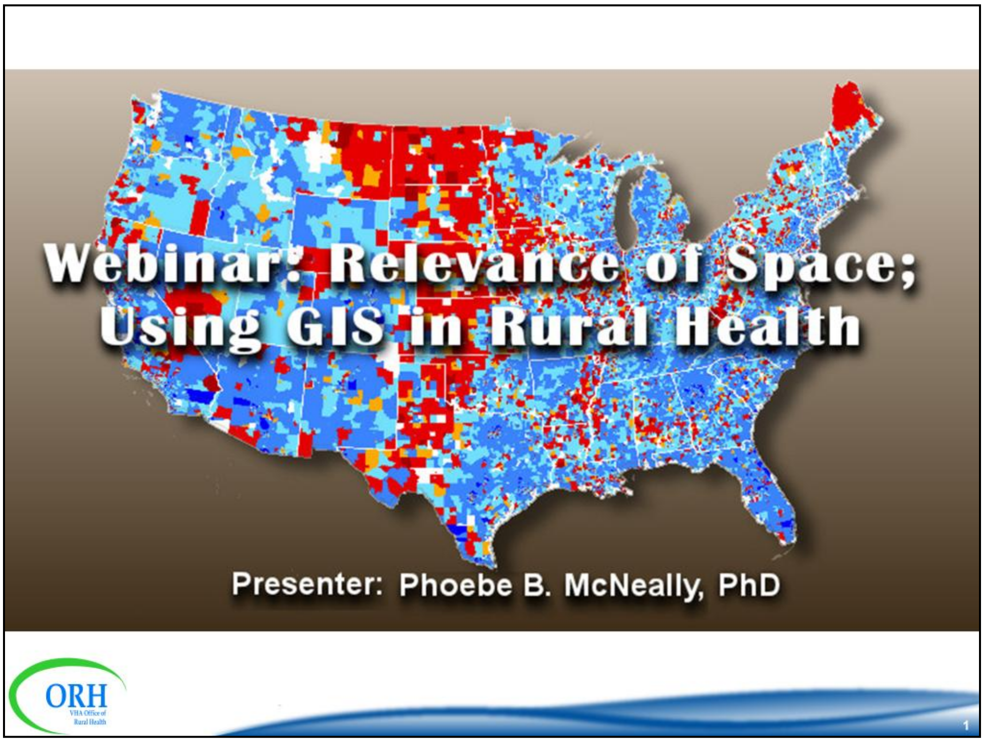
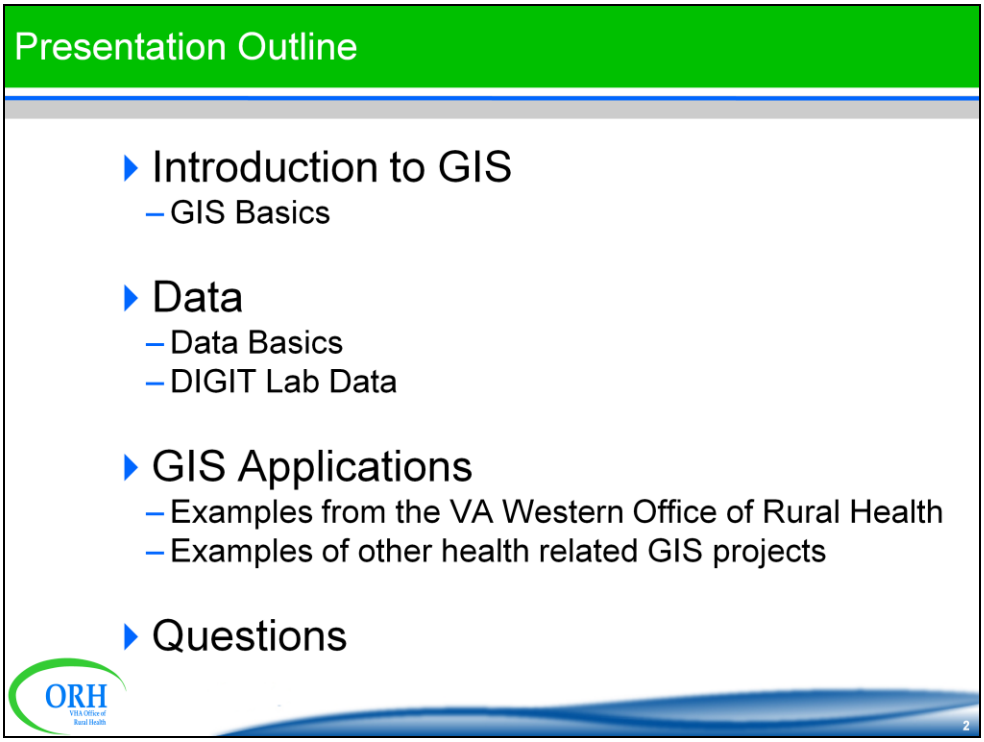
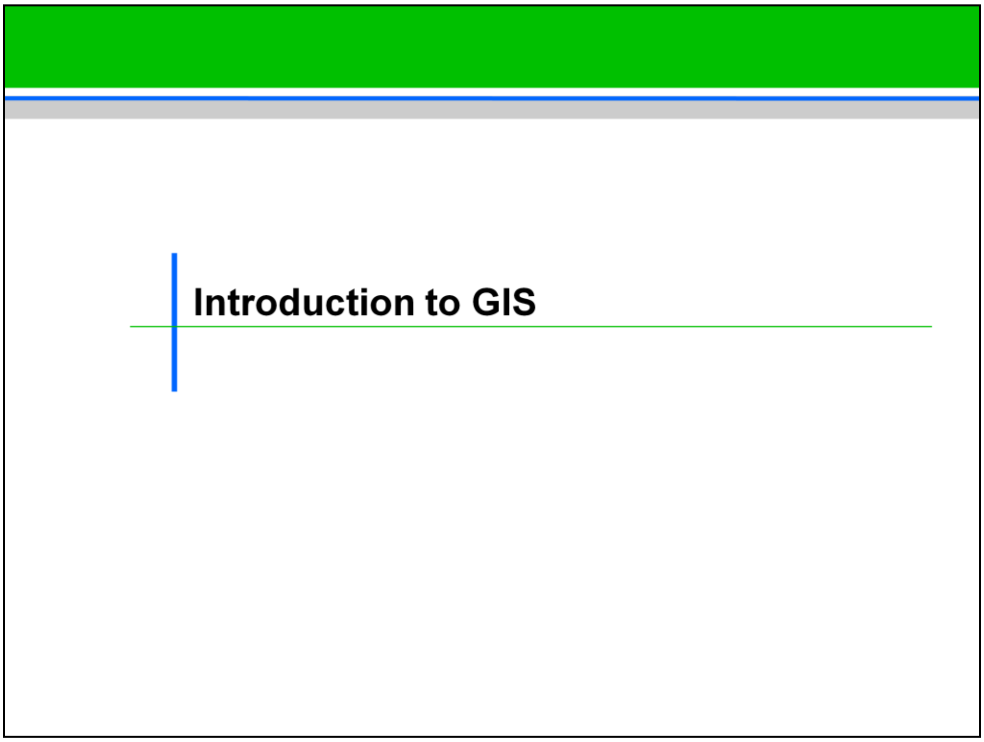


Welcome, Dr. McNeally. Thank you all for attending today’s workshop. I’m very happy to be here and to share GIS. I’m very passionate about it and I see a lot of uses of it in many different areas. Okay. Today's talk will be the Relevance to Space: Using GIS in Rural Health.

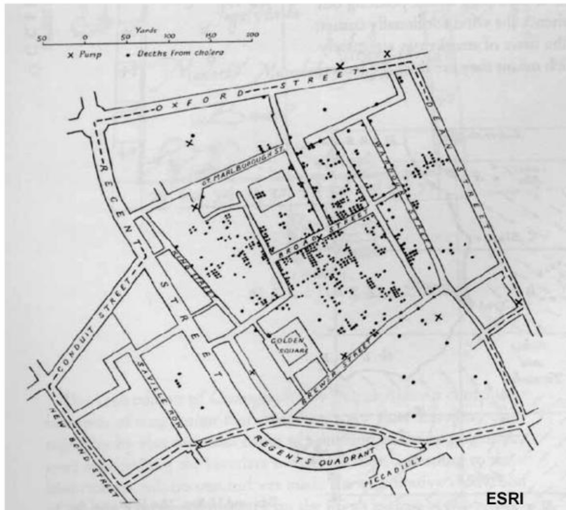


I'll begin with a brief introduction to GIS, which stands for geographic information systems. I'll provide you some background in just the overall basics -- an hour isn't very much time to cover everything. Then I will go into talking about data, what data goes into a geographic information system, and then data that the DIGIT lab has on hand and that we have been using working with the Western Office of Rural Health. Then I will go into the more exciting part of the presentation which is the applications. I will show you examples from the Western Office of Rural Health, the things I've been working on with Dr. Bair and Nancy Dailey. And, following that with examples of other health-related GIS projects from within the DIGIT lab and from around the country and then I will conclude with questions.



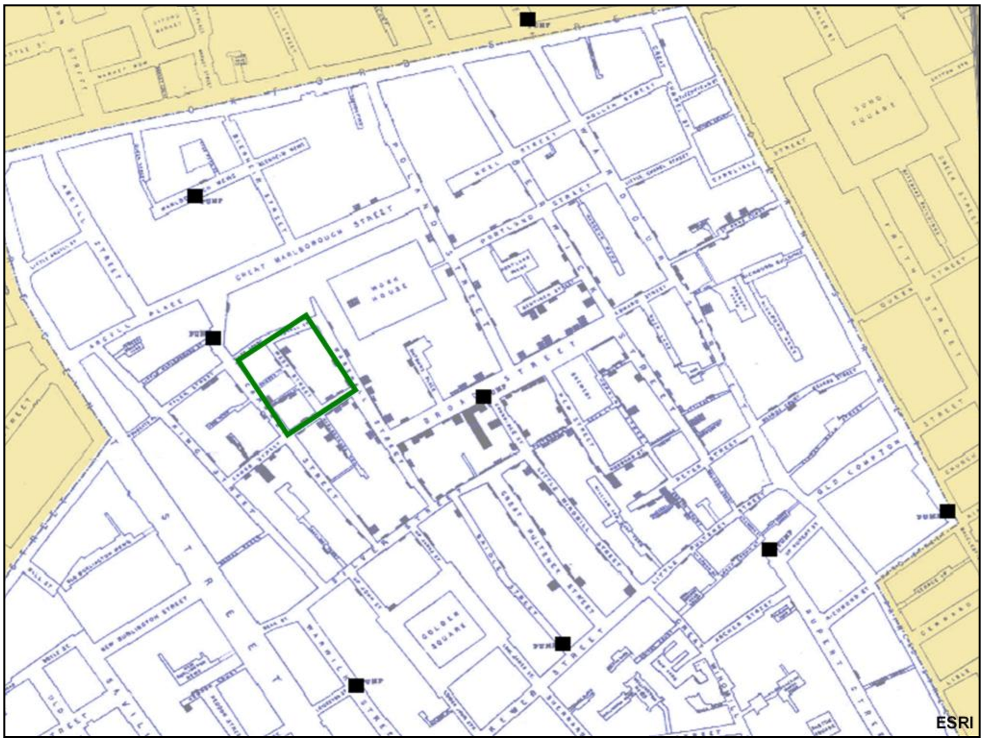
First, just to begin with what geographic information systems is. I would like to start with an example of geographic analysis.

The beginning of geographical analysis….

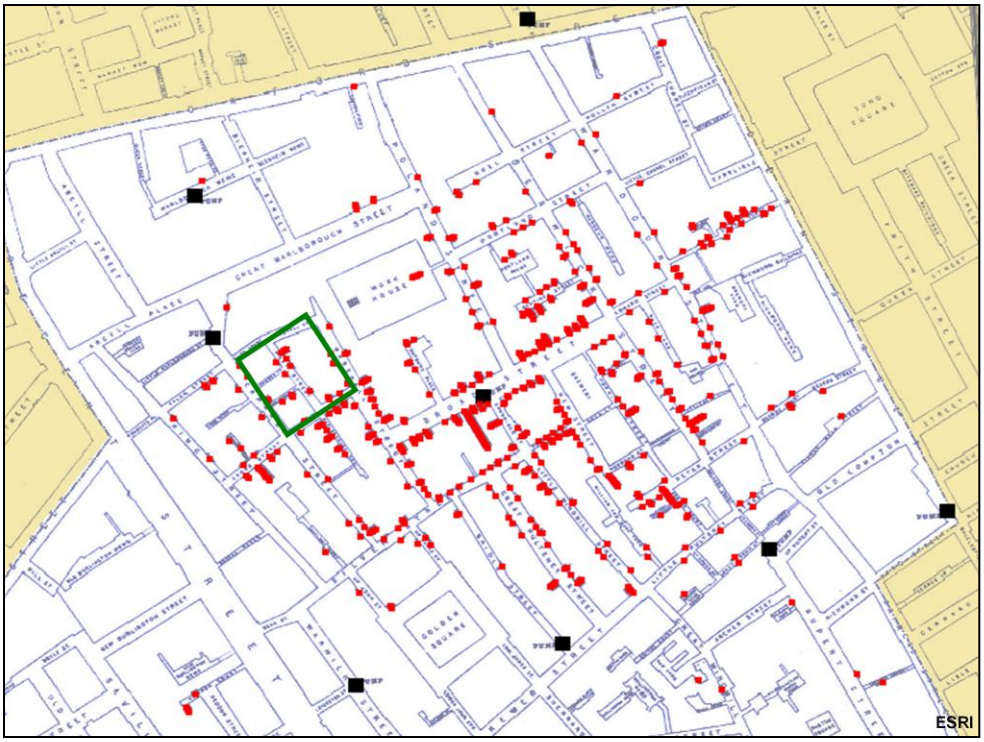


ORH VHA Office of Rural Health

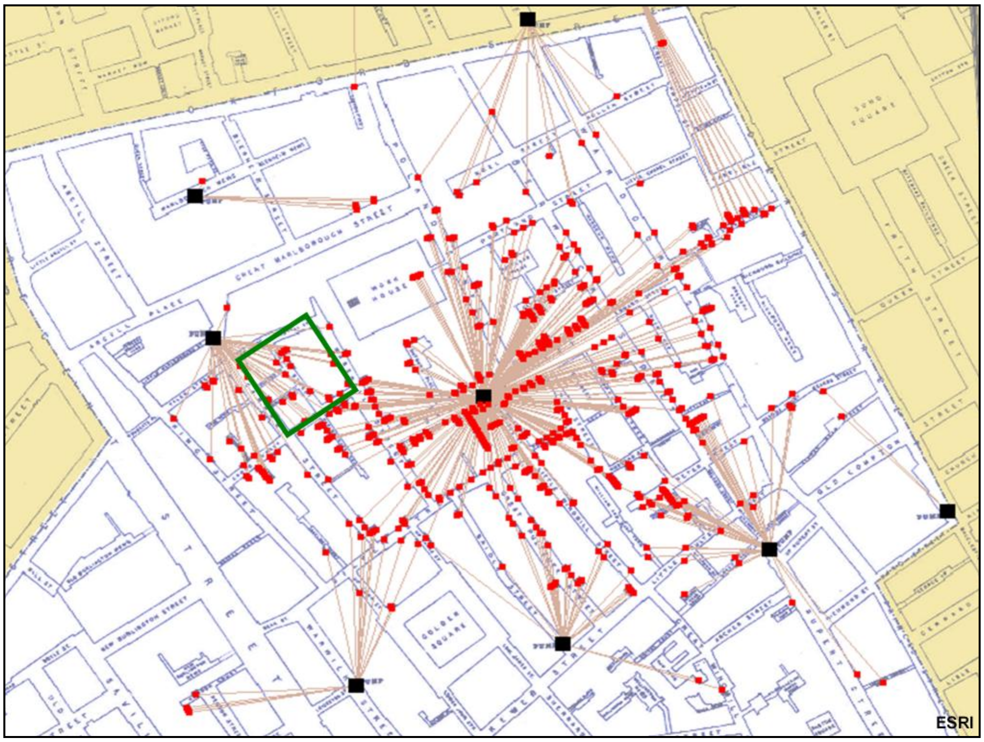
Many of you might recognize this drawing. This is a drawing of a set of streets from London. This is the Soho district. This is actually the very beginning of geographic analysis. This is a map drawn by Dr. John Snow showing the cholera epidemic in 1854 in London. If we look at this a little further, this first slide here shows one of the original drawings of where the outbreaks of cholera occurred. I will walk through this analysis.



