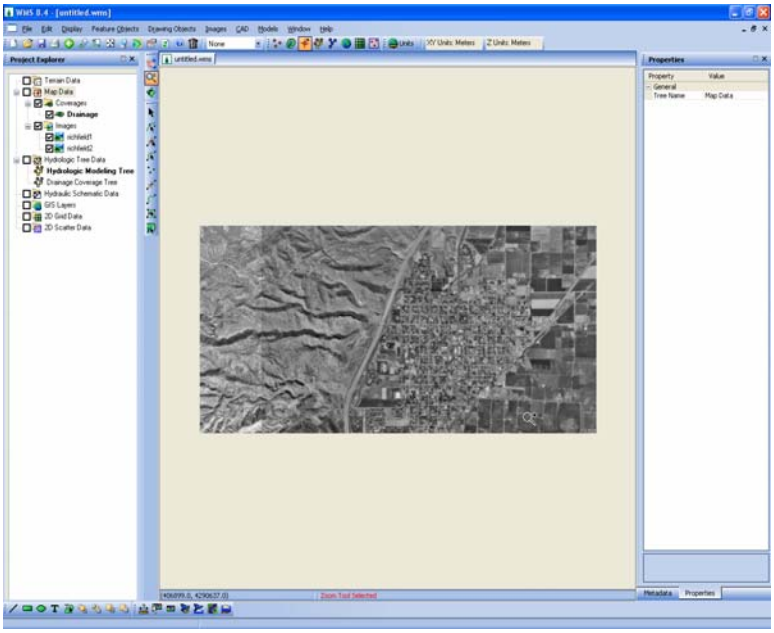
WMS

v. 8.4

WMS 8.4 Tutorial

GSSHA – WMS Basics – Loading DEMs, Contour Options, Images, and Coordinate Systems

Learn how to work with DEMs and images and to convert between coordinate systems in the WMS interface



Objectives

Read digital elevation, image, and GIS shape files into WMS, manipulate the files, and download digital data from the internet. Learn how to georeference image files, convert coordinate projections, and convert data from shapefile to map feature data that can be used for watershed modeling in the WMS GSSHA interface.

Prerequisite Tutorials

- None

Required Components

- Data
- Map

Time

- 45-60 minutes

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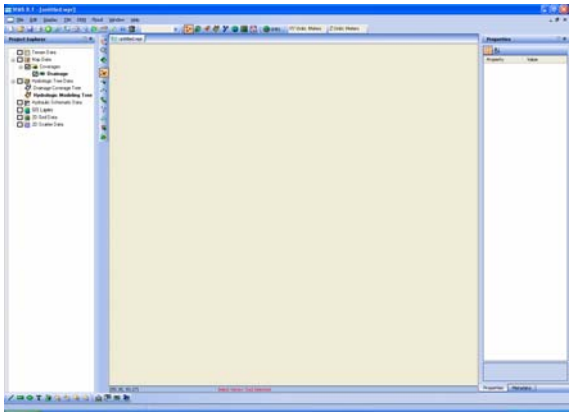
1 Contents

2 Introduction

In this first exercise you will get familiar with the WMS interface and the help system using data from the Park City, Utah area.

3 Objectives

We will learn the basic layout of WMS and get acquainted with the interface.



The left most portion of the WMS window is called Project Explorer, the central part is the display window, and the right part is the Properties window. The properties window changes based on the selected item.

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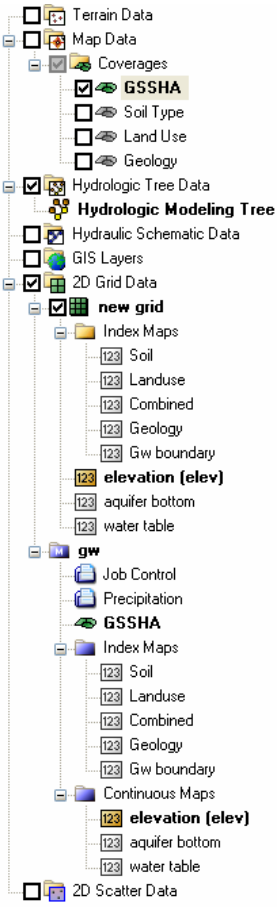
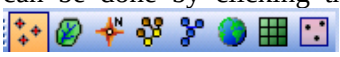
4 Getting Around the WMS Interface

The WMS Help file has a section on some of the basic elements of the WMS graphical user interface (GUI).

4.1 Self-Guided Tour

The WMS Help file is located on a "wiki" site at http://www.xmswiki.com and documents the important elements of the GUI. In this section you will practice on your own to become familiar with the interface, but you can always refer back to the help file on xmswiki.com as needed.



