

Using the AlaskaMapped Web Services in ESRI ArcGIS



Version 3.0, April 16, 2012, updated for ArcGIS 10.0
Produced by the Geographic Information Network of Alaska
<http://www.gina.alaska.edu>

AlaskaMapped is committed to making data freely and easily available through open standards. Unlike many commercial web data services in which the data displayed on screen or in mapping tools is restricted in use, the Alaska Mapped and GINA web maps and web services are designed to be used in virtually any mapping application. Additionally, for all public domain licensed data, the raw data sets have been made available for download by anyone.

In keeping with open standards, GINA uses Open Geospatial Consortium (OGC) web service protocols to distribute these data. There are three basic OGC web service formats that are employed separated according to the data type being delivered by the service. The Web Map Service (WMS) format is used to deploy ortho-imagery, the Web Coverage Service (WCS) for distribution of digital elevation data, and the Web Feature Service (WFS) for related vector and attribute data (i.e. ortho-image or DEM tile footprints and metadata). More detailed background information on OGC can be found at <http://www.opengeospatial.org>.

There are several ways to bring a WebMapService (WMS) or WebCoverageService (WCS) into ArcGIS. Once a WMS or WCS has been added to ArcMap, it can be saved as a layer file (*.lyr). This layer file contains the URL for the web service and can be easily added to any ArcMap map documents. We have pre-generated layer files for every SDMI WMS and WCS that GINA maintains. These are available for download at <http://www.alaskamapped.org/data/arcgis-layer-files>. Once downloaded, all the user must do is to add the layer file to a map document, as is outlined in the steps below. This tutorial includes a demonstration of how to use the WCS in routine geoprocessing workflows. **Note that since the WCS is a raster data product, these examples require the Spatial Analyst extension to ArcGIS Desktop.** This tutorial also covers incorporation of the SDMI inventory WebFeatureService (WFS) to retrieve metadata for the variety web services hosted under the SDMI.



Download SDMI Web Service ArcGIS Layer Files.

1. Navigate your web browser to the SDMI Alaska Mapped home page www.alaskamapped.org

www.alaskamapped.org/data/arcgis-layer-files

Next, click the link on the left side of the screen to go the GIS data layer files page located at <http://www.alaskamapped.org/data/arcgis-layer-files>. This page contains links to download *.lyr files for currently published SDMI ortho-imagery WMS and elevation WCS.



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ArcGIS Layer Files

SDMI
Statewide Digital Mapping Initiative

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ESRI Layer files for the AlaskaMapped services:

- Elevation: SDMI WCS layer
- Imagery: Best Data Layer
- Imagery: Extras

Recommended: For more details and sample images for these layer files, take a look at our [data gallery](#).

Google Earth users can use our [KML files](#).

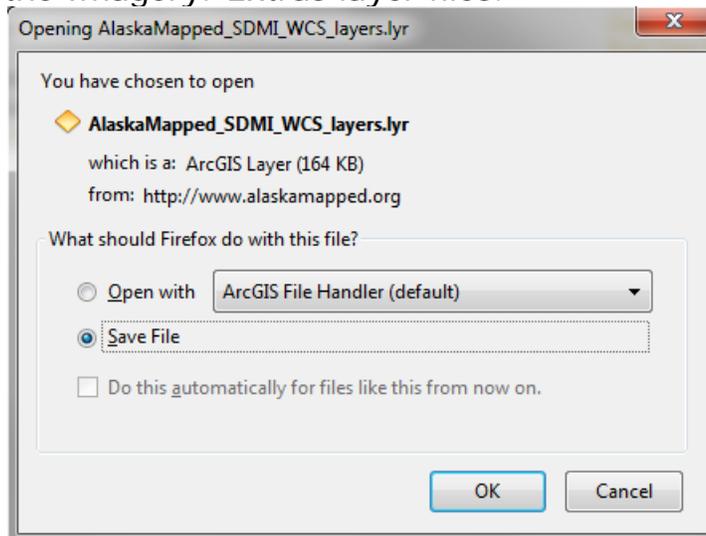
Detailed documentation on how to setup or configure these services manually is available in the following PDF: [Using the SDMI OGC Web Services in ESRI ArcGIS \(pdf\)](#).

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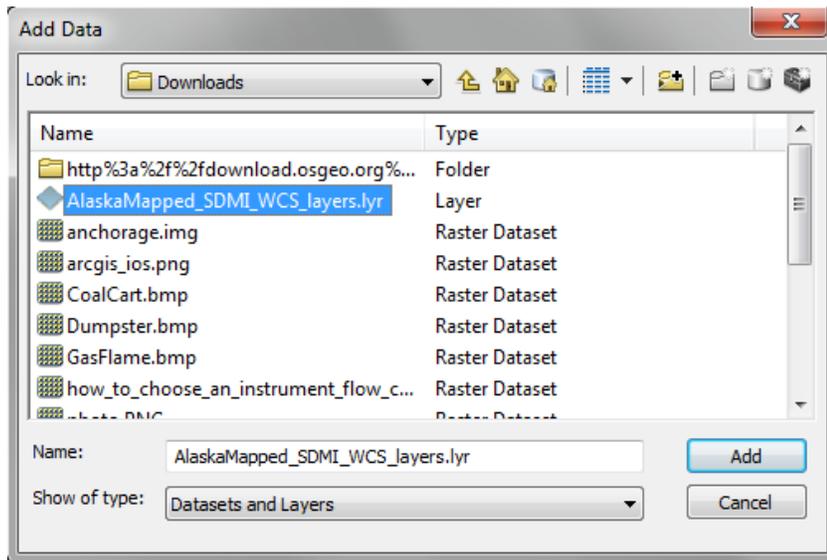
- Download all three layer files to your local machine; the Elevation: SDMI WCS layer, the Imagery: Best Data Layer and the Imagery: Extras layer files.



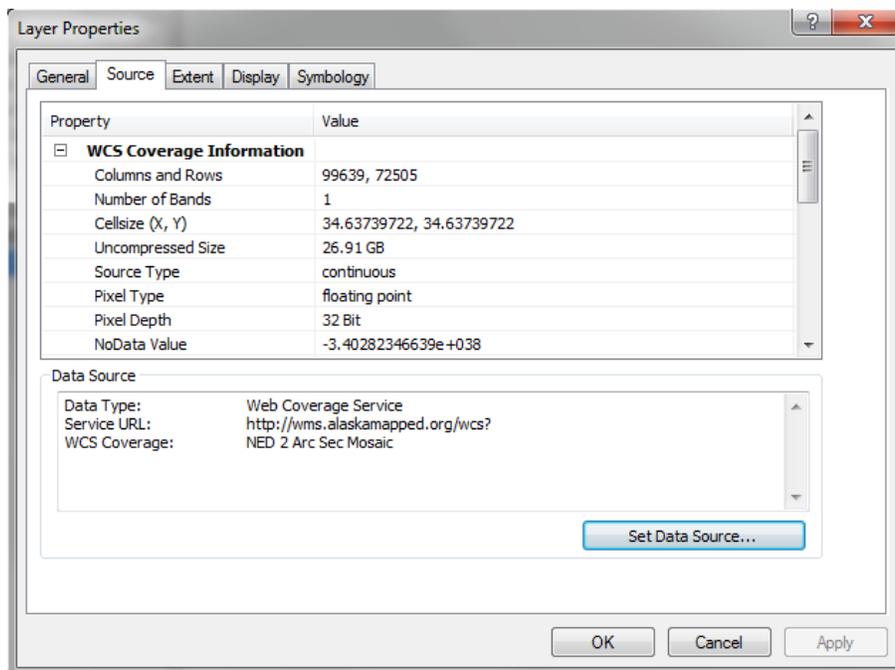
If prompted, choose the Save File option from your browser's dialog, **not** the option to Open with the ArcGIS File Handler. Remember that these layer files contain the URL for the web

service along with some simple ArcMap display properties so they are extremely small files, less than 20Kb or so each, so they will download very quickly.

3. Launch ArcMap and open a new empty map document. Click the Add Data button and browse to the directory where you downloaded the layer files in the previous step. Select the AlaskaMapped_SDMI_WCS_layers.lyr file then click the Add button.



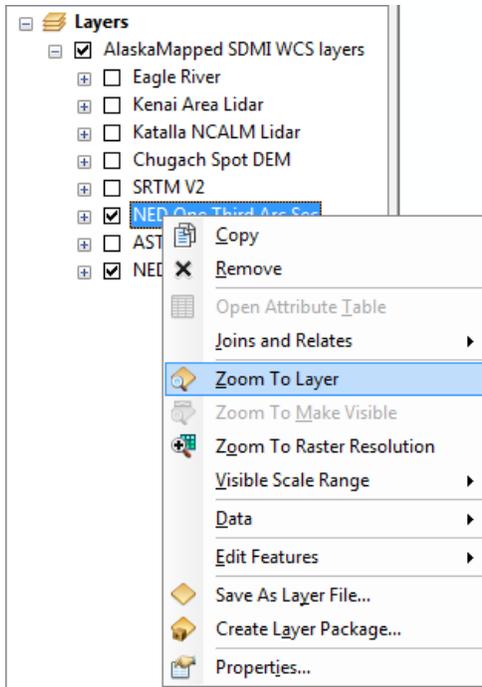
4. The AlaskaMapped_SDMI_WCS_layers file is a grouped layer containing all currently available elevation datasets currently in the WCS. Visibility has set to display only the NED 2 Arc Sec Mosaic so that you don't have to waste time waiting for all of these layers to draw on top of each other. For demonstration, right-click on the NED 2 Arc Sec Mosaic in the TOC and choose the Properties command from the layer context menu.