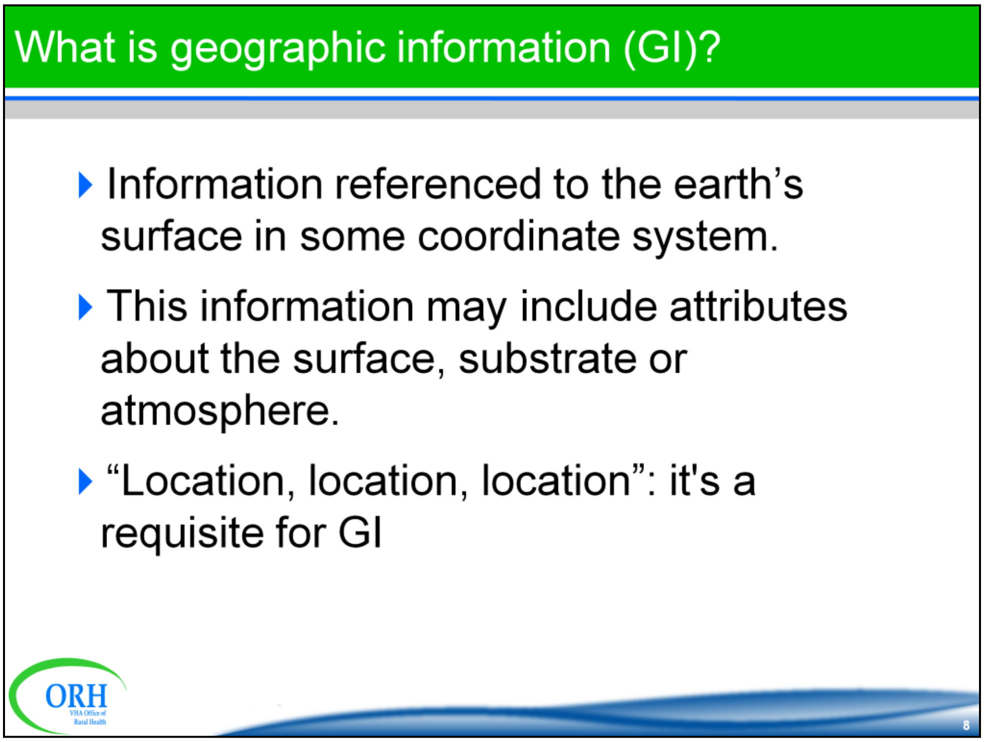
This map is a slightly more up-to-date map and on here you can see the streets again and then there are some black rectangles and a green rectangle. In 1854 there were two competing theories as to the source of the cholera outbreak. The popular theory was that contaminated vapors emanating from an old cemetery caused the disease. The old cemetery is outlined here in Green. They thought that vapors caused the disease. The cemetery was used 100 years earlier to bury victims of the bubonic plague.



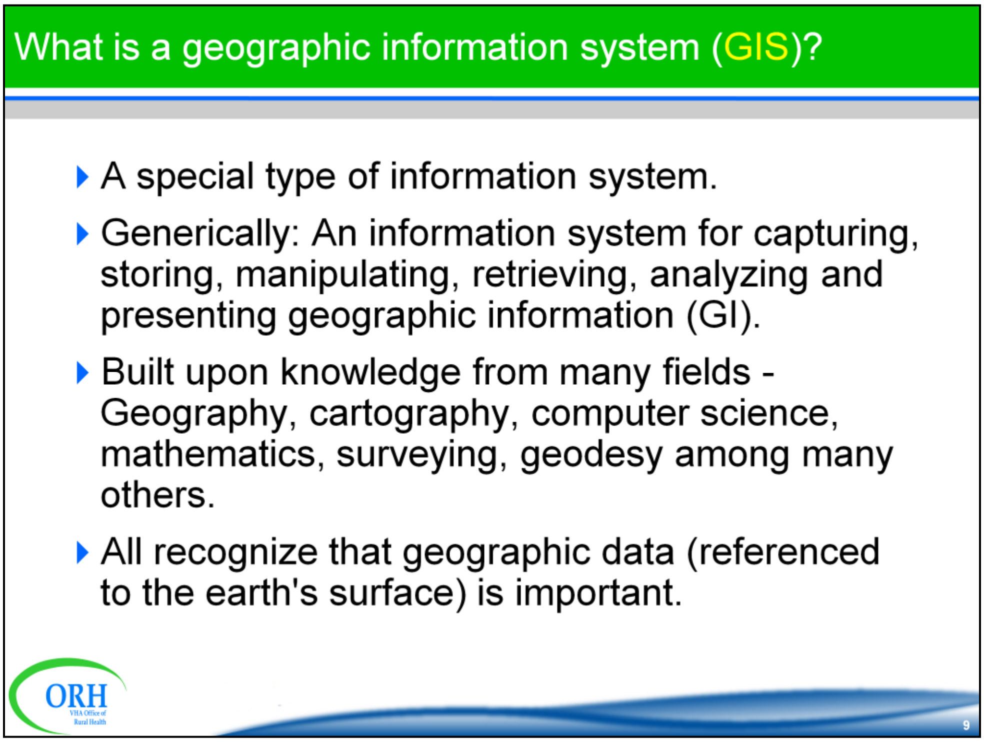
By the time the cholera epidemic occurred there were a lot of buildings built on top of the cemetery. The second theory, that Dr. John Snow proposed, was that the cholera outbreak was linked to the water sources. On this map the black rectangles represent the location of the wells. So what Dr. Snow first did is he located the cemetery and he located the wells on a paper map. Next he plotted all the cholera cases and where the deaths had occurred. So this is the same map again that the red dots show all of the cholera cases.



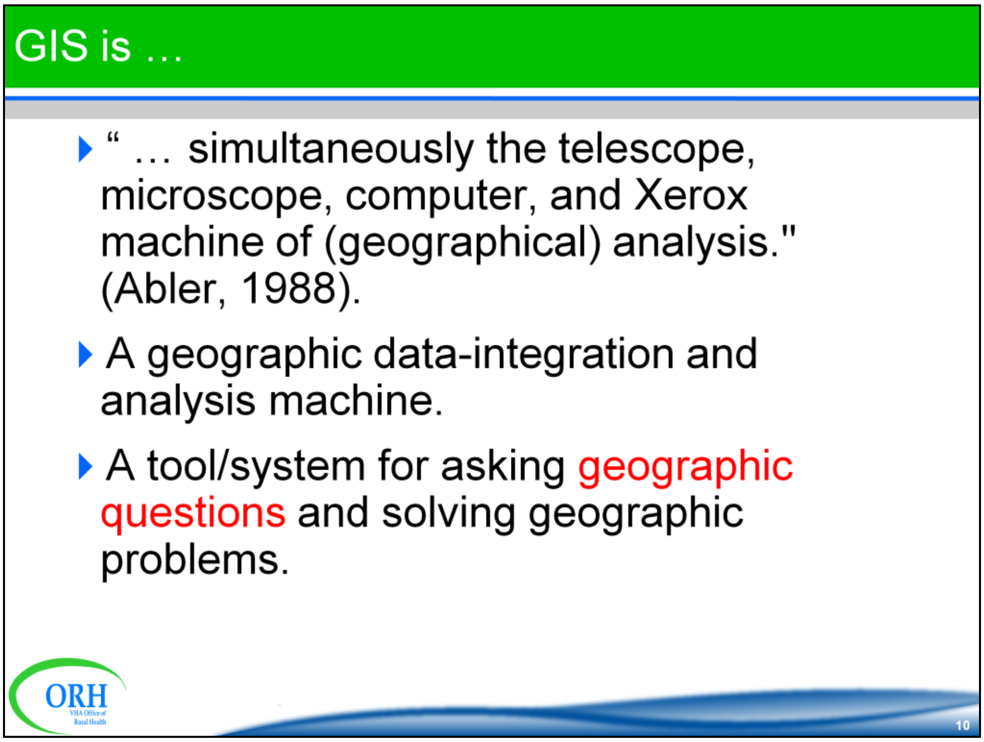
Then he followed this up by correlating the locations of the victims' homes to the source of the drinking water. And so here you can see, with the lines drawn, he linked the victims to what water source they were getting their water from. You can instantly see that there is a pattern involved. This well right in the middle, the Broadstreet Well, was where the majority of the cases were linked to. So he determined that the majority of those who had died had gotten their bad drinking water from the Broadstreet Well and it wasn't at all coming from the bad air from the cemetery, which was the popular belief at the time. After closing the well the number of cases of cholera dropped dramatically and later it turned out that the sewer pipes buried 22 feet down were leaking into the shallow water wells and this Broadstreet Well was only 28 feet deep. So this is the classic example of geographic information analysis and the basis of most of what occurs in our field. This took a long time for Dr. Snow to do because it was done with pen on paper but today it could be done on the GIS in a matter of hours.



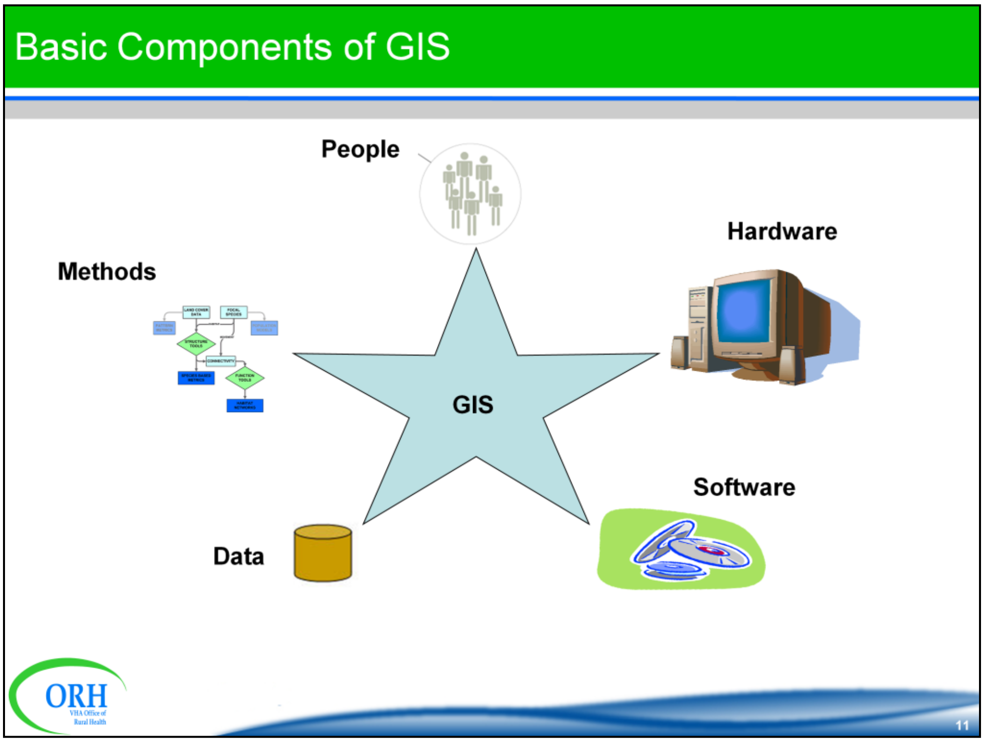
I just wanted to get you thinking about graphic information systems and how it can be used. Now we take a step back and look at what geographic information really is. Geographic information is information referenced to the earth's surface in some coordinate system. It could be a defined system such as latitude and longitude or it could be a made up coordinate system where you put your location at (10,000 , 10,000) on a Cartesian coordinate system. It is just linked to the Earth's surface in some manner. This information is data and meaning. So whenever I refer to information here I am referring to data that has meaning associated with it. For example, a zip code is a number but it also means a space on earth, too. So it may include information about the Earth surface, substrate, or atmosphere. Geographic information is not limited to just the surface of the earth. It could go down into the substrate looking at where oil deposits are, where coal mines are, or you could go up into the atmosphere and look at jet streams. So at any level it is still in reference to the earth. The biggest part is location, location, location. It is a requisite for geographic information system and everything in a GIS or geographic information strategy has to do with location.



So as we move on to taking this geographic information which is data that is tied to the earth's surface and we put it into a system, what exactly are we talking about? A geographic information system commonly referred to as GIS is a special type of information system. In generic terms it is an information system for Capturing: gathering your data; Storing: a place to contain it all; Manipulating: you can move it about or change locations; Retrieving: instead of having things in paper format you can bring it in, it is retrievable from that storage part of the system; Analyzing; and Presenting geographic information. So it is the full picture of everything from capturing the data whether you are capturing it from paper maps or a GPS unit or health system etc. to how you are going to present a final product of your analysis. And it builds upon knowledge from many fields. It is not strictly from geography and cartography which most people assume. A lot of it comes from computer science, mathematics surveying, geodesy, which is a study of the earth and is usually tied to GPS, or global positioning systems, among many others. A lot of fields have contributed to GIS and all recognize that geographic data is important so the overarching theme of this is everything is tied to the surface of the earth.



So what exactly is the definition of GIS? And depending on what article or book you pick up or who you talk to the definition changes greatly. There is no standard definition for GIS so I picked out just a few that I think best represent GIS. In 1988 Abler described GIS as being simultaneously the telescope, microscope, computer and Xerox machine of geographic analysis. And so here he's referring the telescope and microscope as whether you are looking at just a small neighborhood or whether you are looking at a trend or analysis on the state, continent, or global level; and the computer is the working behind it; and the Xerox machine is you can produce lots of output in different ways. Another description is a geographic data integration and analysis machine; so you are integrating geographic data and performing analysis. Overall, it is a tool or system for asking geographic questions and solving geographic problems. These geographic questions can be very simple. For instance, where is Salt Lake City, Utah? Very simply answered. Or it could be much more complex. An example for the VA would be, what effect does closing a clinic have on the veterans in an area? Does it mean that they have to drive further? Does it mean they won't have access to certain services? So you can go from very simple questions as to where is something located, to how is closing or adding or changing something, the "What if" questions, going to affect a larger group.



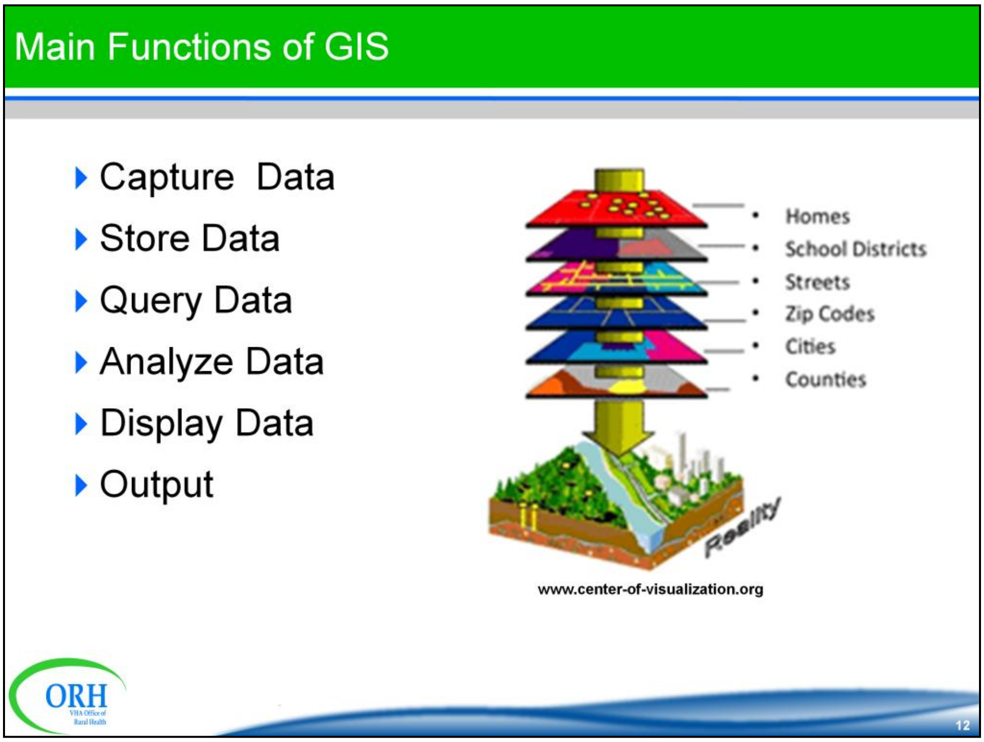
So what we're looking at here is the basic components of GIS. The star in the center represents GIS and each point of the star represents a different component that goes into it. Starting at the right hand side with hardware, this is what most people think is GIS. You have your desktop or laptop and that is where everything resides. The hardware is just providing the platform for everything else. So this is just the mechanical portion of it.