1. Start WMS
2. Select ***Help*** | ***WMS Help***
3. Take a couple of minutes to review the WMS Help wiki and then close the help page
4. Different operations like spatial data reading/editing, hydrologic modeling or grid generation etc. are done using different modules. Switching from one module to the other can be done by clicking the corresponding module icons  in the menu bar. As you do, you will notice menus and tools change according to the available options. Change the module several times and note how the menus and tools change according to the active module. When you are done, be sure the Terrain Data module is active (the first one from the left).
5. If you look at the WMS project explorer, you can see that there is a folder in the project explorer to contain the data associated with each module (the drainage module shares data from the terrain and map modules).
6. The default behavior of the project explorer window is to switch modules as these folders or data contained in them are selected. For example, if you click on the *GIS Layers* folder, the *GIS Module* will be selected and if you click on the *Coverages* folder, the map module will be selected.
7. WMS 8.4 projects are saved as *.wms files. When you save the project, all necessary files are saved and the saved project can be reopened. You should always save your model as a .wms file before creating a 2D grid for a GSSHA model so you have a base project to work with. After building a 2D grid and initializing your GSSHA model, you should save your project as a GSSHA project file (with a .prj extension).
8. You can control which objects are displayed by checking and un-checking the data elements in the Project Explorer window. Set the style, color, and size of elements drawn using the ***Display Options***  , ***Contour Options***  , and other macros.
9. Select ***File*** | ***Open***  Browse and open file ***C:/Training/Images /BaseProj.wms***

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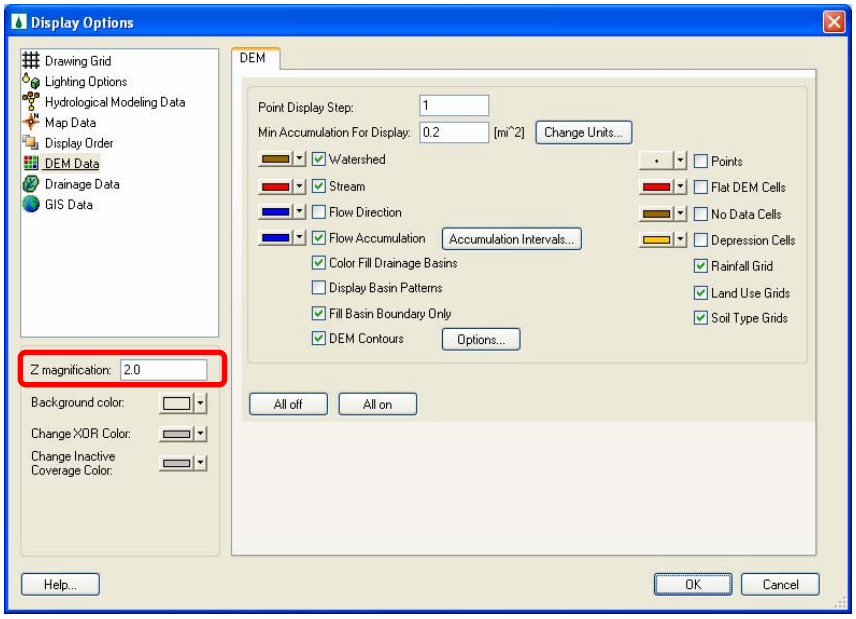
10. Select the ***Contour Options*** macro and experiment with changing some of the contouring options such as the ***Contour Methods***, ***Contour Interval*** and ***Color Ramp.***

11. Controlling what and how objects are visually displayed can be set through the display options. To set the display options, select ***Display*** | ***Display options*** or simply click the display options button on the menu bar.

12. In the *Display Options* dialog box enter 2.0 for *Z magnification*. You can also access the DEM contour options from the display options by selecting the DEM Data object in the upper left corner of the Display Options window. Click the options button next to DEM Contours. Make sure the DEM Contour Method is set to *Color Fill* and click OK twice.



13. Select the *Rotate Tool* and drag your watershed so you can visualize the watershed relief.

14. Select the ***Contour Options*** macro and set the *Contour Method* to *Normal Linear*. Select OK and then select *Plan View* to reset the drawing of the DEM from the changes you made with the rotate tool.

5 Images

Images are an important part of projects developed using WMS. An image is comprised of a number of pixels (picture elements), each with its own color. The resolution, or size, of the pixels determines the area and detail represented in the image. Images may be used in WMS to derive locations for features such as roads, streams, confluences, land use, soils and so forth. Images also provide a base map for your project.

In order to make use of images they must be georeferenced. Georeferencing an image defines appropriate x and y coordinates so that it can be spatially overlaid with other data. Because images are commonly used in Geographic Information System (GIS) programs

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like WMS, data developers often store the georeferencing information as either part of the image file (a geotiff file for example), or in a separate file commonly referred to as a "world" file.

In this section we will experiment with JPG and TIFF image files. We will also see how an image without spatial information can be georeferenced.

6 Geotiff Files

Geotiff images are files that embed the georeferencing information. This means that you do not have to specify coordinates when you read in the image.

6.1 Scales

In this section we will see how the scale of an image affects the display. We will use some of the images for Provo, Utah.

1. Select ***File|New*** or click on macro icon  to open a new instance of WMS.
2. Select ***File | Open***
3. Browse the folder ***C:\Training\Images*** and open the following images:

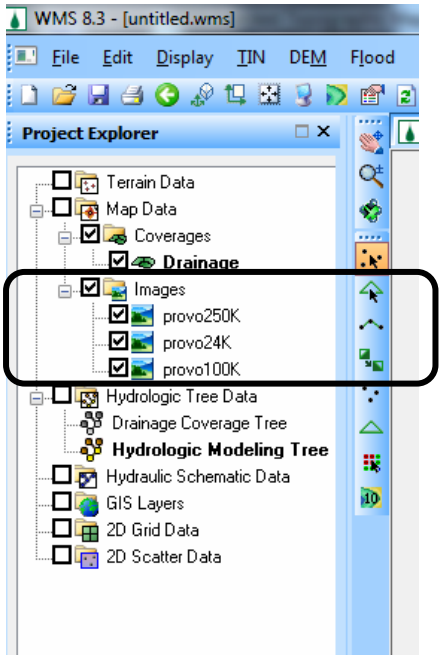
   a) provo24K.tif

   b) provo100K.tif and

   c) provo250K.tif

Click No if prompted to convert to jpg

Note: These are the topographic maps of the Provo, UT area. The three images are of different scales (1:24000, 1:100000 and 1:250000 respectively).



