



GIS Career Awareness Learning Module # 2
Version 3.0 November 28, 2007

How Can GIS Help Us? - GIS Applications in Various Fields

- **Estimated Time:** 2.0 hours
- **Learning Goal:** This module will introduce various GIS applications and illustrate their usefulness in different specialty areas such as traffic and street view (Google map and Traffic 511), wild fire web mapping service, criminal justice (crime mapping and tracking), business and marketing (real estate sales and pricing), and environmental science/ecology (environmental monitoring & management).
- **Platforms:** PC, Mac, or UNIX.
- **Software Tools Required:** Web browser with high-speed Internet access.

Note: This Web-based GIS learning module was developed with support from a National Science Foundation – Advanced Technological Education Program Research Grant (NSF-ATE DUE # 0401990): “A Scalable Skills Certification Program in Geographic Information Systems (GIS).”
(<http://geoinfo.sdsu.edu/hightech>)

**ANSWER ALL QUESTIONS ON THE SEPARATE
ANSWER SHEET**

Section 1 – Traffic Map and Street view

Part I – Google Street view of San Diego State University

To finish this part, you may need to install the Adobe Flash Player Version 9 or newer edition before use. You should spend no more than 10 minutes to spend this part.

As one of most popular web maps, Google map has created a function called “Street view”. Street view combines photos and 3D functionality, and enables the users to have a real view of the place they search. Please pay attention, you could view and navigate within street-level imagery only in certain locations (most of the time, they are major roads in big cities).

- Please navigate to <http://www.maps.google.com>.
- Type “San Diego State University” in the top of the page. The webpage will update as shown below (See Figure 2-1).

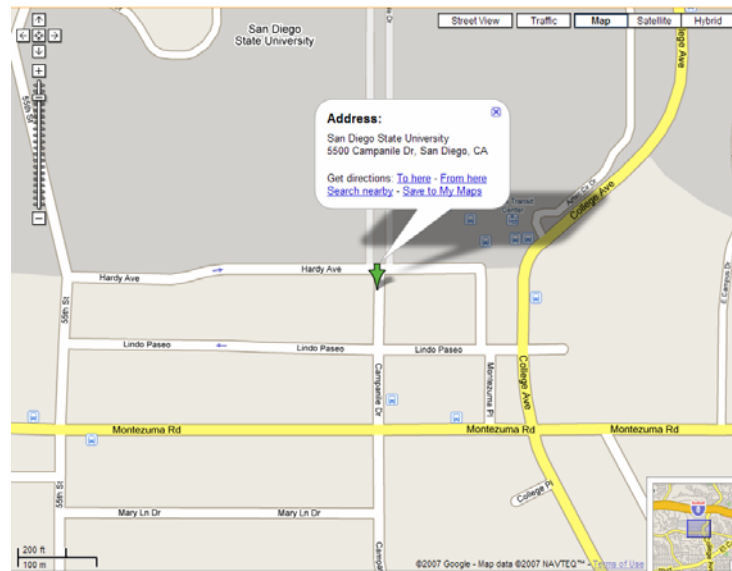


Figure 2-1: Google Map of San Diego State University

- Click on the “Street view” button on the right top of the map. You will see a symbol of a person and some streets which are outlined by a blue frame.
- Drag the person along the blue street and double click when you want to have a street view (See Figure 2-2).



Figure 2-2: the street view of Google Map

- Double click the white arrow in the photo; you will see the street view is changing. Also try panning, rotating and zooming.

Please answer the following questions on the separate answer sheet:

A-1: Is the Google Map Street View imagery real-time?

A-2: Where does Street View imagery come from? When were these pictures taken? Does Google accept photo submissions from individuals?

A-3: Can you see people in the street view imagery? Does Street View violate the privacy of people if they were in the imagery?

A-4: Please key in your home or school address. Is street view available in this area? Is the imagery the same as you see now?

Part II – Traffic Map of Traffic 511

Traffic 511 is a free phone and Web service that consolidates the San Diego region's transportation information into a one-stop resource. 511 provides up-to-the minute information on traffic conditions, incidents and driving times, schedule, route and fare information for San Diego public transportation services, carpool and vanpool referrals, bicycling information and more. Traffic 511 is available 24 hours a day, 7 days a week. Now, let's try some application of the Live Traffic Map. You should spend no more than 5 minutes doing this part.

- Navigate to <http://www.511sd.com>, and click on the link "Live Traffic Map." A new Web page will pop up (See Figure 2-3).
- Try to drag the red pane in the top of the web page or click the colored road in the map. Feel free to use the map tools.