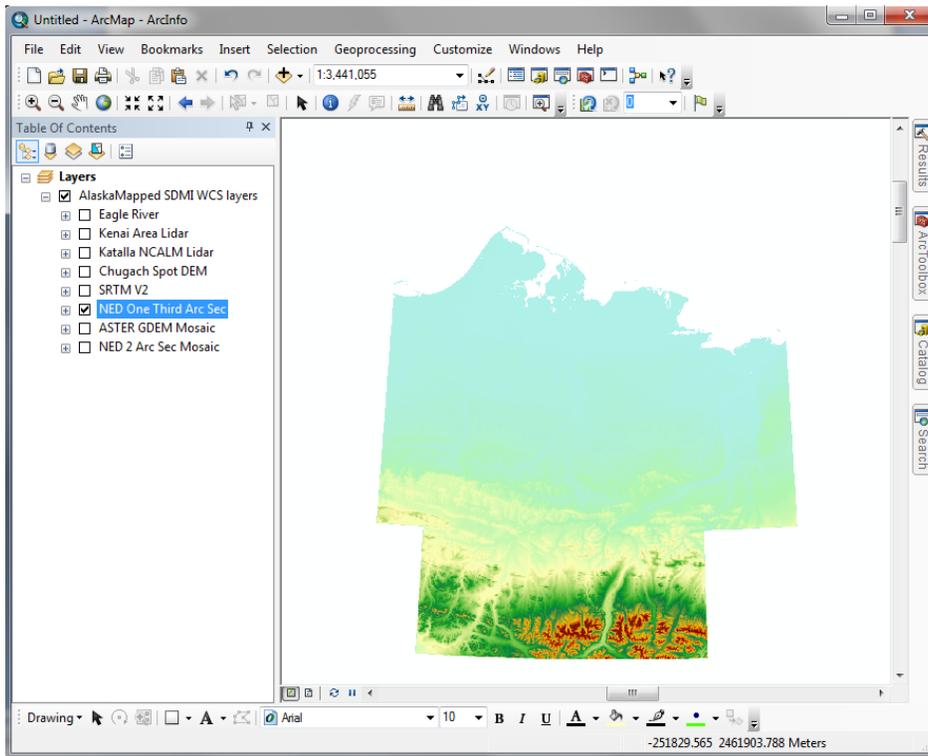
On the Source tab of the Layer Properties dialog, take note of the Spatial Reference, Cellsize and Uncompressed Size. Also note the Data Type and Service URL.

The WCS format actually streams data from the server to the client application as if it were a local resource. It is possible at this point, for example, to export these data from the server to your local hard drive, provided of course you have the free disk space to accommodate it (recall that the uncompressed file size of the NED 2 Arc Sec Mosaic is 26.91GB). The next few steps will outline one method for extracting a subset of data from the WCS layer and using it as an input dataset for further geoprocessing. Cancel the Layer Properties dialog box when you are finished examining these parameters. Take time to examine the properties of the other layers if you would like.

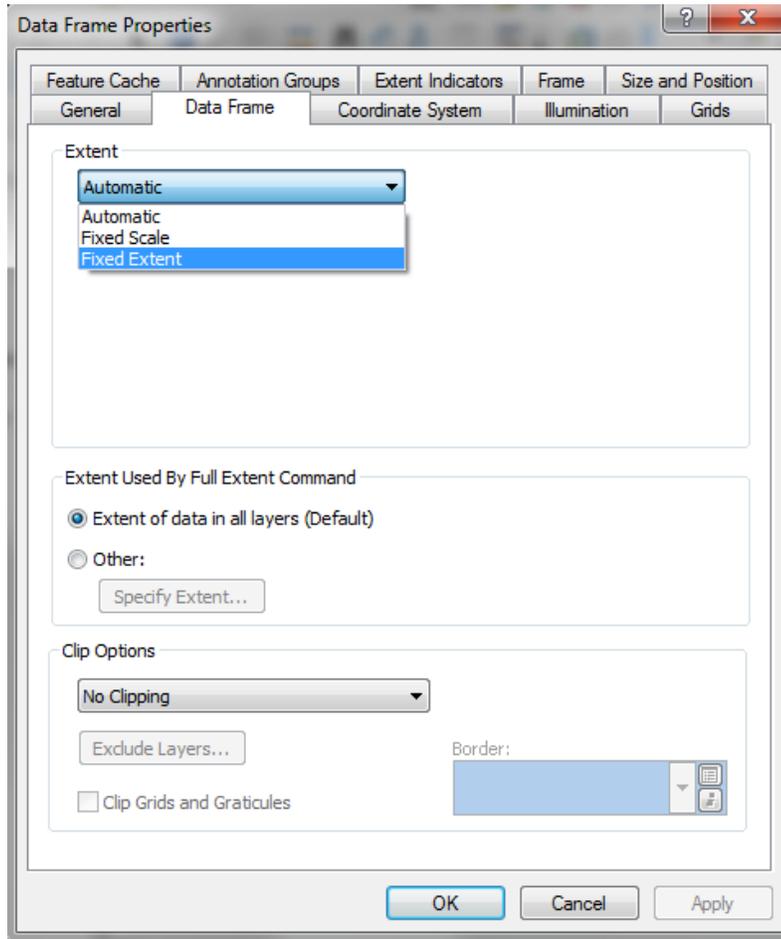
5. Uncheck the visibility check-box for the NED 2 Arc Sec Mosaic, then Check the visibility check-box for the NED One Third Arc Sec layer in the TOC. The NED One Third Arc Sec layer is of much higher spatial resolution than the NED 2 Arc Sec Mosaic and therefore much more suitable for conducting larger scale analyses. Again from the TOC, right-click the NED One Third Arc Sec layer and choose the Zoom to Layer option from the Layer Context Menu (as shown in the following graphic).



Your ArcMap display should look similar to the example below.



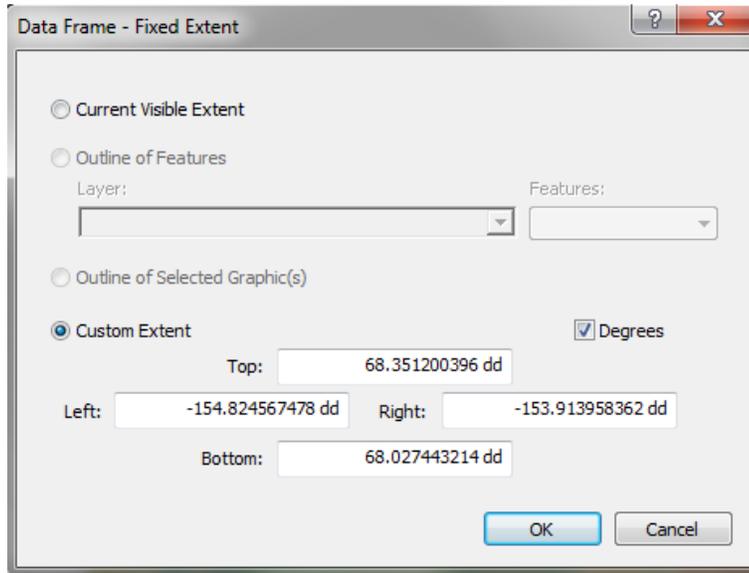
6. Double click on the Data Frame (named **Layers**) in the TOC to launch the Data Frame Properties dialog.



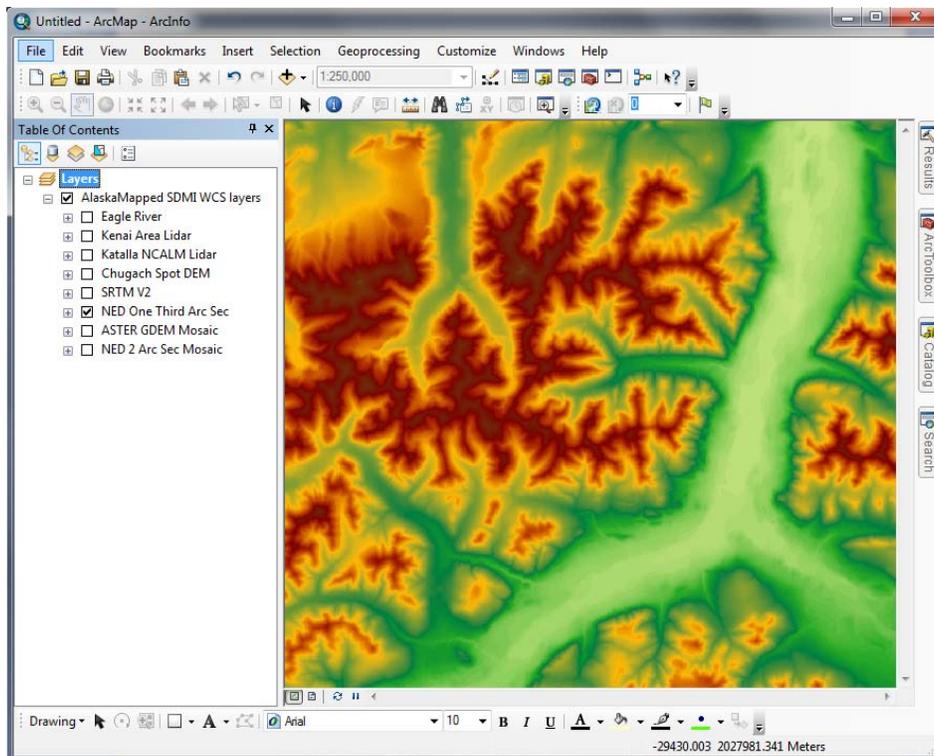
Click on the Data Frame tab then click the pull-down under Extent (the default is set to Automatic). Choose Fixed Extent from the options. Click the Specify Extent button to launch the Data Frame – Fixed Extent dialog. Enable the setting for Custom Extent and ensure the Degrees check-box is checked, then enter the following values in the appropriate text boxes:

Top: 68.351200396 dd
Bottom: 68.027443214 dd
Left: -154.824567478 dd
Right: -153.913958362 dd

Ensure your Data Frame – Fixed Extent dialog looks like the example below.

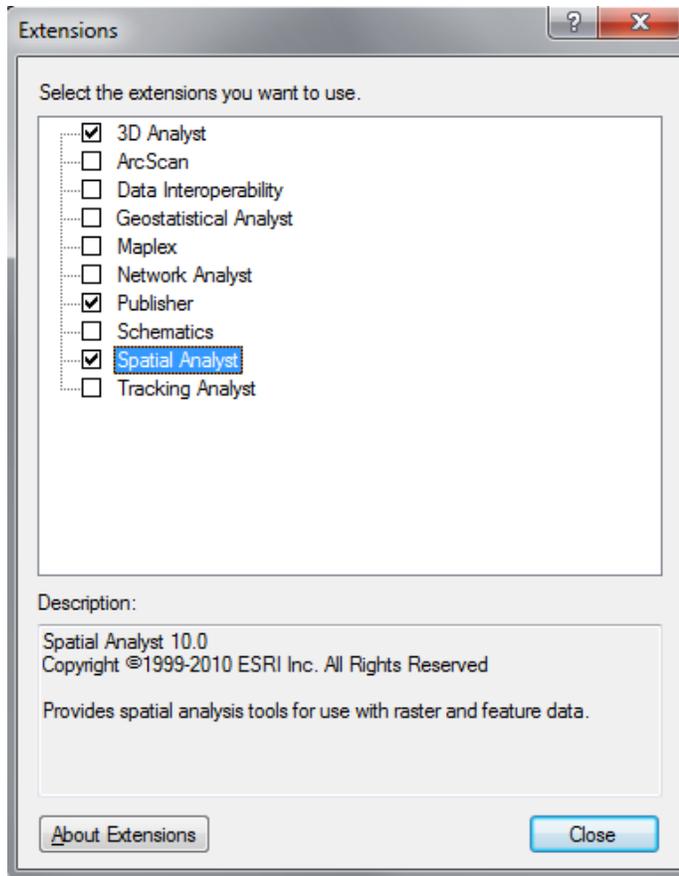


Click OK on the Data Frame – Fixed Extent dialog and the Data Frame Properties dialog boxes. Your ArcMap display should resemble the example below:

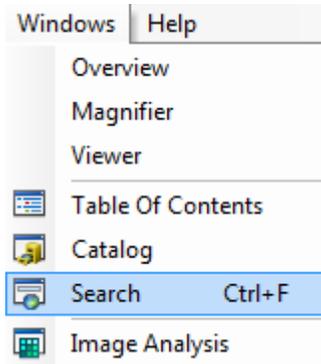


You are now looking at an portion of the Killik River valley inside of the Gates of the Arctic National Park, Alaska.

