Slide One

Text: Standard 1: Maps & Other Geographic Representations

No map is an absolute accurate representation of Earth. There will always be some kind of distortion.

Maps are selected aspects or representations or interpretations of Earth’s surface.

The kind of map or geographic representation we choose to use is a reflection of what kind of information we are trying to illustrate.

[Photo of an orange] If you try to flatten an orange peel, it will rip or tear someplace. The same thing happens if you take Earth and flatten it.

[Clip art of girl looking at a globe] [Image of an Africa-centered Sinusoidal projection of the World]

Audio: Standard one, maps and other geographic representations. The first thing to remember about a map is that there is no absolute accurate representation of the Earth's surface. There's always going to be some kind of distortion associated with any map. Take, for example, the orange that you see at the top of this page. If you were to try to peel the orange in one piece and then flatten it out on a surface, what would happen to that orange peel? It would tear. It would rip. It would in some be distorted, and it would not represent a sphere or an orb or a globe accurately. The same thing would happen if you try to take the globe, peel off the continents and the oceans, and flatten it out on a surface. Something is going to stretch or break or tear or look differently on a flat surface that it does if you put it all back on the globe again. So a map can be presented in many ways, and, essentially, it's a selected aspect or a representation or an interpretation of some part of the Earth's surface, and it's up to the cartographer or the map maker which representation or which projection of Earth that they are going to use to make their map and what kind of information are they trying to illustrate or what are they trying to depict about the Earth, but always there will be some sort of distortion.

Slide Two

Text: FROM: The Adventures of Tom Sawyer…Tom Sawyer and Huck Finn are in a hot air balloon somewhere over Illinois….

[Colorful map of the United States of America] [Text of The Adventures of Tom Sawyer]

• Do maps lie
• What’s a map’s Perspective
• How do maps tell stories & highlight themes
As we just noted, no map is an absolute accurate representation of the Earth's surface. Look at the map on this page. It's pink and green and purple and blue, and it really doesn't look anything like Earth's surface. So do maps lie? What is a map's perspective anyway? And do maps tell stories and highlight themes, and if so, how do they do that? Take, for example, the great story of the "Adventure of Tom Sawyer". Tom Sawyer and Huck Finn are in a hot air balloon somewhere over Illinois, and this is how their conversation goes. Huck Finn says, "I know by the color we're right over Illinois yet, and you can see for yourself that Indiana ain't in sight." Tom Sawyer says, "I wonder what's the matter with you, Huck. You know by the color?" "Yes, of course, I do," says Huck. Tom asks, "What's the color got to do with it?", and Huck Finn says, "It's got everything to do with it. Illinois is green. Indiana is pink. You show me any pink down here if you can. No, sir. It's green." Tom Sawyer said, "Indiana pink? Why, what a lie," and Huck Finn says, "It ain't no lie. I've seen it on the map, and it's pink." Tom Sawyer says, "Seen it on a map? Huck Finn, did you reckon the states was the same color out of doors as they are on the map?" Huck Finn replies, "Tom Sawyer, what's a map for? Ain't it to learn you facts." Tom Sawyer says, "Well, of course," and Huck Finn says, "Well, then how's it going to do that if it tells lies? That's what I want to know."

Slide Three

Text: Maps & Other Geographic Representations

Aerial views of parts of Indiana – and they ain’t pink!

[Image of “remote sensing” map of Illinois] [Aerial map of watershed]

These maps use GIS, remote sensing & hydrologic modeling: They’re not pink, but the one on the left is certainly brightly colored. The “remote sensing” map allows efficient identification of degraded riparian areas in the watershed. It provides a basis for assessment and prioritization of areas to target for restoration. And, the area can be described and analyzed on the basis of channel geometry, land use, soil types, and vegetation.

Audio: Okay. So do maps lie? Well, we do know that there are no states on the -- in the map that are pink so what about these aerial shots of the State of Indiana, the same state that was pink on the map? And the map on the previous page, it's a map that will be able to show us how to distinguish one's state's shape from another and where it is on the map of the United States. It might be a tool for school children or others to start identifying the different states but we do know that the cartographer wasn't trying to lie and tell people that Indiana was pink or Wisconsin was green or some other state was yet a different color. It was just a way to show the shapes and to show the positions on the map to make it easier to learn the states. Take these two pictures of Indiana, the first one on the left-hand side is a remote sensing shot of the state. It's not pink but it certainly is brightly colored. This map allows for the viewer to identify certain things on the map. In this case, we're looking at wetlands or riparian areas in the watershed around the rivers.
of Indiana. So somebody looking at this map might be able to tell where there's land degradation, if an area needs to be reforested and they also want -- they look at perhaps how the channel of the stream may be switching, they'll look at land use types, soil types and vegetation and especially with the map on the right-hand side. So they're both aerial views of the State of Indiana and they sure ain't pink.