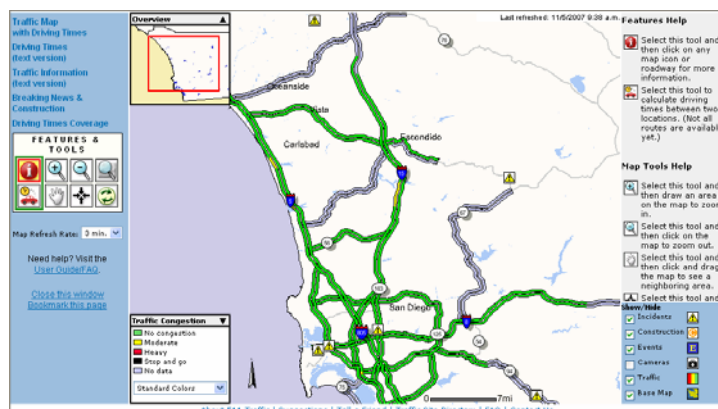


Figure 2-3: The Website of Traffic 511

Read the Feather Help and the legend of the map, try to understand the function of this live traffic map. Pay attention, the color of the road shows the traffic congestion information according to the legend in the bottom of the left side of the web page.

Please answer the following questions on the separate answer sheet:

A-5: How often does the traffic map update?

A-6: How do the different colors congestion levels indicate in the Traffic Congestion layer? (Hint: the speed)

A-7: Where does the traffic information come from?

A-8: Does the map provide all the freeway traffic information in San Diego? Why there is no data in some parts?

A-9: Click the tool button “Driving time”, choose “I-8 E & I-15 (San Diego)” (near symbol freeway 805) for start and “I-8 E & W MAIN ST (El Cajon)” (near symbol freeway 8) for destination (see Figure 2-4). Record the following information appearing on the right of the webpage: The distance, the estimated time, traffic congestion, speed limit, and traffic speed.

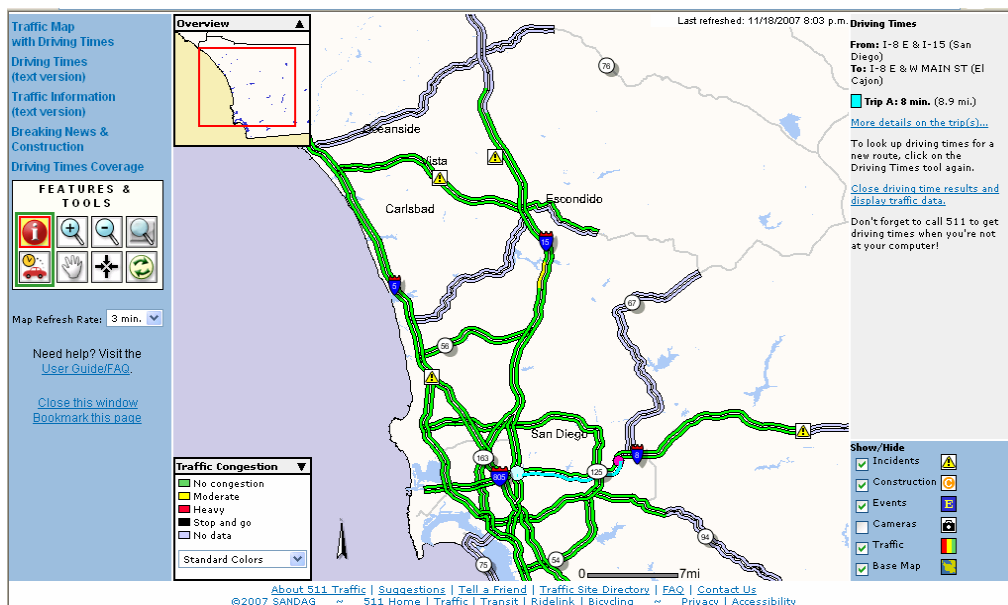


Figure 2-4: The function of Driving Time of Traffic 511

Section 2 – Web Mapping Services for Wildfires

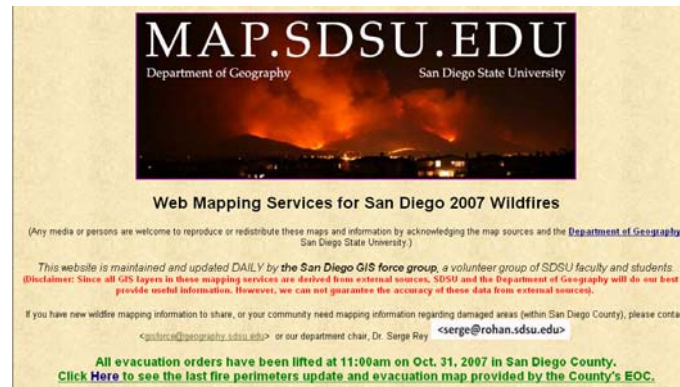


Figure 2-5: The Web Mapping Services for San Diego 2007 Wildfires

Part I – The San Diego 2007 Wildfires

The San Diego 2007 wildfires killed nine people and destroyed hundreds of homes. Wildfires are one of the major natural disasters in California. In the process of salvation and rebuild, GIS can provide the update wildfire spatial information that facilitates communications and resource relocation plans. Now we'll see how GIS helps in this wildfire by scanning a website (Figure 2-5).

