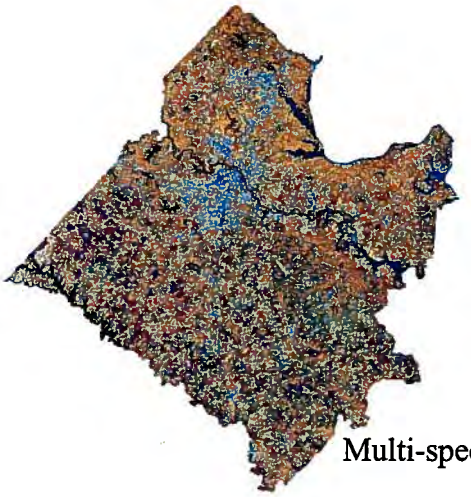
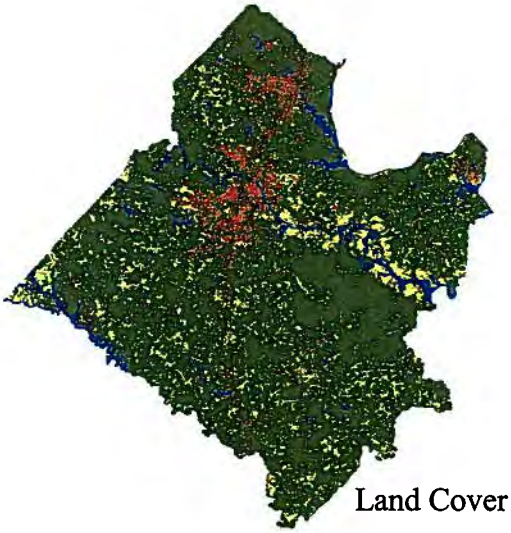
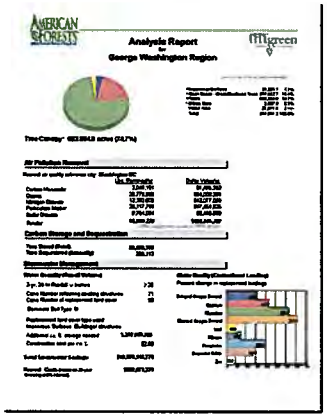
George Washington Region CITYgreen Training Exercise



Multi-spectral Images



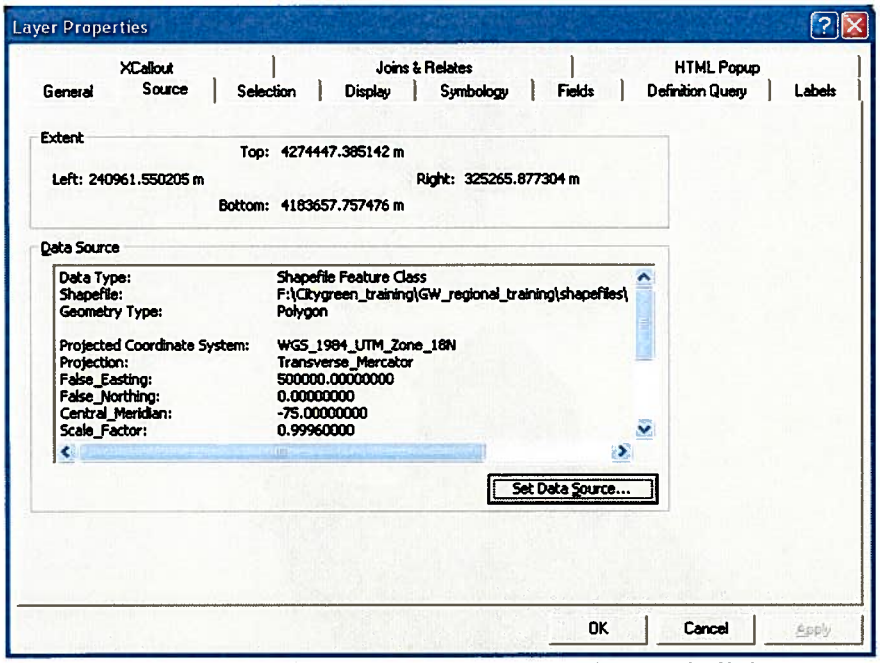
Land Cover Classification



CITYgreen Analysis

1. Importing Data

- Create a work folder in your local drive.
- Copy and Paste **GW_regional_training** folder to your newly created work folder.
- Browse to **GW_regional_training** folder in your work folder and **double-click** on **GW_regional_training.mxd** file. This will open an ArcMap project.
- Data won't be displayed on the ArcMap because the source path has changed. Therefore, we need to set the data source to the right files.
- Right click on **GWRC_Boundary_UTM → Properties →** click on the **Source** tab then click on **Set Data Source…**