4. Once these files are open, you can see them listed in the project explorer (see the following figure).
5. Turn the display of the images on and off by checking them on and off in the project explorer. Leave them all on when you are done experimenting.
6. Select the Zoom Tool  and draw a rectangle over the image to zoom into the area of your preference.

Zooming Tips: With the zoom in tool  selected, if you press and hold the Shift key in the keyboard, the zoom in tool changes to zoom out tool

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You can also use the scroll wheel of your mouse to zoom in and out with any tool or module selected.

7. Zoom into the same location in the three different images and see the difference in resolution, area covered by the images, details captured etc.

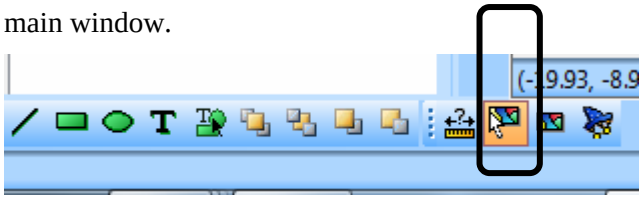
7 Overlaying Images

Here we will see how different types of images can be overlaid together.

1. Close WMS and open a new instance of WMS. Browse and open image ***C:\Training\ Images\provoTStopo.jpg.*** This is a topographical map of Provo area obtained from Terraserver ***(http://www.terraserver.com/)***. This image is already georeferenced.

Many of the tools in WMS depend on your currently defined coordinate system. One such feature that uses your current coordinate system (also called a *projection*) is the *get data* tool. Before using the *get data* tool, you must have your current projection defined so WMS can determine the latitude/longitude coordinates of your required data.

2. Select ***Edit | Current Coordinates*** to set your current coordinates
3. Select the *Global Projection* option
4. Select *Set Projection*
5. Set *Projection* to *UTM*, *Datum* to *NAD 83*, *Planar Units* to *Meters*, and *Zone* to *12 (114°W - 108°W – Northern Hemisphere)*
6. Select *OK*
7. Set the vertical projection to *Local* and the vertical units to *Meters*
8. Select *OK*
9. Select the *Get data tool*  located at the lower left corner of the WMS main window.



10. Draw a rectangle with the mouse pointer around the jpg image that you opened previously. This will open the *Data Service options* dialog. Select the *Terraserver aerial photo* option as shown in the following figure.

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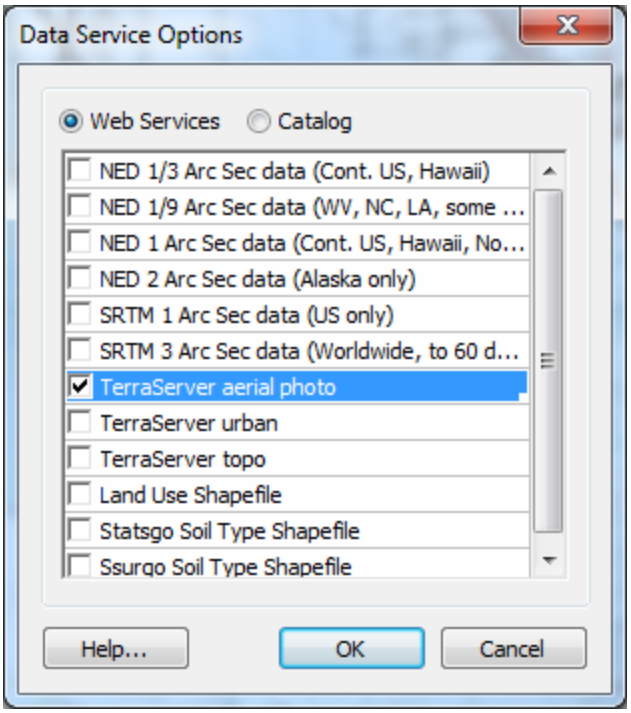

11. Select OK and browse folder ***C:\Training\Personal\Images*** and enter name ***provoTSaerial*** and click Save.
12. Select *Yes* to create the files.
13. WMS will suggest a suitable resolution for the image based upon the size and coverage of the image. You can change the resolution, but here you should use the suggested resolution. Click OK.
14. This will take a moment for WMS to use the web services and download the data from the server.
15. Once done, you will be prompted to build pyramids, select Yes.
16. You can see both the topo map and the aerial photo listed on the project explorer.
17. Right click on the ***provoTSaerial.tsaerial.web*** item in the project explorer and select *Set Transparency*.
18. Move the slider to 40% and click *OK*. You should be able to see the aerial photo on top of the topo map.