Navigate to the website <http://map.sdsu.edu/>. This website is maintained and updated by the San Diego GIS force group, a volunteer group of SDSU faculty and students. You should spend no more than 30 minutes to finish this part.

Task-1: Aftermath and Damage Assessment (using GIS and Remote Sensing Technology):

[1] Aerial Photos for damaged areas and buildings:

- Click the link “[Aerial Photos \(Georeferenced\) for damaged areas and buildings](#)” in the box of “Aftermath and Damage Assessment.”
- Download image 0659, 0672, and 0740 in the part of Collection-A, and see the photos carefully.

Please answer the following question on the separated answer sheet:

B-1: Except the differences of building structures and materials, what are the reasons for contiguous houses might have totally different damage levels? Does the wildfire destroyed houses randomly?

- Click the link “<http://strabo.pictearth.com/missions/2007-10-28/images/>” under Collection-B

- Click the link “[pict_28102007221604.jgw](#)” and “[pict_28102007221604.jpg](#)”

Please answer the flowing questions on the separated answer sheet:

B-2: Comparing the image 0659, 0672 and 0740 above, why you see shadows in picture 28102007221804? When were these images taken?

B-3: What do the numbers in picture 28102007221604 mean? How can we view the images in Google Earth? What’s the information in JGW file (***.jpw)?

[2] High Resolution Satellite Images:

- Click the link “[High Resolution Satellite Images from FORMOSAT-2](#)” and turn to the new page of “FORMOSAT Satellite Images”
- Click the image “[Oct. 26, 2007, FORMOSAT-2](#)” and answer the following questions on the separated answer sheet. (See Figure 2-6)

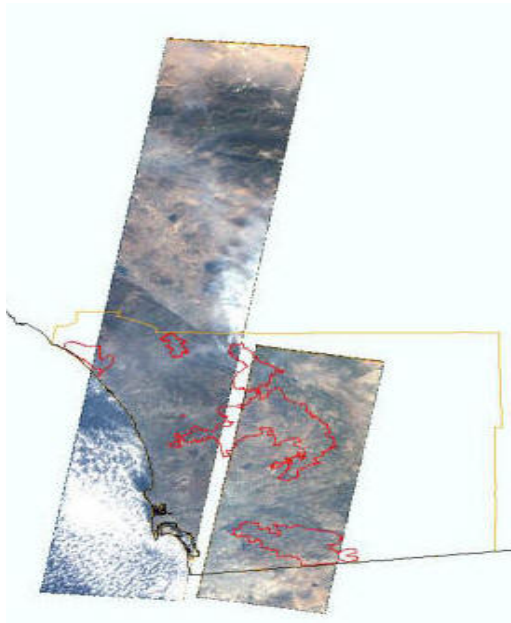


Figure 2-6: Image of “Oct. 26, 2007, FORMOSAT-2”

B-4: What do the polygons outlined by red lines mean? Which part shows the areas destroyed by the wildfire?

B-5: What is the difference of the white areas in the two parts of the image?

B-6: See the last image in this page. What are the differences of La Presa you can see from the image before and after the wildfire? (Hint: Compare the part divided by the red line)

[3] NASA EO-1 and IKONOS Satellite Images

- Click the link “[NASA EO-1 and IKONOS Satellite Images \(preview image\)](#)” and turn to a new page. See the images carefully and answer the following questions.

B-7: See the first four images of this page, the Date Updated on October 25, 2007, Afternoon. According to the direction of the white smoke shown on the images, how can you predict the direction of the wildfire spreading?

[4] GIS Data

- Click the link “[GIS Data \(Fire Perimeters\) and baseline layers provided by San Diego County EOC, SanGIS, and SDSU Geography Department.](#)”
- See the part of “Derived GeoData (SDSU).” Carefully view the image of “Normalized Burn Ratio Witch Fire 2007” and answer the following question on the separated answer sheet (See Figure 2-7).

