Researching Relief Maps

Standard II:

Students will understand that volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.

Objective 2:

Explain how volcanoes, earthquakes, and uplift affect Earth's surface.

Objective 3:

Relate the building up and breaking down of Earth's surface over time to the various physical land features.

Intended Learning Outcomes:

1. Use science process and thinking skills
2. Manifest scientific attitudes and interests
3. Communicate effectively using science language and reasoning

Content Connections:

Math l-1; Integers/number line.
Math lll-2; Locations/coordinate plane.

Science Standard II

Objectives 2 & 3

Connections

Background Information

Earth's surface is constantly changing. Some changes happen very slowly over long periods of time, such as weathering, erosion, and uplift. Other changes happen abruptly, such as landslides, volcanic eruptions, and earthquakes. All around us, we see the visible effects of the building up and breaking down of Earth's surface.

Although most students grasp an understanding of weathering and erosion, they do not understand geological forces and process that have occurred on Earth over long periods of time. Most students understand weathering, erosion and uplift as separate concepts. A common misconception of students is how much time it takes for geologic changes. While it is true that Earth will not change very much in their lifetime, Earth is changing all the time. Another misconception is that weathering and erosion have changed Earth's surface the most. Even though weathering does impact Earth's features, erosion and uplift combined help create the contour to the surface, like the Grand Canyon. This activity is to help students understand that erosion and uplift are forces that are active right now and they have and will continue to change Earth's geological features.

The activities are designed to have students investigate what geological forces created some of Earth's topography and then predict what forces will probably act upon it in the future. Students will investigate areas of the world, United States and Utah to determine

what geological features are located on Earth and make predictions about what they think will happen in the future to that area. The materials are developed to differentiate for student ability levels. Students will need to have an understanding of integers, ordered pairs and coordinate grids to complete the activities. The world activity is for students that are reading on grade level or beyond. Use of the Dynamic Planet Map will help students understand how plate tectonics play into the grand scheme of earth's geological processes. The United States activity is for students on grade level or one level lower. The Utah activities are targeted to be for emergent readers. The materials are developed to be flexible and stress the concepts of uplift and erosion at each level. Activities can be completed as group, small group or individually.

Research Basis

Sutton, J., &: Krueger, A. (Eds.). (2002). *EDThoughts: What we know about science teaching and learning*. Aurora, CO: Mid-continent Research for Education and Learning 52-53

Research and best practice finds that reading, writing, and science are inseparable. Process skills of predicting, inferring, communicating, comparing and contrasting, and recognizing cause and effect relations are needed for science inquiry. Hands-on experiences improve comprehension of text. To increase writing competence, students must be able to organize and communicate observations and data, argue logically, and structure coherent conclusions.

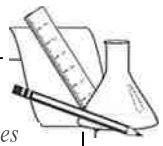
Sutton,]., &: Krueger, A. (Eds.). (2002). *EDThoughts: What we know about science teaching and learning.* Aurora, CO: Mid-continent Research for Education and Leaming 84-85

Learning for understanding should be emphasized, rather than memorized. The article states that different types of learning opportunities are necessary including experimental, symbolic learning, and use of pictorial or graphic representations (maps, films, videos, CD-ROMs, drawings) to help develop a greater depth of understanding.

Invitation to Learn

Pose the question: What geological processes have created areas of Earth? Invite students to brainstorm ideas about how Earth's features have been created. Show the United States Map. Facilitate an open discussion about what some of the lines on the map represent. Point out the latitude and longitude lines on a map. Explain that this is similar to a coordinate grid. Invite students to try and find a mountain location and state the latitude and longitude for that mountain range. Students should be encouraged to use correct vocabulary: (e.g., uplift, plate tectonics, mountains, etc.).