8 Registering Images

Sometimes you will not be able to obtain a geotiff image or an image with a world file. In this case, you can read a background image from common image sources such as scanned paper maps, Google Maps, or Google Earth and geo-reference the image manually. To do this, you need to know the X and Y coordinates of three points on the image. These coordinates can be in a projected or geographic (latitude-longitude) system. Before you scan your paper image, or download an image from the Internet, you should mark the

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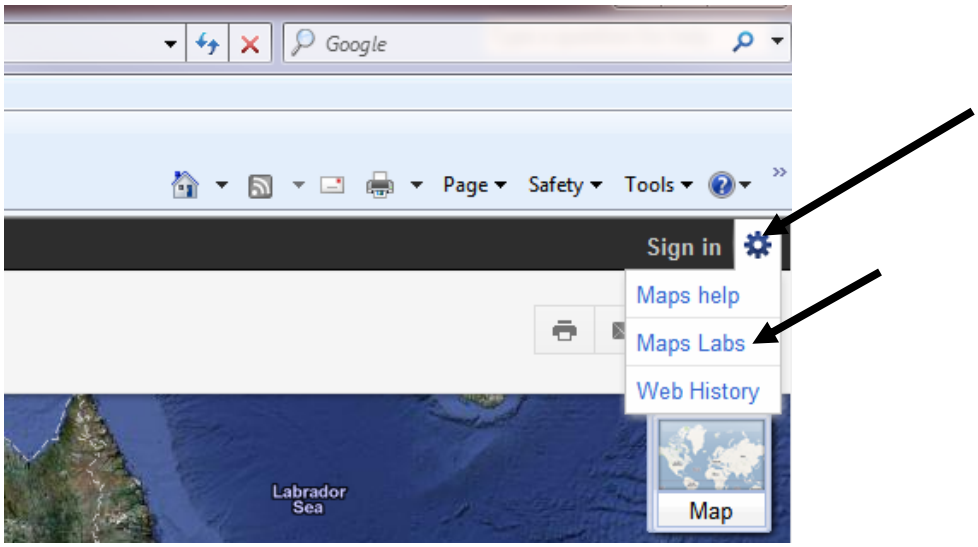
three points you have selected so you can easily find the points on the image when you register the image in WMS.

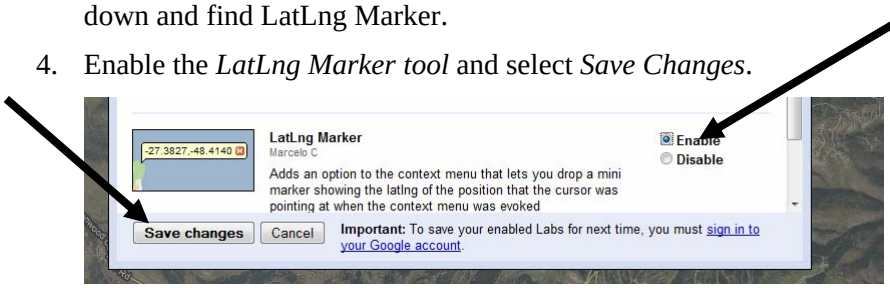
8.1 Downloading image from Google Maps

As an example we will see how an image can be imported from Google maps and get it georeferenced so that the image can be used in WMS.

1. Open a web browser and go to http://maps.google.com/ . Turn the Satellite map option on.
2. On the top right corner of the map click *Options* button and select *Maps Labs.*



3. This will open a pop-up window with a list of Google maps Labs. Scroll down and find LatLng Marker.
4. Enable the *LatLng Marker tool* and select *Save Changes*.



5. Enter Park City, UT in the search box and click *Search Maps.* This will zoom into the area where our watershed is located.

6. Right click approximately near the locations shown in the following figure and select *Drop LatLng Marker*. This puts the coordinate marker at each of the locations you specify. See the following figure.

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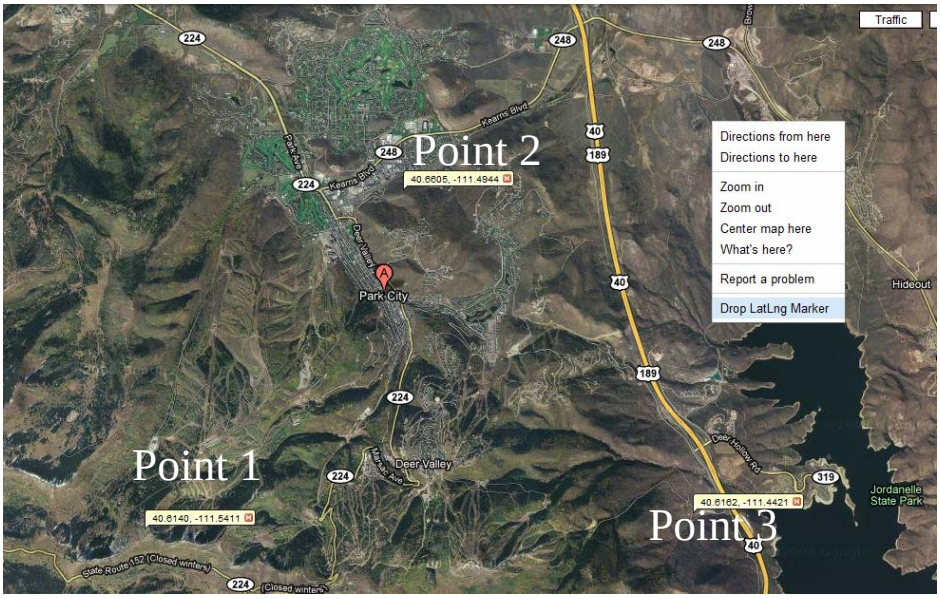

7. You may zoom in more to have a higher resolution image but make sure that all the three markers are within the visible extent.
8. Now press the *Print Screen* key on the keyboard. Open the standard Microsoft *Paint* program from the Start menu on your computer and paste the image into *Paint*. You may want to crop only the portion of the image you need using the Paint program by selecting the area of the image you are interested in, selecting Edit | Copy, selecting File | New, and then selecting Edit | Paste.
9. Once done, save the image as ***C:\Training\Personal\Images\ ParkCity.jpg***.
10. If you have trouble downloading the image, there is one already downloaded in ***C:\Training\Images\ ParkCity.jpg***.