The second component of GIS is the software. So the software is loaded onto the hardware and now they are linked together. Usually people think of software and hardware as one but I like to separate them out. So whether you are using ESRI or GIS software, or Map Info or Clark University's EDRESI, there are a number of different GIS operators available.

The third component is data. GIS needs data to work with. It does not produce results without data input.

The forth component is methods, this is your analysis. What are you doing with that data? How are you manipulating it? What type of questions are you asking? If I want to know how many veterans are located within one hour of a clinic that would create a series of methods using different tools and the data to create that.

And the fifth system is people. I say finally but this is the most important part because you can have the other four components but if you do not have the people to ask the questions, choose, collect, and analyze the data and interpret the results then the GIS system does not run. It cannot run on its own and it really needs the people.

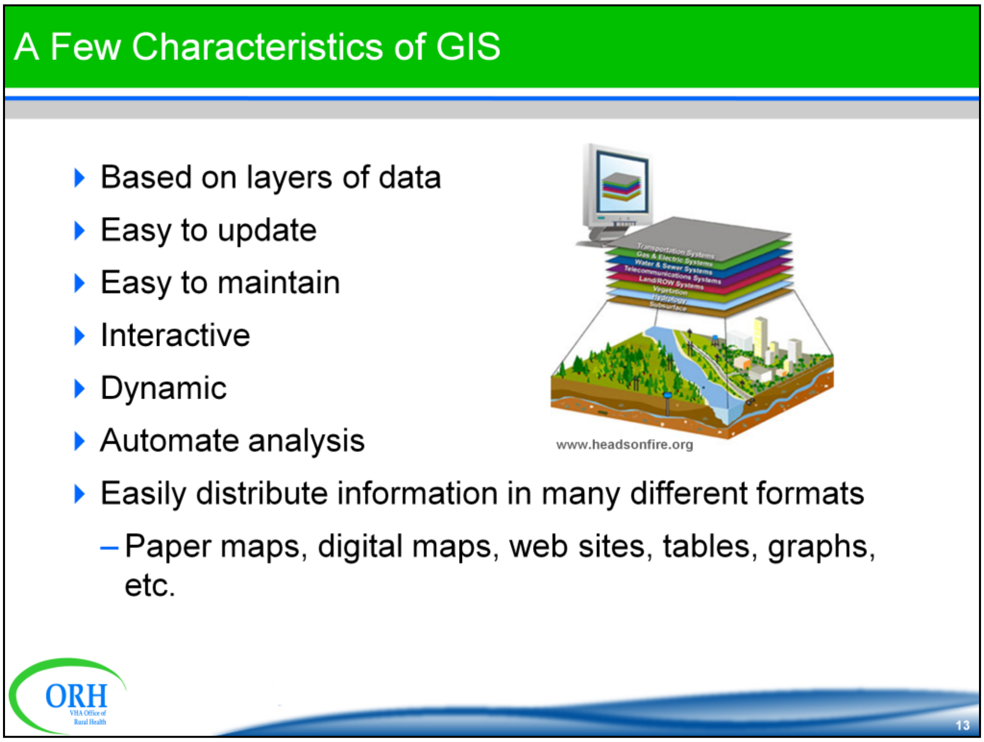


The main functions of GIS can be categorized into seven functions or seven categories. The first is capture data. So on the right-hand side is this graphic. The bottom is a picture of reality. Just a snapshot of a small place in the world. And then you can capture different levels of data from there. For example, this one has counties, cities, zip codes, streets, school districts, and homes extracted from that reality. It did not extract every single portion of that reality but it has chosen that group of information to capture.

So it is used to capture data and then store data. GIS data is stored in two main formats. When we get into the data section of this I will go into much more detail, but it is stored as either rastor or vector.

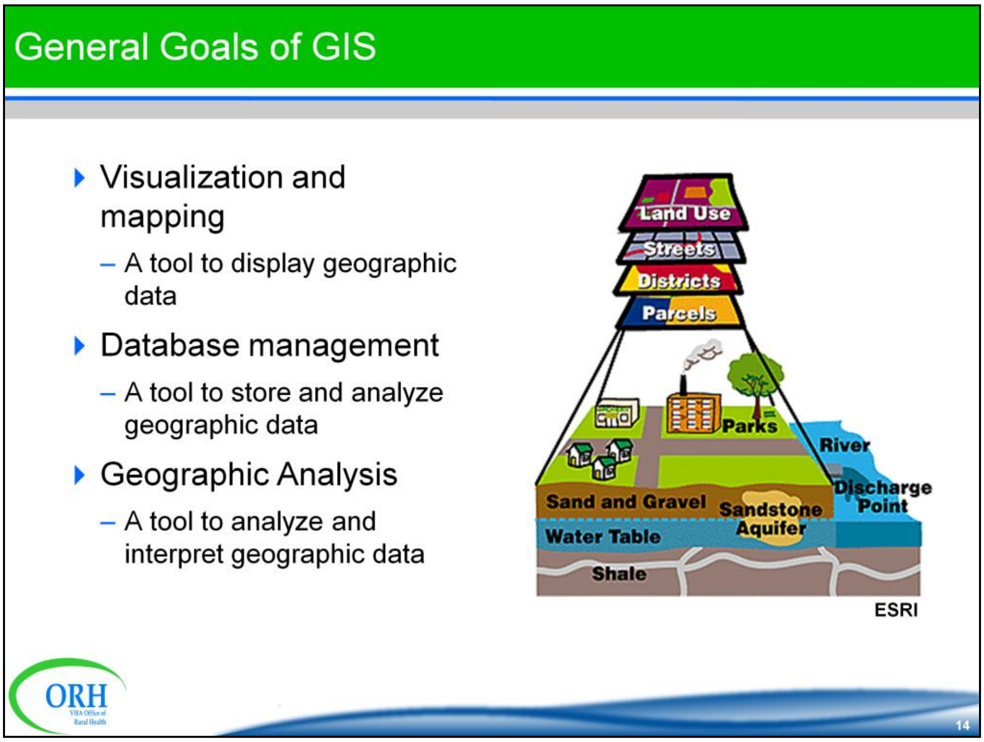
The third function is Query Data. This is, a GIS must provide a utility for finding specific features based on either the location or an attribute. So if you query and say, “I would like to find all of the hospitals located within the state of California.” That would be a query based on location. Or you could say, “I would like to identify all clinics that treat or have a cardiologist on duty.” You could select things based on an attribute field as to whether they had a cardiologist or not and bring in data that way.

The fourth one is Analyzing Data. And this one means a GIS must be able to answer questions regarding the interaction of spatial relationships between multiple datasets. What this means here is that when you query data you are selecting it just based on an attribute field such as location. Where with analysis you are now asking a more involved question. For instance if we go back to, “How many veterans are located within five miles of a clinic, or two hours of a clinic?”, whatever that buffer would need to be, and that involves an analysis process. It’s not just simply asking based on location.



So a few characteristics of this GIS is it's based on layers of data. And in a GIS instead of having everything grouped together, every scene is broken apart into different layers so you can manipulate it and change it. A lot of these diagrams will start looking the same as everyone seems to use the same group of them, and in this one instead of in the past when they just had zip codes and streets and this one now has a subsurface layer, a hydrology layer, vegetation, land systems, etc. So you can see that each one of these now is broken out and so you can think of it as stacking a big sandwich together where each layer in that sandwich represents a part of reality. GISs are easy to update in the sense that they are working off of digital data, so if you need to change an attribute or a location it is quick to do. They can be easily maintained given certain guidelines because, once again, they are in digital format and they are stored in the database.

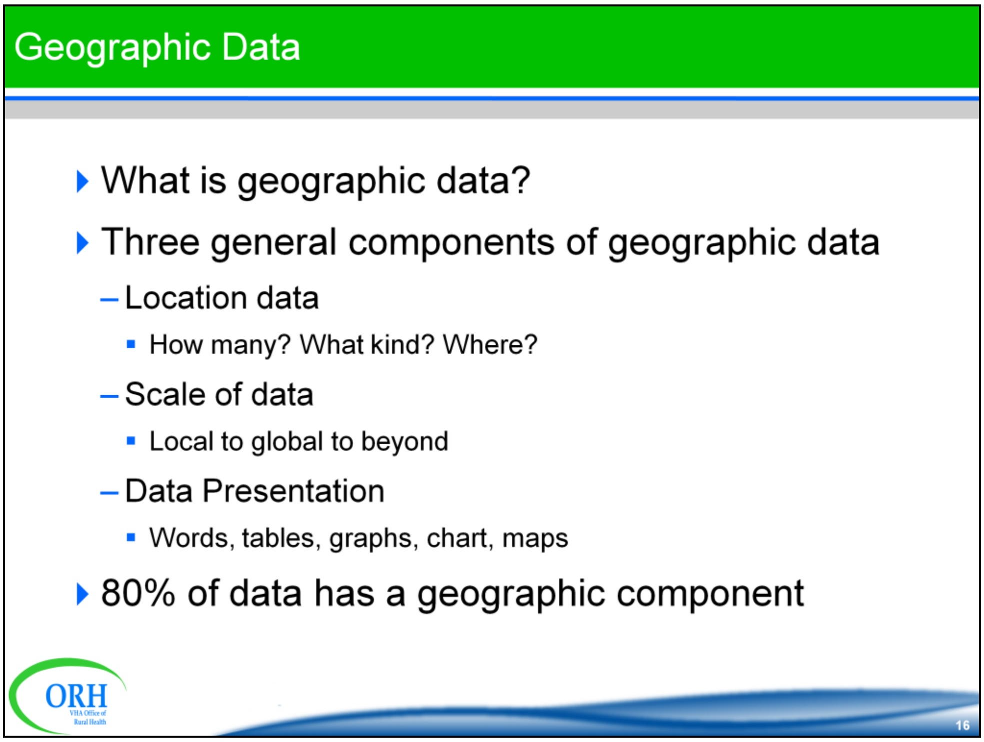
The interactive and the dynamic go together. They are interactive in that the user can move around, can change things. They are dynamic in that when data gets updated it is instantly shown on the GIS. You change the level of viewing from a neighborhood to a state and the state appears. A very important part of a GIS is that it automates analysis. So if you're interested in buffering a set of points and the points might represent your clinics or people. And buffering means that you are selecting an area around each one of them. So if you want to buffer every VA hospital by 5 miles you would not have to do this individually for every hospital, you could just select that layer that contains the hospitals, apply a buffer tool and that could automatically be done for all of those points. So you automate analysis, streamlining processes and also making everything reproducible. And GIS allows you to easily distribute information in different formats. This is going back to that output where you can distribute paper maps,



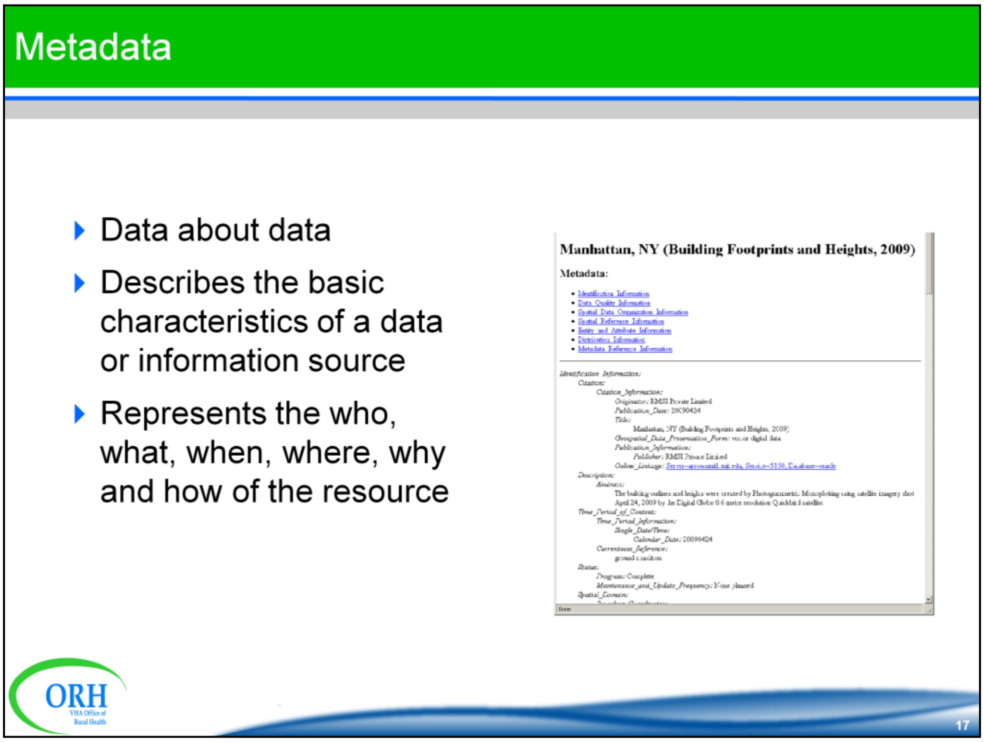
So just to conclude the background of the basics of GIS, there is three general goals of GIS. As I'm looking at this I should have reorganized one. Database Management should be at the top instead of the middle, so I will start there. You have the database management, which is a tool to store and analyze geographic data. In the past when you wanted to store geographic data, it was stored in a paper map and if you needed to update it or change it or do anything, you had to reproduce a paper map which is not a quick process and not everyone has the ability to be able to do that. But now a GIS allows you to store and analyze that geographic data in a digital format which everyone can have access to. It provides geographic analysis, so it's a tool to analyze and interpret your geographic data, ask your questions, run your analysis. And then you have a visualization and mapping format to display this geographic data. So the whole general goal of a GIS is to store and manage the data, perform analysis and then be able to communicate that to the public or to the user through visualization and mapping.

Data

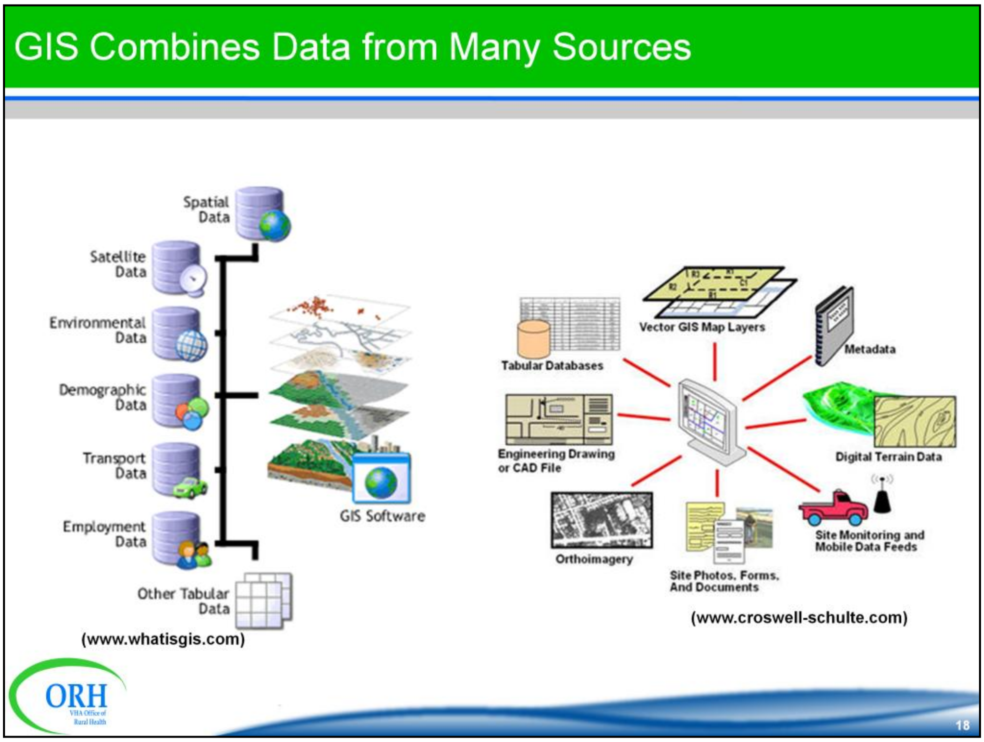
Now switching gears to look at the data that goes into a GIS.