- Browse to \\...***GW_regional_training\shapefiles*** and click on **GWRC_Boundary_UTM.shp** and click **Add.** Then click **OK**
- Similarly, do this to all the layers. Source path for each of the other layers are as follows.

File Names	Path
gw_2001_mosaic_clip.img	\\...\GW_regional_training\imageries
gw_2006_mosaic_clip.img	\\...\GW_regional_training\imageries
gw_2009_mosaic_clip.img	\\...\GW_regional_training\imageries
va_2001_lc_clip_utm_amfor.img	\\...\GW_regional_training\landcover
gw_2001_2006_land_cover_v01.img	\\...\GW_regional_training\landcover
gw_2006_2009_land_cover_v02.img	\\...\GW_regional_training\landcover
gw_2001_2009_cart_output_land_cover_v02.img	\\...\GW_regional_training\landcover

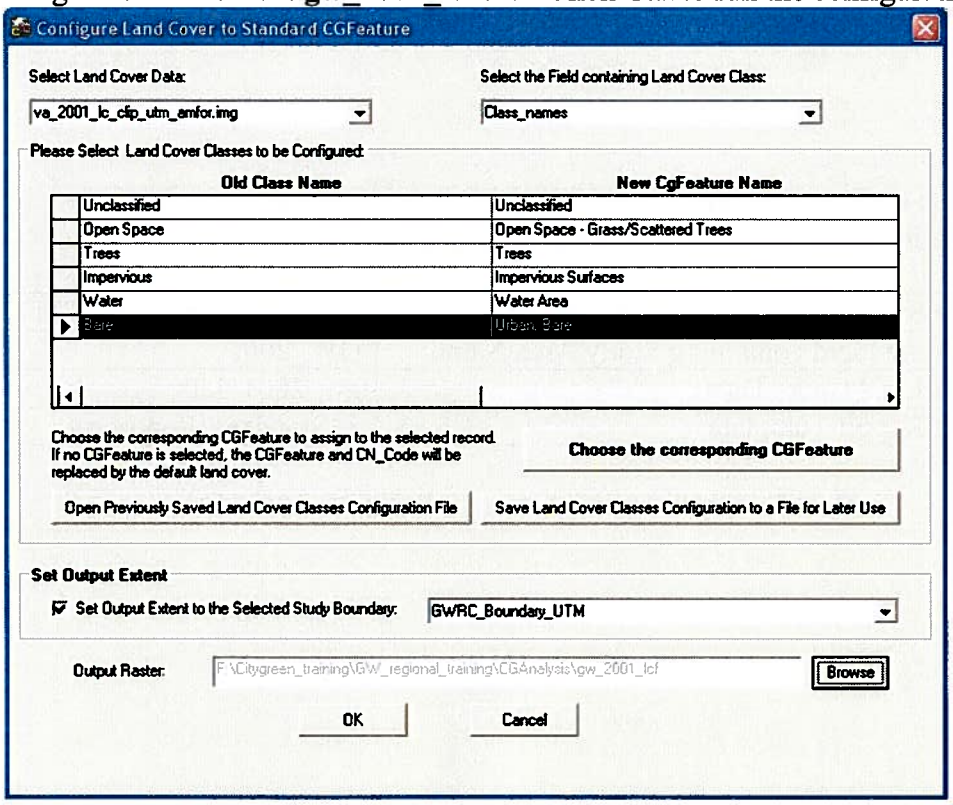
Note: Make sure that data source is set to a right file. Layer name should match with source data.

2. CITYgreen Analysis

In this step, we will configure our land cover categories to CITYgreen's categories.

