Tutorial for the Impervious Surface Analysis Tool (ISAT)

Extension for ArcView

NOAA Coastal Services Center
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Impervious Surface Analysis Tool Extension for ArcView

The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center has developed the Impervious Surface Analysis Tool (ISAT) to help managers and planners make a determination about the impact of impervious surface coverage on local water quality. ISAT (an extension for ArcView® version 3.x) applies impervious surface coefficients to remotely sensed land cover data to determine the total and the percentage of impervious surface area within specified polygons. ISAT can also be used to demonstrate the effects of land cover change on a watershed's imperviousness. The coefficients in ISAT were developed to be used with the NOAA Coastal Services Center's Coastal Change Analysis Program (C-CAP) land cover data, but can be modified for use with various types of land cover data or to match the land cover/land use practices within a specific geographic region.

There are several things to keep in mind when using the ISAT extension:

- Use of ISAT requires the Spatial Analyst extension.

- Due to the large size of full C-CAP scenes (about 15 – 45 megabytes), some operations may be time consuming. Therefore, it is best to perform operations on smaller areas of interest.

- For users that choose to use the C-CAP Data Handler, it should be noted that problems have been detected when using the ERDAS® Imagine® file format (.img) with the ArcView 3.2a patch installed.

> **Note: For more detailed explanations on these issues, or on other problems that may arise, see the troubleshooting guide on pages 18 & 19 of this manual.**

Although this tutorial describes the basic operations of the Impervious Surface Analysis Tool extension, it does assume the user has an intermediate level of familiarity with standard ArcView functionality and a basic understanding of land cover data. For more detailed information on C-CAP land cover data, please refer to the C-CAP Web site at *www.csc.noaa.gov/crs/lca/.*
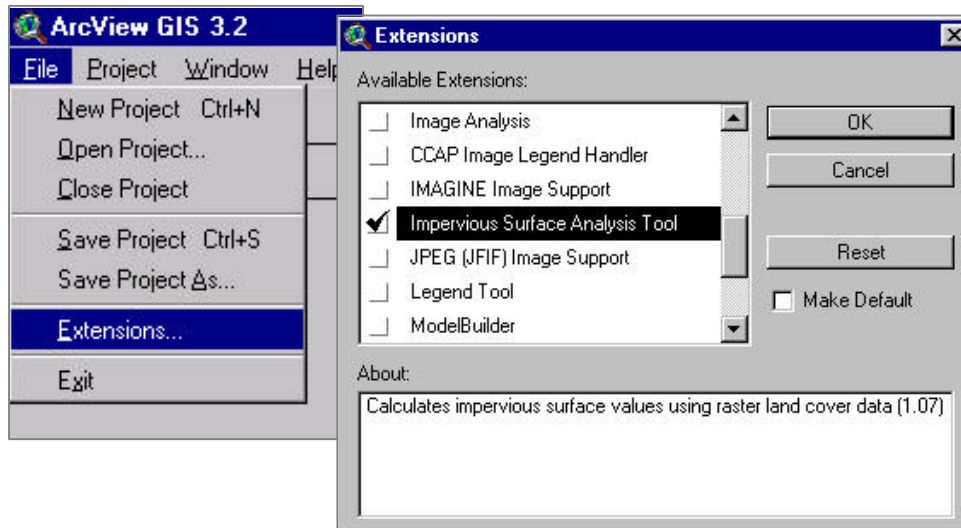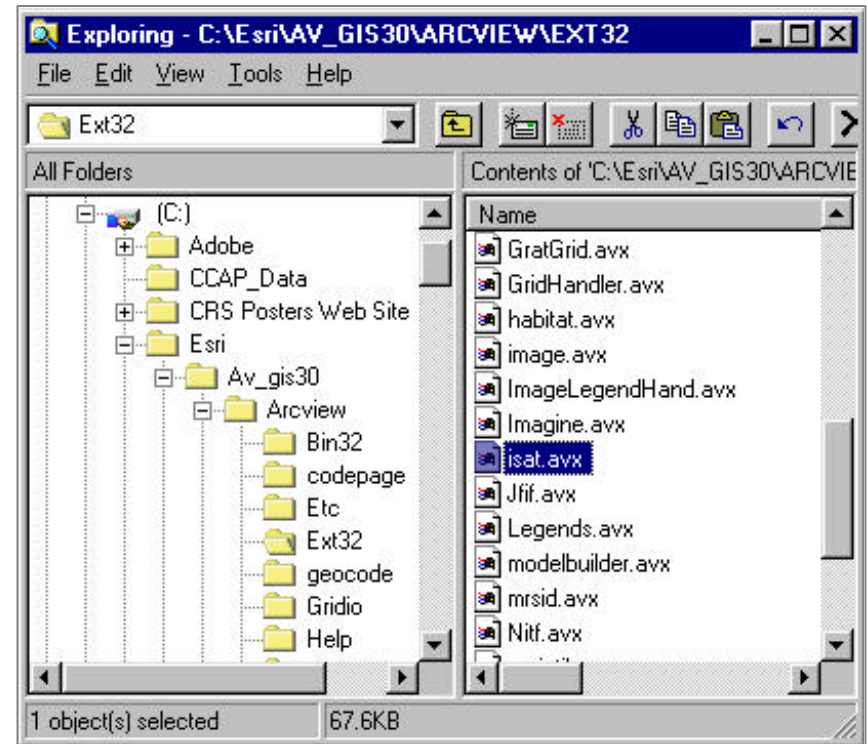
Table of Contents
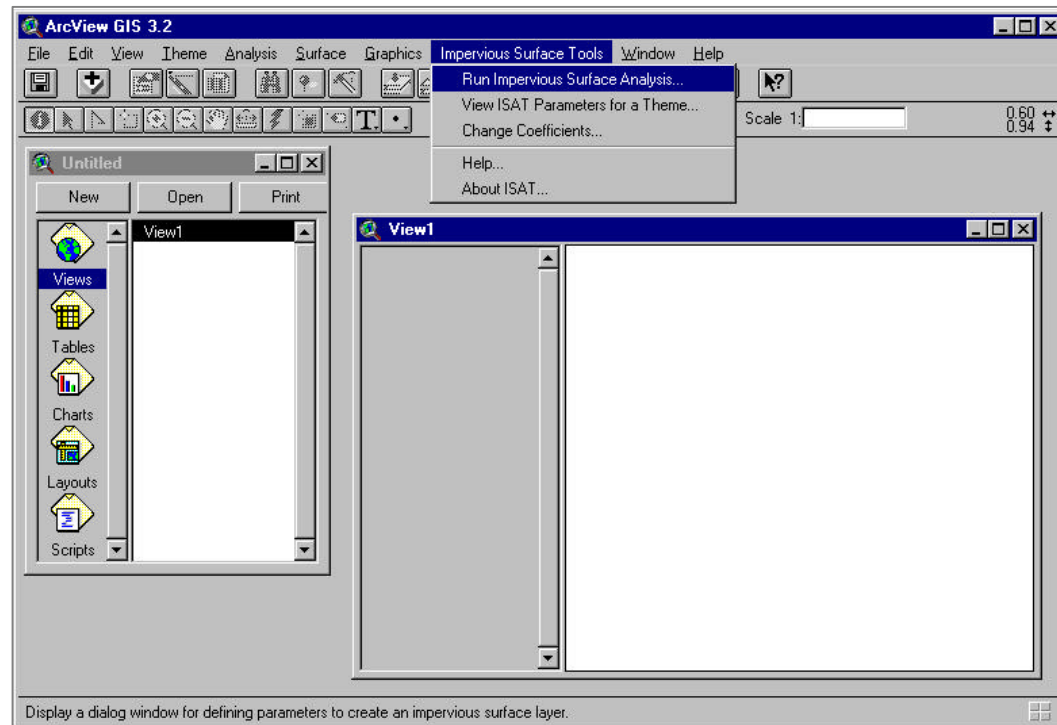
Getting Started

Installing and Loading ISAT

When you downloaded ISAT, you received a zip file containing setup.exe, msxl3.exe (Microsoft® XML Parser), and the files required to walk through this tutorial. Create a c:/isat directory and extract the files into this folder. Run the **setup.exe** program by double-clicking on it. The installation process will place a copy of the ISAT extension in the ArcView extensions folder, typically located at C:\Esri\Av_gis30\Arcview\Ext32.
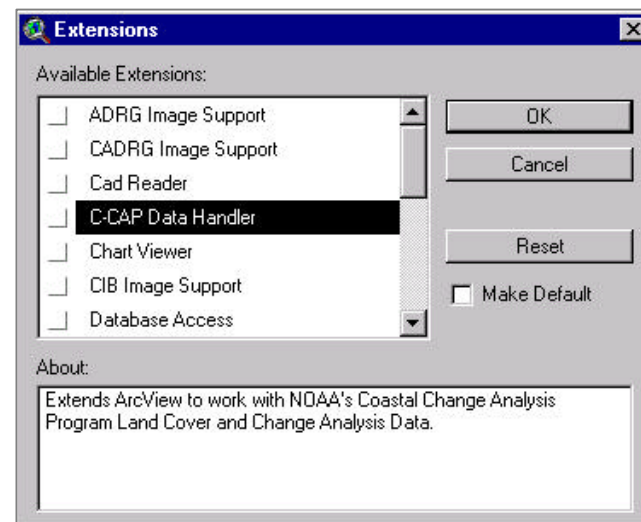
To turn on the extension, open ArcView and choose the **Extensions** option from the **File** menu. This produces a dialog box that allows you to choose which extensions you would like to activate. Choose the **Impervious Surface Analysis Tool** extension by checking the box next to it.

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Once the extension has been turned on, a new **Impervious Surface Tools** menu will be added to your ArcView toolbar (a view must be active within your project to make the menu visible). If you receive an error message reading "429 can't create activeX component" at any point when running ISAT, you may need to install Microsoft® XML Parser on your system. To install Microsoft® XML Parser, run **msxml3.exe** by double-clicking on it. Msxml3.exe was included in the ISAT zip file you downloaded.