Instructional Procedures



Materials

- ❑ *Geological Processes List*
- ❑ Utah relief map
- ❑ World map
- ❑ National Atlas relief map
- ❑ *Research Card*
- ❑ *Landscape Grid*
- ❑ *Portrait Grid*
- ❑ *Research List*
- ❑ *Utah Map*
- ❑ *United States Map*
- ❑ *World Map*

1. For each level there is a black line, letter sized master of *Utah map, United States Map or World Map.* Students are to use an acetate sheet of the *L-grid or P-grid* to overlay over the 8 ½ X 11 map.
2. Using the *Geological Processes List* students will identify areas on the letter-sized maps according to the coordinate given for the area.
3. Correlating the small map location dot to the large *Utah, United States* or *World Map,* students will analyze the large maps and see what geologic features are located in their research area. (Use Dynamic Planet Map, Google Earth, or Internet resource.)
4. Students will then find the Project Card or use the *Research List* to locate information on that area. They will read and discuss their findings and relate what forces they think acted upon the area.
5. Students fill out a *Research Cards* for each area they review. (There are two cards on each page; each student will need at least 2 pages.)
6. After everyone has filled out at least 4 cards, invite them to get into manageable small groups.
7. Choose a group leader. Then have each team member discuss an area they researched and what their findings were. Groups will need at least 10-20 minutes for this part of the activity.
8. As a class, discuss what was learned from the activity, review the concepts of some areas being uplifted, others are eroded (water, wind, chemical, mechanical) and deposited. If time, locate on rivers and where they drain. Discuss what natural disasters (hurricane, earthquake, floods, and avalanches) might impact specific areas on the maps.
9. Note: All three activities investigate the Grand Canyon and Colorado Plateau. Help students to understand that the main geologic processes involved in the Grand Canyon are erosion and uplift. Students many times think that weathering and erosion created the contours of the canyon. The Colorado River, erosion and uplift all were needed in order for the Grand Canyon to develop to what it is today.
10. As a group, hypothesize – What would happen if no erosion or uplift were acting upon Earth? What would it look like? How

would it be different? What will happen in the next 500 years, 5000 years, and one million years?

11. Journal activity. Students will paste their Research Cards into their journals. Invite them to summarize what they have learned today about erosion and uplift in one or two paragraphs.
12. Encourage students to put away maps and materials carefully as directed.

Assessment Suggestions

- Pre-assess student understanding of vocabulary for this Science Standard.
- Verify that students are using correct terminology while doing research.
- Use of coordinate grids to locate places on a large map.
- Use of study skills to locate information from *Research List* or Project Cards.
- Students will use the scientific process to analyze and hypothesize as they complete activity.
- Completion of at least 4 *Research Cards.*
- Appropriate behavior of listening and sharing in groups.
- Journal completed with *Research Cards* and written summary.

Curriculum Extensions/Adaptations/ Integration

- Challenge idea: How did geological processes impact people in the past?
- If available, have students view other topographical or physical maps. Compare and contrast how the maps show physical features. (Social Studies book, reference books)
- Do a research project on active volcanoes, famous volcanoes or earthquakes.
- Use a map of the world and draw lines to indicate where the tectonic plates are located.
- Locate additional areas on a map and explain the geological forces that have impacted that area.

- If students do not fully understand how to do coordinate grids, highlighters of different colors could be used to identify quadrant areas on the grid. List adaptations for learners with special needs.
- Practice locating latitude and longitude of areas instead of coordinate grids.
- Social Studies link - Investigate how geological features of Earth have created political boundaries or impacted civilizations.
- Locate 1-5 places in Utah that have unique geological impact. Bring in postcards or web pages with information for each place.

Family connections

- Provide students with additional project cards. Have them discuss with their family geological areas that their family might be familiar with or would like to study. They can complete a *Research Card* for that area and add it to their journal.
- Locate an area nearby that has interesting geological features. Plan a family vacation to that area. Record what interesting sites might be found at that location. Math connection: calculate how far it is to the site and how many gallons of gas would be needed to complete the trip.
- When earthquakes or volcanoes happen on Earth, find newspaper or Internet articles that talk about the geological forces involved with the earthquake or volcano. Locate those places on a map. (Or as a class track geological events on a map throughout the year.)
- Write responses to this prompt: "If you could go anywhere in the world, where would that be and what would you want to see there?"