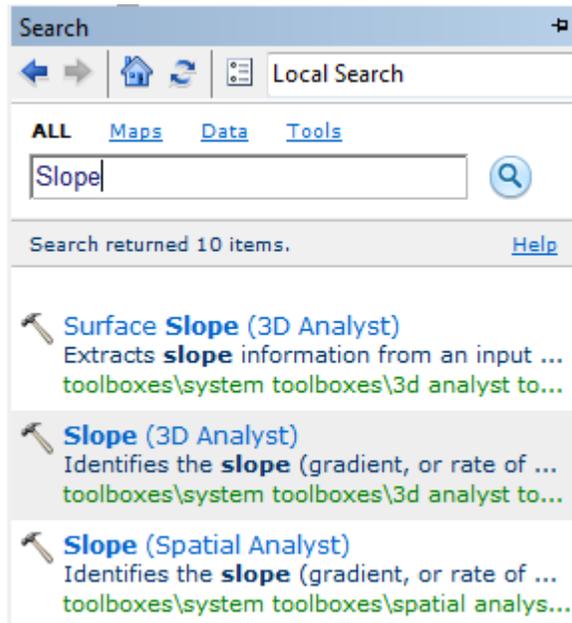
7. From the Customize menu on the main ArcMap menu bar, select the Extensions option to launch the Extensions check-list. Ensure the check-box next to Spatial Analyst is checked, then click Close to dismiss the Extensions dialog and enable the Spatial Analyst extension for your ArcMap session.



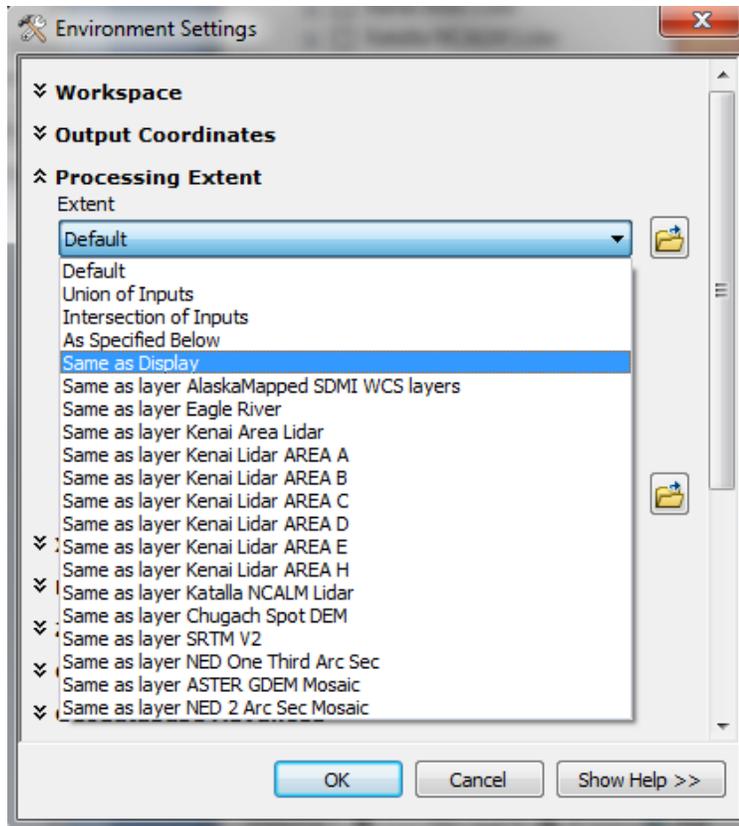
8. From the Windows menu on the main ArcMap menu bar, choose the Search option to ensure that the Search window is available to you in your ArcMap session.



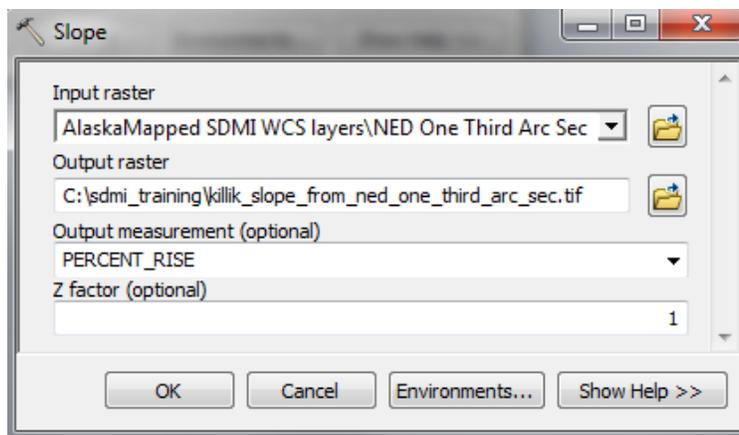
In the Search window, type Slope into the search text box, then hit the Enter key on your keyboard. From the list of available Slope tools, find and click on the the Slope (Spatial Analyst) option. This opens the Slope tool from the Spatial Analyst toolbox.



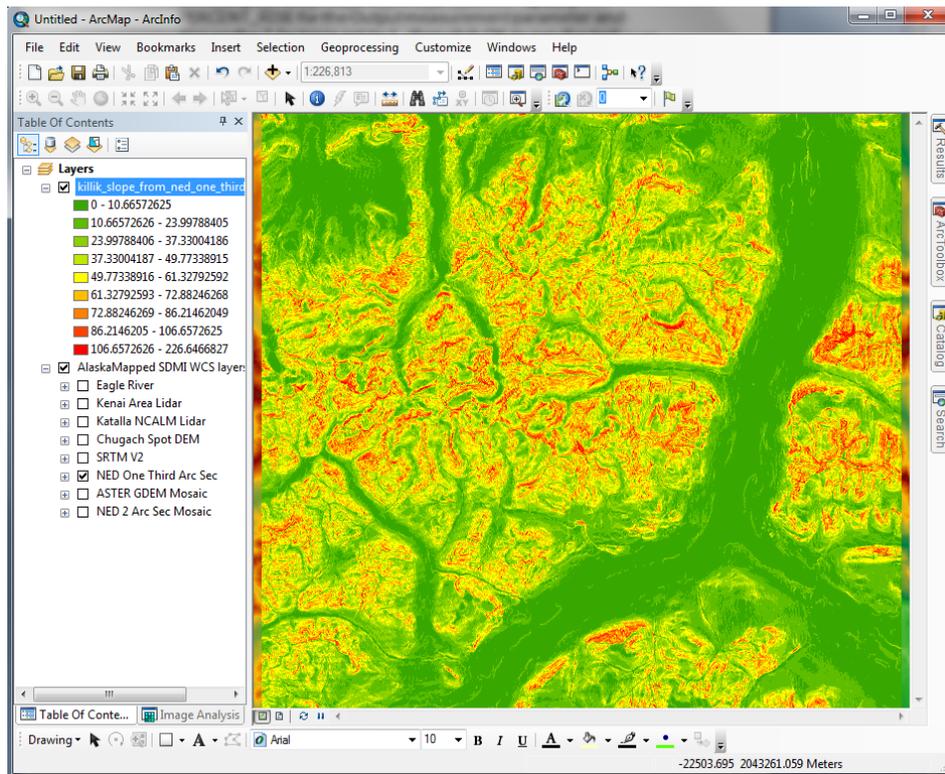
Click the Environments button on the bottom portion of the Slope tool dialog to launch the Environment Settings dialog specific to the functioning of this tool at this time only. Expand the Processing Extent group, then specify Same as Display from the list of available options. This will enforce the same extent settings that you already specified for the Data Frame the Slope tool. Click OK on the Environment Settings dialog.



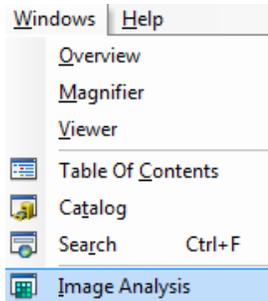
For the Input raster on the Slope tool, click the pull-down arrow and select NED One Third Arc Sec from the list of available layers in ArcMap. Click the browse button next to the Output raster parameter text-boxName, browse to the location of your choice and name the Output raster killik_slope_from_ned_one_third_arc_sec.tif. Specify PERCENT_RISE for the Output measurement parameter and ensure the Z factor is set to 1, then click OK to run the tool.



When the tool finishes running, the output will be added to your ArcMap TOC and symbolized using a pre-defined color ramp named slope that follows a gradient from green to yellow to red with the steepest slopes being red. The values for percent rise range from 0 to essentially infinity. A flat surface is 0 percent, a 45 degree surface is 100 percent, and as the surface becomes more vertical, the percent rise becomes increasingly larger. Notice that the extent of the slope output raster has been defined by your display extent. Your ArcMap display should look similar to the example below.