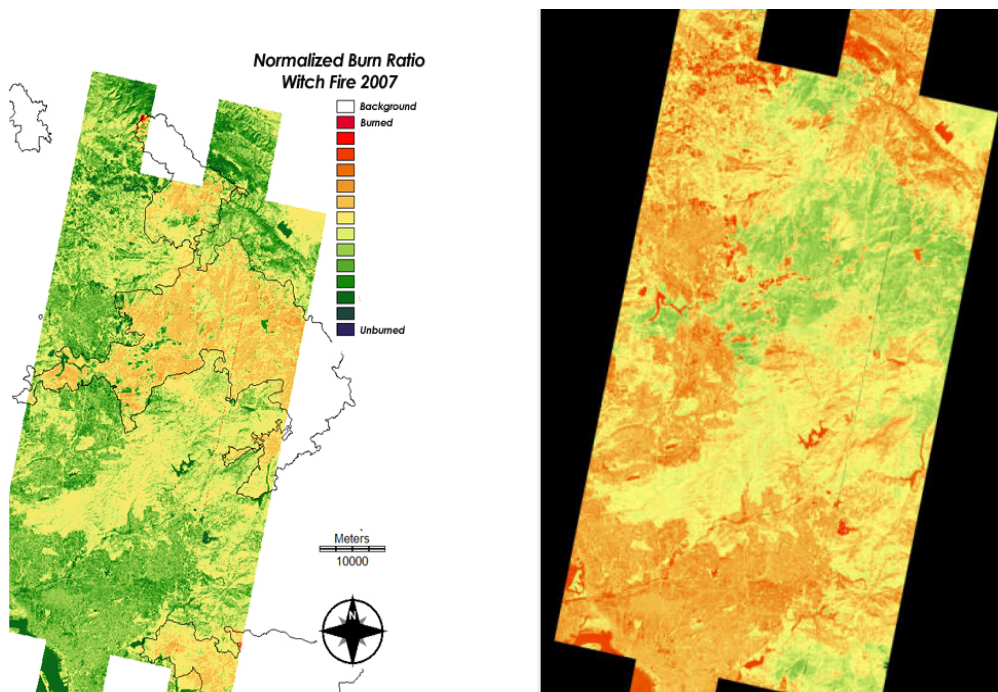


Figure 2-7: Image of “Normalized Burn Ratio Witch Fire 2007”

B-8: Why are some little burned areas (green color) surrounded by heavy burned areas (orange color)? Why do conjoint areas have different wildfire conditions?

Task-2: Evacuation Map Updates and GIS Maps.

This web page includes major government websites (county and city) and GIS maps related to evacuation, traffic updates, power outages and related information.

- Click the link “[Evacuation Map Updates and GIS Maps.](#)” and turn to the new page of “Evacuation Map Updates”.
- Click the link “[10-29-07 Updated Countywide Fire Map Perimeter.](#)” to open the PDF map. Please answer the following questions on separated answer sheet.

B-9: How many shelters you can find on the image?

B-10: We can see that the shelter in Peirce (Olive) Middle School is so closed to the burned are; why did the government set up such a shelter quite near to the burned area?

- Click the first image “[Harris](#)” in the part of “Printable PDF maps”. Please answer the following questions on separated answer sheet. (See Figure 2-8)

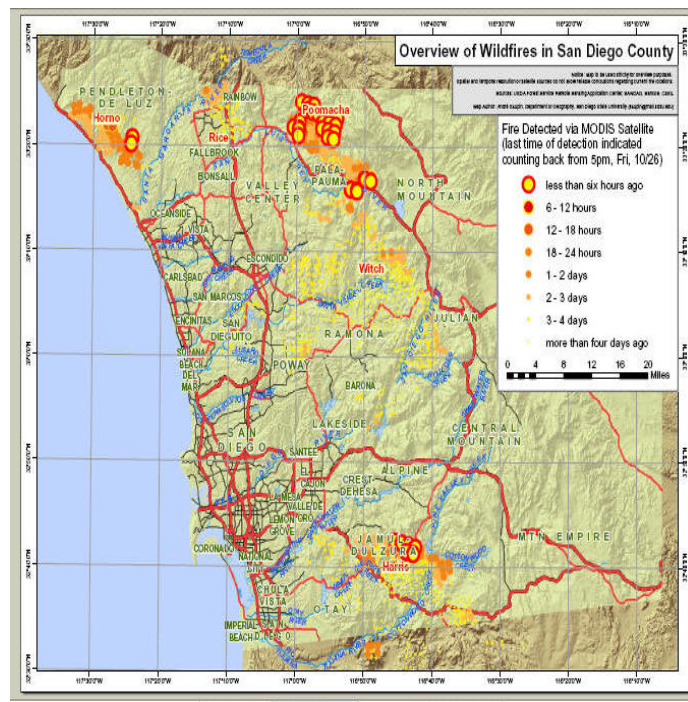


Figure 2-8: The Image of “Harris”

B-11: How many parts of areas were burned less than six hours ago counting back from 5 pm, Friday, 10/26?