**Slide Four**

[Map of Illinois] [Contour map of Piestewa Peak in Squaw Peak Park] [Rendering of a city design]

**Audio:** As ordinary individuals and as highly trained geographers or professionals, we use maps every day to analyze information from a spatial perspective. For example, the map in the upper left-hand corner is a map of Illinois that's useful for transportation. We can tell where we want to go and how we want to get there by looking at the various highways and roadways on the map. The map would be of little use for someone who's trying to check out the various land uses in Illinois or other -- or ask other major questions about Illinois's geography. The map in the top of Piestewa Peak in Arizona shows us the contours of the map. Perhaps if we're really experienced hikers, we would be able to look at this contour map and find out where we should go or where we should avoid. But every little elevation is shown on this map. The map at the bottom is a simulation of what a city might look like. It might be used by architects or geographers, urban planners to help design a city. But it certainly isn't useful for getting around. We wouldn't know how to arrive at point A or point B by looking at this map. So these are just some of the considerations about maps and how we use them, what they're useful for, and so on.

**Slide Five**

**Text:** Every Geographic Representation has a purpose

Geographers categorize maps into two main categories: general reference maps and thematic maps.

Of the maps depicted here, which do you think are general, and which are thematic?

[Photo of a globe] [Image of a United States map] [Map of Arizona State Parks] [Thermal map of Lake Tahoe] Using high resolution thermal infrared data from the Landsat and Terra satellites, the map on the left shows thermal upwelling jets at Lake Tahoe.

**Audio:** Every map and every geographic representation has a purpose. Basically, geographers categorize maps into two main categories: General reference maps or representations and thematic maps. Of the maps depicted on this page, which do you think are general and which are thematic? Take the map in the upper right-hand corner. It's a map similar to the one that Huck Finn and Tom Sawyer were looking at a couple of slides back. The states are all different colors. And they bear no resemblance to the states as they really are if one were to take an aerial photograph. It's a pretty general map, general reference map. We can tell where the states are. What the states' names are. How big they are in relation to other and how far apart they are from each other. But that's pretty much it. So this is a general reference map. Looking at the picture in
the upper left-hand corner, we don't really see a map. But instead we're looking at the globe. The globe is useful information. We can see where the oceans are. We can see where the continents are. If you look closely at this, what you can -- the portion of. Or you can see on this globe. You can see the United States, Canada, Central America, Mexico, and South America. You can see the Andes Mountains and the Sierra Madres and the Rocky Mountains by their orange color. You can see the dark green of the Amazon basin. So there is a few details that you can discern on the map. Perhaps some countries names if you were to swivel it about. But, again, it's a general reference map. It doesn't give you a whole lot of other information beyond what is actually on our map. If you look at the map in the lower right-hand corner, here, again, you see a map of Arizona. This map is a thematic map because this map is showing us Arizona State Parks. And it's divided by region. You can see the central Arizona, northern Arizona, western and southern, and get an idea for what kinds of parks and monuments and historic sites that you can find in Arizona. You can see the highways. So perhaps it'll be a little bit useful in getting from place to place if you're a tourist and traveling through Arizona visiting the State Parks. This is a pretty thematic map. The last map on this page in the lower left-hand corner is a really sophisticated map, remote sensing map, and it's showing thermal up-swelling jets at Lake Tahoe. This is a really specific map, and it's only going to be useful for people who know about this information, and who want to analyze it and know what the brilliant colors on the map means.

**Slide Six**

**Text:** The Stories maps Tell

The theme of this map tells the sad story of just one county and city in the US, that is virtually the same story across many, many counties in the US over the past few years.

[Map of Cook County, IL titled “Foreclosures Completed as of August 2007”]

The map illustrates neighborhoods where housing foreclosures occurred most frequently in Cook County, Chicago, IL in 2007.

**Audio:** A common phrase is a picture tells a thousand words; so it is true with maps. The theme of this map tells the sad story of just one city and one county in the United States that is virtually the same story that we hear across many, many cities and many counties in the United States over the past few years. This map is illustrating neighborhoods where housing foreclosures have occurred most frequently in Chicago, Illinois, in Cook County, in 2007. As you look at the map, you can see the various neighborhoods numbered; and you can see clusters of red dots and areas that have fewer red dots. So this is a density map; and the density that we're looking at, the red dots concentrated in two or three or four different areas, are showing us the complete foreclosures. So in other words, it's showing us neighborhoods where foreclosures have occurred at a higher rate than others. This map might be useful for people who are buying homes and want to look to cash in on a foreclosed home. It might be good for realtors so they have more information for their clients. So this is absolutely considered a thematic map. It's definitely not a general reference map.
Slide Seven

Text: More ways to display geographic information

[Globe with lines of latitude and longitude indicated]

Above, the globe shows us a more true representation of the continents’ shapes and sizes. In addition, we see the lines of longitude and latitude.