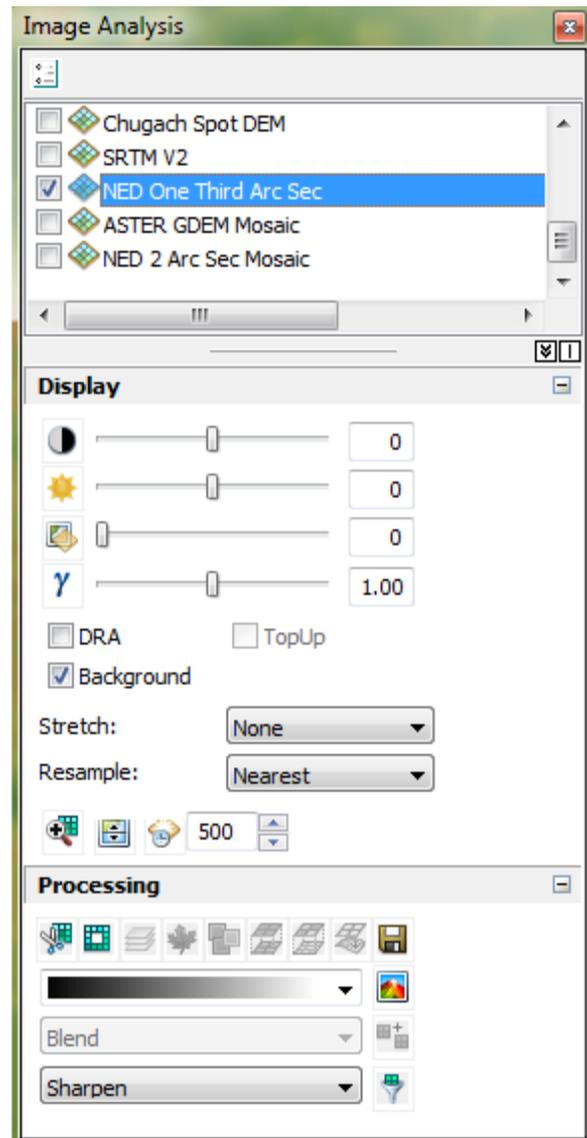


9. From the Windows menu on the main menu bar, choose the Image Analysis option.

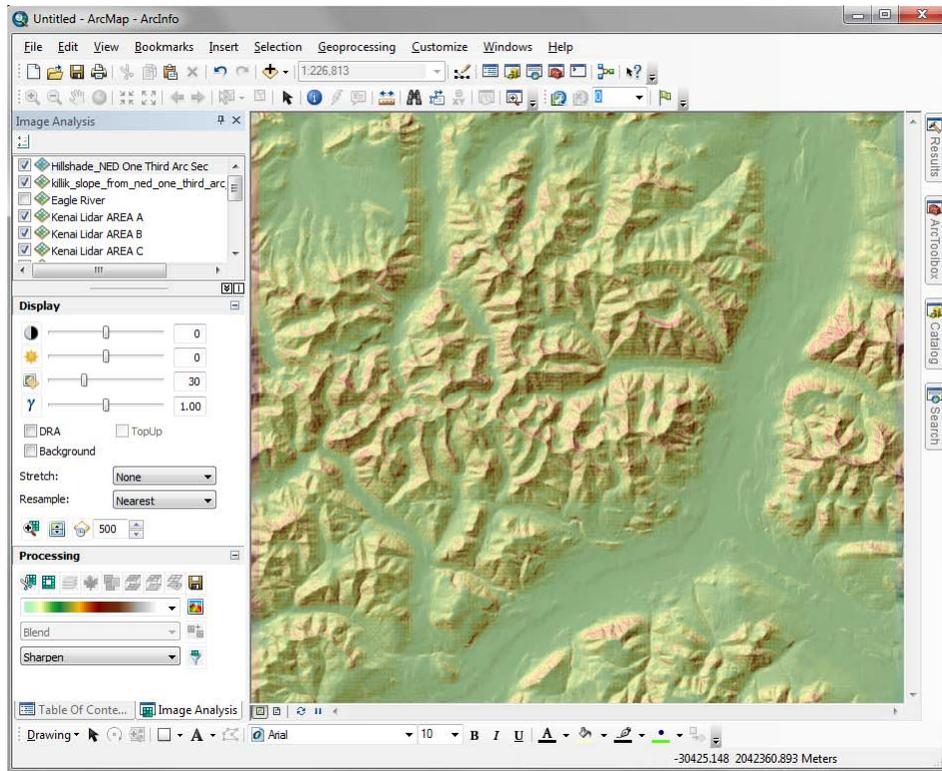


The Image Analysis window is new to ArcGIS 10 and supports the analysis and exploitation of image and raster data in ArcMap with a collection of commonly used display capabilities and processes. This is a window that can be docked, for example, to the side of the application's window and either pinned open or allowed to retract to an Image Analysis tab along the side of the application window.

Select the NED One Third Arc Sec from the list of available raster datasets in your ArcMap document on the top portion of the Image Analysis window. Under the Processing portion of the window, click the color-ramp pull-down next to the Shaded Relief button and choose grayscale from dark to light, then click the Shaded Relief button.

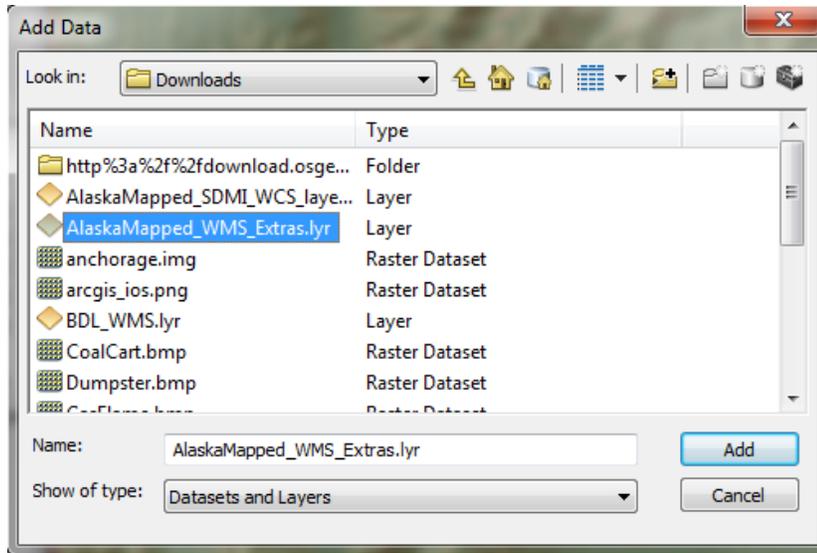


Scroll up to the top of the layer list on the top portion of the Image Analysis window. A dynamic Hillshade_NED One Third Arc Sec layer is added to the list. Select the Hillshade_NED One Third Arc Sec layer from the list to highlight, then drag the slider bar for the Transparency setting under the Display portion of the window to set it anywhere from 30 to 40 percent. Your ArcMap display should look similar to the example below.

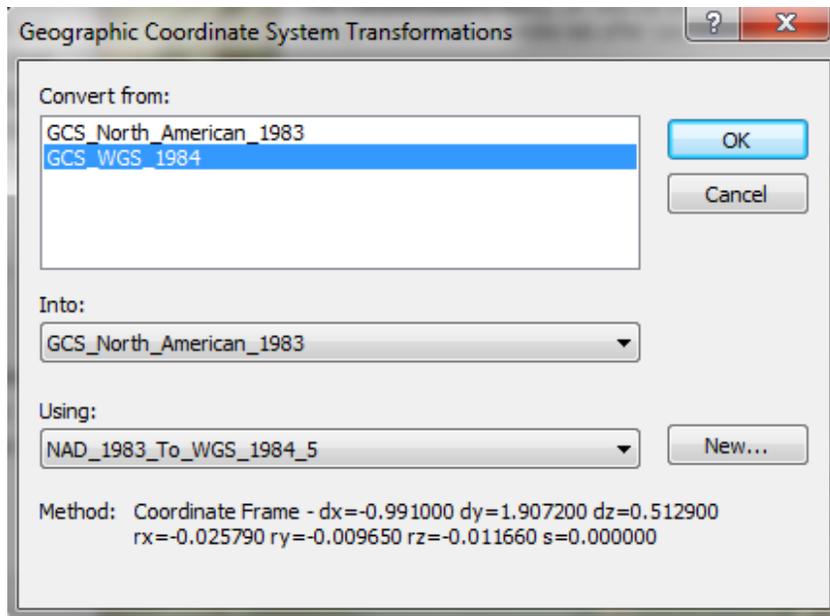


All of the processing tools on the Image Analysis window apply enhancements to selected raster layers on the fly. The original data remains unaltered, with the results added as new temporary layers to the data frame. If you want to save a temporary layer, you will need to export it to a raster dataset.

10. Now add the AlaskaMapped_WMS_Extras.lyr file to ArcMap just as you added the AlaskaMapped_SDMI_WCS_layer.lyr file previously.

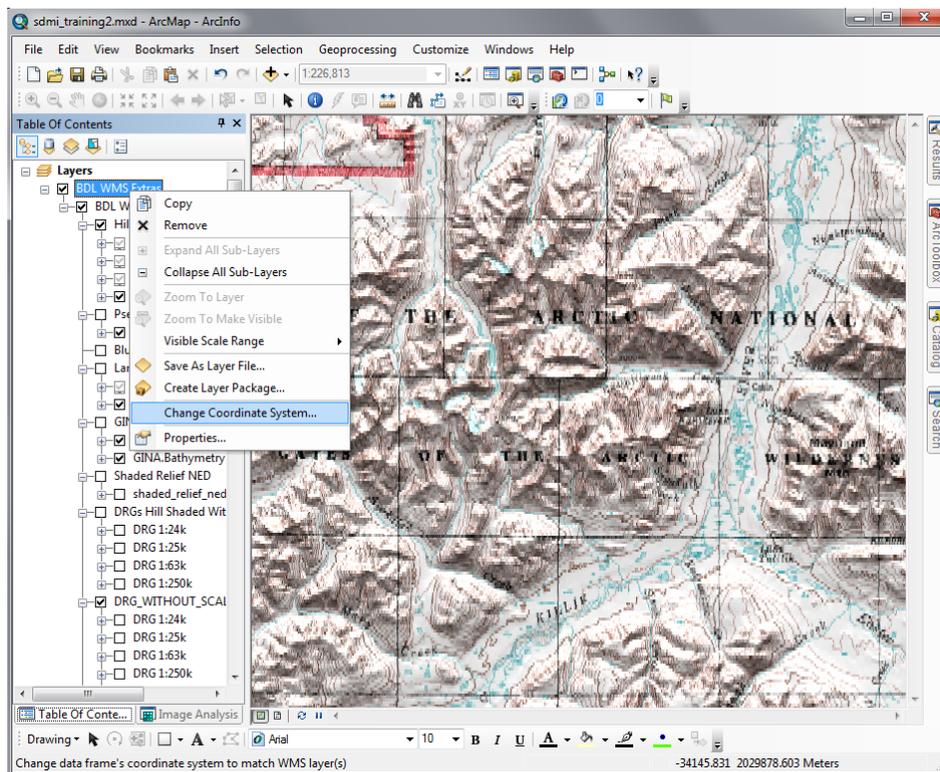


If presented with the Geographic Coordinate Systems Warning, click the Transformations button and set the Convert from: option to GCS_WGS_1984, then set the Into: option to GCS_North_American_1983 and finally the Using: option to NAD_1983_To_WGS_1984_5, which is the currently supported geographic transformation in ArcGIS 10, as follows:

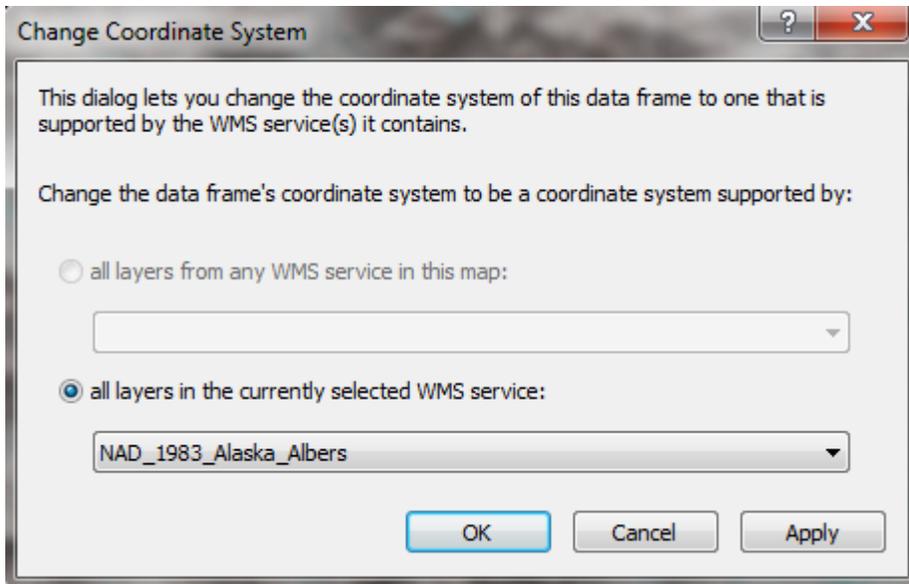


Click OK on the Geographic Coordinate System Transformations dialog, then click Close on the Geographic Coordinate System Warning dialog boxes.

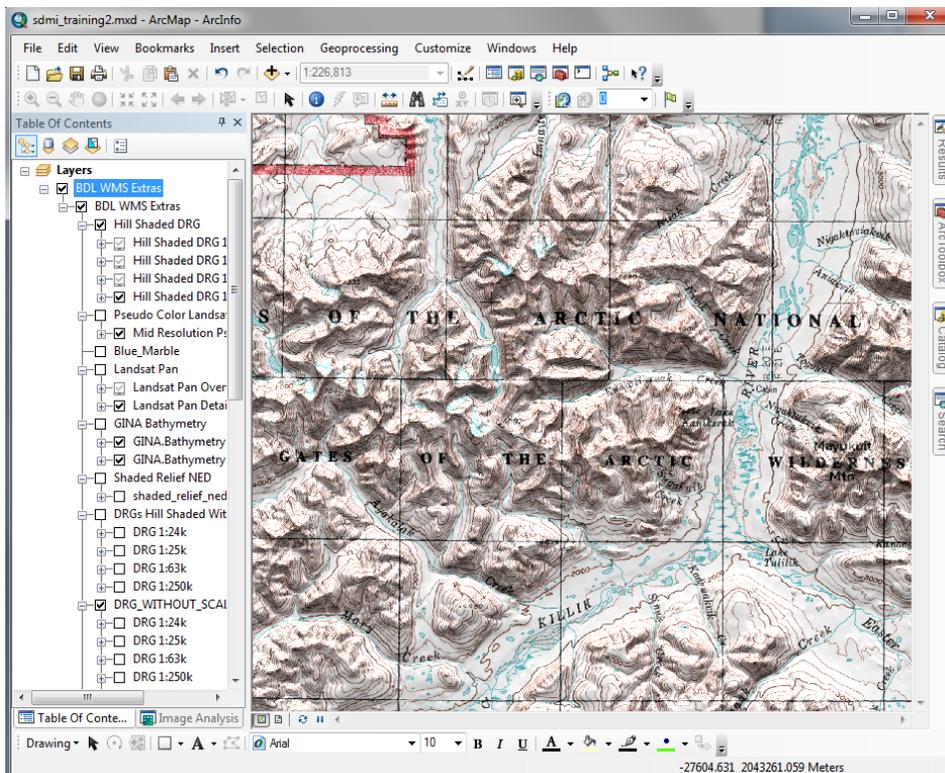
11. If either the BDL_WMS.lyr or the AlaskaMapped_WMS_Extras.lyr are extremely pixilated when first added to an ArcMap document, it is likely that the coordinate system of the data frame is not currently supported by the WMS. To resolve this issue, first, right-click on the AlaskaMapped_WMS_Extras layer in the TOC and choose the Change Coordinate System option from the layer context menu.



Next, set the Change Coordinate System dialog to a spatial reference appropriate for your analysis or map. For this exercise, choose NAD_1983_Alaska_Albers and click OK. Using this method instead of the Data Frame Properties, Coordinate System tab, ensures the spatial reference will be read directly from the WMS and therefore will be displayed at the most optimal resolution.



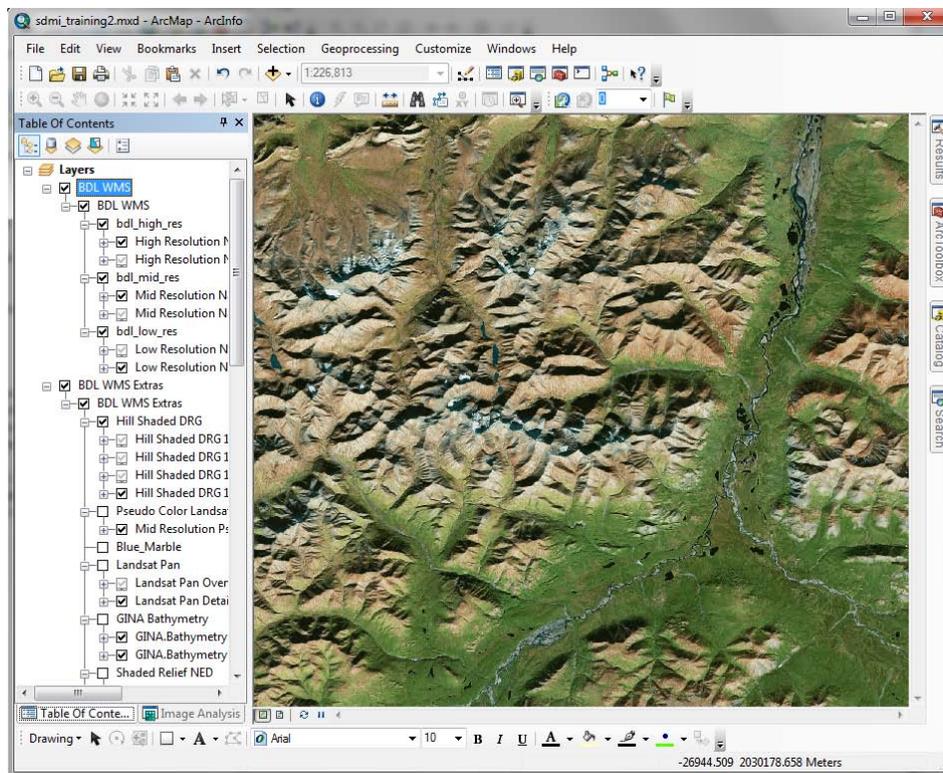
Click Yes if presented with a Warning stating that this coordinate system has a geographic coordinate system that differs from one or more data sources in the map because we have already set the correct geographic transformation in the previous step. Your ArcMap display should look similar to the example below:



Take time to scroll through the list of base layers available from the BDL WMS Layers in the TOC. Note that many of the layer have pre-set scale-dependency and will not display if the scale of the Data Frame is outside of these pre-set tolerances. Layers not being displayed because of scale-dependency are identified by a grayed-out visibility check-box in the ArcMap TOC.

12. Next, add the BDL_WMS.lyr file just as we did the AlaskaMapped_WMS_Extras.lyr and the AlaskaMapped_SDMI_WCS_layers.lyr files earlier. Again, ensure the correct geographic transformation is set if prompted with the Geographic Coordinate Systems Warning dialog. Since the WMS Coordinate System we set in the previous step applies to the Data Frame, the BDL_WMS will also be displayed in that spatial reference and at it's optimal resolution.

Your ArcMap display should look similar to the below example:



- 13.

Some background about the BDL WMS:

The BDL (Best Data Layer) is the repository for the Alaska Statewide Digital Mapping Initiative (SDMI). More information about SDMI can be found at <http://www.alaskamapped.org>. The goal of BDL WMS is to provide open access to the most current, publicly available orthorectified imagery anywhere across the entire State of Alaska. The WMS format is an open source protocol defined by the Open Geospatial Consortium (OGC, <http://www.opengeospatial.org>) and can be implemented in a variety of mapping software platforms, not just ESRI ArcGIS.

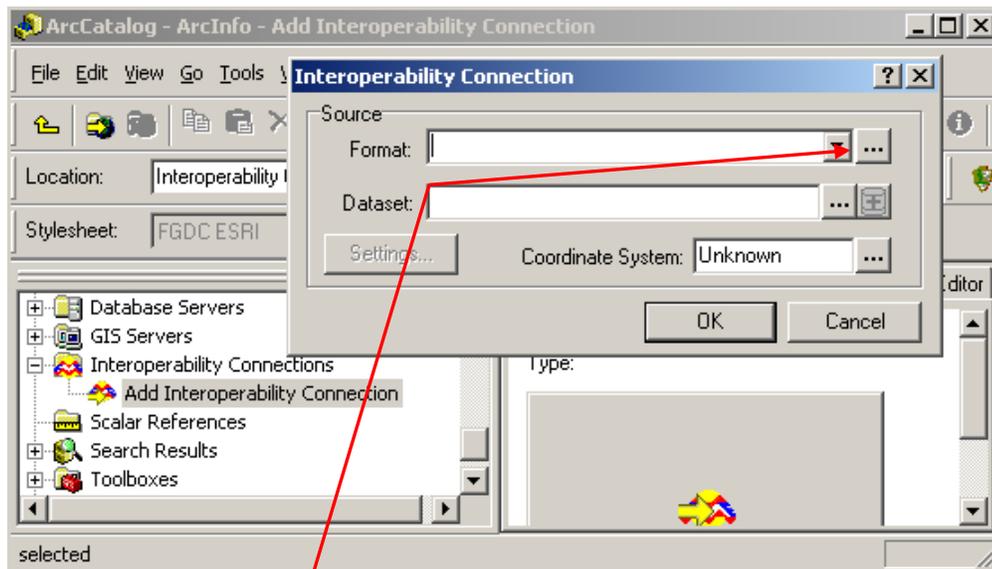
Currently, there are two additional WMS available through AlaskaMapped; one named **Extras** containing a variety of raster datasets that are in frequent demand among end-users of geospatial information (i.e. USGS Digital Raster Graphics, USGS National Elevation Dataset Shaded Relief, etc...), and another named **Charts** containing the full listing of NOAA Nautical Charts for the State of Alaska (not suitable for navigation). These are at the following URLs:

Extras: <http://wms.alaskamapped.org/extras>
Charts: <http://wms.alaskamapped.org/charts> and http://wms.alaskamapped.org/charts_nc (nc = no collar)

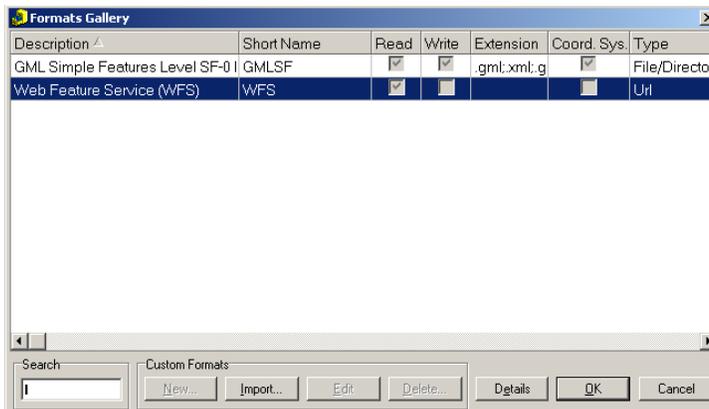
The next section of this exercise covers connecting to the AlaskaMapped Inventory Web Feature Service (WFS) to browse metadata for the BDL WMS interactively using image footprints as a guide.