B-12: According to this map, if you are the chief of San Diego fire department, how would you distribute the resources and manpower to put out the wildfire? Which part should be the most important areas on Oct. 26?

Task-3: 3D Visualization and Animation Maps.

- Click the link of “[3D Visualization and Animation Maps.](#)” and turn to a new page.
- Download the 3D movie and answer the following question on the separated answer sheet.

The imagery that was used as the background images are aerial images taken from airplanes or satellites. The images are imported into GIS software and made into 3-D based on the actual height of the terrain.

B-13: How does the San Diego County hypsography affect the wildfire spread direction to east?

- See the image of “KMZ file for JPL Wind Direction Map Animation” and “NASA JPL Wind Direction Map Animation.” Answer the following question on the separated answer sheet (See Figure 2-9).

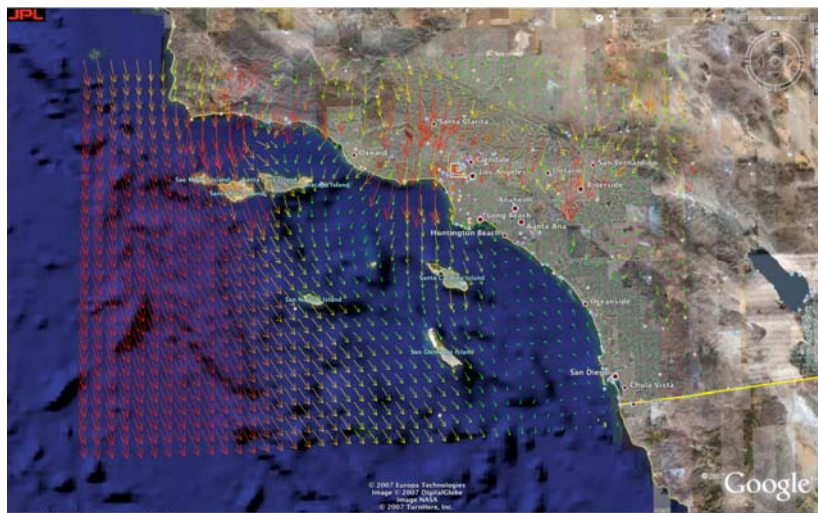


Figure 2-9: Wind Direction Map

B-14: What do the different colors of the arrows mean in the wind direction map?

B-15: How does the wind direction influence the wildfire spread direction?

Task-4: Satellite Images Overlay and Remote Sensing.

This page collects all relevant satellite images and overlays them with GIS layers (streets, highways, rivers).

- Click the link” [Satellite Images Overlay and Remote Sensing.](#)” And turn to the new page.
- See the Animation of NASA MODIS satellite images updated on Oct. 21-29, 2007 carefully. Please answer the following question on separated answer sheet.

B-16: Could you tell us how the animation created? Does the wind direction change from Oct. 21 to 29?

- Take a look at the [Oct. 22, 2007] Satellite Images.

B-17: Compare the original satellite images (without any high way or roads) and the GIS enhanced images (with high ways), which kind of images are more useful? Why?

Section 3 – Criminal Justice - Crime Mapping and Tracking

Part I – City of San Diego Crime Map

The third GIS application example can be used to study and visualize is reported criminal incidents and the locations where they occurred. This is an example of a “Crime Map.” A Web-based mapping tool was developed for the Automated Regional Justice Information System (ARJIS) in San Diego, a computer network utilized by 50 local, state and federal agencies in the San Diego region. Please follow the steps as below and you should spend no more than 10 minutes to finish this part.

- Navigate to <http://www.arjis.org> and then click “**Crime Maps**”. A new Web page will pop up (*If you are using Microsoft Internet Explorer as your Web browser and you receive a message indicating that the pop-up was blocked, hold*

- down the <Control> key and click on the **Crime Maps** link to bypass the Pop-Up Blocker.)
- On the Crime Maps Disclaimer page, click on the button “**Accept**” to continue.
 - On the next page, click on the button “**Go to Mapping**”, the Regional Crime Maps Web interface should appear.
 - Under **Jurisdiction**, click on “**San Diego**”.
 - A column named **San Diego** will appear; choose “**Address**”.
 - In the third column, enter your home or high school street address if you live in San Diego; if not, type “**5500 Campanile Dr.**”
 - Click on “**Verify Address**”. If **multiple addresses** appear, choose any one that is closest to your actual address.
 - Choose “**1 mile**” from the pull-down menu under “**Radius for shaded area around selected location.**” This is known as a “buffer area” and will display all of the incidents within a one-mile radius.
 - Click “**Next**”.