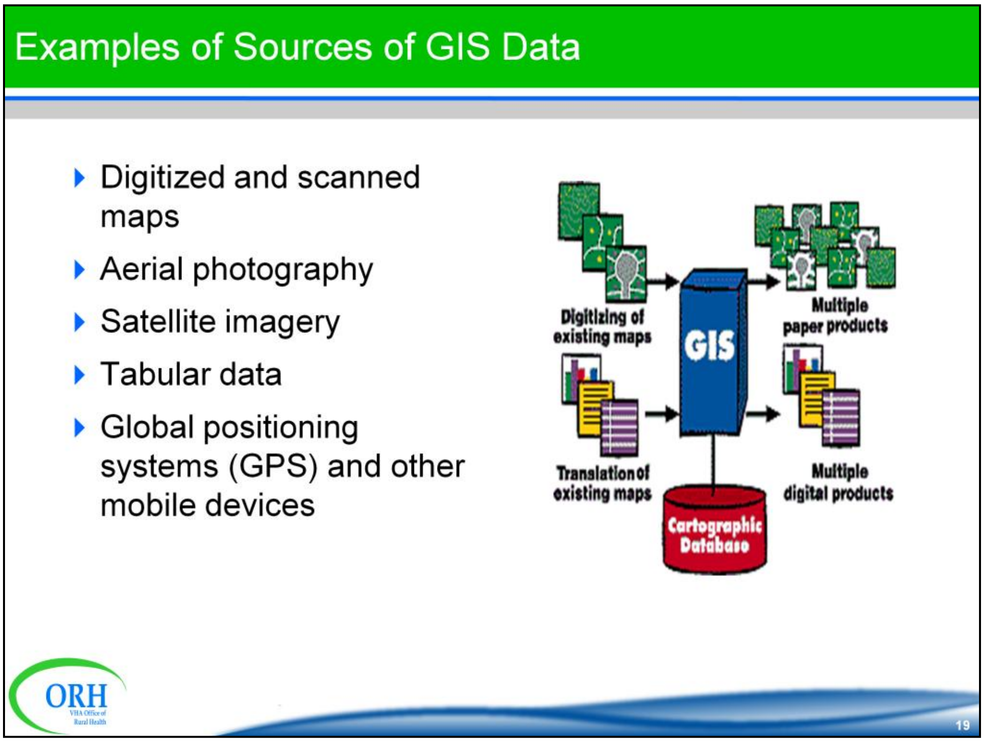
Data is very, very important. Generally it goes on the same principles of many other operations: garbage in, garbage out. If you don't have good data then your products are not going to be very good. What is geographic data? Geographic data has three general components which are: location, scale, and data presentation. The location is the geometry which is your X and Y, and, if there is elevation involved, the Z coordinates. So "where is that data located?" as well as the attributes. So if you have a hospital, you know where it is located, then some of the attributes might be: how many employees, how many beds does it serve, what departments does it have in it, etc. All of the information that isn't specifically location are the attributes. You have a location and a group of attributes and that goes into the "how many, what kind, and where." The scale of the data -- when we talk about the scale of geographic data and mapping is similar to if you have ever picked up a map and seen the scale bar where 1 inch on the map equals 1 mile on the ground or one map unit equals 200 units on the ground. It is the ratio comparing the distance on the map to the corresponding distance on the ground. And in the GIS because it is interactive and dynamic you can look at data on a very local scale. Looking at a neighborhood or home compared to a global and beyond scale. So you could say you wanted to look at the neighborhood, move to the state, country, continent, the globe, to the solar system, etc. So the scale is easily changed. And then the data presentation, how was the data presented and captured? What format is it in? Data comes in lots of different formats, it could be simple words that we need do some manipulation to be able to put it in a geographic information system. It could be simple Excel or Access tables or from an enterprise level data base such as SQL server or Oracle, it can come in graphs, charts, and maps. Surprisingly, 80% of data has a geographic component. Most people think that only data about some place has



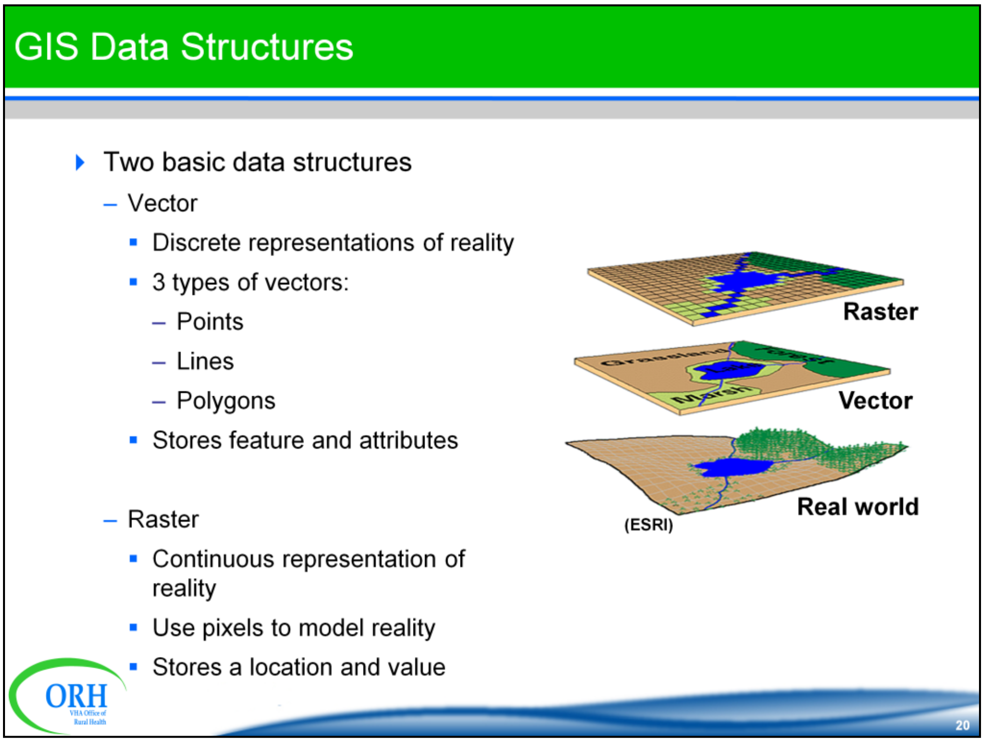
One thing I wanted to mention up front that is a little out of sequence but is very important is metadata. Metadata is data about the data and it describes the basic characteristics about the data or an information source. On the side is an example of metadata from an arcGIS which is a GIS application for Manhattan building footprints and heights. It provides you data about who created the data, what the data is, when and where, why and how the resources were gathered. So I'm going to stress metadata. Lots of people have data, they create data, they use data but they know nothing about the data except for what someone might have told them. What metadata is, is data that travels with those datasets and provides the next user with information about that data. So: what do the attribute fields represent? How the data was collected; What manipulation or changes have occurred to that data; and most importantly, What can the data be suitably used for? This goes into that garbage in and garbage out. If the data was not collected for the purpose you are trying to use it for, there is a good chance it might not be high enough quality for that. So metadata allows you to know that. And all data should have metadata associated with it.



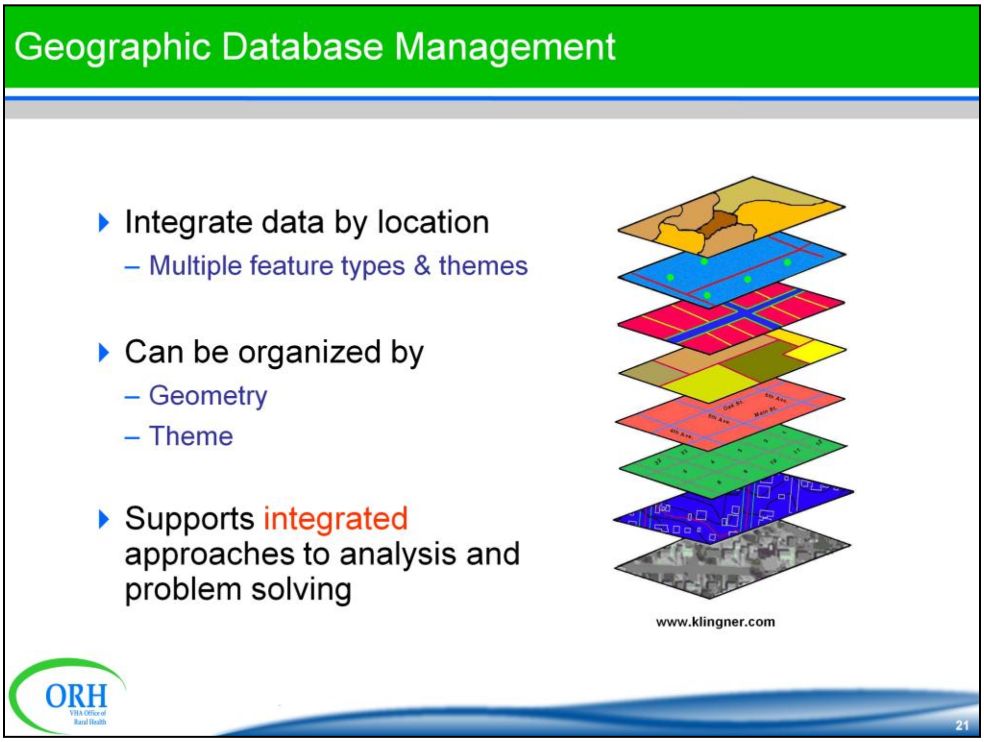
A GIS combines data from many sources and these are two different examples showing different sources of GIS data being combined. So on the left-hand side you have the GIS software and you can see the reality picture again and all of the different layers. Those different layers are coming from many different sources. You have spatial data which could be your elevation, flow, aspect, etc. Satellite data in this case might be from air photos or a satellite image. Environmental data could be air quality, water quality, any type of pollutants around. Demographic data can be data about the population, income and socio-economic. Transportation data consists of roads, streets, cars, what type of transportation is available. Employment data: who works where, how many employees are there, what type of employment is it, etc., and the tabular data is tied to that. So this is just a snapshot showing lots of different data sources feeding into one GIS. Where on the right-hand side, this is an example more for Emergency Management where once again it has GIS map layers; the all critical metadata so that they know what the data is used for; Digital terrain data which is elevation data, then monitoring sites and photos, your orthoimagery is aerial photography, some CAD drawings can go in, etc. So as you can see from these, it is allowing you to combine data from a lot of different sources. And to look more specifically at what some of the common examples are of GIS data, this is just a tiny snapshot. GIS data comes from many different areas, these are just a few of the more popular ones.



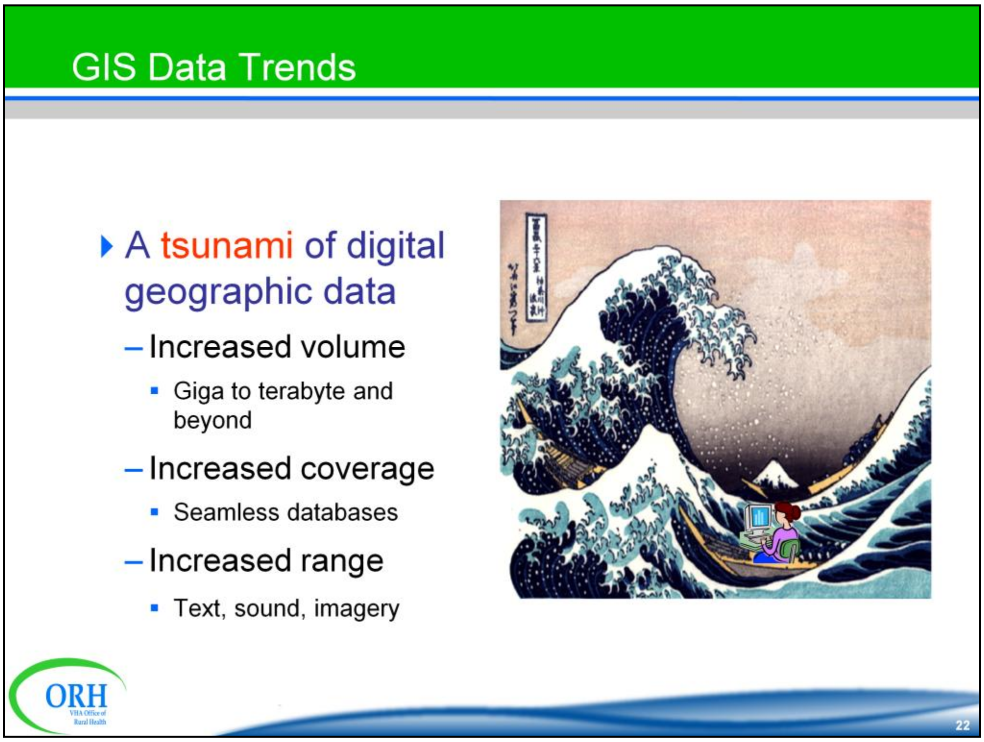
As I mentioned before, in the past geographic data was stored in maps. So if we want to bring them into GIS today we can scan those maps and get a digital image of them, and then we can digitize off of those which is extracting different features from that existing map. There are aerial photographs, photographs taken from planes. Satellite imagery, this is high level imagery. This could consist of imagery looking at land cover classifications, thermal imagery, etc. There is a tabular data and this may be in the VA's instance health records. And the global positioning systems, GPS and other mobile devices. This is the fastest-growing source of data so for everyone who has a cell phone, iPhone, iTouch, iPad, etc., lots of different mobile devices, those devices are generating huge amounts of data that could potentially go into GIS.



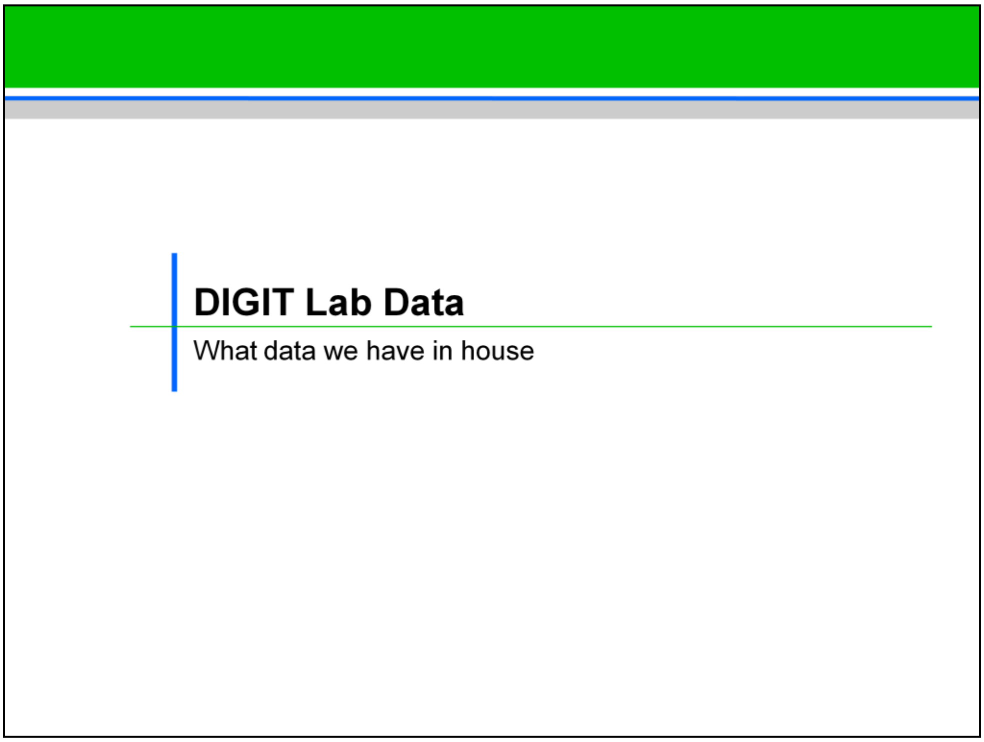
As I mentioned previously there are two basic data structures on how data is actually stored in the GIS, and that is vector and raster. Vector is discrete representations of reality. What this means is every feature that is selected, in this example there is a lake in the bottom picture, that lake is represented as a feature by itself. It is represented as a polygon, as an aerial feature. Vectors are limited to points, lines, and polygons and these can store feature and attributes. In this bottom picture we have a “real world” picture with a lake, a river, there is some swampland in this area, this is forest and this is grassland. In the vector representation, this marshland is represented as a polygon and you can see that it goes around the lake, the lake is another polygon. This river here is a line and then you have the grassland which is another polygon. So these are different and in the GIS systems points are stored together, lines are stored together and polygons are stored together and you can’t mix the three of them. In the raster world, this is a continuous representation of reality. What a raster represents is a gridded set of cells, often called pixels, that all have the same area. It is like putting a screen mesh over the world. Whatever value is in that pixel, or in the majority of that space, the entire pixel gets. So in the top image you can see here the number of cells represents the grasslands, the marsh, the lakes. So the raster stores the location of that cell and one value, whether it is lake, stream, marsh, forest, or grassland. Down here on the vector, you could have this lake stored as a polygon, you could have the lake’s name associated with it, and the average depth, any pollutants or a lot of characteristics stored over here as these attributes.