AlaskaMapped Web Feature Service(WFS) ArcGIS Tutorial

14. Launch ArcCatalog if you don't still have it running.
15. In ArcCatalog, scroll down to the Interoperability Connections entry towards the bottom of the catalog tree. Expand Interoperability Connections and double-click on Add Interoperability Connection to launch the Interoperability Connection dialog.

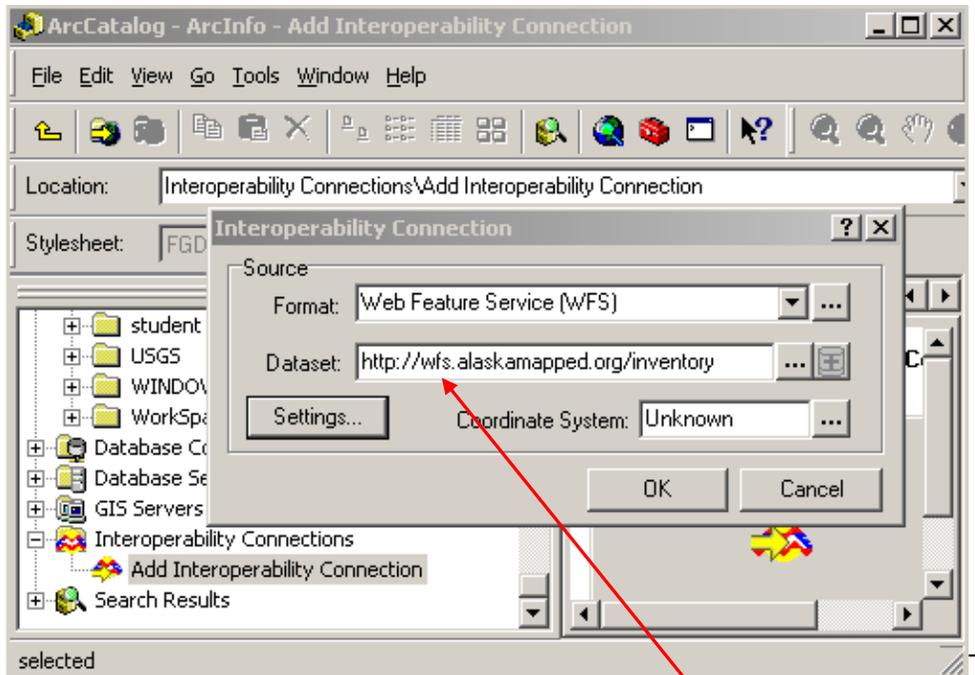


16. Click the ellipsis  next to the Format: window on the Interoperability Connection dialog to launch the Formats Gallery of the Data Interoperability extension. Select the Web Feature Service entry and click the OK button.

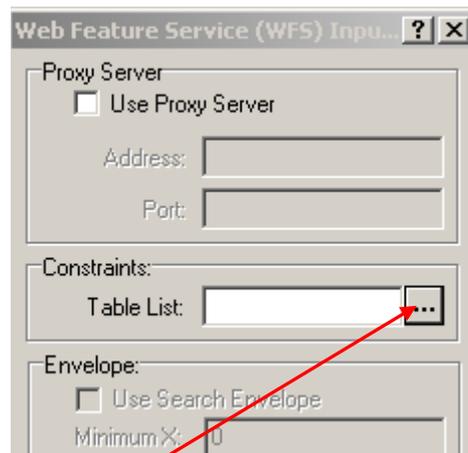


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Type the URL for the AlaskaMapped WFS <http://wfs.alaskamapped.org/inventory> into the Dataset: window as is shown in the example above, then click the Settings button.

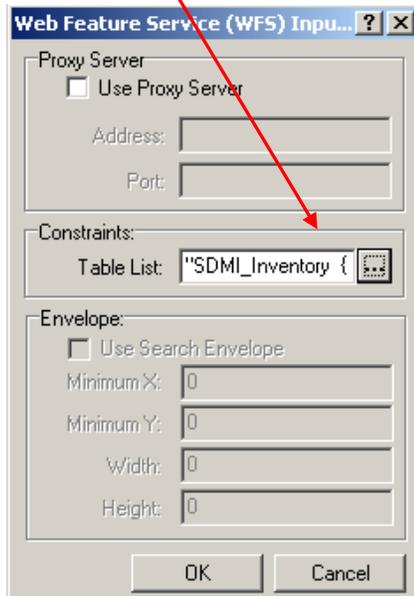


- Click the ellipsis next to the Table List: window under the Constraints: section of the Web Feature Service (WFS) dialog. This may take some time, but the Web Feature Service (WFS) Table List will eventually load.

18. Check the Selected box to the left of the SDMI_Inventory item as in the example above, then click the OK button.



19. Ensure that the SDMI_Inventory is loaded into the Table List of the Settings dialog, then click OK.

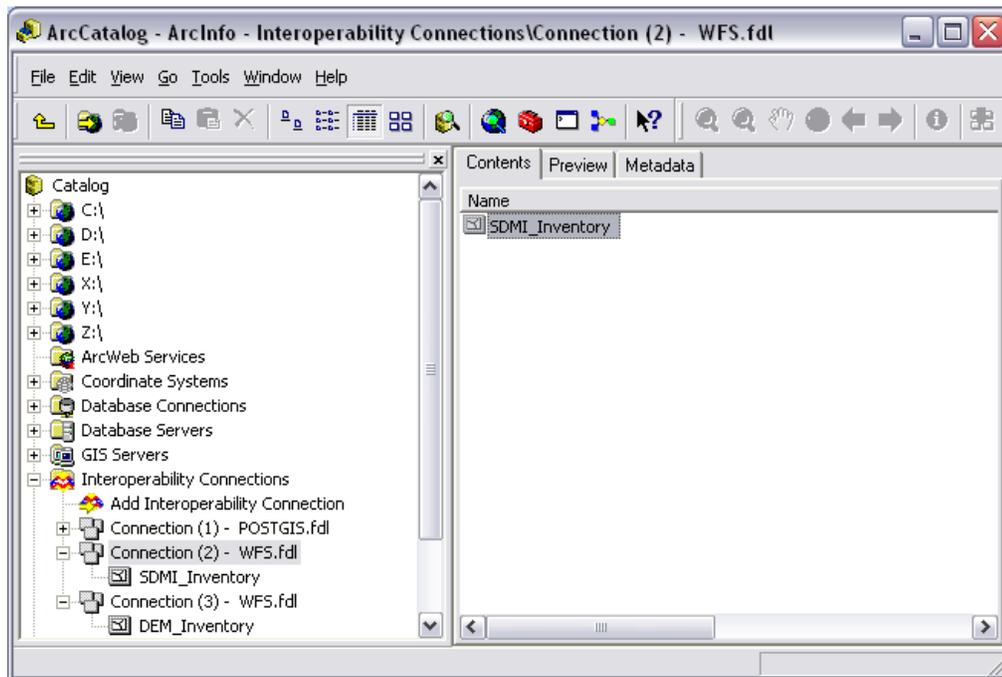


20. The coordinate system for the AlaskaMapped WFS is built into the service. It will NOT function correctly if you specify the coordinate system in the Interoperability Connection dialog. **Note:** Leave the Coordinate System: window of the Interoperability Connection dialog intentionally set to **Read from source**. Your dialog should look exactly like the example below.

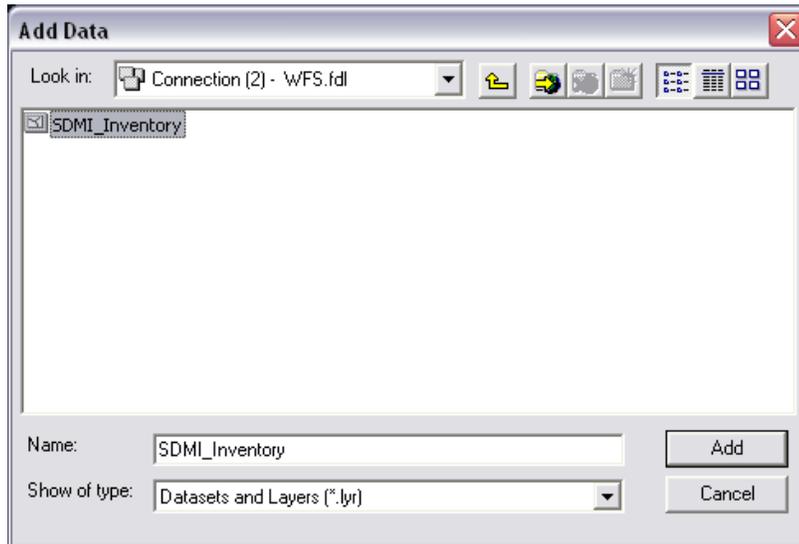


Click OK to complete the connection to the AlaskaMapped WFS Inventory. It will be added to the ArcCatalog tree under Interoperability Connections as Connection (?) – WFS.