Figure 2-10: San Diego County Regional Crime Map Interface

- Under **Incident Types**, choose all types of **Crimes** by checking off all of the criminal incident types under the **Crimes** folder.
- Click the button “**Next**” toward the center-top of the browser window.



Figure 2-11: Selecting Incident Types

- Look up the incidents that have been stored in the system by selecting a range of dates, days of the week, and time range. For now, don't change it. It is automatically set for the last month. Click **"next"**.
- A map should appear around the address you selected. There may or may not be any incidents recorded around the location for the given time period. Incidents are denoted by icons on the map.
- In the Example Crime Map image below this paragraph, you can see several icons including green plus signs (vandalism), yellow dots (theft), and blue triangles (residential burglary).
- Use the Zoom Out and Zoom In controls to change the map areas displayed. If you can't see any incidents, you may need to change the address or the time range. After changing any of the settings, you can redisplay the map by selecting the Map button in the lower-left corner.

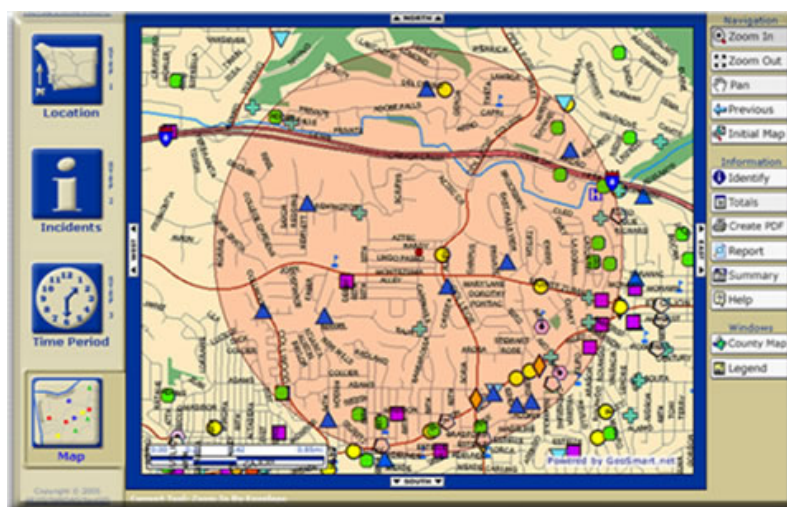


Figure 2-12: Example Generated Crime Map

- Select the Identify button on the right side, and click on any incident icon to get more information.



Figure 2-13: Identifying a Specific Incident

- Change the Location, Incidents, and Time Period by clicking on the buttons on the left side. After that, click on the Map button to redisplay your map. This system covers all areas in San Diego County. You can look up any street address, city and zip code within San Diego County.

Part- II. Please answer the following questions on the separate answer sheet and you should spend no more than 9 minutes to finish this part.

C-1: Based on the Crimes that you mapped, what types of incidents are most frequent around the area you selected?

Go to the Incidents menu by selecting the Incidents button (the big “i” button on the left of the map). Now unselect all of the Crime types and now select all of the Traffic-related incident types. After doing so, redisplay your map by clicking on the Map button on the bottom-left of the browser window.

C-2: Based on the new information that is displayed, what types of Traffic-related incidents are most common on your redisplayed map?

Go back to the Incidents menu by selecting the Incidents button (the big “i” button on the left of the map). Now unselect all of the Traffic-related incident types and now select all of the Arrests and Citation incident types. After doing so, redisplay your map by clicking on the Map button on the bottom-left of the browser window.

C-3: Based on the new information that is displayed, what types of Arrests and Citation incidents are most common on your redisplayed map?

C-4: If you were the mayor of the City of San Diego, how could you use this system to improve the safety of San Diego visitors and residents and why?

Section 4 – Business and Marketing - Real Estate Sales and Pricing

Part I. – Real Estate Housing Costs with Zillow.com

This example will introduce GIS applications in private industry, business, and commerce. Many companies have been utilizing GIS for promoting their businesses and to increase their profits. They do this by conducting market analysis, and making new store and distribution center site-selection studies. GIS can combine information about the cost of land, the cost of local taxes, the local laws and regulations (zoning), the distance to the sales locations (or retail outlets), and the types of customers within the local area (demographic analysis). Using all of this information and more, decision makers can make better business management choices.

The following example introduces a unique GIS application in the Real Estate business specialty area. This application estimates home values based on recent sales in the area of equivalent homes in the area. You should spend no more than 5 minutes to finish this part.