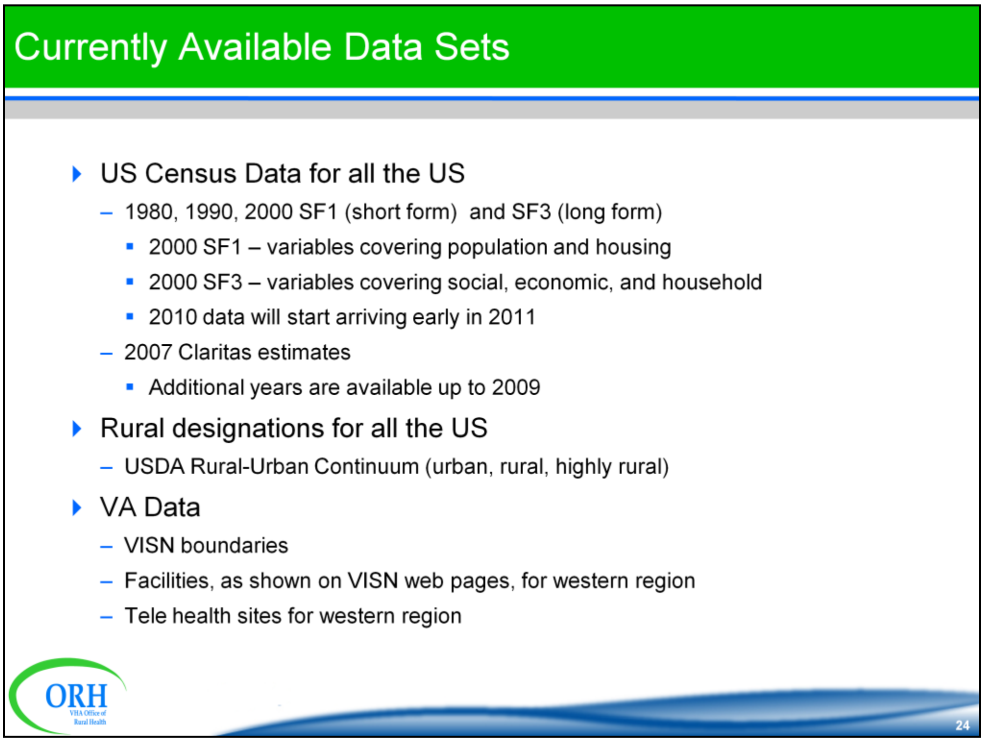
So the vector data is a lot richer in the sense that you can have a lot of attributes associated with it. Rasters are most commonly used for elevation, rainfall, things that are continuous and only have one value that is varying. These are the two main ways that data is stored. So if we get into looking at geographic database management, we see this is an aerial image on the bottom and different layers being stack up. All of this data is being integrated based on location. So you have multiple feature types and themes going down this right-hand side here from the image to it looks like a zipcode or something on top, but they are all being integrated and stacked on top of each other by location. And the data can be organized in two ways, the geometry which is your points, lines and polygons, or raster. Or it can be grouped by themes and that is whether it is a transportation, vegetation, or something to do with the attributes and the nature of that data. So the database management supports integrated approaches to analysis and problem solving because without being able to integrate all of this data based on location, then we would not be able to do the analyses and problem solving that we would like.



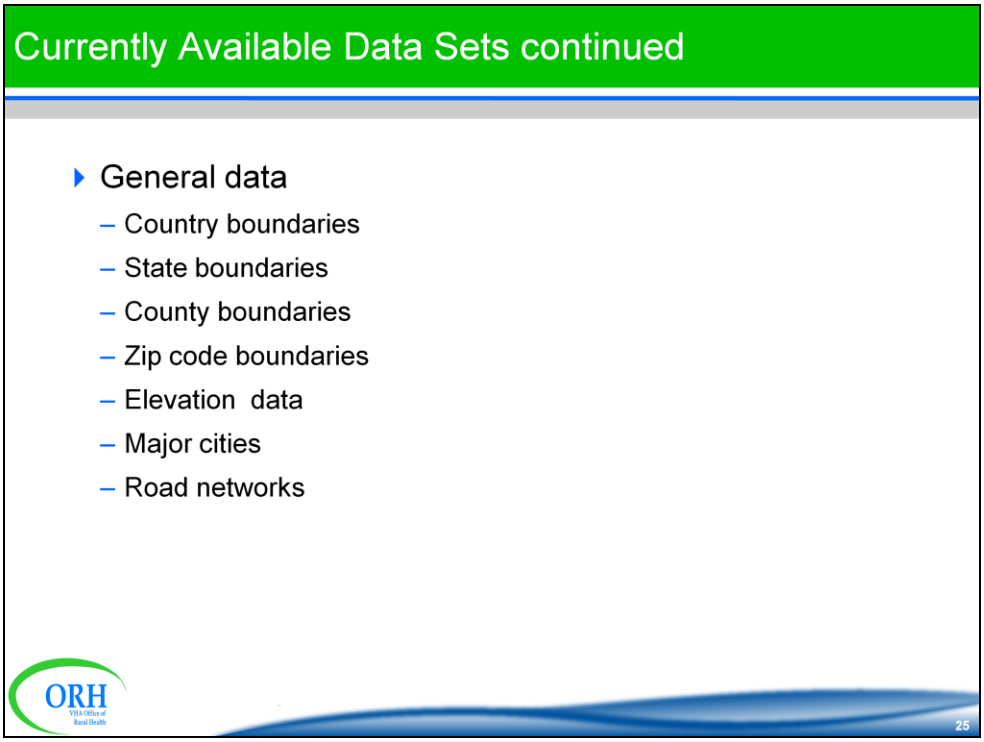
So to just conclude, on the basics behind the GIS data is a little cartoon picture here of looking at a person on their computer using GIS and this big tsunami wave ready to flow over them. There is a tsunami of digital geographic data out there. In the last ten years I don't know how many times it has doubled and everything we do is generating data of some sort. So it's increasing in volume. It wasn't that many years ago that we thought a gigabyte of data was a lot and now we deal in hundreds of gigabytes, terabytes and beyond. Before it was difficult to get data or at least seamless data from many areas. We might have good data for, in my case, Salt Lake City, but the rural part of the state there might not be data available. And now increasingly there are seamless databases not just at your state level but they're at the national or global level. And with increased range of data that we can incorporate in, now we can integrate text, sound, movie clips, imagery, etc. So we are surrounded by a huge volume of data and now it's a matter of finding out how we can use that data for our needs.



So switching gears here to looking at the data that the DIGIT Lab has. This is data we have in house. We've already acquired it. This is, once again, more tailored towards what we have been doing for the Western Region Office of Rural Health. There's lots of other data out there. If you have data in mind that you would like to use, just ask me during the question session.



So a lot of the data we have been using comes from the U.S. Census data and we have this data for the entire United States. We have data from the 1980, 1990, 2000 Census. There are a few problems with the 1980 census because it was not collected for the entire U.S., it was collected for more populated areas. And we have also some from 1970. So those two have a few issues with them. But we have the short form and long form. The SF-1 is the short form. SF-3 is the long form. The short form, if you have received your 2010 census packet, those were the ten questions. So when the 2010 data comes out it will be data associated with those ten questions. The long form is sent to only certain households. I believe one out of every nine households receives the long form. In 2000, the short form, these were variables covering the population housing, so these included information about the sex, age, race, household relationships and family characteristics. Where the long form, SF-3 these are variables covering your social, economic and household information. These could be marital status, education attainment level, income, commuting pattern, housing information such as number of rooms, year the home was built, etc. The 2010 data will start arriving in early in 2011 and we might get the first actually in December of this year but the majority will be coming in 2011.



In addition to the decadal census, there is also 2007 yearly estimates. They are available for every year and these provide estimates of populations in different variables. In addition, there is the rural designations which seems to be important for all of the United States to use the USDA rural/urban continuum. At a county level we have it classified whether it's urban, rural, or highly rural. And specifically for VA data, we have the VISN boundaries for the entire U.S. and the facilities shown on the VISN Web pages for the western region. And we have telehealth sites for the western regions. More general data that we have involves your typical country boundaries, your state and county boundaries, zip code boundaries. We have elevation data, major cities, road networks for all of the United States, a lot of general information we have available to us.

Current VA GIS Products

So getting now into looking at some of the current VA GIS products that we have been developing for Dr. Bair and Nancy Dailey. The first part is they want to look at identifying trends. So looking at 1970 to 2007 the general population distribution, where people were moving to, where they were located as well as the veteran distribution. And then looking at their level of rurality, was it highly rural or was it developing urban.

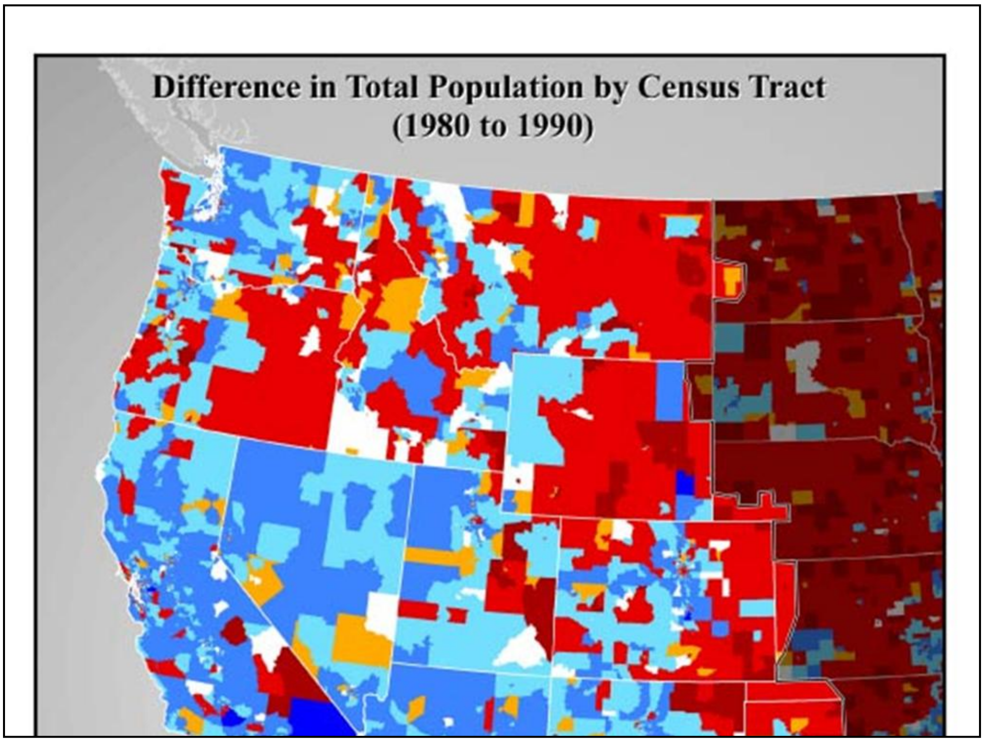
Examples of Current Products

- Identify trends: 1970-2007
  - Population distribution
  - Veteran distribution
  - Level of rurality
- Service analysis for Western Region
  - Identify underserved areas (general)
  - Identify underserved areas (specific)
    - Post traumatic stress disorder

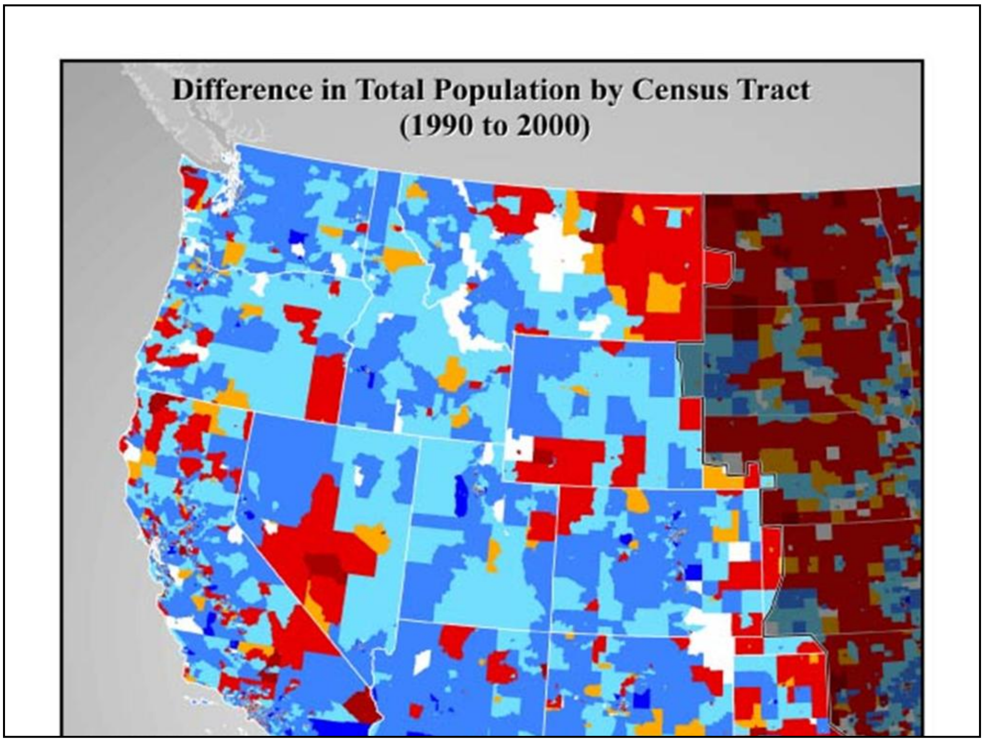
ORH
VHA Office of Rural Health

27

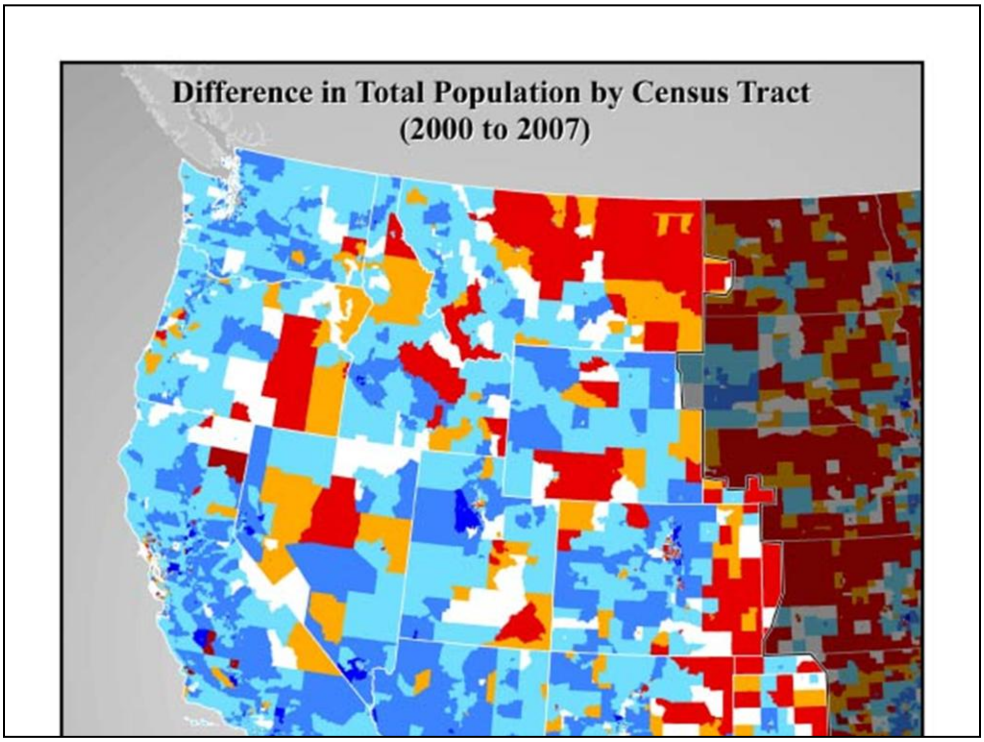
We also did some service analysis for the western region. Looking to identify underserved areas and a general sense with clinics. And we are starting to do some work looking at underserved areas in a specific sense, whether those clinics or hospitals have post-traumatic stress disorder treatment available.