Audio: The representation on this page shows us half of the globe. We can only see one half of the globe at one time. We can never see the whole thing. In this case we're looking at the Western Hemisphere. What we can also see on this representation of Earth are the lines of latitude, which are also called the parallels; and they run horizontally on Earth from east to west, but they are measured north to south. So if we move north from the 0-degree line of latitude or south from the 0-degree line of latitude, we begin counting zero, one, two, three, four, all the way to 90. When we reach 90 north, we're at the North Pole. When we reach 90 south, we're at the South Pole. We can also see the Prime Meridian on this map running through the town of Greenwich, England, which you can see is represented with a red dot. That line is arbitrary. That line could have been placed in any other city or any other country in the world if that's where mapmakers geographers had converged to when they finally established the lines -- the accounting of the lines of longitude, which are also called meridians. From that line we count east and west. We measure north to south, but we count our lines of longitude east to west. And again, on one half of the Earth we come up with 180 degrees. On the other half of the Earth is our other 180 degrees, equaling the 360 degrees in a circle.

Slide Eight

Text: ‘Isoline’ maps

[Map of United States]

Above: Amount of solar energy reaching the US by region.

[Map of Michigan titled “Mean Annual Precipitation in Inches”]

Audio: The maps on this page are called isoline maps. And then what they're recording are the contours. The undulations or the gradients in a particular phenomenon that they're trying to depict graphically. With the map of the United States in the upper right-hand corner, what we're seeing is the amount of solar energy that reaches the U.S. by region. So the colors on this map range from a deep red, where we see most of Arizona. To a light green where we see some of our northern states. Wisconsin and Michigan and some of our upper northeast states. And also the Pacific Northwest, which is even a darker green. And this is just showing us then, again, the solar energy that's reaching the United States. In the map in the lower left-hand corner, what we're looking at is a map of Michigan. And we're looking at the mean annual precipitation in inches as it varies throughout Michigan. And what we might have to know about Michigan is
that it's got part of Lake Superior. It's got a part of Lake Michigan. And it's got a part of Lake Eerie to contend with. So depending on the winds, depending on the seasons and so on, we're going to have different rainfalls. Different inches of rainfall in different parts of the state. So in this case we're looking at the darkest brown to the darkest blue. And all the gradient colors in between. The brown is showing us where there is the least amount of precipitation annually in Michigan. And as we move our way down to the dark solid blue, we're seeing the parts of Michigan that get the most rainfall.

**Slide Nine**

**Text:** Thematic maps

[Map of Wisconsin]

This map of Wisconsin illustrates the occurrence of the Polish surname “Zywicki” in Wisconsin using a blue scale, with the darkest blue representing the highest density of Zywicki surnames.

**Audio:** This thematic map is probably not too useful to a whole lot of people, except in this case, the Zywicki family in Wisconsin. Zywicki is a Polish surname or a Polish last name, and many of the residents -- or many of the Zywicki's live in Wisconsin. So it's a thematic map all right, but it's not too useful to too many people exempt the Zywicki's and, perhaps, some historians who are looking at surnames in Wisconsin or perhaps settlement of Poles or other ethnic groups in Wisconsin. So what we see here from the very lightest colors, or the white color, would be a real low intensity or a low settlement or zero settlement of the name Zywicki in Wisconsin. The light yellow through the greens also represent lower or medium levels of numbers of Zywicki residents in various counties in Wisconsin. If you look almost at the center of Wisconsin, a little bit central, south, you are going to see the highest intensities of Zywickis. Now, if I were a Zywicki and I was planning a family reunion, probably it would make sense for me to plan my reunion around the area where we see most Zywicki surnames; assuring that that's where our cousins and our family members are going to come from. But beyond that, this map doesn't tell us how to get any place. It doesn't tell us what kind of soil we have, what kind of crops we can grow or cows we have in our -- amount of cows we have in the fields. It's just simply showing us one particular last name in Wisconsin.