Note: If you plan to use C-CAP land cover data with ISAT, the C-CAP Data Handler will complement the functionality of ISAT by allowing you to easily convert C-CAP data into the grid format required by ISAT. The C-CAP Data Handler can be downloaded at *www.csc.noaa.gov/crs/lca/av_ext.html*. A user's manual is also provided.
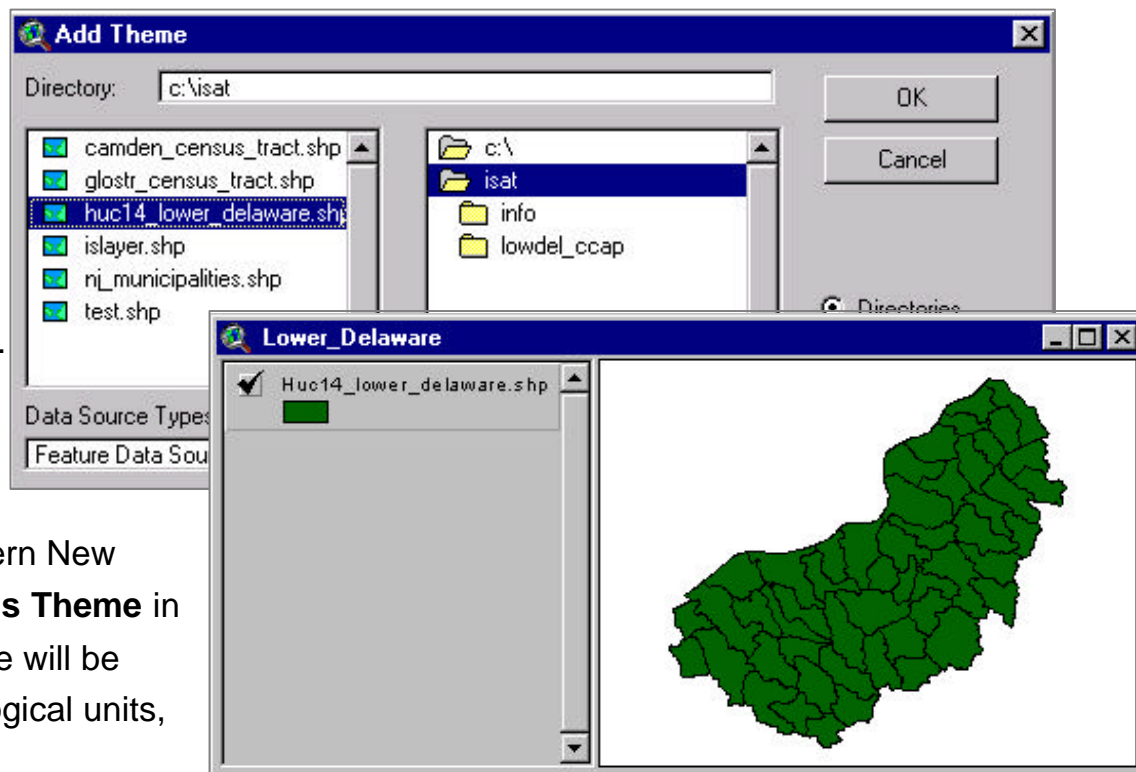

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Creating Your ArcView Project

Required Layers

You should now have the ISAT extension loaded and an **Impervious Surface Tools** menu on your tool bar when a view is active. The first step in using the Impervious Surface Analysis Tool is to add the two files to the view that are required to run ISAT: a shapefile that contains polygons of the areas you want to analyze (referred to as the **Analysis Theme**) and land cover data in ArcGrid format (referred to as the **Land Cover Grid**). If these two file types are not included in the view when you select **Run Impervious Surface Analysis**, you will be prompted with an error message stating such. ISAT will not run until one file of each type is added.
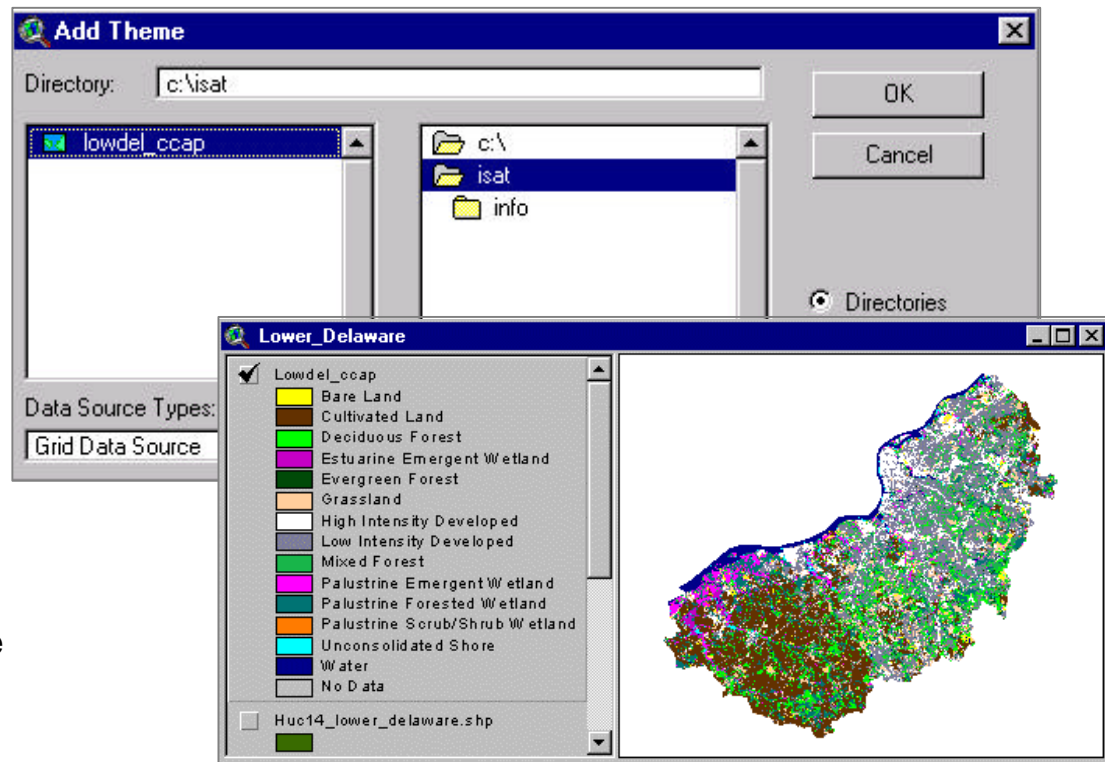
Adding the Analysis Theme

Click on the **Add Theme** ![button] button. Navigate to the **c:/isat** directory and be sure that the **Data Source Types:** drop-down menu is set to **Feature Data Source**. Select **Huc14_lower_delaware.shp** and click **OK**. Turn on the theme to view the hydrological unit code (HUC) boundaries for the Lower Delaware watershed in western New Jersey. This shapefile will be your **Analysis Theme** in ISAT. Most commonly, the Analysis Theme will be polygons of watershed boundaries, hydrological units, or municipal boundaries.

Adding the Land Cover Grid

A land cover grid describes the landscape in terms of general classes of land cover: forest, water, wetlands, urban, and so forth. ISAT takes a land cover grid and applies an impervious surface coefficient to each land cover classification to designate a percentage of imperviousness for that land cover type. The land cover grid must be in ArcGrid format to run ISAT.

Click on the **Add Theme** [+] button. You should still be pointing to your **c:/isat** directory. Be sure that the **Data Source Types:** drop-down menu is set to **Grid Data Source**. Select **lowdel_ccap** and click **OK**. Turn on the theme to view the land cover data for the Lower Delaware watershed in western New Jersey. This file will be your **Land Cover Grid** in ISAT. You may double-click on the grid legend and load the **ccap_legend.avl** legend file to change to the standard C-CAP classification legend.

Since this land cover data file is in ArcGrid format, it can simply be added to the view. If your land cover data are not in ArcGrid format, you must convert the data to a grid file in ArcView before running ISAT. If your land cover data are in grid format, skip the next page and go to the "Optional Layers" section.
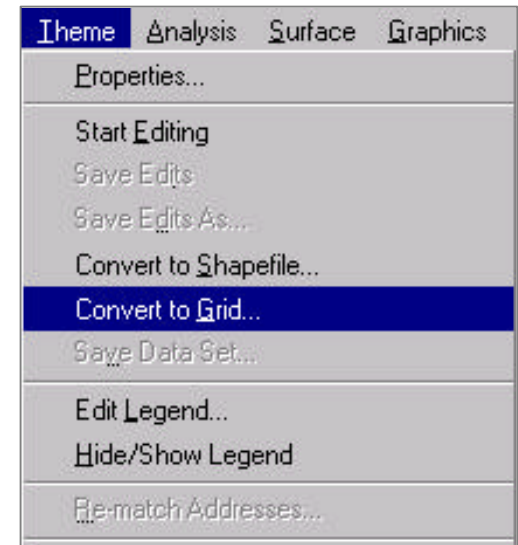
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Converting Land Cover Data to ArcGrid Format

Land cover data that are not in grid format (but are in a format recognized by ArcView) can be converted to a grid using the **Convert to Grid** option on the **Theme** menu. After you have added the land cover theme to the view, make it active by clicking on it in the table of contents and selecting **Convert to Grid**.

Importing and Converting C-CAP Land Cover Data

Use of the C-CAP Data Handler extension provides an alternate method for importing and converting C-CAP data that are in the default file format (.img or .flt) to ArcGrids. Select either **Import Imagine File** (.img) or **Import Binary Raster** (.flt), depending on the file format. This converts the C-CAP file to a grid for use in ArcView and applies the standardized C-CAP legend.

After selecting a land cover file to convert/import, you will be asked to rename and save the newly created grid theme. The grid name must be less than 13 characters in length and contain no blank spaces. After designating a new name and a path, click **OK**. This import and conversion process may take several minutes.

Note: Since you will now have a grid file in addition to the land cover data file, you will need to have ample space (approximately 50 megabytes) on your hard drive to carry out the conversion process.

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Optional Layers

The Impervious Surface Analysis Tool has two options that require the use of additional data layers.