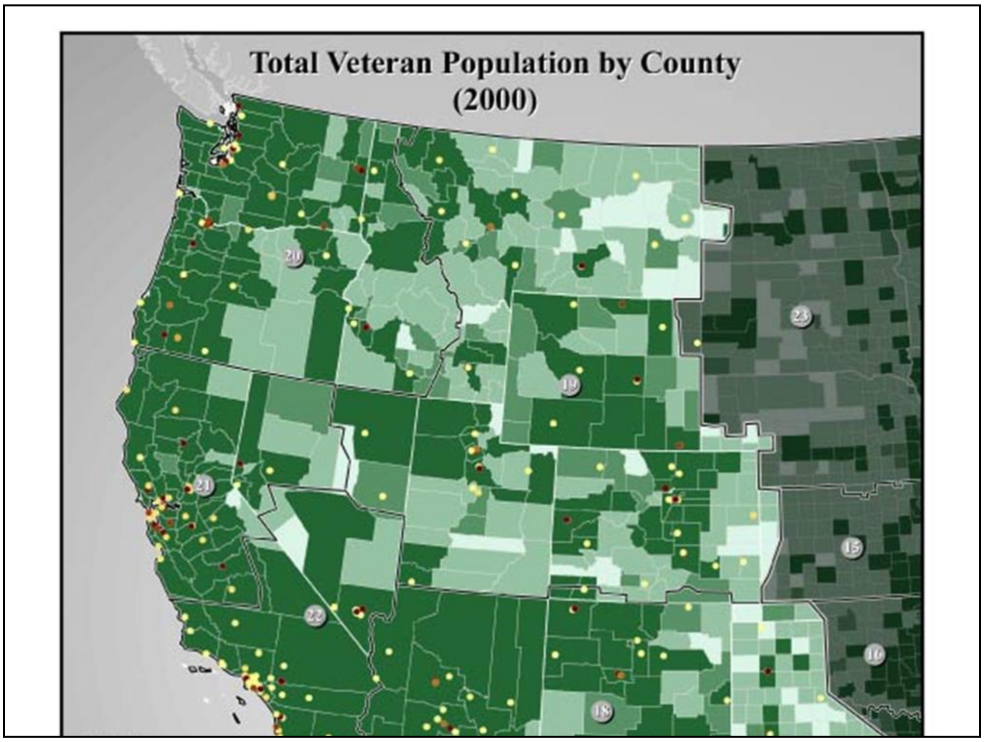
This first map is showing you the difference in total population by census tract. This is looking at 1980 to 1990. We eliminated 1970 because that was only for the very populated areas. So the red colors show the darker the red the more people have left. White, the population changed between zero and 50 people. And then as you go through the light shades to the darker shades this shows a change of greater than 5,000.



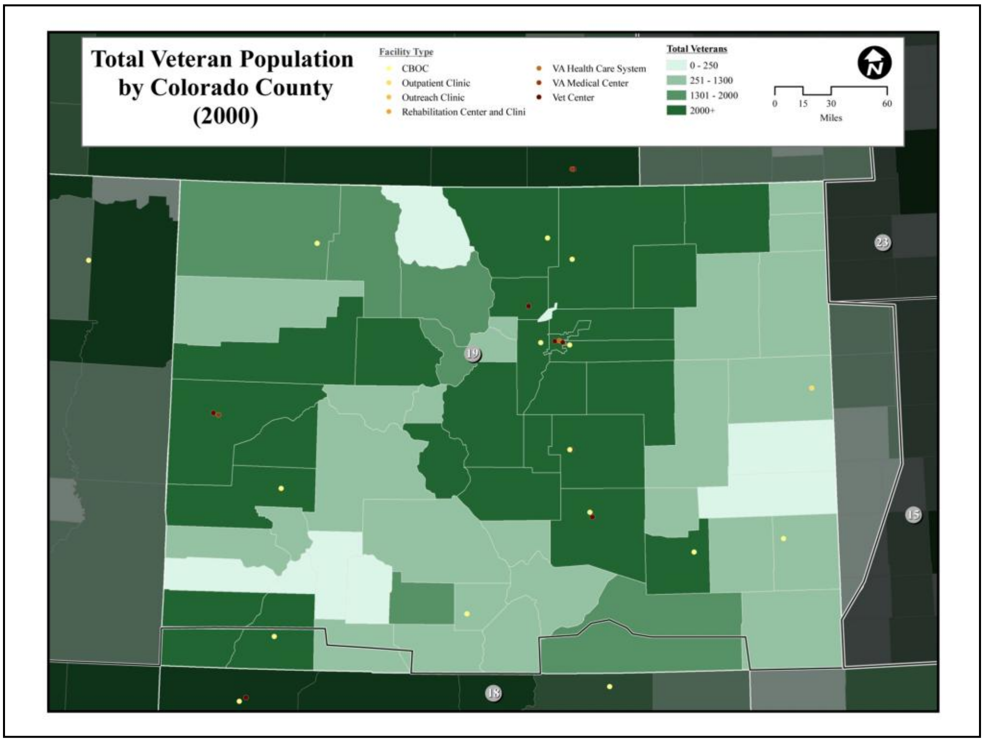
This is for the western region so this line and where it's darker is just shading out to highlight the western region. So you can see that in parts of eastern Montana and the Midwest people were moving and California and the South were gaining population. That was for 1980 to 1990. And you can look at 1990 to 2000 and start to see different trends. We have this available for the entire United States.



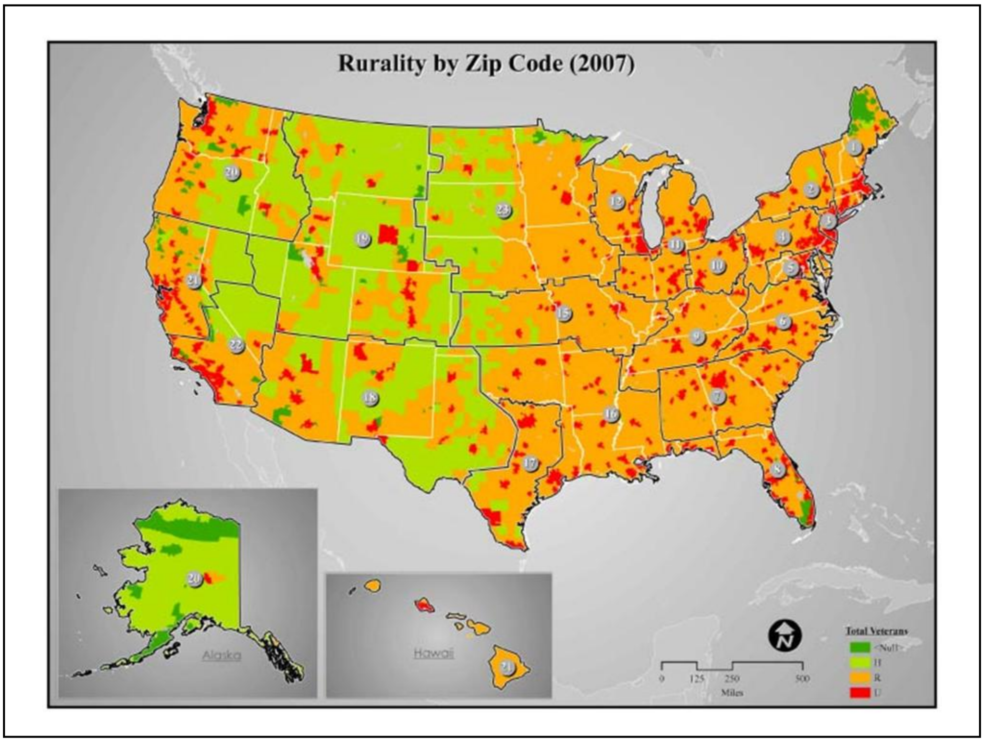
Last we looked at 2000 to 2007 to see where more people were moving and you could get a general sense of the changing dynamics in the population.



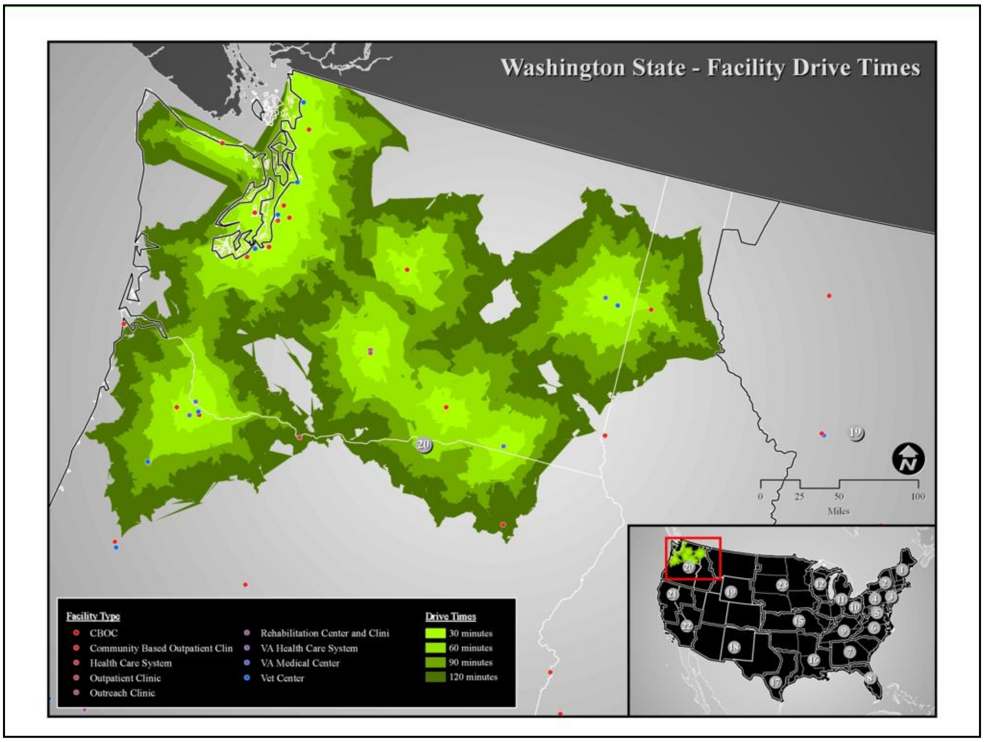
Then looking specifically at the veteran population. Here we’re just looking at the year 2000. The annual yearly estimates of veteran population I found not to be very good. One of them actually had a county that had 100% veteran population in it which I know cannot possibly be true. After looking at the data and consulting with Dr. Bair and Nancy, we decided to stick with the 2000 data because that seemed to give the best estimate. So here the 2000 data is grouped with the lightest green is zero to 250, the next level of green is 251 to 1300, then 1301 to 2000, and the darkest green means that there is greater than 2000 veterans in that area. On top of this we have the different VISNs marked with their boundaries as well as the facility types are the points in the background.



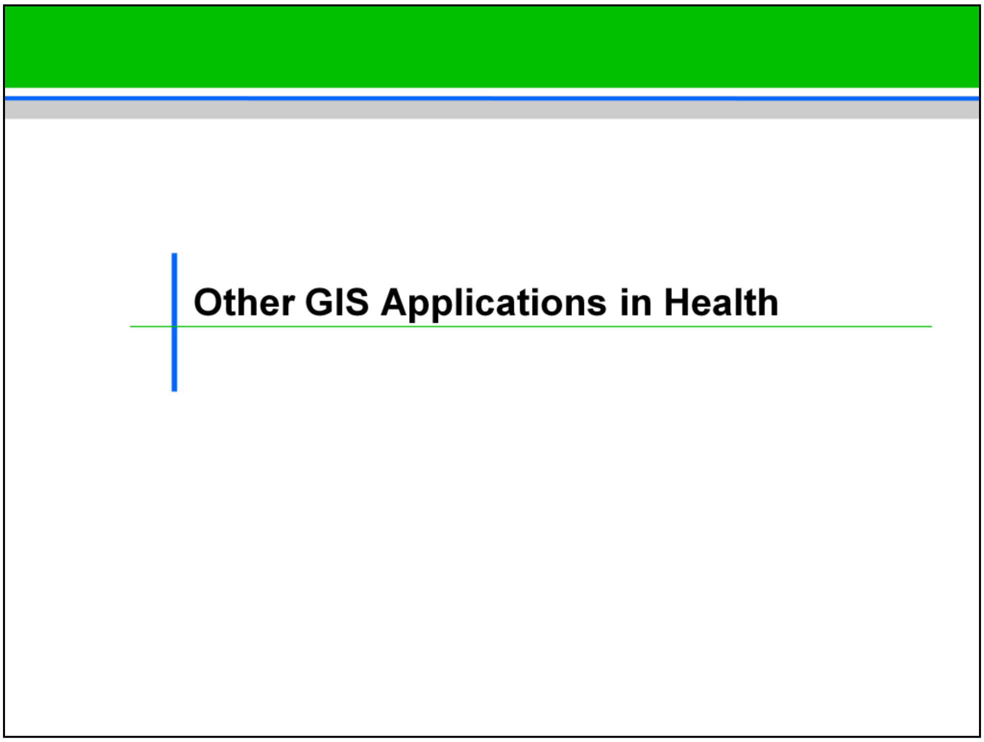
Then what we did is created that individual map for each of the states in the western U.S. so they could zoom in and get a better picture of their veteran population that they were trying to serve. And this also has the facilities located on it. Some of these could be combined, all of the databases have them listed slightly different.