21. Expand Connection (?) – WFS in the ArcCatalog tree to view its contents.

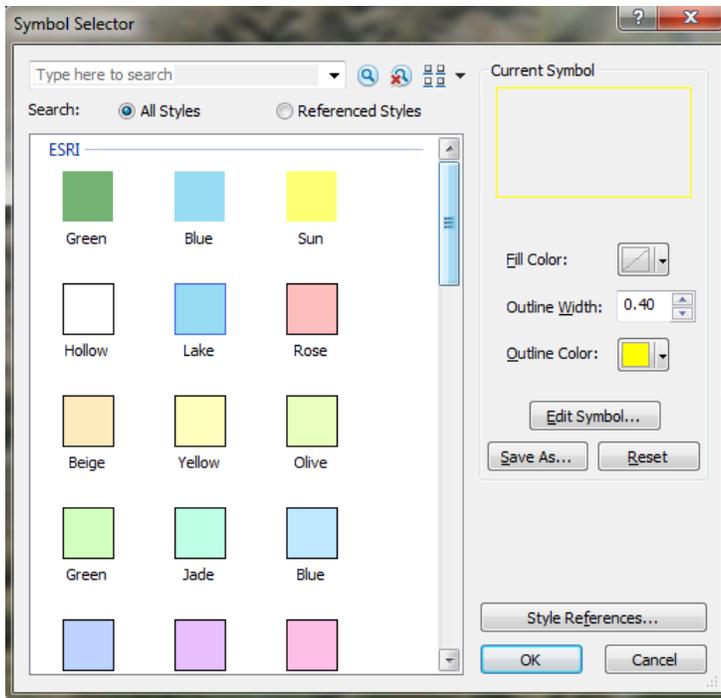


22. Bring ArcMap back to the front of your desktop. Click the Add Data button and set the Look in: window to Interoperability Connections. Double-click the entry for Connection(?) – WFS.fdl, select the SDMI_Inventory Polygon layer and click the Add button.

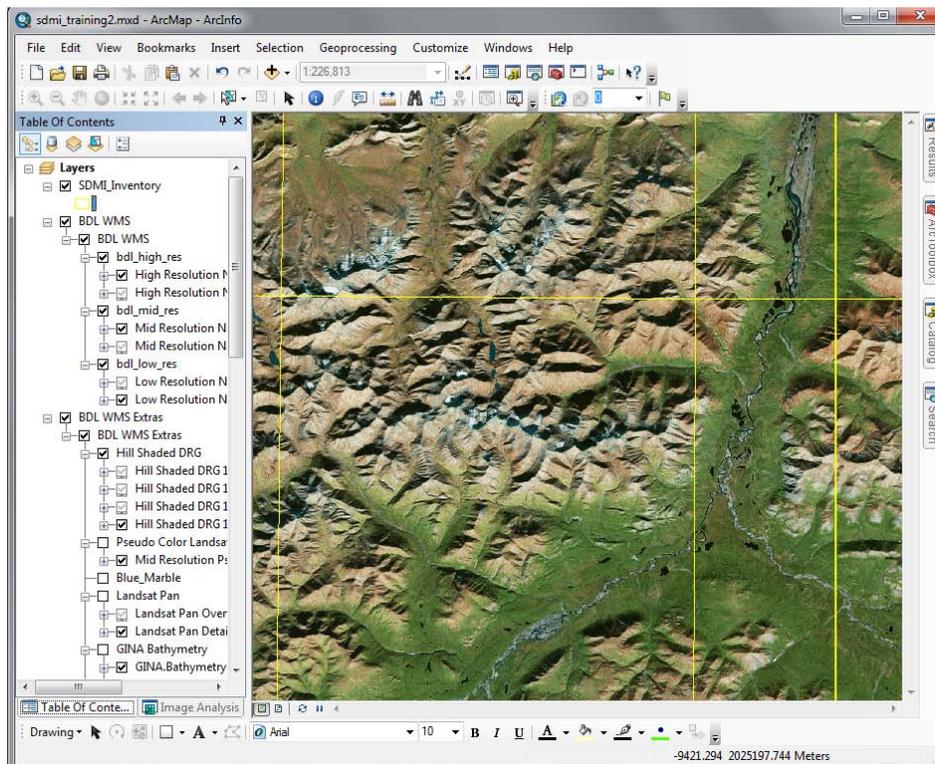


The SDMI_Inventory Polygon layer is a vector data WFS that contains a footprint (boundary) polygon feature and record of attribute for all tiles ingested and maintained in the AlaskaMapped BDL WMS and Extras WMS, as well as minimum metadata stored in the form of the attributes of each polygon which pertain to each ortho image tile being referenced by an Inventory polygon. These data are a live connection to the database server hosting the BDL WMS and are created on-the-fly from the bounding coordinates of every image tile that has been ingested into the either service.

23. Click Close on the Geographic Coordinate System Warning if it is presented. Left-click the symbol for the SDMI_Inventory layer in the TOC to open the Symbol Selector dialog and set the Fill Color to No Color and the Outline Color to Solar Yellow, then click OK.



Your ArcMap display should look similar to the example below:

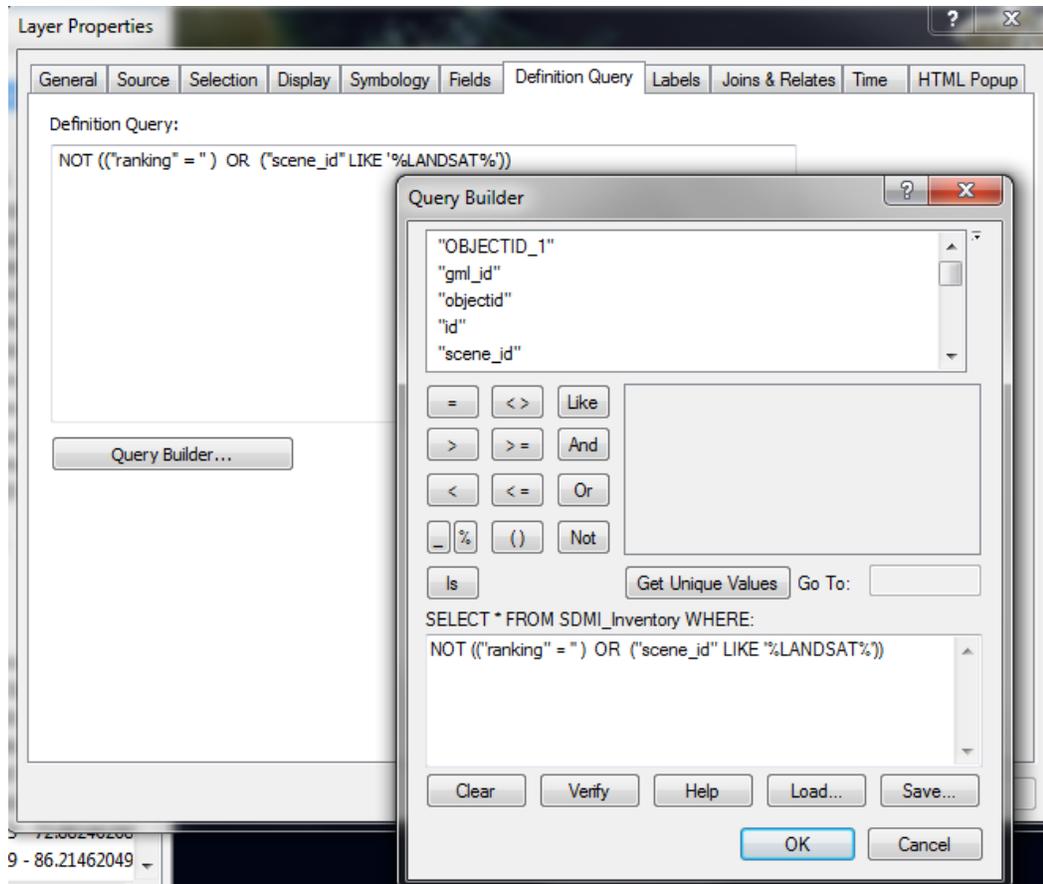


24. Right-click on the SDMI_Inventory layer in the TOC and choose the Open Attribute Table command to launch the attribute table for the layer. Take time to scroll through the attributes to get idea of the information contained in the SDMI_Inventory minimum metadata. This is the best way to obtain metadata for tiles that participate in the BDL WMS, or to hyperlink to the www.browse.alaskamapped.org website to download the imagery if it is within the license constraints to do so (i.e. Public Domain).

scene_id	downloadable	start_time	end_time	source_res	contact	license_type
SPOT.DNR.INTERIOR.TANANA_VALLEY.T	true	2003-05-30 00:00:00	2007-08-11 23:59:59	2.5	Doug Hanson (formerly: Gordon Worum)	Public SPOT
SPOTS.SDMI.ORTHO.20110525.1148_1084	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110525.0972_1076	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110525.0974_1076	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.0996_1074	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOT.DNR.INTERIOR.TANANA_VALLEY.T	true	2003-05-30 00:00:00	2007-08-11 23:59:59	2.5	Doug Hanson (formerly: Gordon Worum)	Public SPOT
SPOT.DNR.INTERIOR.TANANA_VALLEY.T	true	2003-05-30 00:00:00	2007-08-11 23:59:59	2.5	Doug Hanson (formerly: Gordon Worum)	Public SPOT
SPOTS.SDMI.ORTHO.20110525.0976_1160	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1020_1110	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1024_1112	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
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SPOTS.SDMI.ORTHO.20110517.1028_1122	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1030_1126	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1030_1128	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1030_1130	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1032_1126	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1032_1128	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1032_1130	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1032_1132	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1032_1134	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1034_1132	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110517.1040_1124	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110525.0990_1098	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110525.0990_1100	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho
SPOTS.SDMI.ORTHO.20110525.0990_1110	false	2009-05-01 00:00:00	2010-09-30 23:59:59	2.5	Dayne Broderson	SDMI SPOTS Ortho