Adding Population Data

The **Coefficients** section in the Impervious Surface Analysis Tool dialog box requires additional data to use the **Calculate** feature. The Calculate feature will allow you to instruct ISAT to spatially select which coefficients to apply based on the population density (**Definition Field**) within a selected shapefile (**Population Density Theme**). The Population Density Theme and Definition Field will be specified within the Population Density Calculation dialog box.
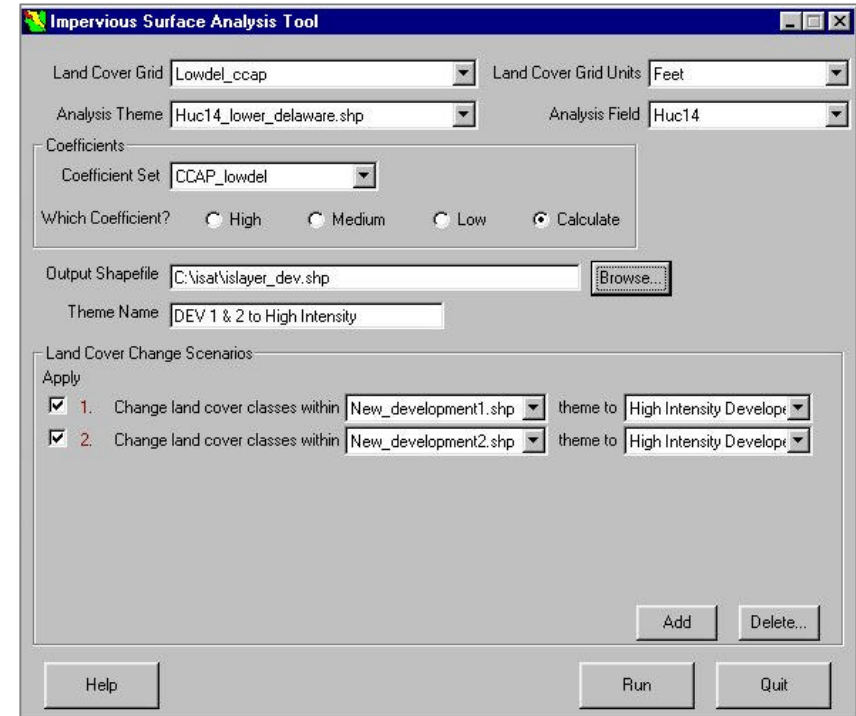
Click **Add Theme** 🔽 and select **nj_municipalities.shp.** Be sure that the **Data Source Types:** drop-down menu is set to **Feature Data Source**. Click **OK**. Do not turn on this theme; you will use it later in the lesson.

Adding Shapefiles for Land Cover Change Scenarios

The **Land Cover Change Scenarios** section of the Impervious Surface Analysis Tool dialog box also requires the use of additional data. The land cover classifications for the land cover grid can be changed to a new classification within a selected area of a designated shapefile. ISAT will recalculate the percent impervious surface after reclassifying the grid cells in the area of change.
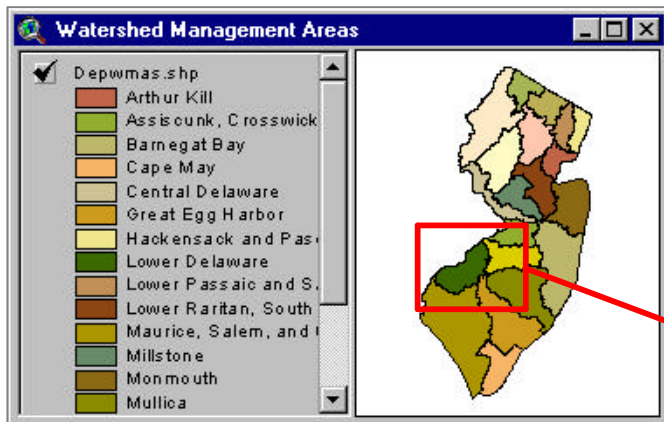
Click **Add Theme** 🔽 , hold the **Shift** key and select **New_development1.shp** and **New_development2.shp**. Click **OK**. Do not turn on these themes; you will use them later in the lesson.
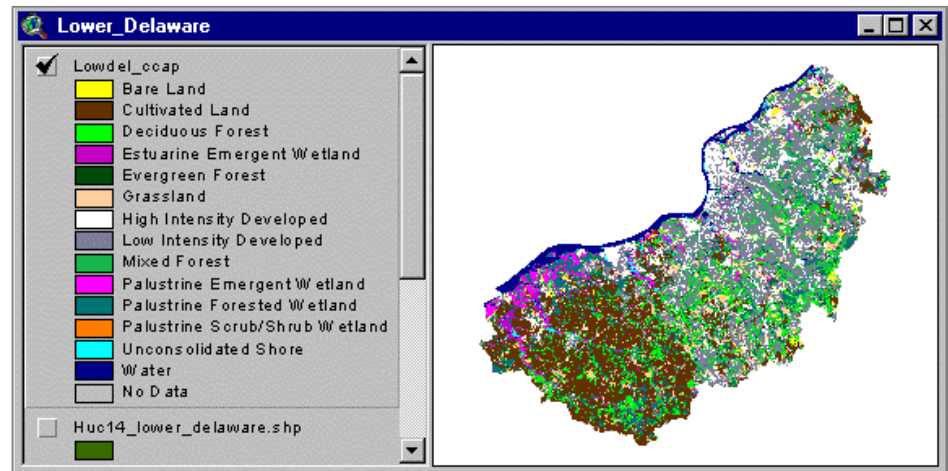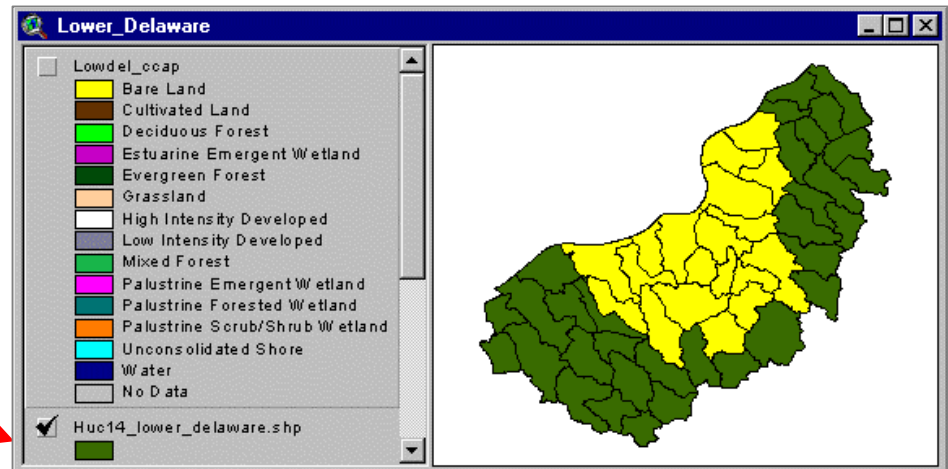
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Selecting Your Area of Interest

You now have both a Land Cover Grid and an Analysis Theme in your ArcView project. Turn off **Lowdel_ccap** and make **Huc14_lower_delaware** active so that the HUC shapefile is the only theme shown in the view. Select the area of interest using the **Select Feature** tool. You can click and drag the mouse to select an area of polygons, or hold **Shift** to select multiple polygons. The selected area is highlighted in yellow. This is the area for which ISAT will calculate impervious surface coverage. If nothing is selected, the analysis will be performed on all polygons.

C-CAP Land Cover Grid over area of interest.

Shapefile of watersheds in the state of New Jersey. The Lower Delaware watershed is the Analysis Theme.

Lower Delaware Watershed in New Jersey, subdivided into smaller hydrological units. Yellow hydrological units are the selected units within the watershed to be analyzed by ISAT.
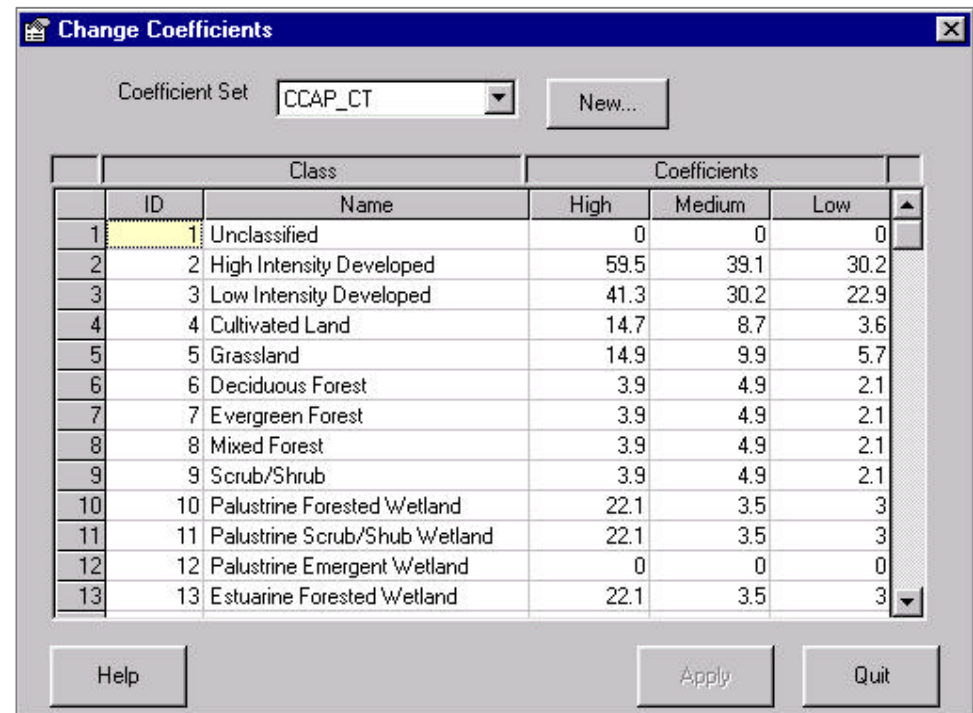
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Running the Impervious Surface Analysis Tool