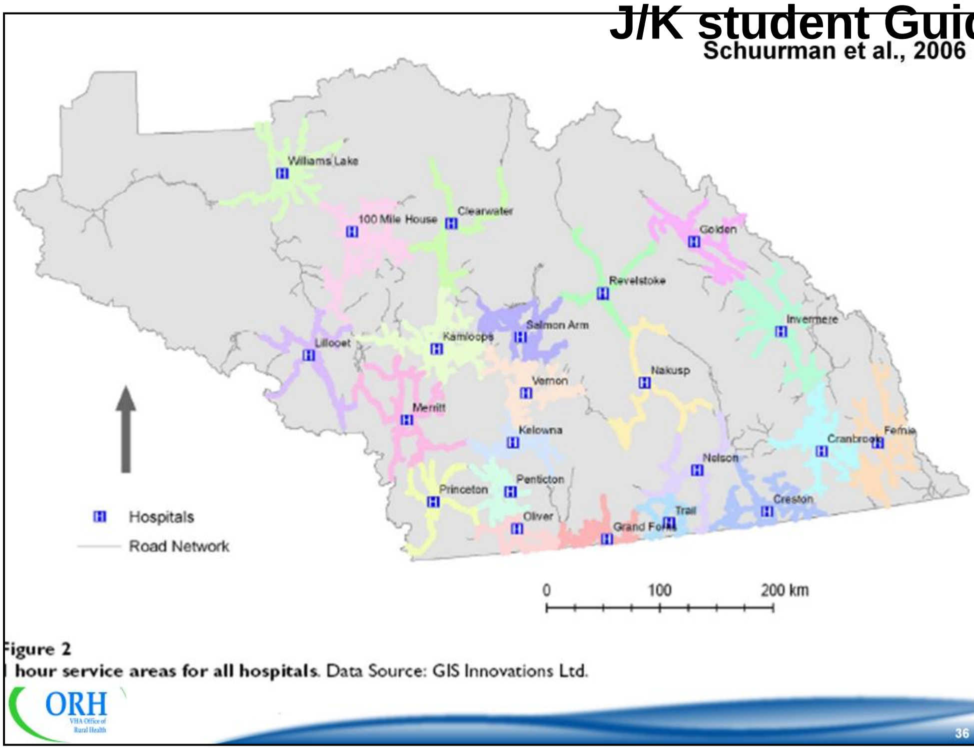
So as we move on to rurality, this is looking at the rurality by zip code taken from the 2010 USDA urban/rural continuum. The dark green we didn’t have a classification for it and that was just a little bit in Maine and Alaska. Most of that actually got moved into highly rural. This light green color represents highly rural. Orange is rural and red is urban. As you might expect, you can see the eastern U.S. is mostly urban and rural. There is a large portion of the Midwest or Intermountain West that is highly rural as well as Alaska.



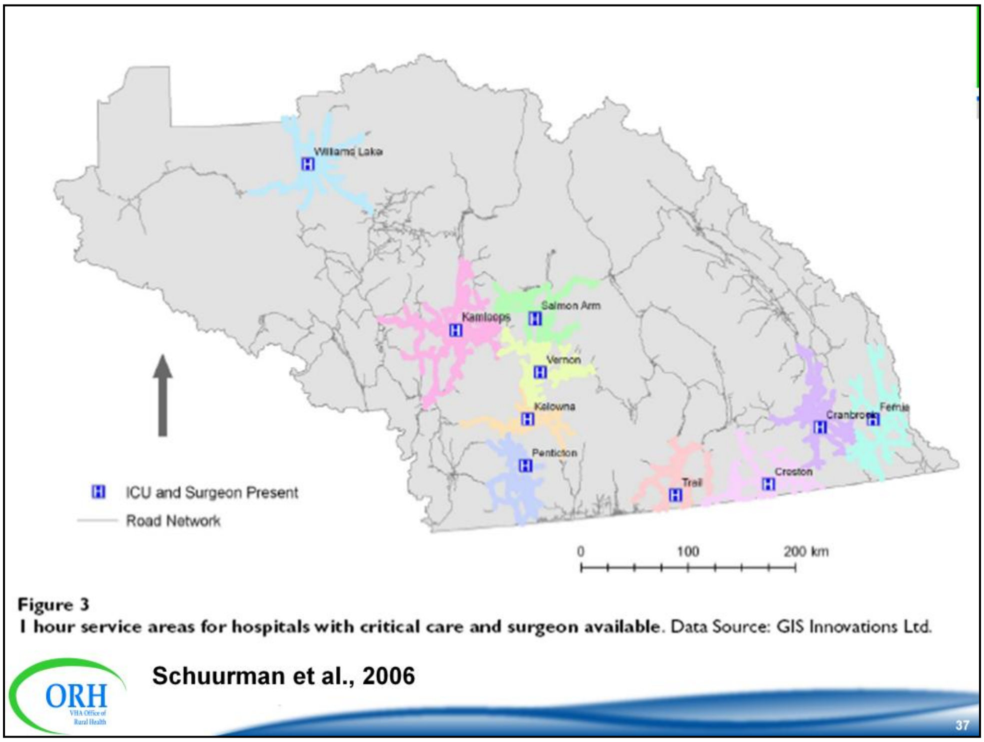
The next part of this was looking at facilities and their drive times where veterans access these facilities. This is just showing Washington state. One difference here is this has all facility types included so this includes the veteran centers, which don't necessarily provide any medical care. And the lightest green is 30 minutes, the darkest green is 120. So you're looking at 30 minute drive time increments, 60, 90 and 120. What this allows one to do is you can start to see that veterans located in this area up in the north are outside of 2 hours drive time. You can start to see where clinics might be better suited to be located if you're putting new ones in. And if you combine this data with the veteran population estimates you could get a sense of what your service target population would be. How many people would need those services.



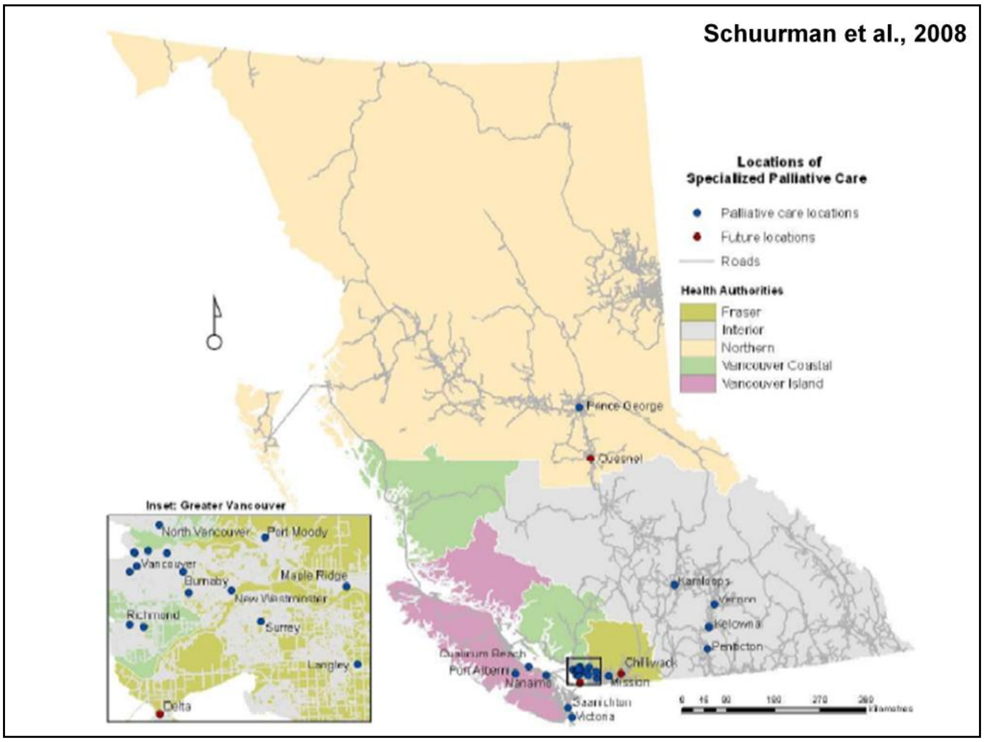
Those are just looking at a few examples that we have done for the VA and now I'm just going to go through quickly some of the applications that have been done for other areas.



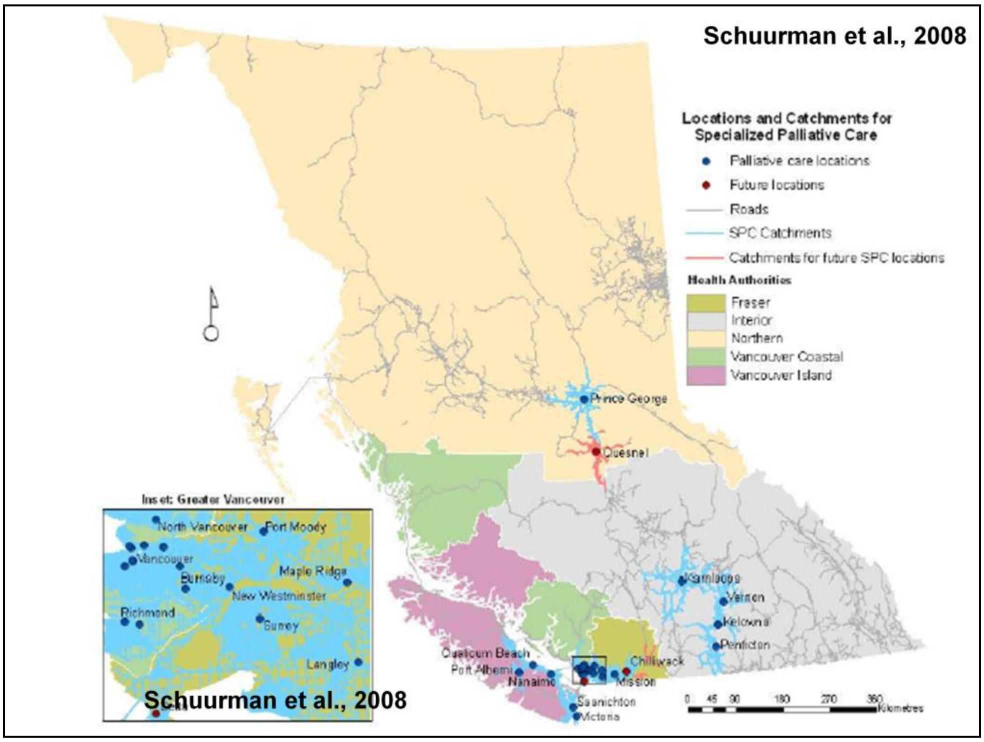
This is looking at some work by Nadine Schuurman out of British Columbia and this is also on service time. This is looking at one-hour service areas for all hospitals in British Columbia and they are each color-coded by the hospital. You can see the area covered from a one-hour service area and then specifically



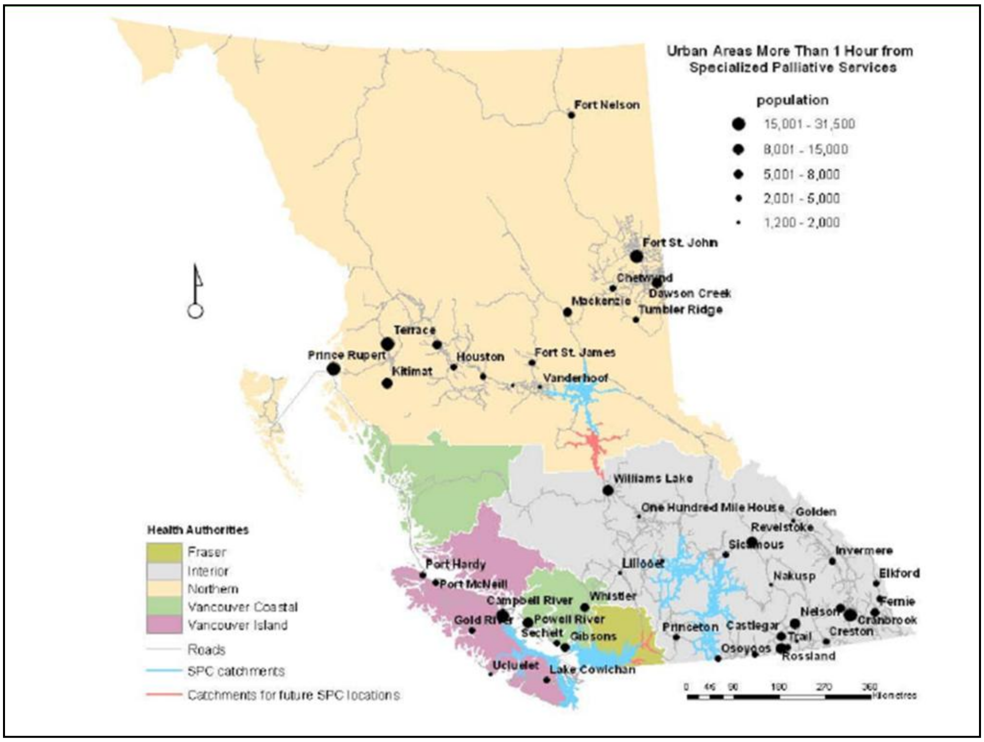
if you are looking at hospitals with Critical Care and surgeons available then they shrink greatly and you have areas that don't have access within the critical 1-hour, that golden hour.



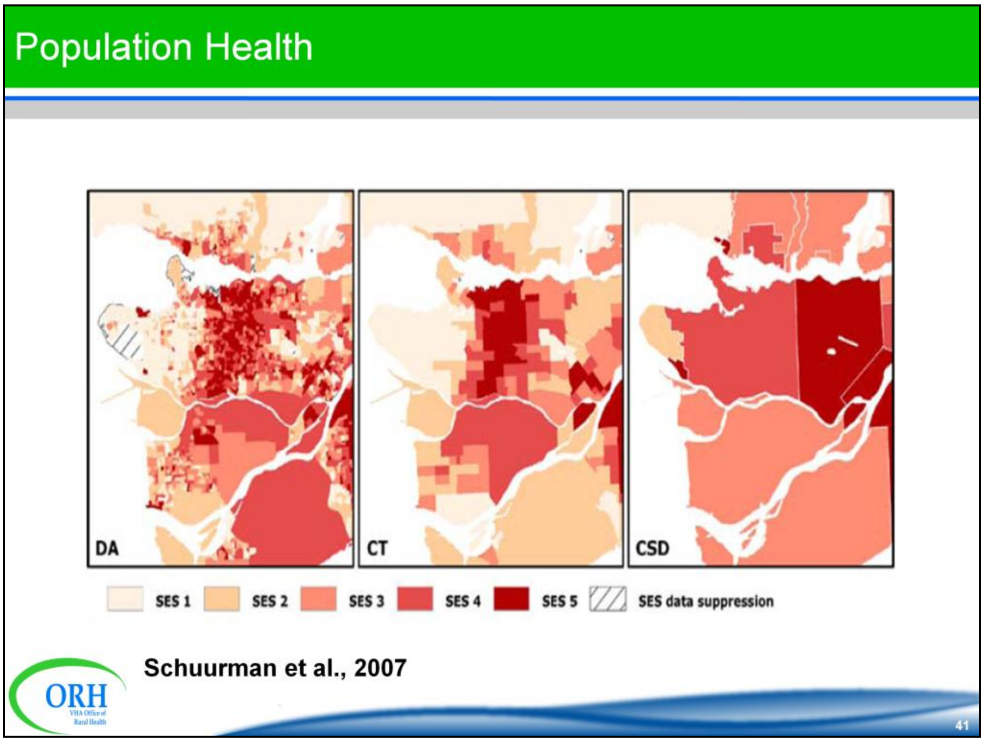
This looks at locations with specialized palliative care. The map shows the locations of palliative care facilities and their health authority boundaries. And then if we change that--



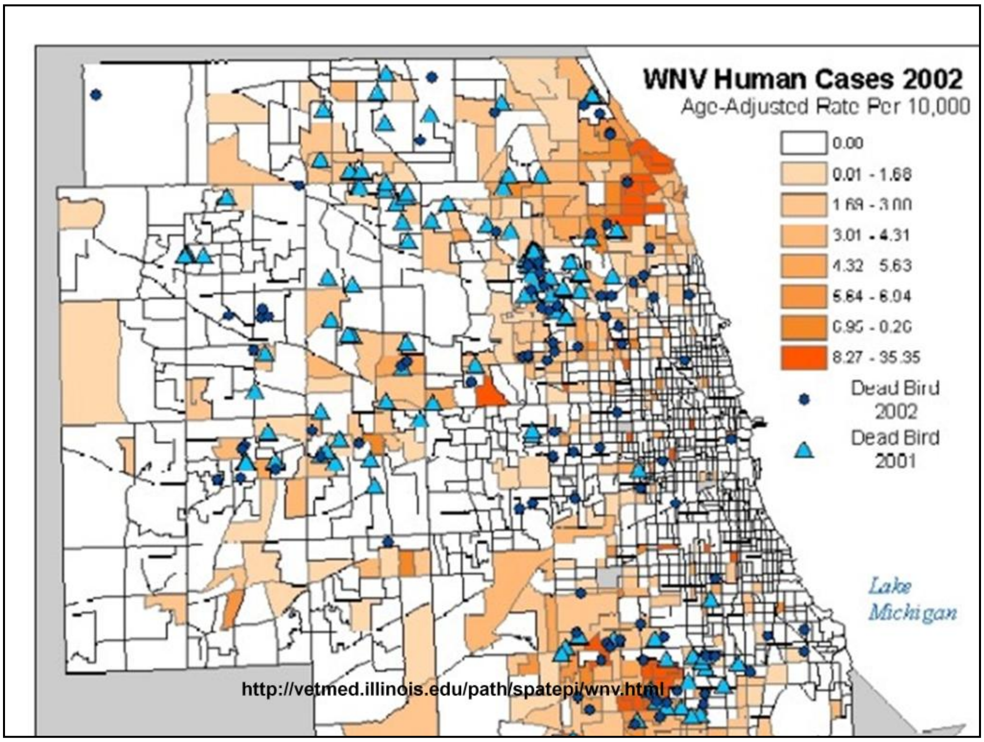
and look at the blue now shows your specialized palliative care catchment. This red one shows a future location. You can see now what area has access to the specialized palliative care.