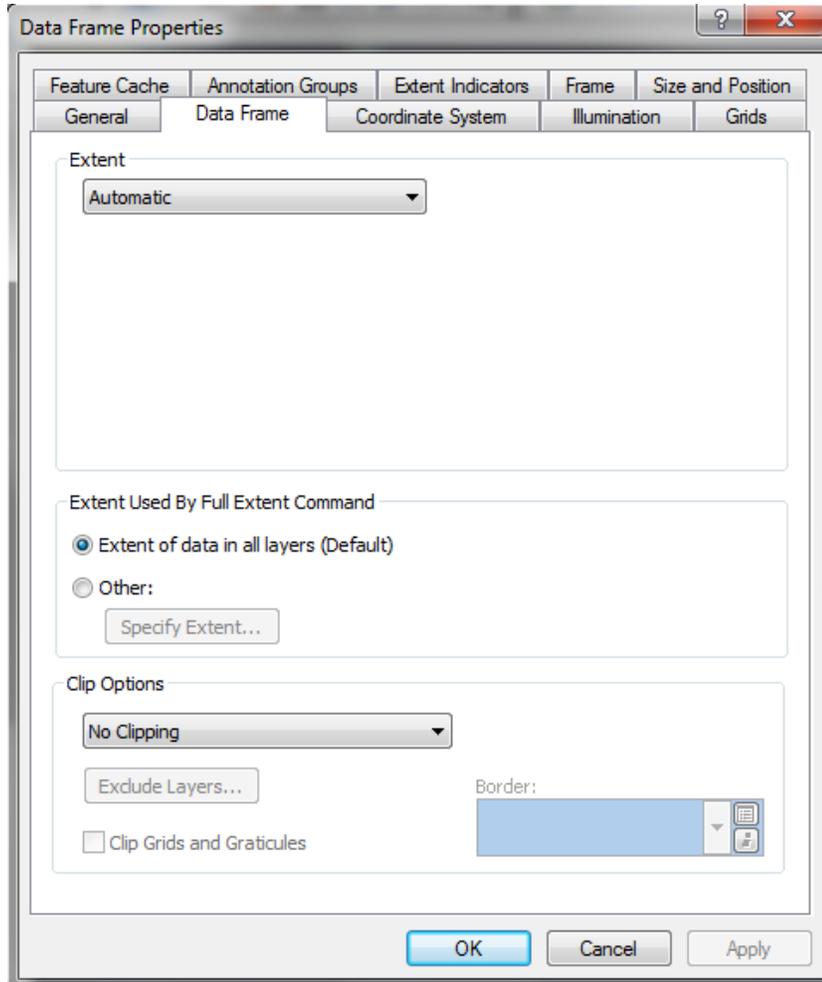
25. To make the inventory easier to understand, set a Definition Query to show only the image footprints that are under Public Domain and not BMNG. Close the table window. Double-click on the SDMI_Inventory layer to launch it's properties then activate the Definition Query tab. Click the Query Builder button and either type or build the following expression:

NOT (("ranking" = " ") OR ("scene_id" LIKE '%LANDSAT%'))

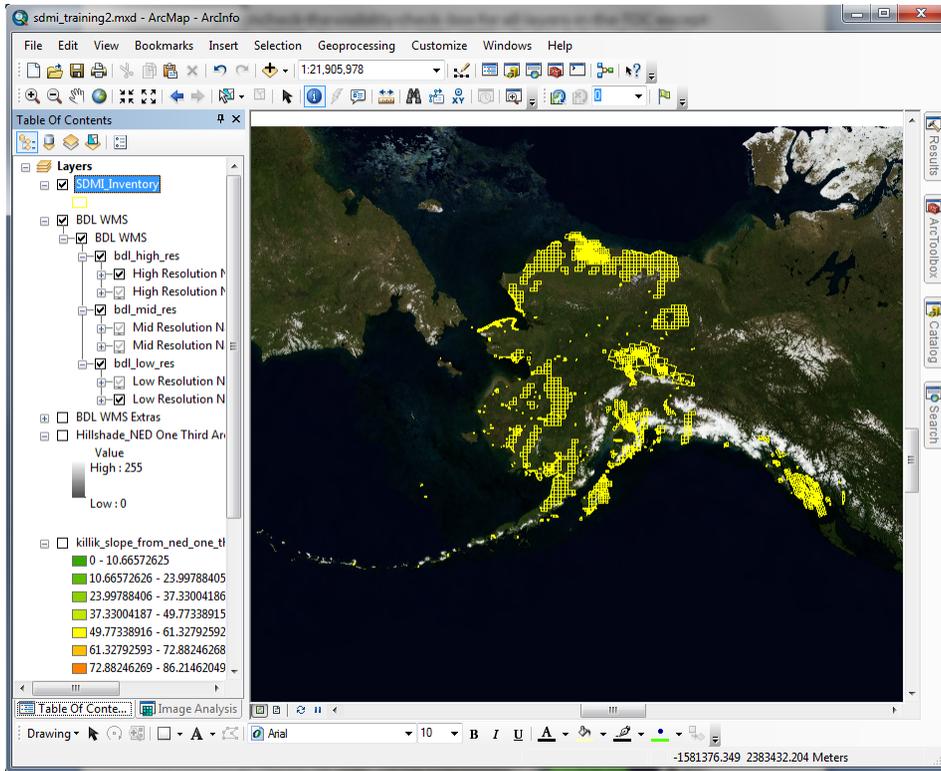


Your Query Builder and Definition Query tab of the Layer Properties dialog should look as it does in the example above. Click OK to the Query Builder and Layer Properties dialog boxes.

26. Double-click on the Data Frame (named Layers) in the TOC to open the Layer Properties dialog and set the Extent to Automatic on the Data Frame tab, then click OK to remove the Custom Extent parameters set earlier.

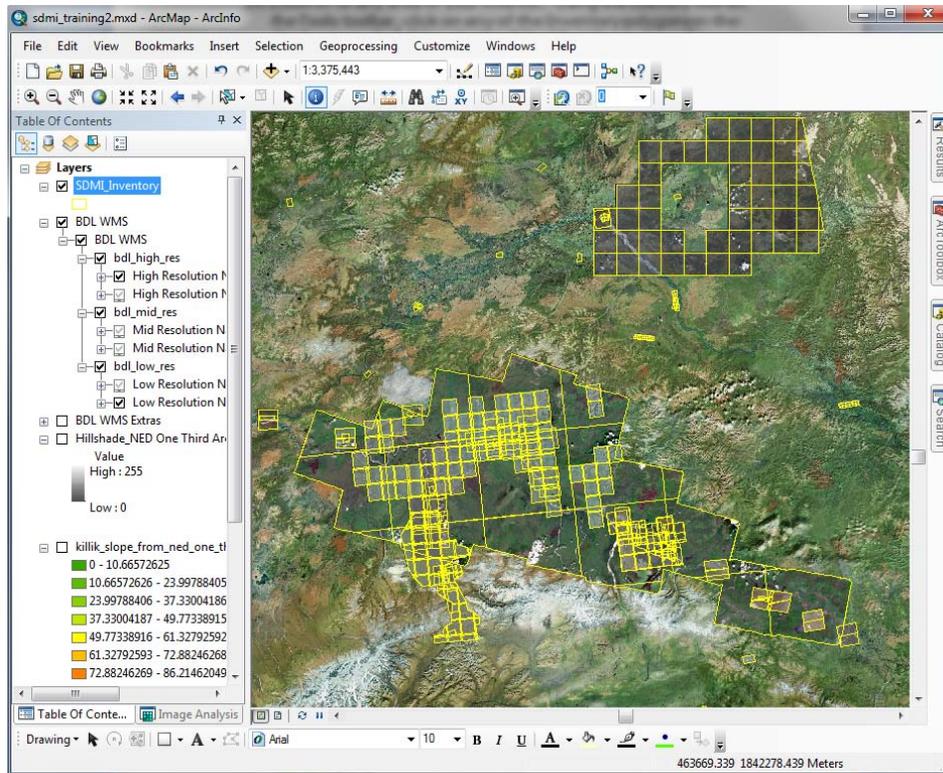


27. Uncheck the visibility check-box for all layers in the TOC except the SDMI_Inventory and BDL WMS. Right-click on the NED 2 Arc Sec Mosaic and choose Zoom to Layer. Your ArcMap display should look similar to the example below:



Only the footprints for ortho-imagery tiles of higher spatial resolution than 2.5 meters are visible.

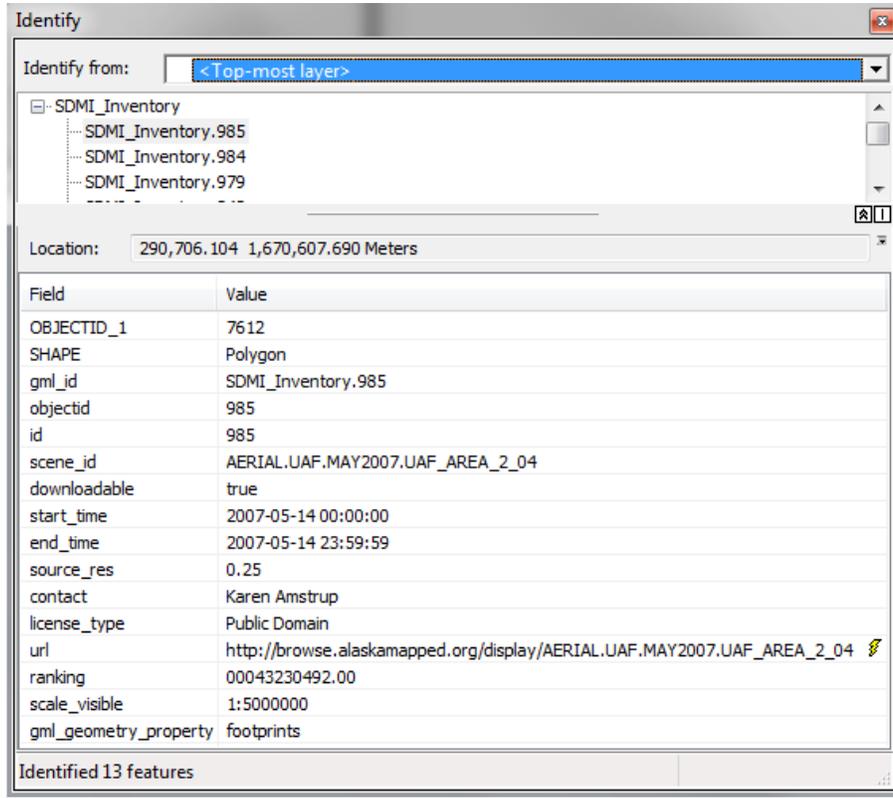
28. Zoom in to any area of your interest.. The example above is zoomed in on the Fairbanks North Star Borough to demonstrate the relationship between the SDMI_Inventory and the BDL WMS



29. Using the Identify tool on the Tools toolbar, click on any of the Inventory polygons in the display area. In left hand side of the Identify window, all image tiles beneath your mouse click will be listed. Selecting one of these records will flash the footprint polygon related to the selected record on the map display.

Notice that a minimum set of metadata has been built into the Inventory WFS pertinent to the BDL WMS ortho image underlying the Inventory footprint polygon (i.e. contact, license_type, etc...). Pay special attention to the downloadable field. If the value for this field is the letter t, the original ortho imagery being referenced by that inventory polygon and displayed by the BDL WMS is freely downloadable from the browse.alaskamapped.org website.

If necessary, scroll down on the Identify window until the url field is visible. Notice the hyperlink lightning bolt icon to the right of the url value.



- If the “downloadable” field in the SDMI_Inventory WFS contains the value of ‘true’, you may click on the lightning bolt to launch the www.browse.alaskamapped.org download page specific to the ortho image represented by that Inventory polygon.