8.2 Geo-referencing images in WMS

You will use the Google Maps image that you downloaded for Park City and define the coordinates so it is in the same projection as your hydrologic model.

1. To overlay the image with a hydrologic model, first open the WMS project file for Park City at ***C:\Training\Images\Baseproj.wms***.
2. Open the image you downloaded in a previous step. This image should be located at ***C:\Training\Personal\Images\ParkCity.jpg***. If you had trouble capturing and saving the image, there is an image already saved at ***C:\Training\Images\ParkCity.jpg***.
3. When reading the image, click *Yes* to build pyramids.

The image will appear in the Register Image dialog. The three latitude/longitude markers are also displayed. There are also three "+" symbols with the numbers 1, 2, and 3 by them (much larger and visible). You need to place the numbered plus signs over the tip of the place markers and enter the corresponding coordinates in the fields below to register the image.

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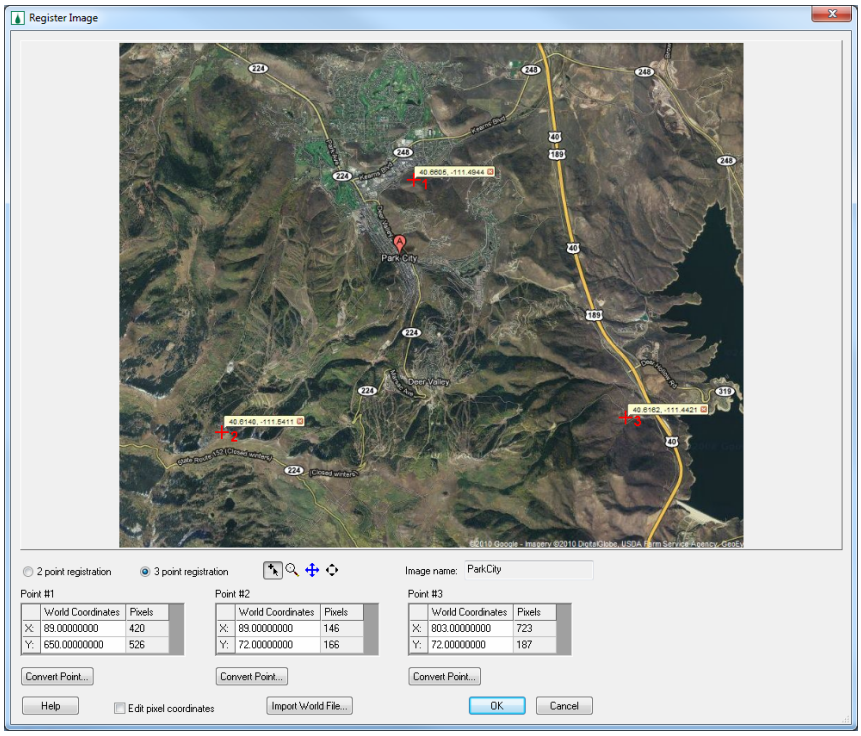
4. Use the *Point Selection* tool to drag each "+" symbol over the closest lat/lon coordinates as shown in the following figure. You may wish to place the symbols close and then zoom in on the area for more accuracy. Once you zoom in there is a *Frame* tool that you can use to re-center the image so that you can zoom in on another registration point. Do your best to move each plus mark over the tip of the pins in the image.



The coordinates for the three points are known in geographic (latitude/longitude) coordinates. We will register using these coordinates and then convert to the projected UTM coordinates after reading the image. In order to properly register, the coordinates must be decimal degrees.

5. Using the values shown in the respective *LatLng* markers, enter the appropriate x (longitude) and y (latitude) values for the three points.

   Note that longitude values west of the prime meridian should be entered as negative. If you enter the values as specified on the markers (+/-), your coordinates will be correct.

   Also notice that Longitude or Easting is the X-coordinate and Latitude or Northing is the Y-Coordinate.

6. When you have correctly entered the three coordinates select *OK* in the Register Image dialog

The data is not showing up because the coordinate system of the delineated watershed does not match with the coordinates of the image you just registered. Do the steps in the following section to learn how to convert the coordinate system of the image so the image overlays the watershed.

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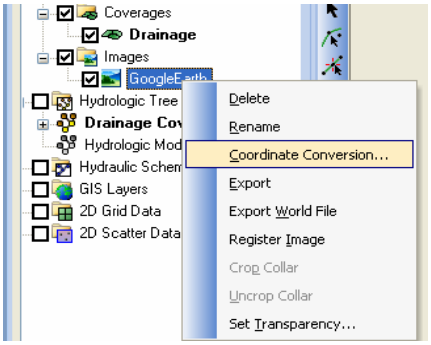
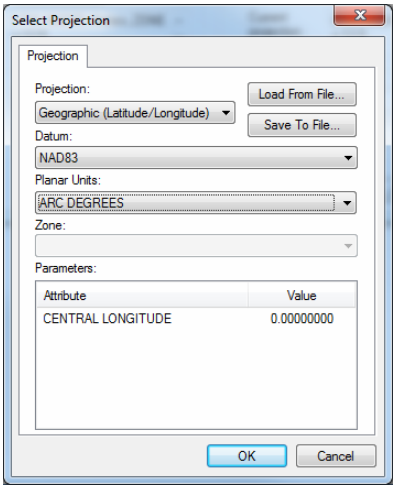
8.3 Converting the Coordinates to UTM

Geographic coordinates are commonly used on maps because they provide a global reference for any point in the world. However, for engineering work a planimetric (XY or Cartesian) coordinate system is necessary. The Universal Transverse Mercator (UTM) projection is a commonly used coordinate system. We will convert the coordinate system from geographic to UTM.