- Click on **CITYgreen for ArcGIS → Configure Land Cover Map …**

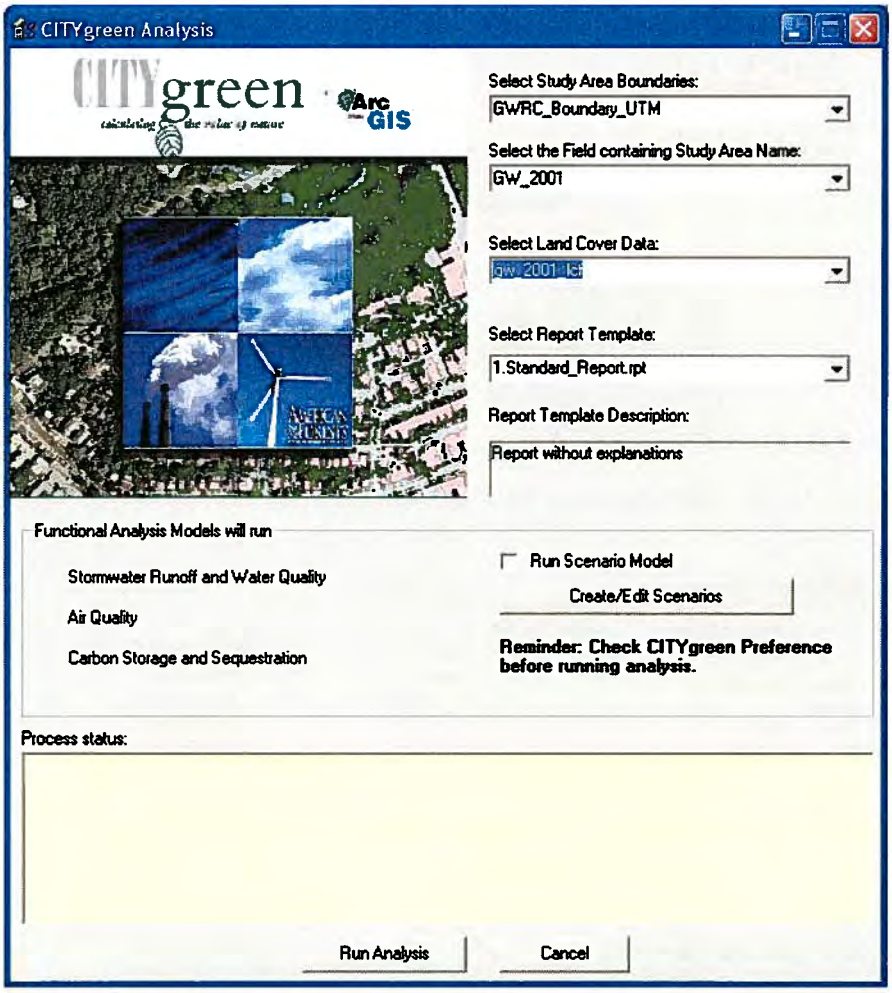
- We will run the analysis on 2001 land cover first.
- Choose **va_2001_lc_clip_utm_amfor.img** under **Select Land Cover Data:**
- Choose **Class_names** under **Select the Field containing Land Cover Class:**
- Click on each of the categories then click **Choose the corresponding CGFeature**
- Choose a corresponding land cover feature from **Choose CGFeature** window and click **OK** button to finish.
- After all the classes are assigned to **New Cgfeature Name**, check the **Set Output Extent to the Selected Study Boundary** box and choose **GWRC_Boundary_UTM**
- Click on **Browse** button to navigate to the folder where the output will be generated. Name it **gw_2001_lcf** then Click **OK** to run the configuration



Configured Land Cover

- Click on **CITYgreen for ArcGIS → CITYgreen Analysis …**
- Choose following parameters in **CITYgreen Analysis** window.

Select Study Area Boundaries:	GWRC_Boundary_UTM
Select the Field containing Study Area Name:	GW_2001
Select Land Cover Data:	gw_2001_lcf
Select Report Template:	1. Standard_Report.rpt



- Click on **Run Analysis**. Analysis will take few minutes to run. Once it is finished, a report will appear.