- Please navigate to <http://www.zillow.com>.
- Type in the street address of a house. It is also okay to just type the street name without the address number. Then, type the city and either the state or zip code.
Example:
Type in “**Catalina Blvd**” first, and “**San Diego, CA**” in the text field.
- A map should appear. You can navigate it by changing the direction, zooming in/out once it is displayed. You can change the level of detail. Try several different views to see which one you prefer. Make sure the estimated home prices are visible. Note that the home prices are displayed in 100,000’s. For example \$400K means \$400,000. (See Figure 2-14)

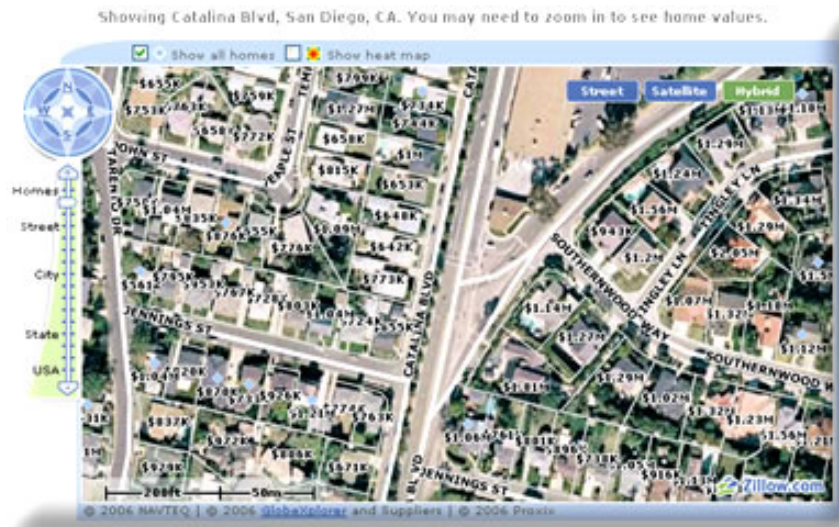


Figure 2-14: Address Input Example

Part II– Please answer the following questions on the separate answer sheet and you should spend no more than 10 minutes to finish this part.

After selected an area, click on a home and determine its estimated value.

D-1: *What is the street name of your selected home?*

D-2: *What is the estimated value of your selected home?*

D-3: *What is the estimated value of the neighboring property to the east of your selected home?*

D-4: *What is the estimated value of the neighboring property to the west of your selected home?*

D-5: *Is there any difference in the estimated values between the three properties (original selected home, one to the east, and one to the west)?*

Again, click on the first home which you selected to get a pop-up window with more information. In addition to estimated value, the address, the number of bedrooms, the number of bath rooms, and the square footage of the house may be displayed. Get more information for the two neighboring houses as well.

D-6: *Is the property that you selected larger or smaller than the other two neighboring houses and does this difference seem to affect the housing costs?*

D-7: If you wanted to buy a home in San Diego, how could you use this Website to help you to select the house?

D-8: If you wanted to sell a home in San Diego, how could you use this Website to help you to select the house?

Section 5 – Environmental Science/Ecology - Environmental Monitoring & Management.

Part I – San Diego Watershed Common Ground Website

This section will introduce GIS applications in environmental science and ecology with specific examples for environmental monitoring and management tasks. Many federal agencies, such as the U. S. Geological Survey (USGS) and the Environmental Protection Agency (EPA), and local governments have been using GIS to manage their watersheds, water supplies, wildlife, wetlands. The following example will introduce a research project developed through the collaboration of the SDSU Geography Department, the City of San Diego, a private environmental consulting company, and San Diego Coastkeeper (a non-profit environmental advocacy group).

- Navigate to <http://www.sdbay.sdsu.edu>, click on the link “**Journey through a Watershed Video**”.
- Watch the **4-minute** multimedia video (You will need to have a multimedia video player on your computer). Please answer the following questions after watching the video and spend no more than 9 minutes to finish this part.



Figure 2-15: San Diego Bay Watersheds: Common Ground Home Page

E-1: Where did the pollutants come from?

E-2: Where did the pollutants end up?

E-3: What can you do to help keep San Diego Bay clean?

- Close the video player window and switch back to the home page (<http://www.sdbay.sdsu.edu>).
- Select the quick link “What is GIS?” on the right side and spend five minutes reading the Webpage content.
- Now select the **Maps** pull-down menu at the top, then select **Interactive**.
- A disclaimer page will appear. Scroll down to the bottom and click on the **Agree** button.
- A new map window should have popped up. On the right side of the window, you will see a list of layers which organize water quality data around the San Diego region. Click and place a check mark in the square “check box” next to the **Pueblo Watershed** in the Layers list to display it in the map.
- Also, select the circular “radio button” of the same layer---the **Pueblo Watershed**. This will allow you to explore the Pueblo Watershed data interactively on the map.