**Slide Ten**

**Text:** Maps’ limitations & projections

[Image of cylindrical, conical and azimuthal map projections]

Above = Three classes of map projections:
Example: Large area/US = Cylindrical
Medium area/state = Conical
Small area/city = Azimuthal
Audio: Again, it's important to remember that a map cannot be an absolute and accurate representation of the Earth's surface. So, in other words, maps have many limitations. And there are many ways or many projections we can use to represent the information we're trying to display on a map. In the earlier part of this presentation, you saw a picture of a sinusoidal map. Or what's commonly called the orange peel map. And it looks like you -- what you might see if you were to peel off that entire orange skin and try to place it on a flat surface. This map, this picture on this slide is showing us three different map projections that a cartographer might also choose to use. Depending on what on -- depending on what information she or he was try to go convey to the person who views the map. So the example on the far left is a cylindrical projection. If, for example, you were trying to depict a large area of the Earth's surface, say the United States or Western Europe or Africa, you might choose to display it with a cylindrical map projection. If you look at the picture in the middle, the conical map shape, you can see that it might be more appropriate for a medium area of the Earth's surface. Perhaps a state or a region. Maybe the southwest. Or the Great Lakes region. Or some other smaller part of the United States. A medium area. If we look at the third map or the third projection on this slide, the azimuthal, that would be the more appropriate projection to use if you were trying to display information about a smaller area, a city perhaps, or a portion of a large city. This might be the most accurate or applicable type of projection to use. So it always will vary depending on what kind of information you have. And how you want to represent that information. What story is your map trying to tell you?

Slide Eleven

Text: Maps' limitations & projections

As mentioned, no map is an absolutely accurate representation of Earth’s surface. The most accurate is a globe, but you really can’t carry a globe around in your pocket or backpack, and it isn’t likely to help you find your way to any given point. If you try to flatten a globe, what happens? Think about what would happen if you tried to take an orange peel and flatten it – it cannot be done without tearing, breaking, or distorting the orb.

[Image of a map]

Above, an equal-area map projection correctly represents areas’ sizes of the sphere on the map.

The map below shows an equidistant map projection, which correctly represents distance.

[Image of map]

On a Mercator or conformal map projection, meridians and parallels intersect at right angles.

[Image of map]

Audio: So even though a globe is the most accurate representation of the earth. It's really hard to put in our back pocket or in a backpack and carry around with us all day. Looking at the three map representations on this page, they all look similar. But there are differences if we look closely. These are three more projections. The map in the upper left-hand corner shows an equal-area map projection. And this one correctly represents areas' sizes on the map. The map directly
to its right shows an equidistant map projection. And in this case, it's showing continents or places correctly represented by distance. In the map in the lower left-hand corner, we see a Mercator or a conformal map projection. And if you remember, a few slides back when we looked at the globe with the lines of longitude and the lines of latitude. We could see how really the lines of longitude converge at the South Pole and at the North Pole. They are not parallel like they are on any of these three maps. So right away we know there is some distortion. But a map, a Mercator map, for example, might have been very, very useful for sailors navigating the seas.

### Slide Twelve

**Text:** Map Scale

[Image of four examples of scales, from small to large]

Map scales are represented in 3 main ways:

- **Graphic Scale** – using a bar or line showing the equivalent miles or kilometers on the Earth
- **Verbal or Written Scales** – using words, such as “1 inch = 5 miles,” and
- **Representative Fraction** – (see examples on left)

A way to remember and differentiate ‘large’ from ‘small’ scale maps is: ‘small scale’ = little detail; and ‘large scale’ = greater detail on the map.