1. Right-click on the *ParkCity* image icon in the Project Explorer and choose the ***Coordinate Conversion*** option



2. Select the *Global Projection* radio button in the *Object Projection* section in the *Reproject Object* dialog
3. Select *Geographic (Latitude/Longitude)* from the *Projection* drop down box
4. Select *NAD 83* from the *Datum* drop down box and *ARC DEGREES* under the *Planar Units*.



5. Select *OK*
6. Set the Vertical System projection to *NAVD 88(US) and* units to *Meters*
7. Toggle on the *Specify* check box in the *Project Projection* in the *Reproject Object* dialog
8. Select the *Global Projection* radio button
9. Set *Projection* to *UTM*, *Datum* to *NAD 83*, *Planar Units* to *Meters*, and *Zone* to *12 (114°W - 108° W – Northern Hemisphere)*
10. Select *OK*
11. Set the Vertical System projection to *NAVD 88(US) and* units to *Meters*
12. Select *OK*

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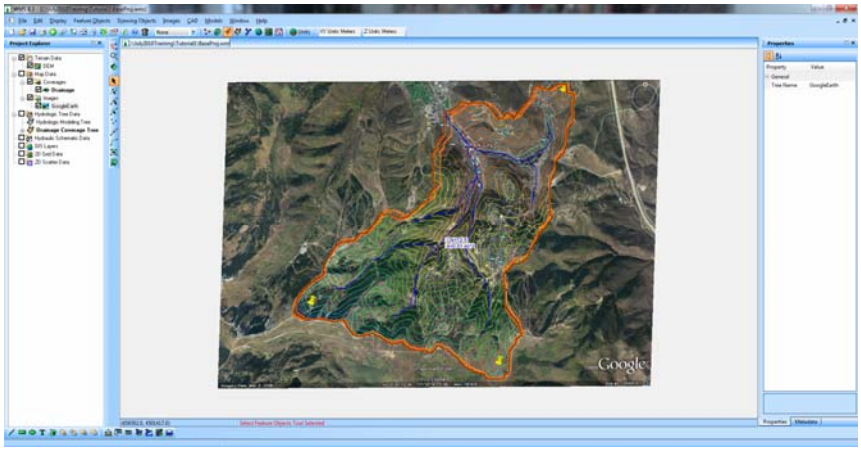
There might be some distortion in the image as it is converted from geographic to UTM because a degree of longitude has a shorter distance the farther north you are, but this is normal. Any measurements taken or data created from the image will have XY distance units of meters.



8.4 Exporting a World File

Once you have georeferenced an image, you can then export a world file so that you can use it for future use.

1. Right-click on the *ParkCity* image in the Project Explorer and select *Export World File.*

   If you save the world file with the same name as the original JPEG image but with a ".jpw" extension. If you export a world file with the same prefix as the JPG image, the image will open be georeferenced next time you open it. However, if a world file is saved with a different name, you will have to import the world file after reading the JPEG image. We will now see how world files work.

2. Save the file as ***C:\Training\Personal\Images\ParkCity.jpw***—the WMS default file name. Click *Save.*

3. In the WMS project explorer, delete the *ParkCity* image by right-clicking on the image and selecting *Delete*.

4. Select ***File | Open*** and select the file ***C:\Training\Personal\Images\ParkCity.jpg.*** If asked, go ahead and build pyramids. Now the image opens as a georeferenced image.

Note: As discussed above, if the image and the world file are at different locations, if they have different names, or if there is no world file, opening an image will display the *Image Registration* dialog.

If you see the ***Image Registration*** dialog but you already have a world file at a different location or with a different name, click the ***Import World File*** button at the bottom of the ***Registration*** dialog. Browse to and open the world file and click ***OK***. The image will show up as a georeferenced image.

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9 World Files

Many image files do not contain georeferencing information. For example, JPEG files do not have georeferencing "tags" in the file like TIFF images may have. Most organizations that make images available distribute world files containing the georeferencing information along with the image files. These world files usually have the same prefix as the corresponding image file, but with the extension .tfw for TIFF images (for JPEG files, the extension is .jpw, .jgw, or .jpgw). If you download a world file and are asked to supply a name for the file, use the same prefix as the image file with a ".jpw" or a "tfw" extension and WMS will automatically recognize the world file and register the associated image.

Use the following procedure to view the information contained in the world file:

1. Select ***File*** | ***Edit File***
2. Browse and open ***C:\Training\Personal\Images\ParkCity.jpw***

Because there is a world file named *ParkCity.jpw*, the image is automatically registered after reading the JPEG image. If WMS does not find a world file for an image, you would have the option of importing the world file from within the registration dialog.