Additional Resources

Media

Utah Map - Relief map of Utah, 1:1,000,000, 1965, Map 20 Utah Geological Survey

United States Map - U.S. Geological Survey, Reston, Virginia 22092 Sheet Number 56 National Atlas Relief Map

The Dynamic Planet - Geological Investigations Series Map I-2800

Web sites

Wikipedia www.wikipedia.com

USGS National Map Viewer http://nmviewogc.cr.usgs.gov/viewer.htm

USGS This Dynamic Planet http://mineralsciences.si_edu/tdpmap/

This Dynamic Planet http://baird.si.edu/minsci/tdpmap/viewer.htm

USGS Earthquakes http://earthquake.usgs.gov/

Google *Earth* www earth.google.com/

Geologic Points of Interest http://www_fs.fed.us/r4/resources/geology/geo_points interest/ activities/cliffs canyons outcrops.shtml

A Lesson in Plate Tectonics http·//www.extremescience.com/PlateTectonicsrnap_htm

Organizations

Utah Geological Survey, UGS office at the Department of Natural Resources (DNR) Building at 1594 West North Temple, Suite 3110, Salt Lake City. 801.537.3300; http://www ugs. state.ut.us/

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

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Location: _____

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Location: _____

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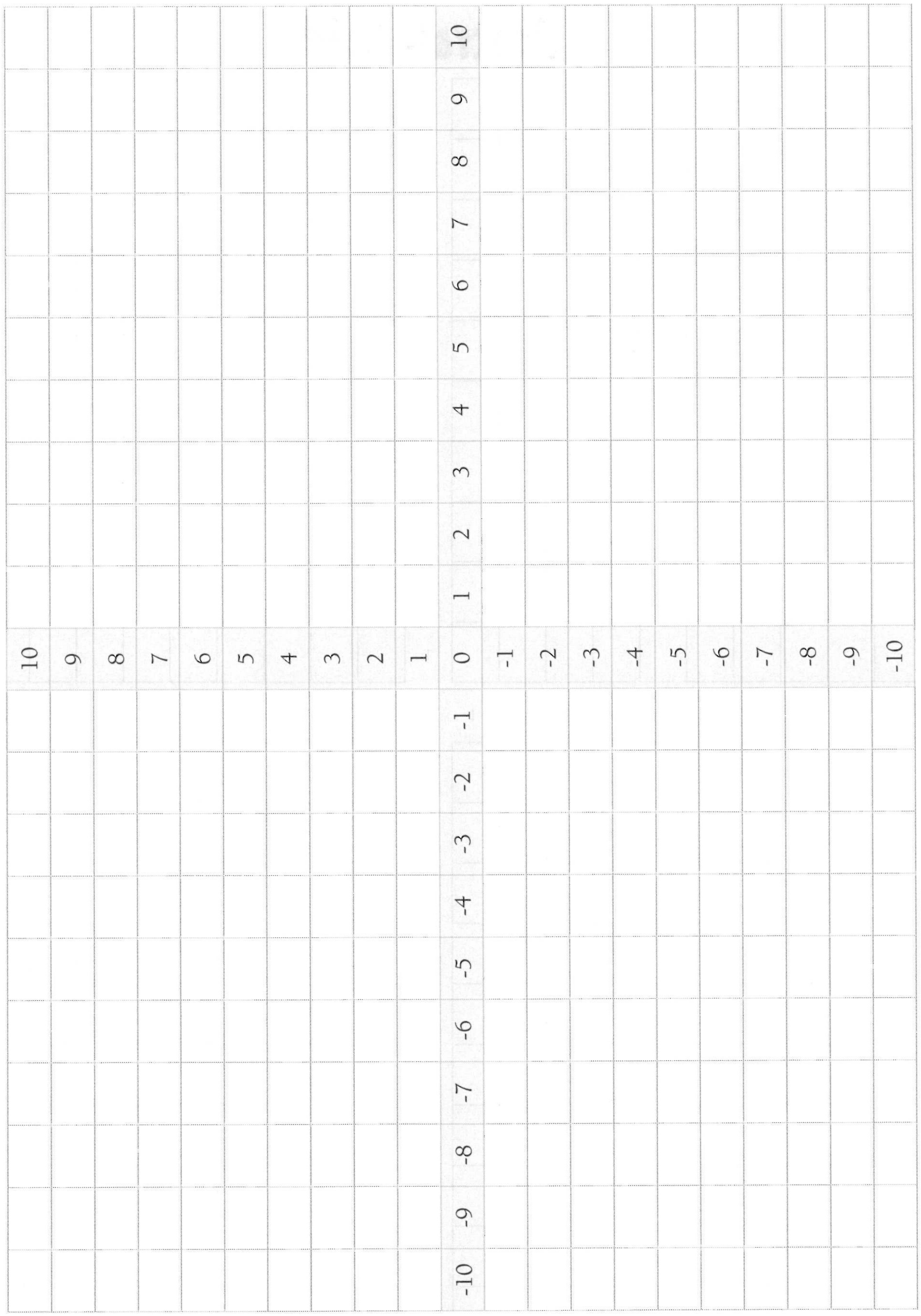
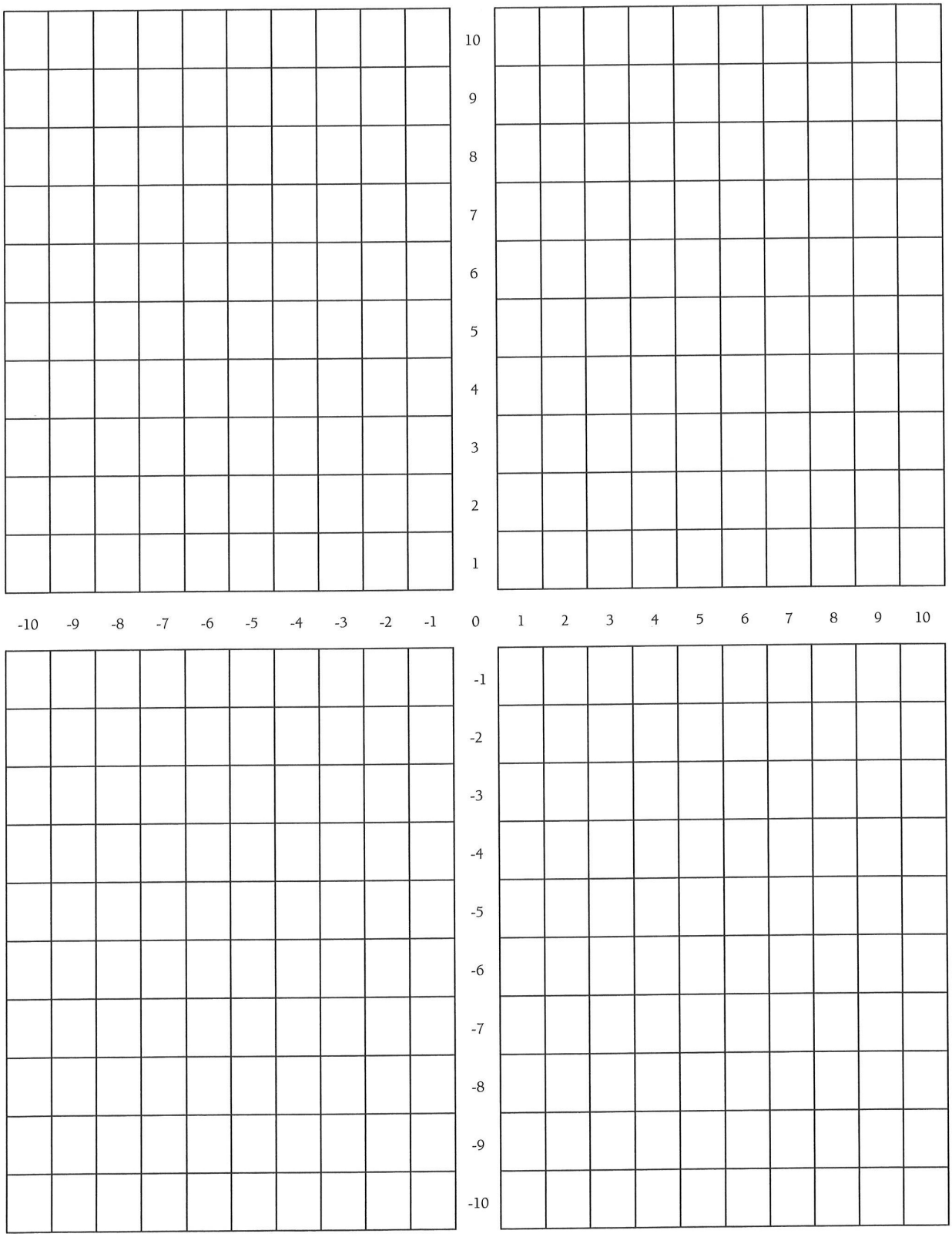
Landscape Grid