**Audio:** Another important concept in map making and map reading is the scale of the map. In this image on this page, we have four different map scales. And looking at -- looking at the images, we see first of all the focus of all our images is Atlanta. So at the first images -- image shows us a map of the United States with Atlanta. With the map of the dot showing where Atlanta is. The second image shows us a smaller portion of the U.S. A region, let's say, the southeast United States. And there again we see Atlanta. Moving further down, the third map shows us the state of Georgia and its neighboring states. Also with a dot showing us where Atlanta is. The fourth map on here, the bottom image, shows us a city map of Atlanta. With the roads, with the loops, the highways and so on. So what we're seeing here are different scales. Moving from the top, which is a small-scale map to the bottom, which is a large scale map. Certainly there are smaller scale maps. We could look at a world map with the dot, again, of Atlanta. It would be very -- of very little use for us. Except to know where in the United States, more or less, Atlanta is. But it wouldn't tell us a whole lot of other information. By the time we get down to the bottom map, we can see how we can get around. We could use this if -- if we were tourists in Atlanta. So one good way to remember this -- this concept of scale is to remember that a small-scale map has little detail. Like it might have all the continents or the entire world. But -- but your theme, Atlanta, is very difficult to tell anything about. A large-scale map is going to be a smaller portion of the Earth's surface, like metropolitan Atlanta. But it's going to have a lot more detail. It's going to show us exactly how we can get around and which roads to take. So just looking at the maps, we can see that there are different scales. Three ways of representing scale on a map are verbal, graphic, and representative fraction. On most maps we can see one, two, or even all threes of these ways in which the map reader. You or me can look at this map and see how -- how big it is in relation to the planet. So looking at the verbal scale.
You'll see it written something like this. On our first map it says one inch equals 1,485 miles or one centimeter equals 940 kilometers. So we know that one inch on the map surface equals 1,485 miles on Earth's surface. Or one centimeter on the map is 940 kilometers. That's our verbal scale. It says it in words. The graphic scale shows us, essentially, the same thing. And if you look at the bottom image on in the -- in the graphic scale next to it. You'll see, for example, that the top bar graph shows us about two inches on a map. And says it's equal to 30 miles. The lower bar is in kilometers. And it shows us how much space on the map equals 30 kilometers on Earth's surface. So you can, essentially, take a pencil or a ruler or anything else. And if you know how much 30 miles is on that map, you can -- you can measure it using your ruler. Your finger. Whatever instrument you have. And you can see approximately how far you have to go. That's our graphic scale. And then the representative fraction scale, again, is showing us, for example. Moving to the top picture. We see that one unit on the map surface equals 94,000 units on the Earth's scale. Moving down to the third map of, basically, the state of Atlanta. We can see that one unit on the map's surface equals 16 hundred thousand units on the earth's surface. And so on.

**Slide Thirteen**

**Text:** Patterns & Distribution

Maps, like other images, convey a great deal of information at a glance. Geographers use maps to plot and show ‘patterns’ on Earth’s surface, and distribution’ of phenomenon on Earth.

[Map of the United States]

The map above illustrates the spatial ‘distribution’ of six religious denominations.

**Audio:** Geographers and others use maps to explain and to illustrate patterns and distribution of phenomenon on the Earth's surface. So, for example, the map on this page illustrates the spatial distribution of religious denominations. We can see, for example, how the primary religions break down in the United States. We can see that in the South and Southeastern portion of the United States, the area is heavy with Southern Baptists. The midsection of the United States and Eastern portion of the United States shows a high proportion of United Methodists. The yellow map or the yellow states on the Western side of the map show us a high proportion of LDS or Mormons in the United States. And so on and so forth. So again, we can look at the map at a glance and see, more or less, in which portions of the United States do we have various religious concentrations. It's a very useful map if we're -- if we are looking for some piece of evidence to help us supplement other documentation or information we have about religion in the United States.

**Slide Fourteen**

**Text:** The graph below illustrates religious diversity in Hawaii by percent of Hawaii’s population.

[Graph titled Religious Diversity in Hawaii]

**Audio:** The image on this page is not a map. But it is another way in which geographers represent information that we could, indeed, plot on a map. In this case we're looking at the
religious diversity in Hawaii from the 2000 census. Information that was collected by people responding to the census. At that time the total population of Hawaii was 1,211,537. And of that number, five religions are represented on this graph. So we're seeing that almost 30 percent of Hawaii's population in 2000 is Christian. Maybe about 8 percent is Buddhist; one percent, Jewish. About 10 percent identified themselves as other. And over 50 percent of the population in Hawaii identified themselves as unaffiliated. So, again, this will give us a sense of what religious denominations inhabit Hawaii. But not much other information. So it's thematic. It has a specific purpose. And it's trying to convey information about Hawaii's religion. And that's all it's going to tell us.

**Slide Fifteen**

**Text:** Conclusion: Maps & Other Geographic Representations

Knowing how to identify, access, evaluate, and use all of these geographic resources will ensure students of a rich school experience in geography and the prospect of having an effective array of problem-solving and decision-making skills for use in both their educational pursuits and their adult years.

**Audio:** After viewing this lesson on maps and other geographic representations, you will know how to identify, access, evaluate, and use all of these geographic resources to ensure that your students have a rich school experience in geography and will end up by being able to problem solve and make effective decisions in both their education, as well as in their daily lives.

**Slide Sixteen**

**Text:** By Beth Larson, PhD

Lecturer in the School of Geographical Sciences and Urban Planning,

Arizona State University, 2010

[Photo of Elizabeth Larson]

**Audio:** This lesson on maps and other geographic representations has been written and narrated by Dr. Beth Larson, lecturer in the School of Geographical Sciences and Urban Planning at ASU, 2010. Thanks.