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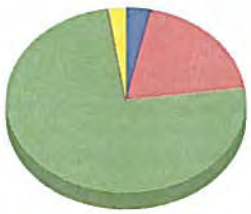
Analysis Report
for
George Washington Region 2001

CITYgreen
calculating the value of nature



Land cover in acres and percentages

Impervious Surfaces	30,324.7	3.3%
Open Space - Grass/Scattered Trees	177,052.7	19.4%
Trees	683,894.6	74.7%
Urban: Bare	2,057.5	0.2%
Water Area	21,611.8	2.4%
Total:	914,941.3	100.0%

Tree Canopy: 683,894.6 acres (74.7%)

Air Pollution Removal

Nearest air quality reference city: ***Washington DC***

	Lbs. Removed/yr	Dollar Value/yr.
Carbon Monoxide:	3,048,151	$1,495,953
Ozone:	23,775,580	$84,000,331
Nitrogen Dioxide:	12,192,605	$43,077,093
Particulate Matter:	20,117,799	$47,454,825
Sulfur Dioxide:	9,754,084	$8,418,080
Totals:	**68,888,220**	**$184,446,282**

Dollar values are based on 2009 dollars

Carbon Storage and Sequestration

Tons Stored (Total):	29,428,998
Tons Sequestered (Annually):	229,113

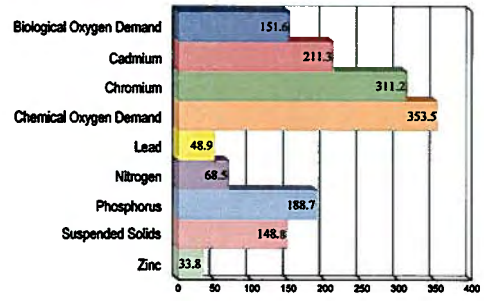
Stormwater Management

Water Quantity (Runoff Volume)

2-yr, 24-hr Rainfall in inches:	3.25
Curve Number reflecting existing conditions:	71
Curve Number of replacement land cover:	93
Dominant Soil Type: B	
Replacement land cover type used: Impervious Surfaces: Buildings/ structures	
Additional cu. ft. storage needed:	5,288,059,385
Construction cost per cu. ft.:	$2.00
Total Stormwater Savings:	**$10,576,118,770**
Annual Costs (based on 20-year financing at 6% interest)	**$922,074,229**

Water Quality (Contaminant Loading)

Percent change in contaminant loadings



- Similarly, repeat step **2. CITYgreen Analysis** for 2006 and 2009 land cover.

  Steps for the land cover configuration will be same. The only difference will be on **CITYgreen Analysis**. Fill the following parameters in **CITYgreen Analysis**:

For 2006 land cover

Select Study Area Boundaries:	GWRC_Boundary_UTM
Select the Field containing Study Area Name:	GW_2006
Select Land Cover Data:	gw_2006_lcf
Select Report Template:	1. Standard_Report.rpt

For 2009 land cover

Select Study Area Boundaries:	GWRC_Boundary_UTM
Select the Field containing Study Area Name:	GW_2009
Select Land Cover Data:	gw_2009_lcf
Select Report Template:	1. Standard_Report.rpt