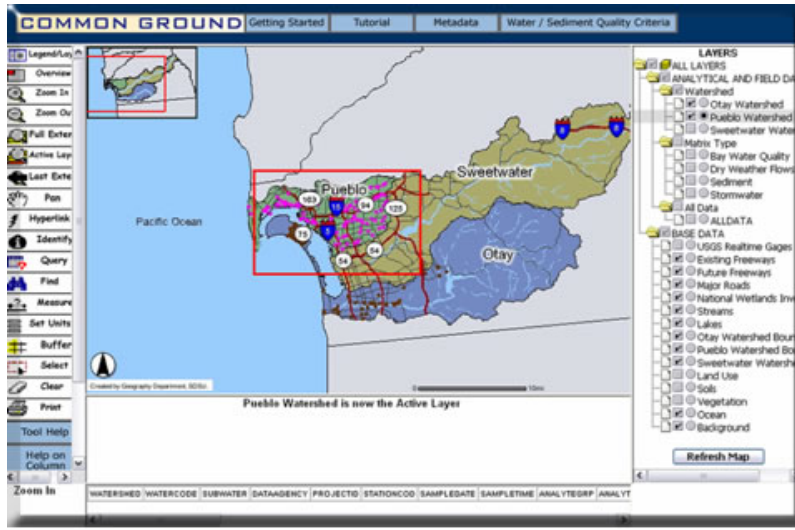


Figure 2-16: Zooming In to Water Quality Monitoring Sites

- On the left side of the map, click the “Zoom In”. Next click and drag a rectangular box around the area with the pink water quality monitoring sites (See above).



Figure 2-17: Zoomed In to Water Quality Monitoring Sites

- After you have successfully zoomed in (See above), click on the Identify tool located on the left side.
- Now, select one of the Pink water quality monitoring points on the map. If successful, the system will check the database of the water quality monitoring station located at your selected site and display the information in a table below the map. Briefly examine the data and feel free to check the data at other water quality monitoring sites (the pink dots).



Figure 2-18: Displaying Water Quality Monitoring Data

Part II– Please answer the following questions on the separate answer sheet and you should spend no more than 6 minutes to finish this part.

E-4: The word “Analyte” describes the substance that is being analyzed. In this application, the analytes are the substances measured in water. In your database query result of water quality data, what is the first ANALYTE listed?

E-5: For this analyte, what is its corresponding RESULT value and UNIT?

E-6: What do the RESULT value and UNIT represent?

E-7: How can you use this system to monitor the water quality in your neighborhood?

Section 6 – Additional GIS Web Applications

The next step is to visit ONE GIS application website (from the following table or other places) and provide a short summary of the Website's purpose and its major GIS/Mapping functions. You should spend no more 15 minutes to finish this part.

Website	Description
http://geoinfo.sdsu.edu/campusmap/	San Diego State University Campus Map
http://maps.google.com/	Google Maps
http://www.mapquest.com/	MapQuest

F-1: Please write down your selected Website on the separate answer sheet:

F-2: Please write down a short summary (100 words) of your selected Website's purpose and its major GIS/Mapping functions on the separate answer sheet:

Section 7 – Written Assignment

Now that you have seen five GIS applications examples in five different fields, we would like you to answer some questions with the idea that you will be putting them all together in a 250-word paragraph (approximately one typed page) by including the following information. You should spend no more than 25 minutes to finish this part.

G-1: In your paragraph, please highlight five different applications of GIS. Can you think of ONE additional new application area that was not mentioned in this learning exercise? Please mention it if you can think of one.

G-2: In your paragraph, please discuss which application you liked the best and tell us WHY? Do you think that this GIS application can help people? How can it help people?

G-3: In your paragraph, please tell us if it was difficult or easy to access the Web GIS maps using your Web browser. Why was it easy or difficult?

Student Survey

This learning module was developed specifically for you---the students---in order to expose you to GIS and related geospatial technologies.

GIS and related geospatial technologies, similar to what you worked with in this learning module, are major components of one of the most important new industries for career growth. Businesses, organizations, and governments are increasingly seeking skilled talent in this industry.

Now, to benefit other students and the authors of this learning module, you are required to finish this Student Survey and please send it back to the San Diego State University NSF-ATE team. We would greatly appreciate your input. Please take time to answer these questions as openly and honestly as possible. **They will not affect your grade or score.** You can provide your feedback to your teacher/educator along with the learning module answers on the separate answer sheet.

Thank you for helping us improves our modules!

S-5: What did you like best about this learning module two? Why?

S-6: What did you like least about this learning module two? Why?

S-7: Was there anything that was really hard to understand or difficult to complete in this module two? What was it? Why?

S-8: Is there anything in this learning module two that we can add, exclude, or change to make it better? What is it? Why?