornadoes, deaths related to tornadoes, damage in terms of dollars caused by tornadoes). Then, inform the students that they will be mapping the yearly number of tornadoes by state as well as the average yearly number of deaths caused by tornadoes by state. The time period for their data will be 1950-1994. **3.** Distribute to the students a U.S. map, the map instructions, and the data sheet (as follows). The students should follow instructions; you may want to perform the first statistical mapping with them (HINT: TODALSS is an acronym that relates to the components of a good map which the students must incorporate into their maps -- title, orientation, date, author, legend, scale and source). Make sure that the numbers (ie, 20/6 -- # of tornadoes and # of deaths per year) within each state are explained in the legend. Otherwise the map reader will not understand the significance of the map.
4. When the students are completed with their maps, discuss the results: What significant observations to you note? Where are tornadoes most likely to occur? Least likely? Why? Which states are the least deadly? Most deadly? [Is it Texas with the largest total number of deaths? Or is it Massachusetts with a high ratio between the numbers of tornadoes and deaths? It is interesting to note that Massachusetts is the only non-contiguous state mapped. In June 1953, Massachusetts had one powerful tornado that killed some 90 people; this one, very deadly tornado pushes the average number of deaths per tornado way up for this state.] Does a 0/0 in Alaska mean they have never reported a tornado or had no one die between 1950-1994 due to a tornado? Not necessarily; remember, the numbers indicate an average over 45 years. Actually, Alaska reported one tornado with no deaths over this 45 year period. But a state like Colorado reported ten total deaths over the same time period; this figure, however, averages less that one death per year, so a "0" is recorded.
5. Next, have the students focus on the "why there" question of geography by reading the "Birth of a Killer" article in the March 10, 1996 Indianapolis Star; this article has an excellent explanation incorporating maps and diagrams that states why the midwest, south and southeast experience more tornadoes than any other areas of the country.

Adaptations / Extensions
1. Using similar data or the above data, students could create choropleth maps (colors for different ranges of data) focusing on total number of tornadoes by state, total number of tornado deaths by state, total number of tornado injuries by state, and total dollar damage caused by tornadoes by state.
2. Rank the states in order for the various statistics, then, color pencil the top ten and the bottom ten. **3.** Have the students interview tornado survivors about their experiences. Many Hoosiers have been involved in either the Palm Sunday tornadoes (1965) and/or the Super Outbreak of Tornadoes (1974).
4. Have the students research the Fujita Scale; this scale measures tornadoes by wind speed and the resulting damage caused by the varying wind speeds.
5. Discuss the regional concept of "Tornado Alley" with the students. Why is a certain state

considered a part of the region while another is not? Is Indiana in Tornado Alley? Investigate.
6. Many areas of the U.S. are vulnerable to other natural hazards, such as, earthquakes, volcanoes, floods,... Use this lesson as a springboard for studying other natural hazards and their geographic distributions and the concepts of regions.

MAP INSTRUCTIONS:

1. Locate and label each state, using the zip code abbreviation for each state on the chart. In addition, for each state, put the average number of tornadoes per year followed by the average number of tornado deaths per year. For example, Alabama would look like: AL 20/6; indicating that Alabama is abbreviated AL with 20 tornadoes reported (average) each year and an average of 6 deaths due to tornadoes each year.
2. Using a colored pencil of your choice, shade in lightly only those states that have recorded at least one death (on average) per year. Then, apply TODALSS to your map. Make sure your title is accurate and that the numbers you used on your map are explained as part of your legend.
3. Write down 3-5 significant observations about your completed map. In other words, what pattern(s) does your map reveal?
4. Answer the following questions: (a) What area(s) of the country has the greatest risk to tornadoes? (b) What physical features are associated with this area? (c) What specific physical regions are associated with this area?

TORNADO QUIZ

For each of the following, put a “T” for true statements and a “F” for false statements.

1. Tornadoes occur more frequently in the United States than in any other country on Earth.

2. Areas near rivers, lakes and mountains are safe from tornadoes.

3. As a tornado passes overhead, low pressure associated with it can cause buildings to explode.

4. Windows should be opened before a tornado approaches to equalize pressure and minimize damage.

5. In Indiana, tornadoes touch down more frequently between 3-6 p.m. than in any other three hour time period.

6. Tornadoes can occur during every month in Indiana.

7. More tornado touch-downs in Indiana have occurred in April than in any other month.

8. Texas ranks first in the number of reported tornadoes.

9. Indiana ranks first in the total cost of damage as a result of tornadoes.

10. Mr./Mrs. (insert teacher's name) has never experienced a tornado "up close and personal".

Answers to the Tornado Quiz:

1. True 2. False; no place is safe from tornadoes. Yellowstone National Park was affected by a tornado in the late 1980's. This tornado left a path of destruction up and down a 10,000 foot mountain. 3. False; most structural damage associated with a tornado is due to the violent winds and flying debris slamming into buildings. 4. False; opening windows allows more damaging winds to enter the structure. Leave the windows alone and, instead, quickly go to a safe place. 5. True; In Indiana, between 1950-1994, 316 reported tornado touch-downs occurred during the 3:00-6:00 p.m. period followed closely by 249 touch-downs between the 6:00-9:00 p.m. period and 231 between noon and 3:00 p.m. The three-hour time period in which the least number of tornadoes occurred was 30 between 3:00-6:00 a.m. 6. True 7. False; Between 1950-1994, June had the most reported tornado touch-downs with 258. April was a close second with 244, May had 118 and March 103. January was the month with the fewest reported touch-downs over the time period with 10 touch-downs. 8. True; Between 1950-1994, 5,490 tornadoes were reported in Texas. Indiana had 886 tornadoes. 9. False; Between 1950-1994 (in adjusted dollars to reflect inflation) Texas was the first with about $1.96 billion dollars in damage, but Indiana was a close second at about $1.65 billion dollars in damage. 10. (fill in the appropriate answer from the teacher's experiences)

AVERAGE YEARLY NUMBER OF TORNADOES & AVERAGE YEARLY DEATHS CAUSED BY TORNADOES: 1950-1994

Alabama AL 20/6 Montana MT 4/0 Alaska AK 0/0 Nebraska NE 37/1 Arizona AZ 3/0 Nevada NV 1/0 Arkansas AR 19/6 New Hampshire NH 2/0 California CA 5/0 New Jersey NJ 2/0 Colorado CO 25/0 New Mexico NM 9/0 Connecticut CT 1/0 New York NY 6/0 Delaware DE 1/0 North Carolina NC 13/2 Florida FL 45/2 North Dakota ND 18/0 Georgia GA 20/3 Ohio OH 14/4 Hawaii HI 1/0 Oklahoma OK 51/5 Idaho ID 3/0 Oregon OR 1/0 Illinois IL 25/4 Pennsylvania PA 10/2 Indiana IN 20/5 Rhode Island RI 0/0 Iowa IA 31/1 South Carolina SC 9/1 Kansas KS 47/4 South Dakota SD 25/0 Kentucky KY 8/2 Tennessee TN 11/4 Louisiana LA 24/3 Texas TX 122/11 Maine ME 2/0 Utah UT 2/0 Maryland MD 3/0 Vermont VT 1/0 Massachusetts MA 3/2 Virginia VA 6/1 Michigan MI 16/5 Washington WA 1/0 Minnesota MN 18/2 West Virginia WV 2/0 Mississippi MS 23/9 Wisconsin WI 19/2 Missouri MO 26/3 Wyoming WY 10/2

source: Indianapolis National Weather Service; spring, 1996

http://www.iupui.edu/it/geni/home.html