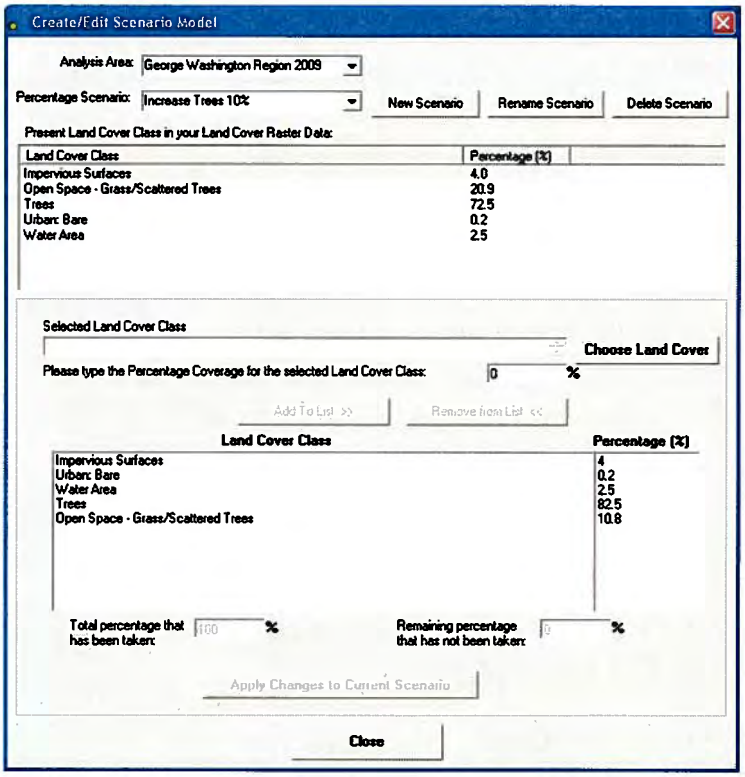
Scenario Modeling

In the next exercise, we will conduct scenario modeling and analyze the results.

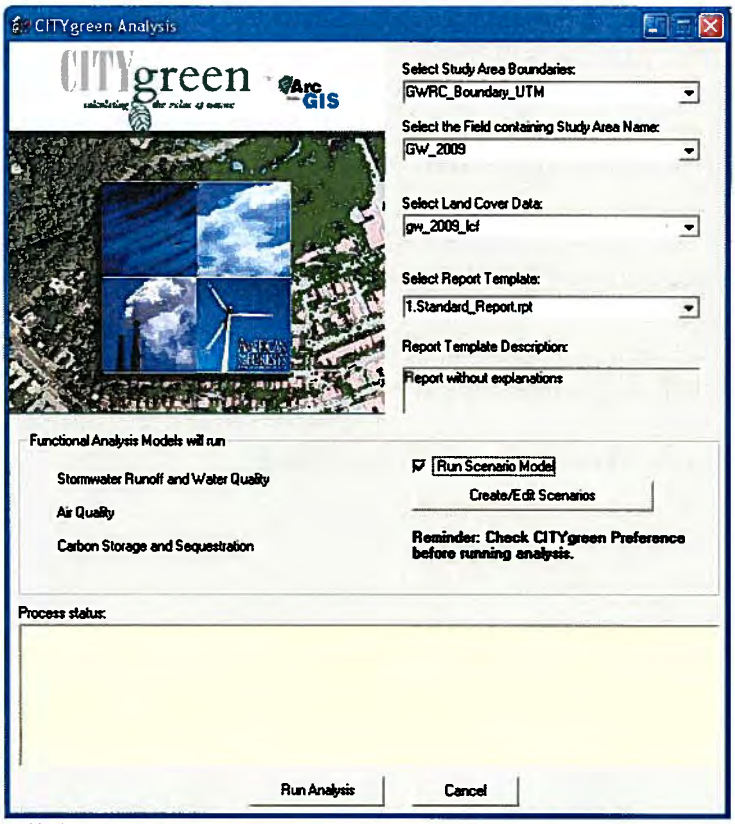
- Click on **CITYgreen for ArcGIS → CITYgreen Analysis …**
- Choose following parameters in **CITYgreen Analysis** window.

Select Study Area Boundaries:	GWRC_Boundary_UTM
Select the Field containing Study Area Name:	GW_2009
Select Land Cover Data:	gw_2009_lcf
Select Report Template:	1. Standard_Report.rpt

- Click **Create/Edit Scenarios**
- A **Create/Edit Scenario Model** window will open.
- Choose **George Washington Region 2009** for **Analysis Area:**
- Click on **New Scenario** button and name it **Increase Trees 10%** and **OK**
- Under **Land Cover Class**, click on the **Impervious Surface** then click **Add To List >>**
- Similarly, click **Urban: Bare** and **Water Area** and click **Add To List >>**
- Now, click on **Trees** then under **Selected Land Cover Class**, add **10%** to the existing trees percentage **(i.e. 82.5%)**.
- Finally, click on **Open Space – Grass/Scattered Trees** and click **Add To List >>** button. CITYgreen will automatically adjust the percent coverage of **Open Space – Grass/Scattered Trees**.
- Now click on **Apply Changes to Current Scenario** then **Close**



- Check on **Run Scenario Model**



- Click **Run Analysis**

- A scenario report will display.