Portrait Grid



Geological Processes

World Investigations

	Geologic Area	Quadrant
1	Himalayas	(4, 3)
2	Surtsey	(-1, 7)
3	Mid-Atlantic Ridge	(-1, 1)
4	Andes Mountains	(-3, O)
5	Iceland Weathering	(-1, 8)
6	Qinghai-Tibetan Plateau	(4, 3)
7	Niagara Falls	(-4, 5)
8	Antarctica	(-6, -7)
9	Grand Canyon	(-5, 4)

United States Investigations

	Geologic Area	Quadrant
1	San Andreas Fault	(-8, O)
2	Rocky Mountains	(-5, 2)
3	Mesa - Glass Mountains	(-1, -2)
4	Mount St. Helens	(-8, 7))
5	Yellowstone National Park	(-5, 4)
6	Appalachian Mountains	(4, -2)
7	Mississippi River Basin/Delta	(2, -6)
8	Crater Lake	(-8. 6)
9	Grand Canyon	(-6, -1)

Utah Investigations

	Geologic Area	Quadrant
1	Arches National Park	(-7, 4)
2	Little Cottonwood Canyon	(0, 4)
3	Great Salt Lake	(-3, 5)
4	Hoodoos - Bryce Canyon National Park	(-2, -6)
5	Thistle Landslide	(1, 1)
6	Capitol Reef National Park	(1, -4)
7	Bonneville Salt Flats	(-7, 4)
8	Dinosaur National Monument	(7, 3)
9	Grand Canyon	(-2, 9)

Remember: The x-coordinate tells the distance right (positive) or left (negative). The y-coordinate tells the distance up (positive) or down (negative).

Research Lists

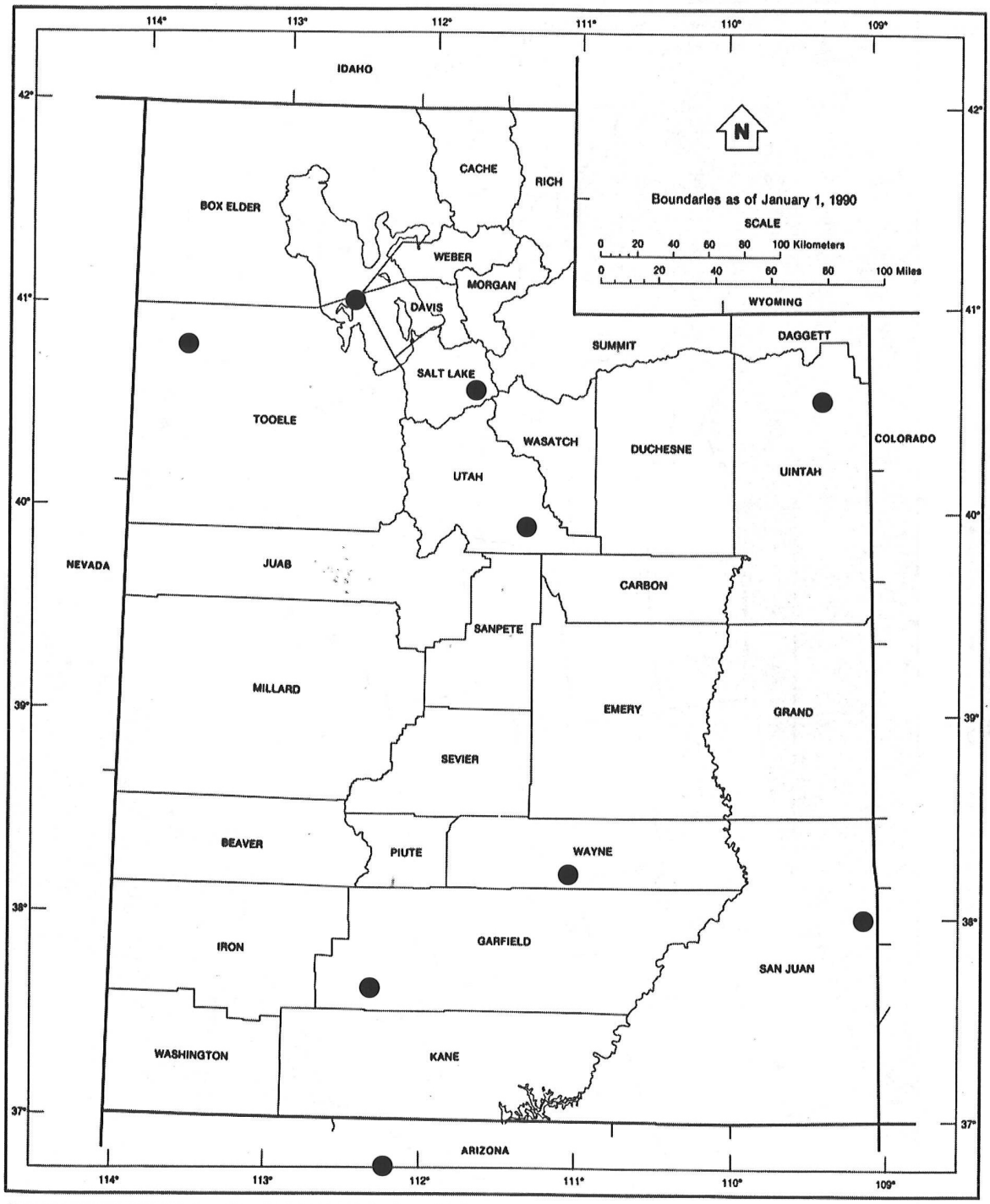
Research List – World		
World 1	Himalayas	http://en.wikipedia.org/wiki/Himalayas
World 2	Surtsey	http: /en.wikipedia.org/wiki/Himalayas
World 3	Mid-Atlantic Ridge	http://en.wikipedia.org/wiki/Mid-Atlantic_Ridge
World 4	Andes	http://en.wikipedia.o rg/wiki/Andes
World 5	Iceland Weathering	http://en. wikipedia.org/wiki/Weathering
World 6	Qinghai-Tibetan Plateau	http://en.wikipedia .org/wiki/Plateau http://en.wikipedia.org/wiki/Chang_Tang
World 7	Niagara Falls	http://en.wikipedia.org/wiki/Niagara_Falls
World 8	Antarctica	http://en.wikipedia.org/wiki/Anarctica
World 9	Grand Canyon	http://en.wikipedia.org/wiki/Grand_Canyon