10 GIS Shapefiles

GIS shapefiles are another data source frequently used in developing models with WMS. In this section you will see how commonly used shape files for land use and soil data can be obtained and used in WMS.

10.1 Geospatial data acquisition

There are several locations where you can obtain various types of geospatial data. The XMS wiki at http://www.xmswiki.com has a special geospatial data acquisition page which has tutorials and tips on downloading these data from the most convenient sources for use in WMS, SMS or GMS. In this section, you will download a shapefile with land use data and open it in WMS.

1. Start a web browser and type the following link into the address bar: `http://www.xmswiki.com/xms/GSDA:GSDA`. This will take you to the Geo-Spatial Data Acquisition Home page.
2. Under *Surface Characteristics*, select *Land Use.*
3. Select the *WebGIS* link.

4. Under *Land Use* select *Shapefile (UTM)*

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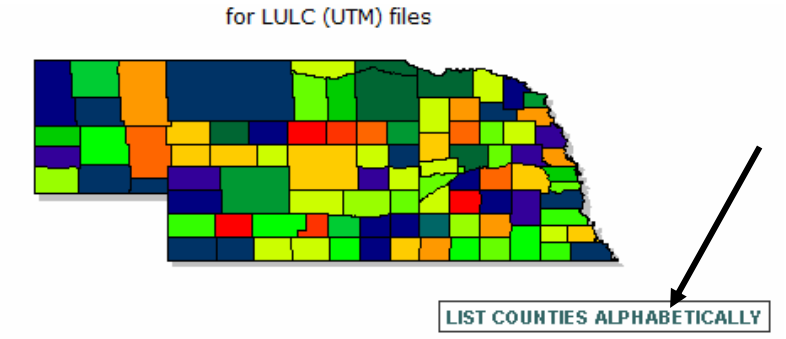
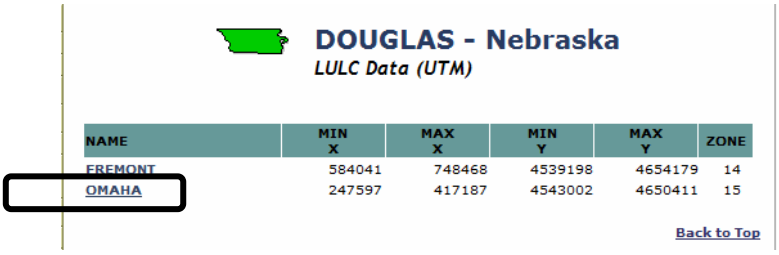
5. For this exercise, you will get the land use data for Omaha. In the US map, select Nebraska.
6. Click on *List Counties Alphabetically*



7. In the list that displays, select *Douglas County*
8. Select *Omaha* on the top of the list.



9. Save ZIP file archive on your computer.
10. Outside of WMS, browse to the folder where you saved the Omaha.zip file and extract the files to ***C:\Training\Personal\Images***.
11. In WMS, delete your data by selecting ***File | New***.
12. Before reading any data, you should set your coordinate system by setting your coordinate system. Select ***Edit | Current Coordinates*** to set your current coordinates.
13. Select the *Global Projection* option.
14. Select *Set Projection.*
15. Set *Projection* to *UTM*, *Datum* to *NAD 83*, *Planar Units* to *Meters*, and *Zone* to *15 (114°W - 108°W – Northern Hemisphere)*.
16. Select *OK.*
17. Set the vertical projection to *NAVD 88(US)* and the vertical units to *Meters.*

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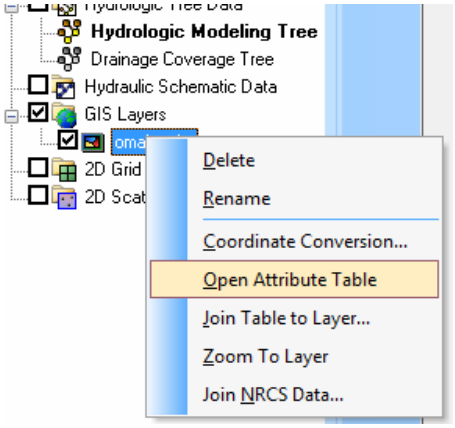
18. Select *OK*.
19. Open the aerial photo covering the region surrounding Omaha at the following location: ***C:\Training\Images\Omaha\AerialPhoto.jpg***. Select ***Yes*** if asked to generate image pyramids.
20. In the project explorer, right click on *GIS Layers* and select *Add Shapefile Data…*
21. Browse and open the land use shapefile that you downloaded ***(C:\|Training\Personal\Images\omaha\omaha.shp)***
22. Now you can see the land use shape file overlaying the aerial photo for the city of Omaha.
23. Right click *omaha.shp* on the project explorer and select *Open Attribute Table*. This will open the attribute table for the land use shape file. You should be able to see *LUCODE* as one of the attributes. **LUCODE** is the USGS land use code. You will be using this attribute to define overland flow roughness values and other surface characteristics in later tutorials.



24. This shapefile is in the GIS module of WMS. To use this shapefile for hydrologic and hydraulic calculations, you need to convert it to data in the map module of WMS. You will do this in a later section.
25. Do not close WMS, we will keep working with this data in the following section.

10.2 Geospatial data processing

Some of the GIS data are not 'ready to use' like the land use shapefile we used in the previous section. We need to process these data before they can be used. In this section we will see how some of these tools can be used in WMS with a soils shapefile.

We will open a SSURGO soil shapefile for Omaha and process it so that it can be used for defining infiltration and other soil-derived properties required for GSSHA models.