You are now ready to begin using ISAT. The **Impervious Surface Tools** menu has five choices: **Run Impervious Surface Analysis, Change Coefficients, View ISAT Parameters for a Theme, Help,** and **About ISAT**.
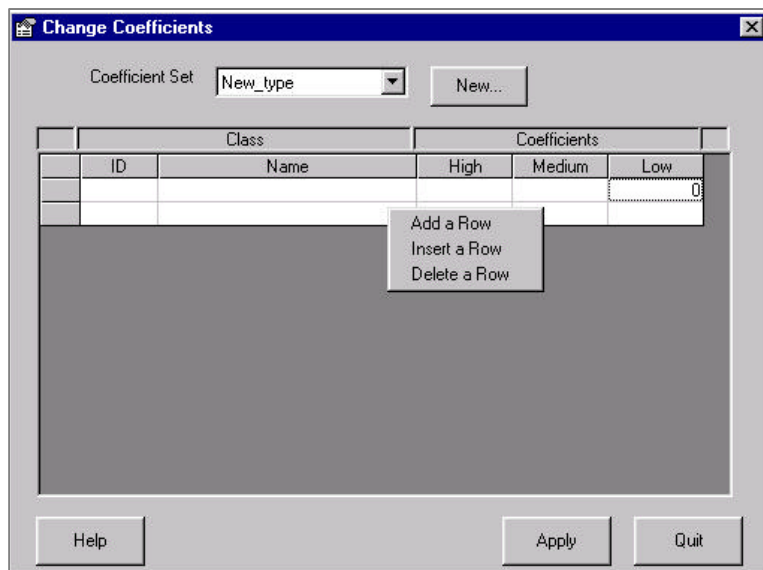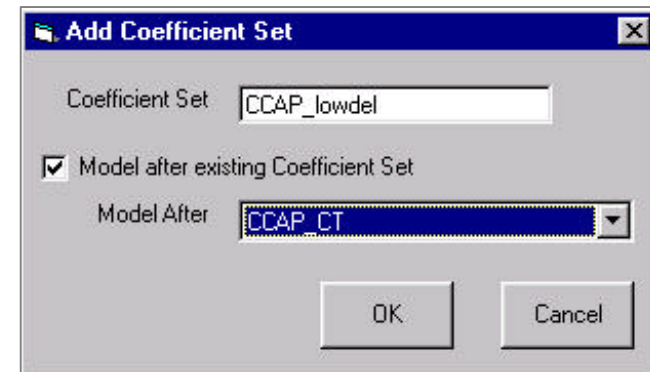

Change Coefficients

Choose **Change Coefficients** to display the **Change Coefficients** dialog box. The **Class** column shows each land cover category and its associated ID Number as defined for C-CAP data. The **Coefficients** column shows High, Medium, and Low impervious surface coefficients for each land cover class. These levels are based on the population density of the interest area. Use the drop-down menu beside **Coefficient Set** to choose **CCAP_CT**.

Coefficient Set: CCAP_CT

	ID	Name	High	Medium	Low
1	1	Unclassified	0	0	0
2	2	High Intensity Developed	59.5	39.1	30.2
3	3	Low Intensity Developed	41.3	30.2	22.9
4	4	Cultivated Land	14.7	8.7	3.6
5	5	Grassland	14.9	9.9	5.7
6	6	Deciduous Forest	3.9	4.9	2.1
7	7	Evergreen Forest	3.9	4.9	2.1
8	8	Mixed Forest	3.9	4.9	2.1
9	9	Scrub/Shrub	3.9	4.9	2.1
10	10	Palustrine Forested Wetland	22.1	3.5	3
11	11	Palustrine Scrub/Shub Wetland	22.1	3.5	3
12	12	Palustrine Emergent Wetland	0	0	0
13	13	Estuarine Forested Wetland	22.1	3.5	3

The listed coefficients were derived based on impervious surface data in the state of Connecticut and may not apply if you are performing this analysis on another area. (The "Tool Assumptions/Technical Information" section includes some references on how you can derive coefficients for your data in your interest area.) The table will allow you to adjust the impervious surface coefficients for the listed land cover classifications.

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The **New** button allows you to create and save new coefficient sets with your land cover data. Now assume that you have derived your own impervious surface coefficients for the Lower Delaware watershed. Assume that many of the coefficients are identical to the coefficients listed in **CCAP_CT**, but based on your calculations, the coefficients listed in the High population density column should be higher. Click on **New** to bring up the **Add Coefficient Set** dialog box. In the **Coefficient Set** field, type **CCAP_lowdel** to designate a name of your new coefficient set. Select **Model after existing Coefficient Set**, and in the **Model After** field, select **CCAP_CT**. This will allow you to make changes to the **CCAP_CT** file without writing over it. Your changes will be saved in a new file called **CCAP_lowdel**. Click **OK**.

If you had not selected **Model after existing Coefficient Set**, then you would have been given an empty table to enter in your own land cover class names and IDs and your own coefficient values. This option would be used for land cover data with different classifications than C-CAP data. Right-click within the table to display options to **Add a Row** (appends a row onto the end of the table), **Insert a Row** (inserts a new row above the currently highlighted row), or **Delete a Row** (delete the highlighted row).

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Your Coefficient Set should now read CCAP_lowdel. Now you can begin editing your coefficient values. Click in the **High** column of the **High Intensity Developed** row. Change the Coefficient from 59.5 to 72. To change the coefficients, put the cursor inside the corresponding cell and edit as you would in any spreadsheet. Continue to enter new values in the **High** column as shown in the table below.

Land Cover Class	CCAP_CT High Coefficient	CCAP_lowdel High Coefficient
High Intensity Developed	59.5	72
Low Intensity Developed	41.3	49
Cultivated Land	14.7	18.8
Deciduous Forest	3.9	6.5
Evergreen Forest	3.9	6.5
Mixed Forest	3.9	6.5

Click **Apply** to save the changes and **Quit** to close the **Change Coefficients** dialog box.
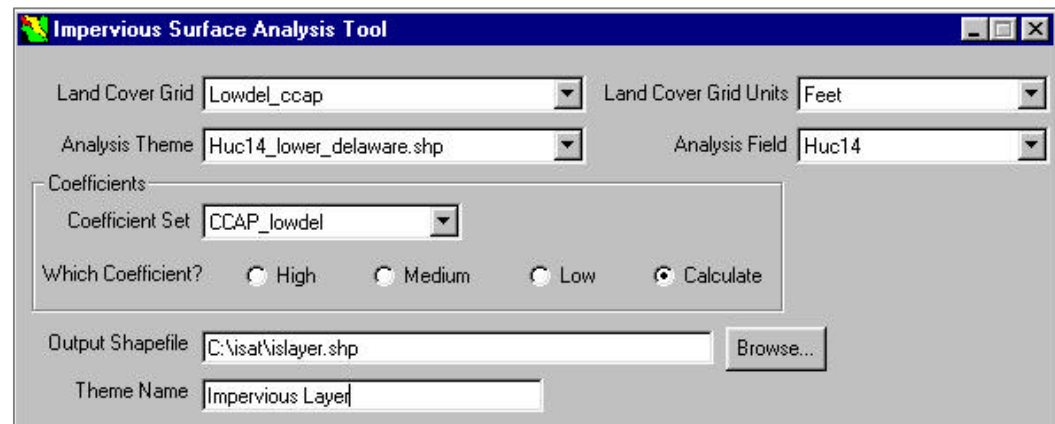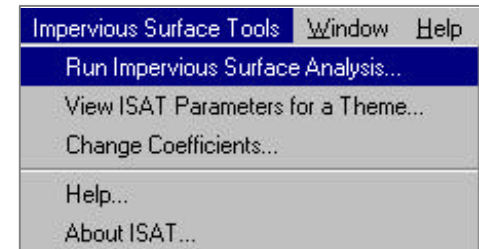

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Run Impervious Surface Analysis

Now choose the **Run Impervious Surface Analysis** option from the **Impervious Surface Tools** menu to display the **Impervious Surface Analysis Tool** dialog box.

For **Land Cover Grid,** select **Lowdel_ccap**. The Land Cover Grid defines the land cover classes to which impervious surface coefficients will be applied. The drop-down list shows all the grid themes within the view. **Land Cover Grid Units** specifies the units of your land cover data (feet or meters). Land cover data in feet will yield results in acres and land cover data in meters will yield results in hectares. Select **Feet** because your C-CAP land cover data are in feet. (C-CAP data are in meters when downloaded off the Center's web site.)
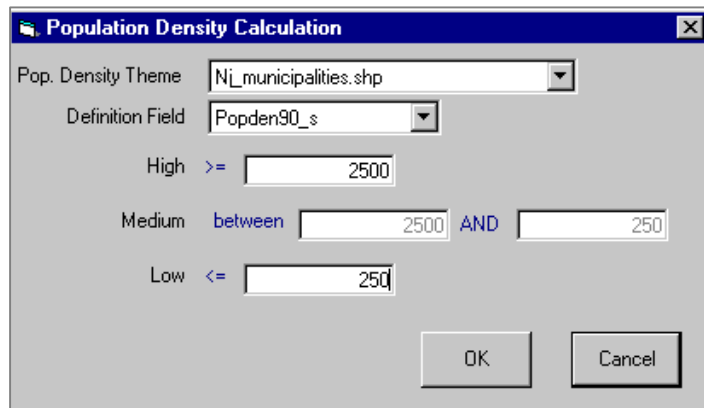

Analysis Theme is the shapefile of HUCs that you added to your view, **Huc14_lower_delaware.shp**. **Analysis Field** is the attribute from the Analysis Theme shapefile that defines the grouping of areas that will be assigned a unique impervious surface value. Choose **Huc14**. The Analysis Field you choose will depend upon the scale you want to investigate.