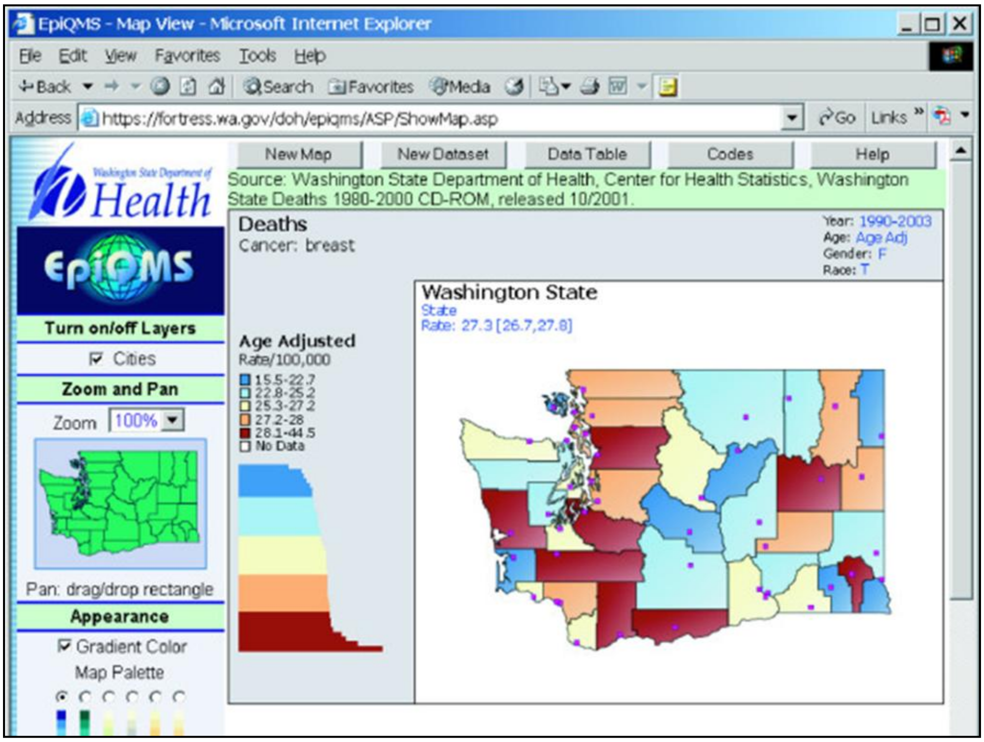
And then here you look at that combined with the population and you notice that there are very large areas that have no population associated with being able to receive that care. So once again, this allows you to identify areas where future treatment centers could be helpful.



Another set of her work, this is looking at creating an index. This is the VANDEX, the Vancouver Area Neighborhood Deprivation Index. She took a set of variables very similar to our census data, and created an index to show what areas have more access or are deprived from health care and which areas are not. And she weighted variables, most closely related to health centers, average income, home ownership, a single parent, no high school education, etc. So you can start to get a general idea of how that looks. This was done at three different spatial areas: here is the dissemination area, this was done at the census tract, and then this was done at the Census Subdivision Administrative boundaries. You can see at this level it is not very helpful but to run an index at the dissemination area, you can start to find neighborhoods that you can target for certain health plans, etc.



This example here is taken from Illinois. This is looking at West Nile Virus in human cases in 2002. They have been age-adjusted for rates per 10, 000, so the white is zero cases and as it gets darker orange it increases the number of cases. The circles represent dead birds in 2002 and the triangles represent dead birds in 2001. You can start to see some patterns and this could be used for different things later on. Then if you zoom out, which is what this inset map shows, this identified the high-cluster areas. So you can start to see some patterns. There is more clustering and down here there is a little more clustering. But the true picture is when you zoom-out and start to identify areas where there is a higher prevalence of West Nile Virus.



This is another example from Washington state. This is looking at their EpiQMS, which is their Epidemiological Query and Mapping System. What this allows people to do is go in and select what you'd like to look for and this one is looking at breast cancer, deaths associated with breast cancer. Blue is fewer deaths, red is higher deaths. Then you can map it by counties to see if there are any trends in the data.

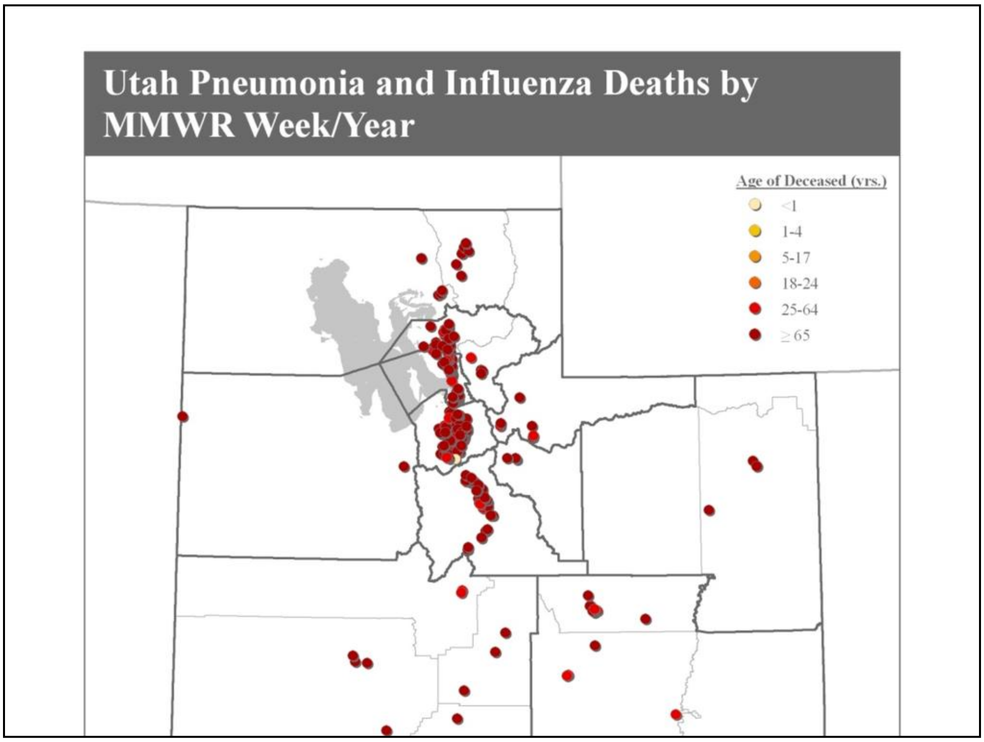
Utah Department of Health

- Pneumonia and Influenza death mapping
- 10 seasons of data (1999/2000 to 2008/2009)
- Static weekly maps and animated seasonal movies

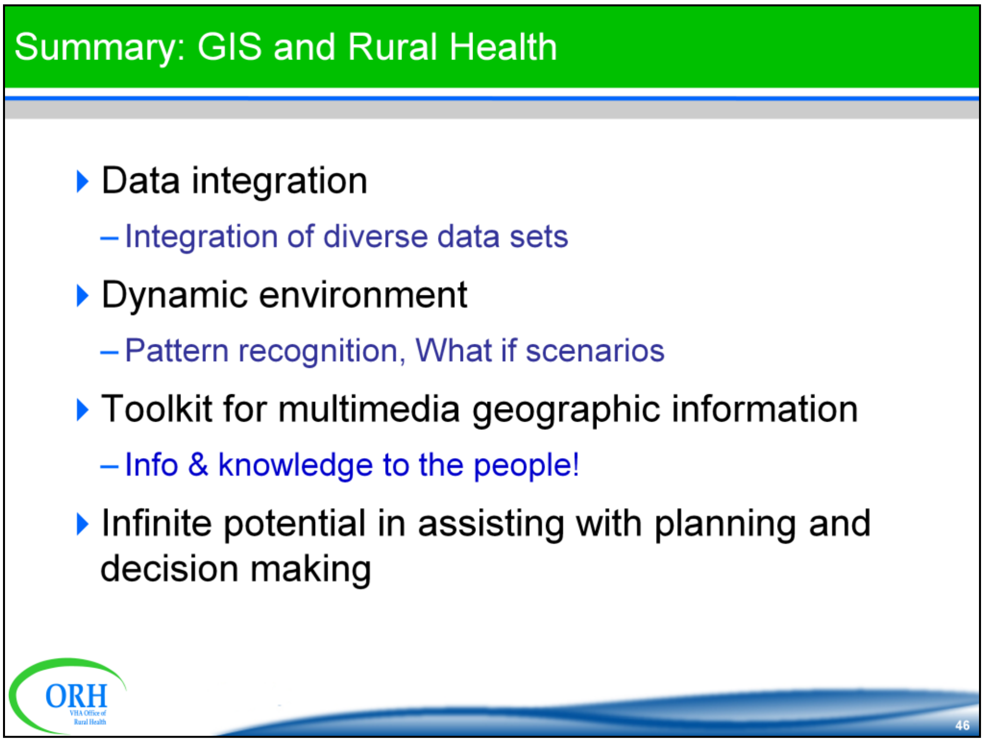
ORH VHA Office of Rural Health

44

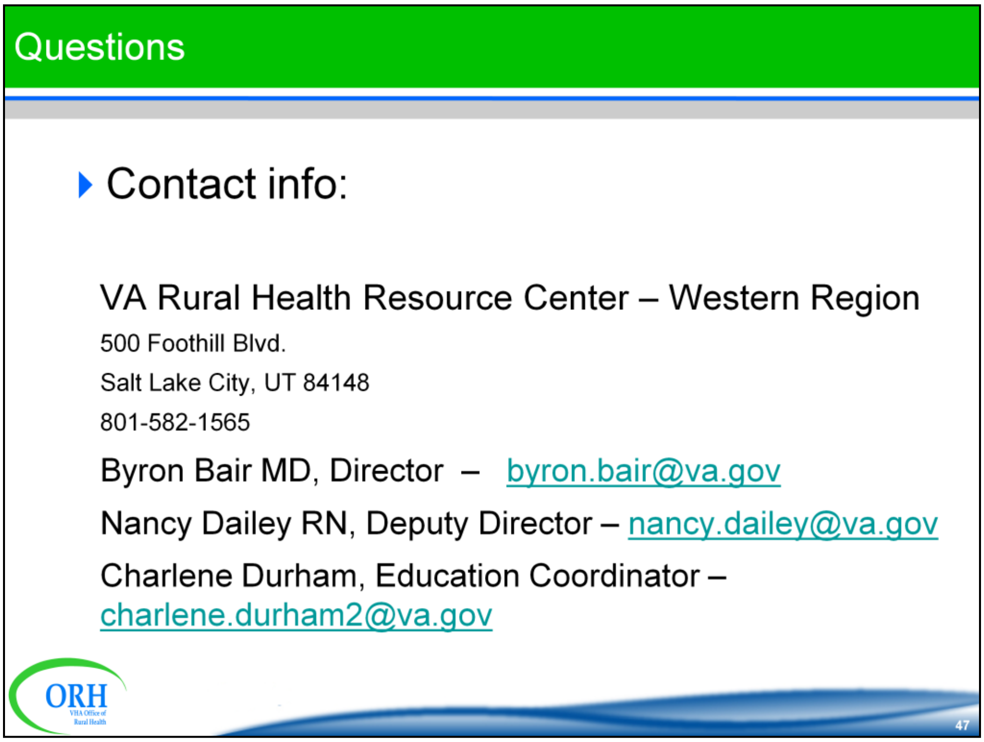
I am just going to wrap up very quickly. So we had that one from Washington. This one had a video clip but unfortunately it was not able to play. The last example I'm going to show you is the Utah pneumonia and influenza deaths by flu weeks. We did this by the MMWR weeks/year. This was looking at, for each of the 40 weeks of the flu season, the deaths and the age of those deaths and where they were located in the state of Utah.



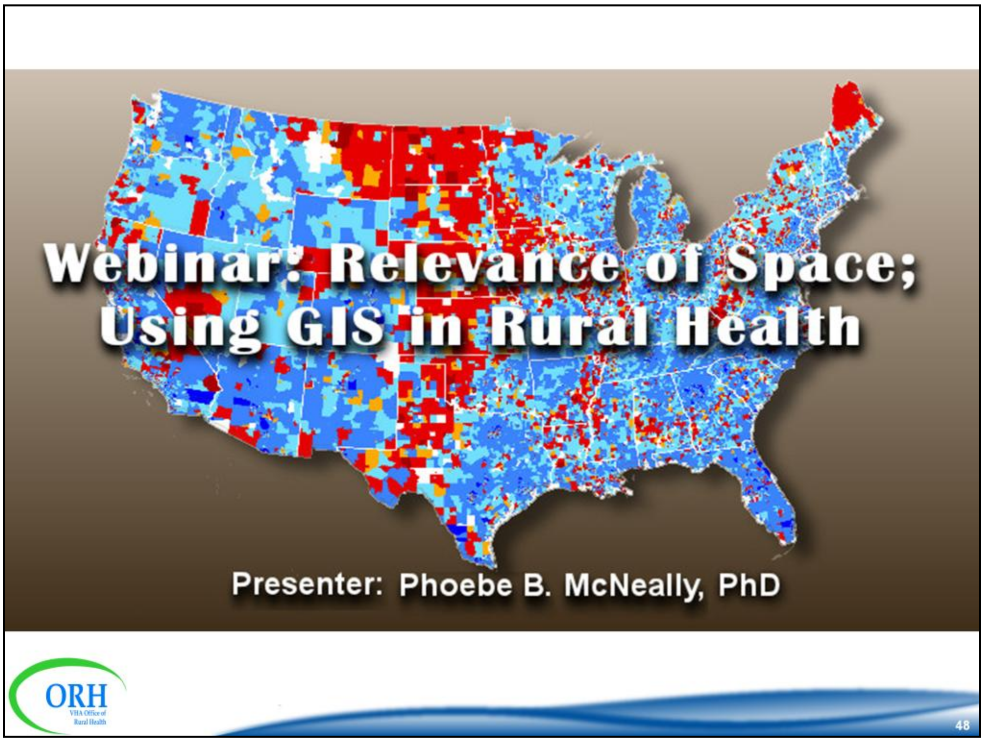
So this is week one from 2009. We did the CD for the number of deaths for that week. The color is associated with age so if it is a lighter color it is young and over 65 is this darker color. We did this for every week and animated it so you could see the trend and patterns changing per flu season for the past ten flu seasons. This is interesting for them to see the different patterns and changing of how the flu and pneumonia deaths occurred.



And finally, just to wrap up GIS and rural health, one of the key things is data integration. It allows integration of diverse data sets. It provides a dynamic environment where you can change things, you can ask questions, you can do pattern recognition. But importantly it is a tool kit for getting multi-media geographic information and knowledge to the people. So it's just a way to provide people with information and knowledge and start to be able to ask a lot of these questions that they have always wanted to, but didn't have the means to. It has infinite potential in assisting with planning and decision making. You have access to data in a different format than most people usually look at it. You can start to see patterns and make better decisions having to do with planning. And with that, thank you. I'm sorry it was a little hurried at the end.



The best way to use my resources is to go directly through the Western Region Rural Health Resource Center and these are the e-mail addresses for Dr. Bair, Nancy Dailey, and Charlene Durham.


Webinar: Relevance of Space; Using GIS in Rural Health
Presenter: Phoebe B. McNeally, PhD
ORH
VHA Office of Rural Health
48