1. Right click *GIS Layers* in the project explorer. Browse to and open the file ***C:\Training\Images\Omaha\Soil\Spatial\soilmu_a_ne055.shp.***

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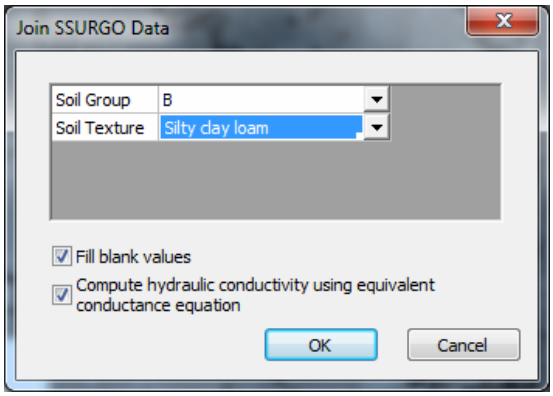
2. When the soil shapefile is read into WMS, the projection file associated with the file is read and the coordinates of the data are converted from Geographic (Lat/Lon) to the current coordinate system (UTM Zone 15).
3. Right click on *soilmu_a_ne055.shp* and open its attribute table. In the attribute table, notice that there are only a few properties associated with each soil polygon, but there are no recognizable soil attributes. To get the soil properties associated with each soil polygon, you will need to read these properties from tables included with the SSURGO data.
4. To read the properties, close the attribute table and right click on *soilmu_a_ne055.shp* in the project explorer. Select *Join NRCS Data.*

The soil attributes associated with the soil polygons are stored as separate tables. Selecting the **Join NRCS Data** command allows you to link these tables to your shapefile so you can use them.

5. In the *Join SSURGO Data* dialog select both check boxes and leave the Soil Group and Soil Texture fields as they are. See the following figure:



6. Click OK.
7. Right click on the soils shape file under GIS Layers and open the attribute table again. This time you will see that several soils properties have been added as attributes.

11 Mapping Shapefiles to WMS coverages

The SSURGO shapefile that we processed in the previous step is still in a GIS format that WMS cannot use directly. In order to use it the polygons overlapping our watershed need to be copied to a WMS Soil Type coverage. This is done from the GIS module.

1. In the project explorer (left side of WMS main window), right click on "*Coverages*" and select "*New Coverage*"

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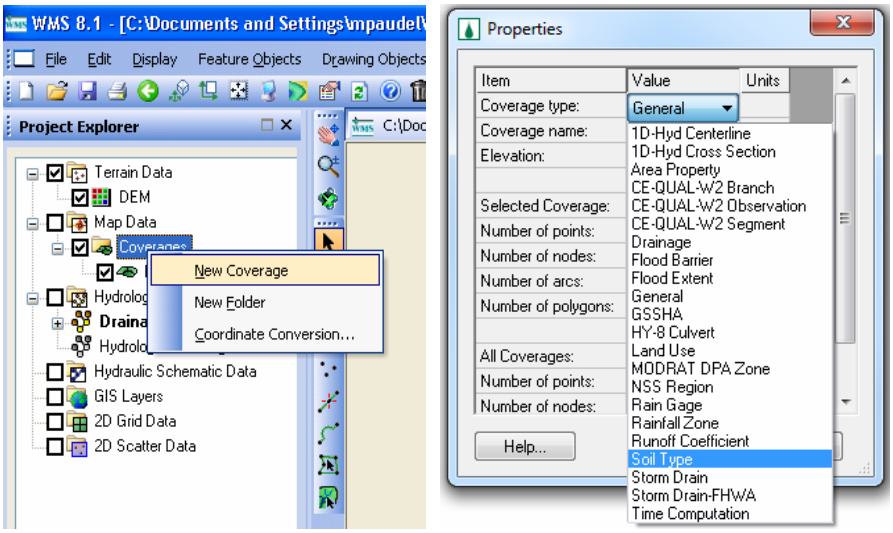

2. Select the coverage type to be *Soil Type* and click *OK*. This will create a new soil type coverage in the project explorer. Note that WMS creates a Drainage coverage automatically as soon as WMS is opened. When you create a GSSHA grid, the drainage coverage is converted to a GSSHA coverage.
3. Click on the new soil type coverage in the Explorer window to make it active.
4. Click on the *soilmu_a_ne055.shp* (under GIS layers) to make it active and change to the GIS module as we are going to map the data from the soil shapefile to the soil type coverage.
5. Turn off the check box next to the **omaha.shp** shapefile you read in a previous section. This is the land use shapefile and you do not want the data in this shapefile included in your soil type coverage.
6. Click on the "*Select shapes tool*"  and drag a rectangle around a watershed area you are interested in to select all land use polygons that overlap your watershed. Do not worry if you select polygons that are outside the watershed boundary, WMS will use the watershed boundary to clip the land use polygons.
7. Select ***Mapping | Shapes –> Feature objects***, click "*Next*" and make sure that the fields are mapped properly. For example, the TEXTURE field should be mapped to Texture, HYDGRP should be mapped to SCS soil type, and so on. Click "*Next*" and click "*Finish*".
8. The selected soil polygons are now converted to a coverage in the WMS map module and saved in the WMS map file format. You no longer need the GIS data once it is mapped to a coverage. You may delete the soil shape file under GIS layers (Right click on *soilmu_a_ne055.shp* and select delete).

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