Research List - United States (U.S.)		
U.S. 1	San Andreas Fault	http://en.wikipedia.org/wiki/San_Andreas_Fault
U.S. 2	Rocky Mountains	http://en. wikipedia.org/wiki/Rocky_Mountains
U.S. 3	Mesa - Glass Mountains	http://en. wikipedia.org/wiki/Mesa
U.S. 4	Mount St. Helens	http://en.wikipedia.orglwiki/Mt._St._Helens
U.S. 5	Yellowstone National Park	http://en.wikipedia.org/wiki/Yellowstone_National_Park
U.S. 6	Appalachian Mountains	http://en.wikipedia.org/wiki/Appalachian_Mountains
U.S. 7	Mississippi River Basin	http://en.wikipedia.org/wiki/Mississippi_River
U.S. 8	Crater Lake	http://en.wikipedia.org/wiki/Crater_Lake
All Teams	Grand Canyon	http://en.wikipedia.org/wiki/Grand_Canyon

Research List - Utah		
Utah 1	Arches National Park	http://en.wikipedia.org/wiki/Arches_National_Park
Utah 2	Little Cottonwood Canyon	http://en.wikipedia.org/wiki/Little_Cottonwood_Canyon
Utah 3	Great Salt Lake	http://en.wikipedia.org/wiki/Great_Salt_Lake
Utah 4	Hoodoos (Bryce Canyon National Park)	http://en.wikipedia.org/wiki/Hoodoo_%28geology°%29
Utah 5	Thistle Landslide	http://en.wikipedia.org/wiki/Thistle,_Utah
Utah 6	Capitol Reef National Park	http://en.wikipedia.org/wiki/Capitol_Reef_National_Park
Utah 7	Bonneville Salt Flats	http://en.wikipedia.org/wiki/Bonneville_Salt_Flats
Utah 8	Dinosaur National Monument	http://en.wikipedia.org/wiki/Dinosaur_National_Monument
All Teams	Grand Canyon	http://en.wikipedia.orglwiki/Grand_Canyon