> **Note: The Analysis Theme menu will only list themes that contain at least one string or integer type attribute. The Analysis Field menu will also only list string or integer type attributes within the Analysis Theme.**
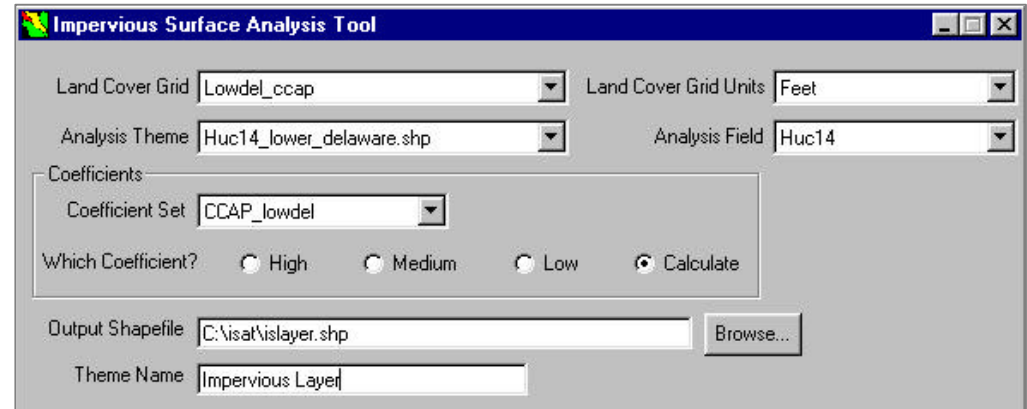
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Coefficients

Coefficient Set defines the set of land cover coefficients to use. You will want to use the coefficients just defined, **CCAP_lowdel**.

*For municipalities with a population density ≤250, **Low** coefficients will be applied. For municipalities with a population density 250 to 2500, **Medium** coefficients will be applied. For municipalities with a population density ≥2500, **High** coefficients will be applied.*
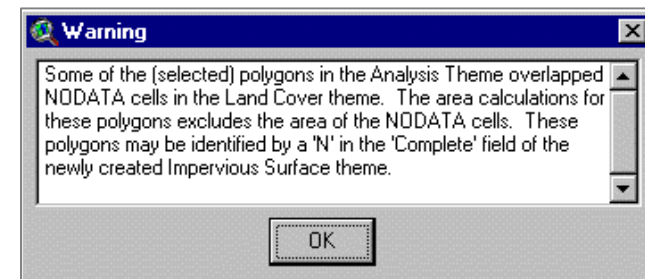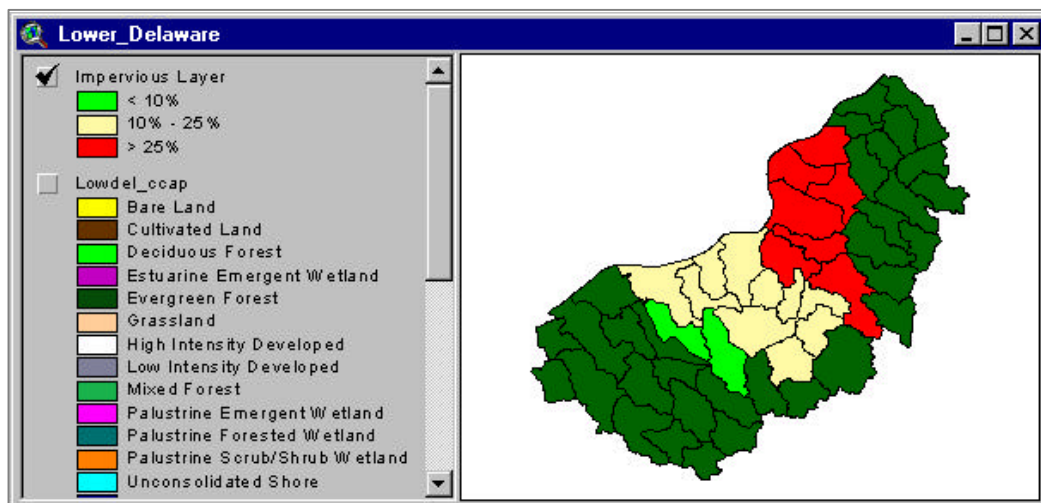
Note: The Definition Field drop-down menu will only list numeric attributes within the population density theme.

Impervious surface coefficients have been found to vary with the population density. **Which Coefficient?** allows you to choose which coefficient to apply (i.e., High, Medium, or Low). The **Calculate** option under **Which Coefficient?** will enable ISAT to apply a high, medium, or low coefficient based on the population density of each particular area. Select **Calculate** and the **Population Density Calculation** dialog box appears. The **Pop. Density Theme** is the file in which your population data are spatially defined (e.g., census data). Choose **Nj_municipalities.shp**. The **Definition Field** is the attribute within your Pop. Density Theme that contains the population data. Select **Popden90_s**. Now you must specify the ranges that instruct ISAT when to apply the high, medium, or low coefficient. Type **2500** in the **High** field and type **250** in the **Low** field (do not use commas in these numbers). Click **OK** to apply this population density information.

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Output Shapefile is the name you designate to the output file. Click **Browse** to navigate to your c:/isat directory and type **islayer** in the **File name** field. Click the **Save** button. **Theme Name** allows you to describe the theme within the view in more detail than the Output Shapefile name. The output file will be an impervious surface polygon shapefile similar to the one seen below. Type **Impervious Layer** in the **Theme Name** field. Click **Run** [Run] at the bottom-right-hand corner of the **Impervious Surface Analysis Tool** dialog box to run ISAT.

If grid cells in the selected polygon have a NODATA value, you will see a warning. Check the islayer.shp table to see which polygons are affected. You will want to remember these NODATA values in your final interpretation.

The output shapefile will be added to the view after all the processing is complete. Turn on the **Islayer.shp** theme to view the impervious surface layer. The default legend applied to the new theme indicates the potential impact to water quality based on the estimated percentage of imperviousness within each analysis field.

Green areas are labeled <10%, which corresponds to <10% impervious surface (Protected), yellow areas are labeled 10%-25% which corresponds to 10%-25% impervious surface (Degraded), and red areas are labeled >25%, which corresponds to >25% impervious surface (Impacted).

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Select **Islayer**.**shp** in the table of contents and click **Open Theme Table** 🔲 to display **Attributes of Islayer.shp**. The attribute table contains four columns for each **Analysis Field (Huc14)**: **TotalAcres, TotalISAcres, pctIS,** and **Complete. TotalAcres** is the total area within each analysis field, **TotalISAcres** is the total impervious surface area within each analysis field, and **pctIS** is the percentage of impervious surface within each analysis field.

These results are in acres because you specified **Land Cover Grid Units** of **Feet**. Had your land cover grid been in units of meters, these results would have been given in hectares.

When ISAT is calculating impervious surface coverage, it checks for polygons that do not overlap data cells. If you received a warning stating that some of the selected polygons in the **Analysis Theme** overlapped NODATA cells in the **Land Cover Grid**, then the area calculations for these polygons excludes the area of the NODATA cells, and will be identified with an "N" in the **Complete** column of the attribute table.

Shape	Huc14	TotalAcres	TotalISAcres	pctIS	Complete
Polygon	02040202120020	7977.011252	2051.166908	25.71	N
Polygon	02040202140010	7671.896687	1140.614983	14.87	N
Polygon	02040202130060	3944.028286	759.071221	19.25	Y
Polygon	02040202120060	2432.465822	466.590665	19.18	Y
Polygon	02040202120100	3109.633352	668.214684	21.49	Y
Polygon	02040202120050	3139.433169	581.093358	18.51	Y
Polygon	02040202140020	4633.427084	453.478746	9.79	Y
Polygon	02040202120040	4131.055507	716.144803	17.34	Y
Polygon	02040202130040	7616.300013	1156.236759	15.18	Y
Polygon	02040202130050	6500.808277	582.216634	8.96	Y
Polygon	02040202130020	5152.255273	890.269814	17.28	Y

A .prm file is created for each Impervious Surface (IS) theme (is_layer.shp) and contains the ISAT parameters that created the IS theme. To view the .prm file, choose View ISAT Parameters from the drop-down menu.

Land Cover Change Scenarios

The **Land Cover Change Scenarios** section of the Impervious Surface Analysis Tool dialog box allows you to predict the effect that land cover change (e.g., further development of a watershed) will have on water quality by actually changing the land cover classes within a theme to an alternate land cover class (High Intensity, Low Intensity, Evergreen Forest, Grassland, etc.).

In the **Impervious Surface Analysis Tool** dialog box, be sure the upper portion of the dialog box is filled out with the the same information as was used in the previous portion of this exercise (see graphic). Change the **Output Shapefile** to **ISlayer_dev**. Click **Add** under **Land Cover Change Scenarios**. A row is added to define a new land cover change scenario. In **Change land cover classes within**, select **New_development1.shp**. In **theme to**, select **High Intensity Developed** to change all the land cover within New_development1.shp to High Intensity Developed. Perform the same steps to change all the land cover within New_development2.shp to High Intensity Developed. Be sure that the **Apply** box is selected for both scenarios and **Run** the impervious surface analysis.

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ISAT will recalculate the percentage of impervious surface after dynamically reclassifying grid cells for the area of change in the land cover grid to the indicated land cover class. The **Output Shapefile** will be added to the view after all the processing is complete. The default legend and attribute table showing percentage of imperviousness will again be applied to the new theme.

There is no limit to the number of land cover change scenarios that can be defined. However, the more defined the scenario, the more time ISAT will take to perform the analysis.

Turn on the **Islayer_dev.shp** theme and drag the **New_development** themes to the the top so they can be viewed. Notice that Islayer_dev.shp now has a higher percentage of imperviousness around the newly developed areas.

HUC changed from <10% to 10%-25% impervious.

HUC changed from 10%-25% to >25% impervious.

The difference in impervious surface calculations can also be seen when comparing the attributes tables of the two islayer themes (before and after the added development scenarios). Notice that percentage of imperviousness changed from 18.51 to 30.71 percent in the first highlighted polygon and from 8.96 to 21.13 percent in the second. Each polygon (Huc 14) within the analysis theme that is overlapped by the newly developed areas will show new percentage of imperviousness values.

To delete a scenario that has been added, click on the Delete button to access the Delete Scenario dialog box. Enter the number of the scenario you wish to delete and press OK.

Troubleshooting Guide

I am getting the following error message during installation: "429 can't create activeX component."
You may need to install Microsoft XML Parser on your system by running msxml3.exe.

I am trying to rename my grid, but it won't allow me to.
Grid names can't have more than 13 characters, nor can they contain any blank spaces.