Utah Map

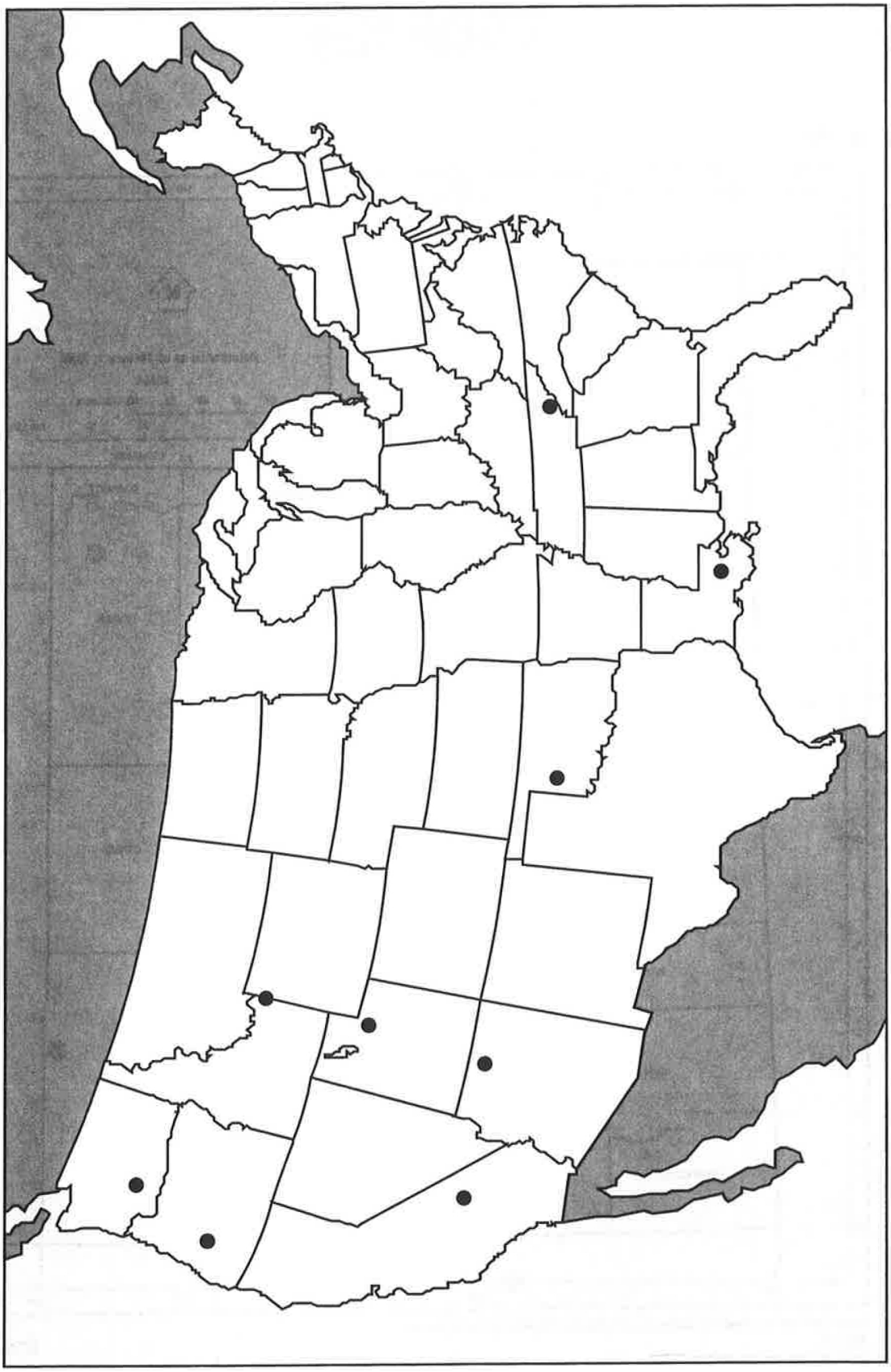
Counties



U.S. DEPARTMENT OF COMMERCE Economics and Statistics Administration Bureau of the Census

MAPS **UTAH G-1**

United States Map



World Map