I am using C-CAP data, but the view doesn't look like the examples in the manual.
The C-CAP Data Handler has been designed to be used with C-CAP data in the newly standardized classification scheme. These data can be downloaded from the C-CAP Web site at *www.csc.noaa.gov/crs/lca/locate.html.*

When I am using the C-CAP Data Handler and I try to import an Imagine file, it won't work. I get the warning "Error in CC.ImportImagine at 930."
Make sure you are not using the ArcView 3.2a patch. The 3.2a patch renders ERDAS Imagine files incompatible with other ArcView versions and this extension. ESRI is aware of the problem and will produce ArcView version 3.3 to address this and other issues.

How do I know the projection of the C-CAP data?
You can find this information in the metadata. When you download the data from the C-CAP Web site, you get a metadata (*.met) file along with the Imagine file.

Troubleshooting Guide (continued)

The Impervious Surface Analysis Tool extension is selected within the extension menu, but the Impervious Surface Tools menu is not there.
Make sure that a view is active. To do this, click in the view window or double-click on the view name in the project window.

I'm trying to run the Impervious Surface Analysis Tool, but I getting the error message, "No grid themes found in the 'View1' view. Please add a land cover grid to the view."
ISAT requires a land cover theme in ArcGrid format. You must add one to the view before ISAT will run.

I'm trying to run the Impervious Surface Analysis Tool, but I getting the error message, "No polygon feature themes in the 'View1' view that contain at least one string or integer type attribute. Please add a theme or edit an existing theme's attribute table in the view."
ISAT requires a polygon feature theme with at least one string or integer type attribute. You must add one to the view before ISAT will run.

I'm trying to run the Impervious Surface Analysis Tool, but my computer keeps freezing up.
Full land cover data sets can be large and operations on them are often time- and resource-consuming. It is therefore best to perform operations on the smallest area of interest practicable. Try selecting specific polygons within your Analysis Theme.

I have a land cover grid and a shapefile open in ArcView, but ISAT will not run and gives an error that the two layers do not overlap.
Make sure the land cover grid and shapefile are in the same projection.

Tool Assumptions/Technical Information

The Impervious Surface Analysis Tool uses several assumptions that result in a simplification of real world processes. Assumptions include the following:
- Stream quality is a function of the percentage of impervious surface area
- Each watershed operates independently of upstream watersheds
- Watershed characteristics such as soils, topography, stream density, etc. are not considered
- No distinction is made between total and effective impervious area
- The spatial distribution of impervious surface and its proximity to drainage systems is ignored

The Impervious Surface Analysis Tool uses Spatial Analyst to overlay polygon data (e.g., watershed data) on land cover data to calculate the area of each land cover category within each polygon. Avenue scripts then apply impervious surface coefficients (IS_i) to calculate the impervious area percentage for each polygon (IS_w) using the following equation:

$$IS_w = \frac{\sum_{i=1}^{n} Area_i * IS_i}{Total\ Area}$$

References for Coefficient Methodology (located at *http://resac.uconn.edu/publications/tech_papers/index.html)*:

Civco, D.L., and J.D. Hurd. 1997. "Impervious Surface Mapping for the State of Connecticut." Proceedings of the 1997 American Society for Photogrammetry and Remote Sensing (ASPRS) Annual Convention, Seattle, WA. Volume 3, pages124 to 135.

Sleavin, W., S. Prisloe, L. Gianotti, and D.L. Civco. 2000. "Measuring Impervious Surfaces for Nonpoint Source Pollution   Modeling." Proceedings of the 2000 ASPRS Annual Convention, Washington, D.C. 11 pages.

Flanagan, M., and D. Civco. 2001. "Subpixel Impervious Surface Mapping." Proceedings of the 2001 ASPRS Annual Convention, St. Louis, MO.

Helpful Links and Contacts

For more information on the NOAA Coastal Services Center, Nonpoint Education for Municipal Officers (NEMO), C-CAP data, or Remote Sensing, visit the following Web sites or contact Center staff at *csc@csc.noaa.gov*.

- NOAA Coastal Services Center

  www.csc.noaa.gov/

- Locate and Download C-CAP Data
  www.csc.noaa.gov/crs/lca/locate.html

- Nonpoint Education for Municipal Officers (NEMO)
  http://nemo.uconn.edu/

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Addendum to ISAT Tutorial:
ISAT Version 2.0

New Menu Options in ISAT Version 2.
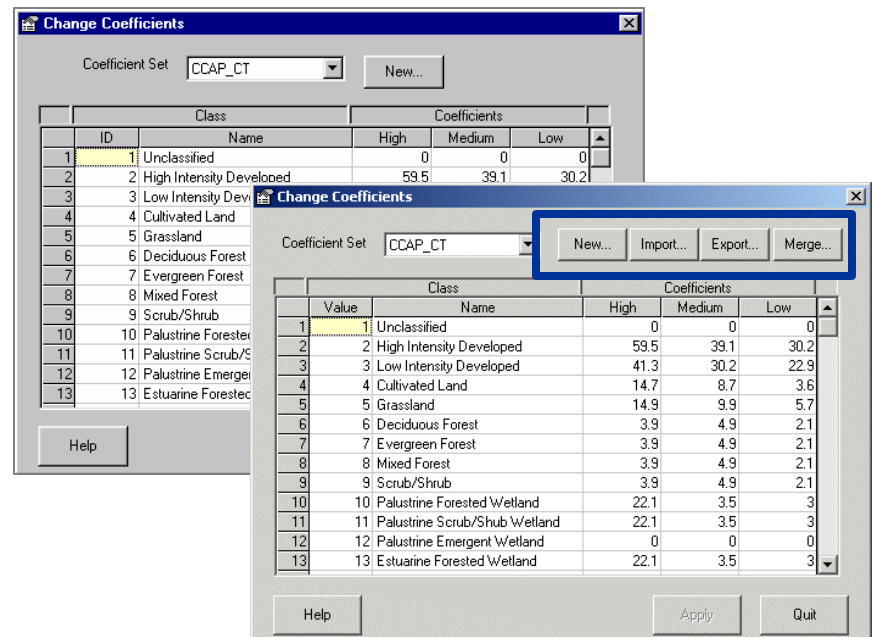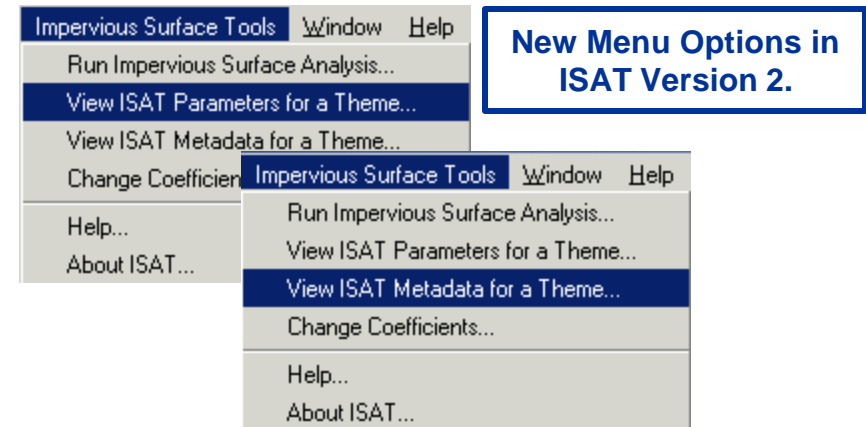
These options provide a record of the ISAT parameters used in generating a specific impervious surface layer:

• View ISAT Parameters for a Theme
• View ISAT Metadata for a Theme

These options provide functionality to more easily incorporate new coefficient sets into ISAT and to share coefficient sets among other ISAT users:

• Change Coefficients
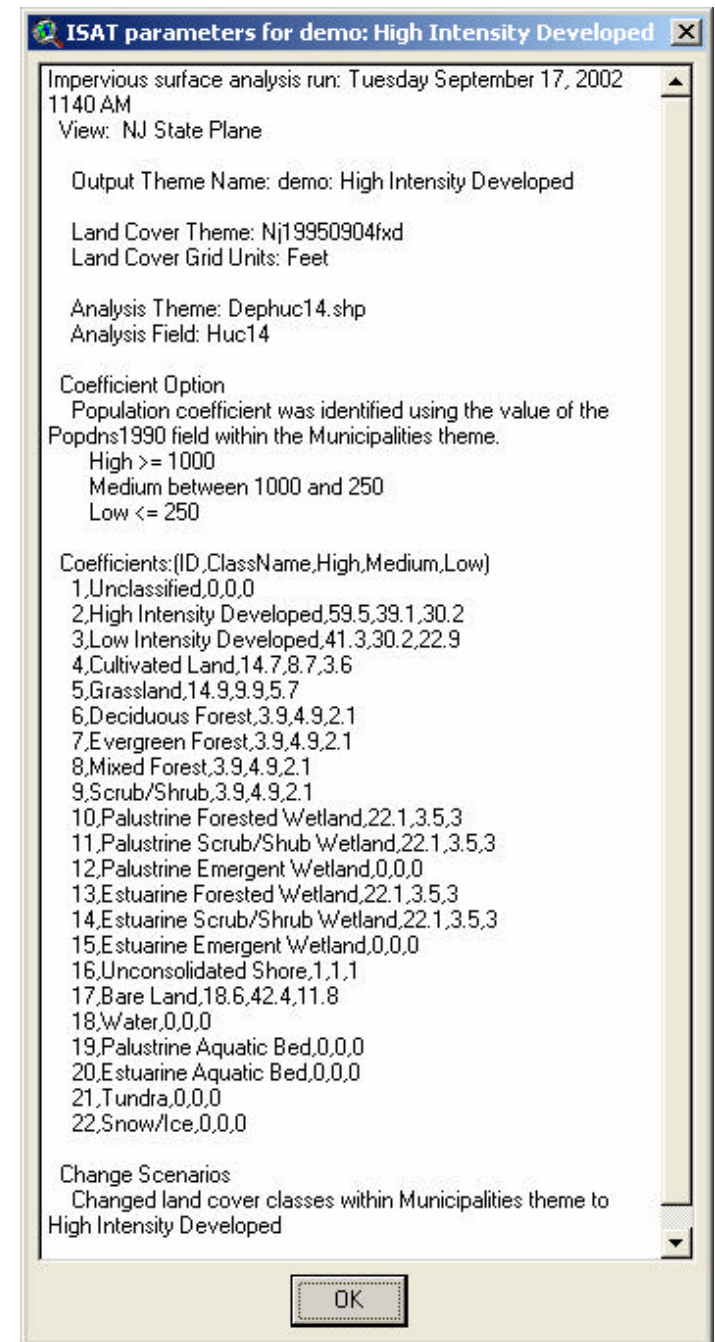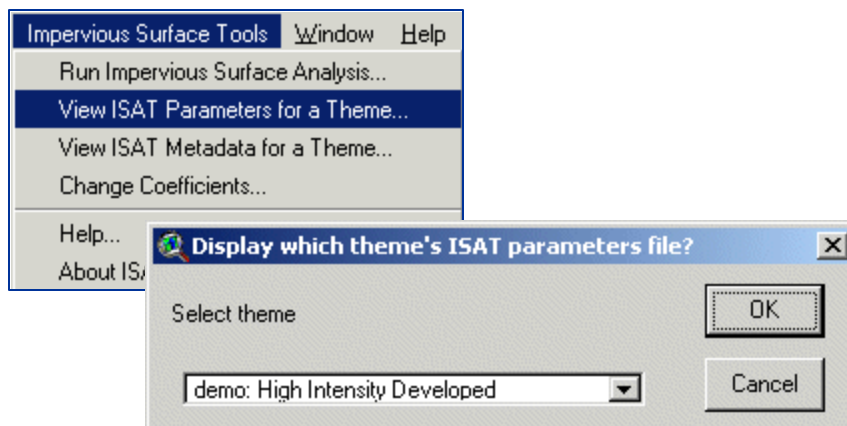 • Import
  • Export
  • Merge

View ISAT Parameters for a Theme

Displays file *theme_name*.prm, which contains a list of ISAT parameters used to generate an impervious surface layer in ISAT.
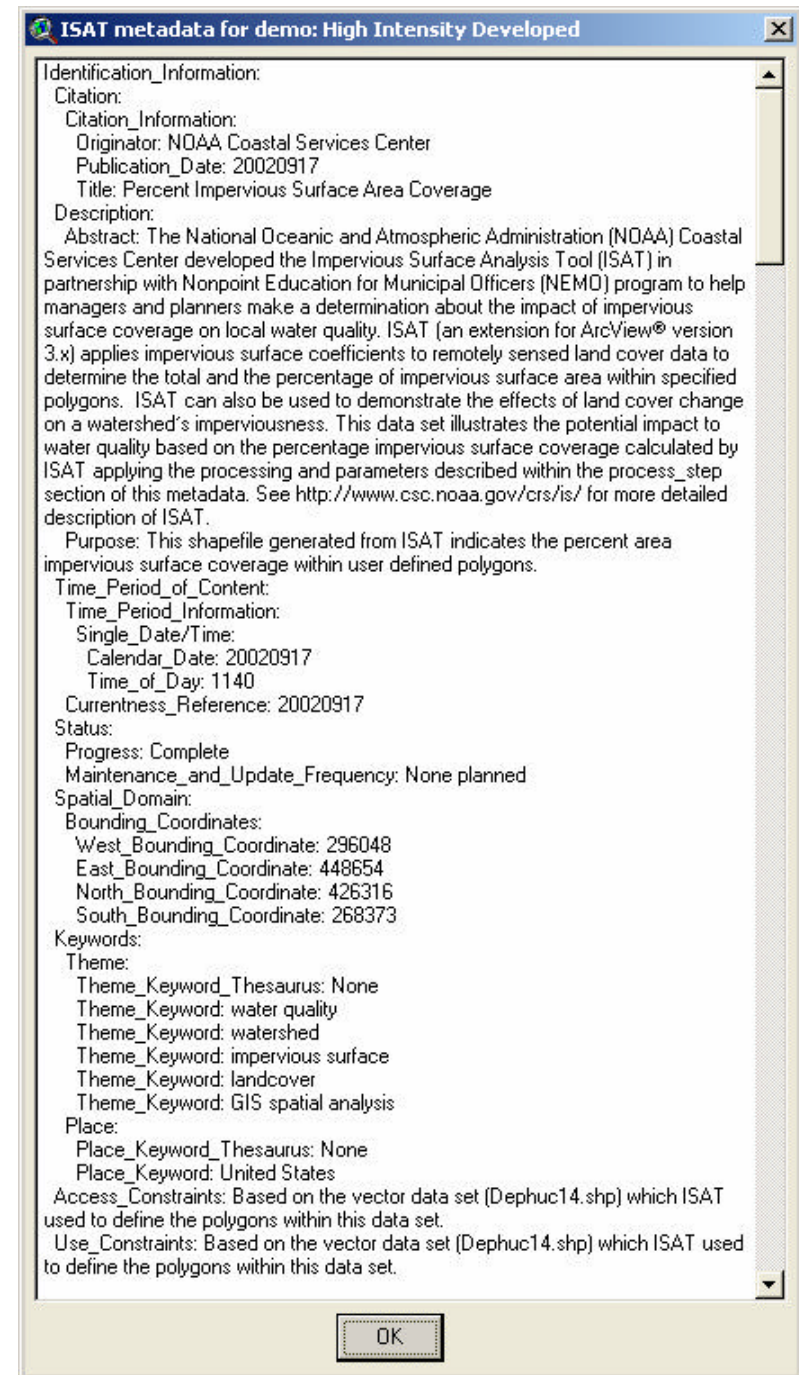
Parameters include:

- Land cover grid and units
- Analysis theme and field
- Coefficient option choices
- Coefficient values
- Change scenario description

ISAT parameters for demo: High Intensity Developed

Impervious surface analysis run: Tuesday September 17, 2002 1140 AM
View: NJ State Plane

Output Theme Name: demo: High Intensity Developed

Land Cover Theme: Nj19950904fxd
Land Cover Grid Units: Feet

Analysis Theme: Dephuc14.shp
Analysis Field: Huc14

Coefficient Option
   Population coefficient was identified using the value of the Popdns1990 field within the Municipalities theme.
      High >= 1000
      Medium between 1000 and 250
      Low <= 250

Coefficients:(ID,ClassName,High,Medium,Low)
   1,Unclassified,0,0,0
   2,High Intensity Developed,59.5,39.1,30.2
   3,Low Intensity Developed,41.3,30.2,22.9
   4,Cultivated Land,14.7,8.7,3.6
   5,Grassland,14.9,9.9,5.7
   6,Deciduous Forest,3.9,4.9,2.1
   7,Evergreen Forest,3.9,4.9,2.1
   8,Mixed Forest,3.9,4.9,2.1
   9,Scrub/Shrub,3.9,4.9,2.1
   10,Palustrine Forested Wetland,22.1,3.5,3
   11,Palustrine Scrub/Shub Wetland,22.1,3.5,3
   12,Palustrine Emergent Wetland,0,0,0
   13,Estuarine Forested Wetland,22.1,3.5,3
   14,Estuarine Scrub/Shrub Wetland,22.1,3.5,3
   15,Estuarine Emergent Wetland,0,0,0
   16,Unconsolidated Shore,1,1,1
   17,Bare Land,18.6,42.4,11.8
   18,Water,0,0,0
   19,Palustrine Aquatic Bed,0,0,0
   20,Estuarine Aquatic Bed,0,0,0
   21,Tundra,0,0,0
   22,Snow/Ice,0,0,0

Change Scenarios
   Changed land cover classes within Municipalities theme to High Intensity Developed

OK

View ISAT Metadata for a Theme

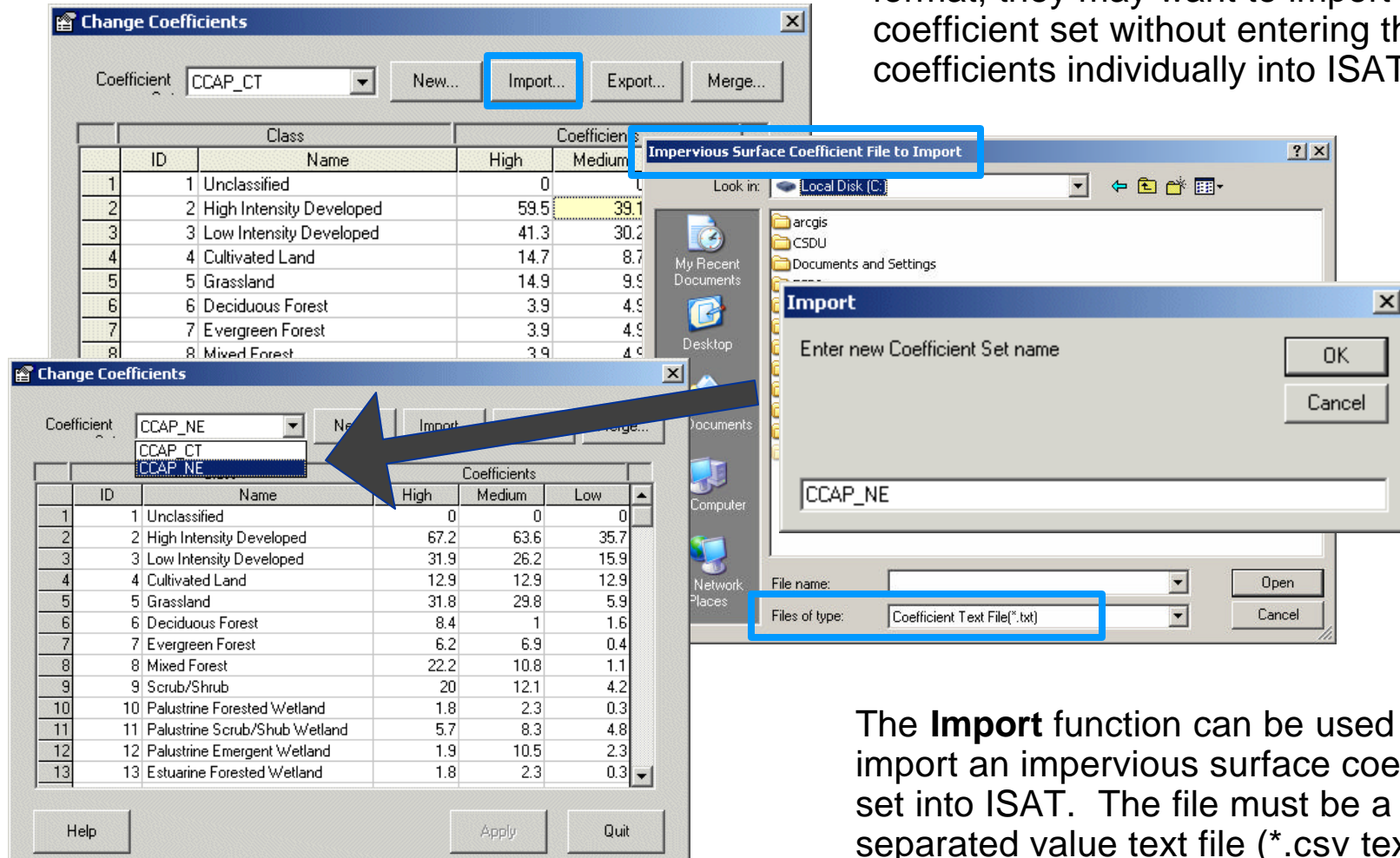Metadata for a selected impervious surface layer generated by ISAT is almost Federal Geographic Data Center (FGDC)-compliant. Users must edit the file (*theme_name*.met) to add:

- Bounding coordinates: There will be valid latitude/longitude values if the vector data within the view are geographic. Otherwise they represent the bounds based on the datum/projection of the vector data.

- Datum/projection: This information is unknown by ISAT and will require updating by the user.
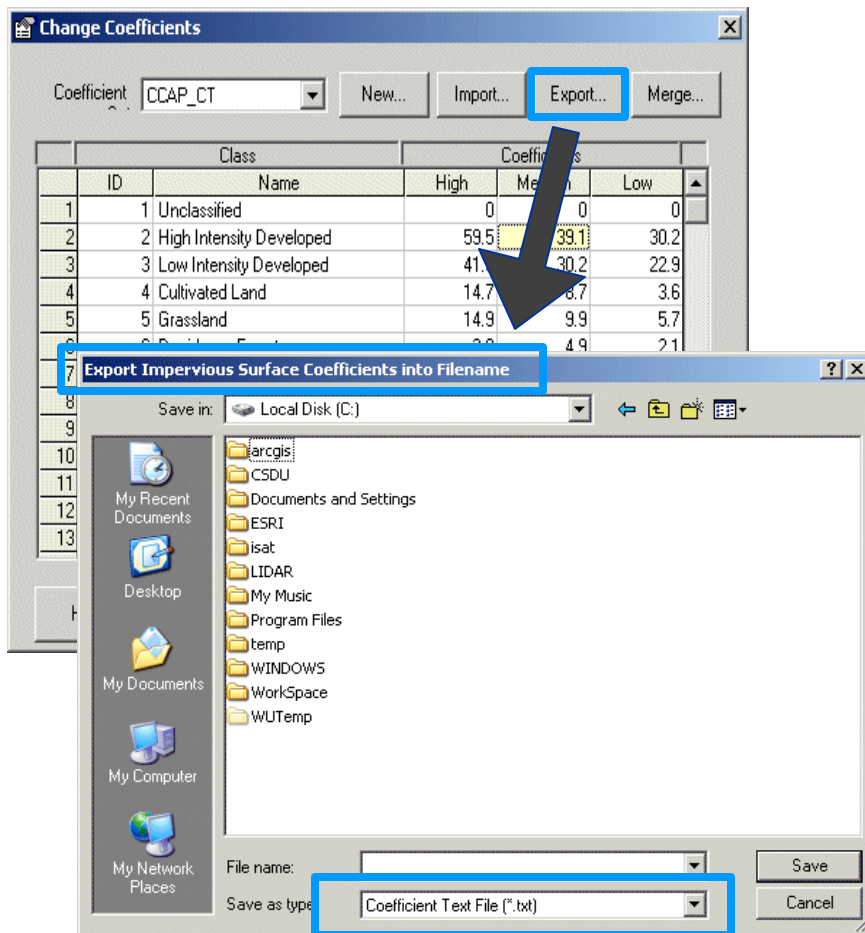
Change Coefficients: Import

When users have impervious surface coefficients in a spreadsheet or text format, they may want to import that coefficient set without entering the coefficients individually into ISAT.

The **Import** function can be used to import an impervious surface coefficient set into ISAT. The file must be a comma-separated value text file (*.csv text file).

Change Coefficients: Export

When users create new impervious surface coefficient sets within ISAT, they may want to save a coefficient set to a text file so that they can manipulate it outside of ISAT or provide it to another ISAT user.

The **Export** function can be used to export an impervious surface coefficient set to a Coefficient Text File (*.csv text file). Users can specify the location and file name for the coefficient set and access it in a text editor or spreadsheet.

ISAT Coefficient Set That Can Be Imported/Exported

7,Evergreen Forest,6.2,6.9,0.4

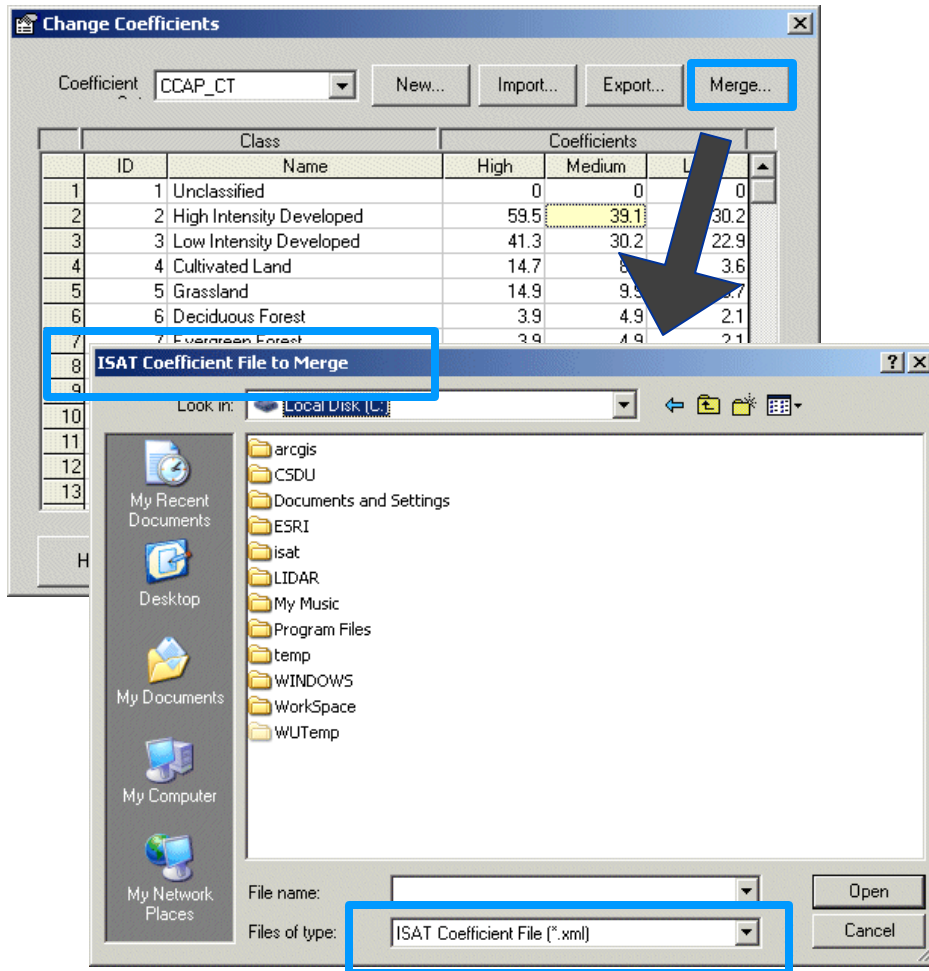Coefficients defined for high, medium, and low population densities

Description of the land cover class

The classification value within the land cover classification grid

- The Coefficient Text File is a comma-separated value (*.csv) text file
- The Coefficient Text File can be opened and edited in a spreadsheet. It must be saved as comma-delimited text file with either the *.csv or *.txt extension.

```
Value,ClassName,High,Medium,Low
1,Unclassified,0,0,0
2,High Intensity Developed,67.2,63.6,35.7
3,Low Intensity Developed,31.9,26.2,15.9
4,Cultivated Land,12.9,12.9,12.9
5,Grassland,31.8,29.8,5.9
6,Deciduous Forest,8.4,1.0,1.6
7,Evergreen Forest,6.2,6.9,0.4
8,Mixed Forest,22.2,10.8,1.1
9,Scrub/Shrub,20.0,12.1,4.2
10,Palustrine Forested Wetland,1.8,2.3,0.3
11,Palustrine Scrub/Shrub Wetland,5.7,8.3,4.8
12,Palustrine Emergent Wetland,1.9,10.5,2.3
13,Estuarine Forested Wetland,1.8,2.3,0.3
14,Estuarine Scrub/Shrub Wetland,5.7,8.3,4.8
15,Estuarine Emergent Wetland,1.9,10.5,2.3
16,Unconsolidated Shore,6.9,5.3,5.3
17,Bare Land,75.2,73.3,9.7
18,Water,0.9,1.8,0.0
19,Palustrine Aquatic Bed,0,0,0
20,Estuarine Aquatic Bed,0,0,0
21,Tundra,0,0,0
22,Snow/Ice,0,0,0
```

Change Coefficients: Merge

Coefficient sets are stored in an XML formatted file (isprops.xml). The file is located within the ArcView install directory, typically C:\ESRI\AV_GIS30\ARCVIEW\ETC. This XML file is read by ISAT to identify the coefficient sets listed in the **Coefficient** dropdown list.

The **Merge** function can be used to combine two impervious surface coefficient collections (*.xml files). All coefficient sets from a selected coefficient *.xml file are merged into the user's current coefficient *.xml file, isprops.xml. This provides a useful way to share coefficient sets between users.