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Analysis Report
for
George Washington Region 2009: Increase Trees 10%

CITYgreen
calculating the value of nature

Land cover in acres and percentages

Impervious Surfaces	36,573.0	4.0%
Open Space - Grass/Scattered Trees	98,747.1	10.8%
Trees	754,318.2	82.5%
Urban: Bare	1,828.7	0.2%
Water Area	22,858.1	2.5%
Total:	914,325.1	100.0%

Tree Canopy: 754,318.2 acres (82.5%)

Air Pollution Removal

Nearest air quality reference city: ***Washington DC***

	Lbs. Removed/yr	Dollar Value/yr.
Carbon Monoxide:	3,362,033	$1,649,998
Ozone:	26,223,855	$92,650,208
Nitrogen Dioxide:	13,448,131	$47,512,927
Particulate Matter:	22,189,415	$52,341,454
Sulfur Dioxide:	10,758,504	$9,284,926
Totals:	**75,981,938**	**$203,439,513**

Dollar values are based on 2009 dollars

Carbon Storage and Sequestration

Tons Stored (Total):	32,459,429
Tons Sequestered (Annually):	252,705

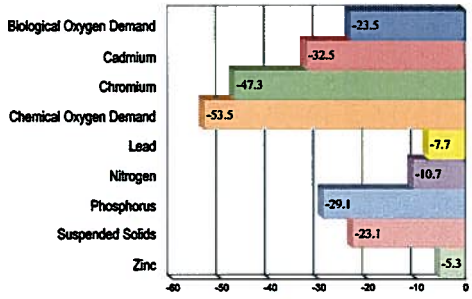
Stormwater Management

Water Quantity (Runoff Volume)

2-yr, 24-hr Rainfall in inches:	3.25
Curve Number reflecting existing conditions:	71
Curve Number of replacement land cover:	68
Dominant Soil Type: B	
Replacement land cover type used: Impervious Surfaces: Buildings/ structures	
Additional cu. ft. storage needed:	-573,108,169
Construction cost per cu. ft.:	$2.00
Total Stormwater Savings:	**$-1,146,216,338**
Annual Costs (based on 20-year financing at 6% interest)	**$99,932,364**

Water Quality (Contaminant Loading)

Percent change in contaminant loadings



Creating Data

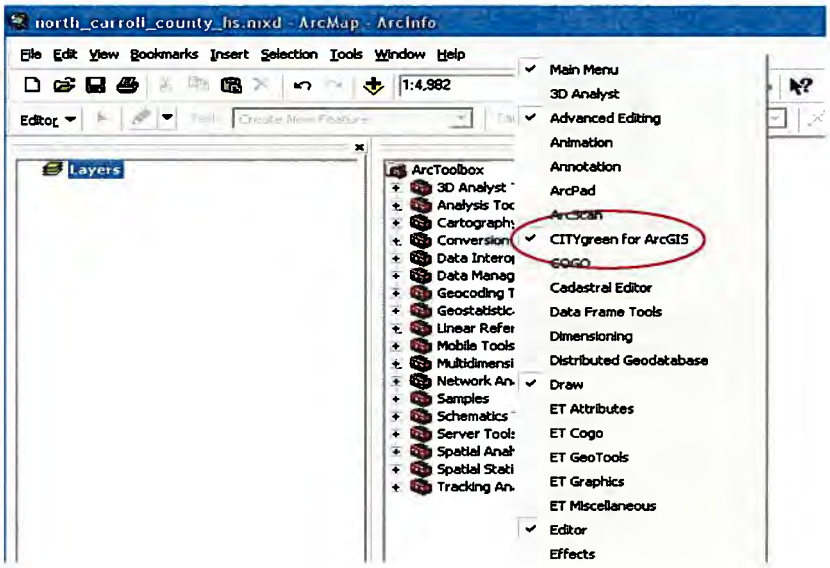
- Open **ArcMap** 

by selecting it from the program menu or desktop shortcut.

- Select **A new empty map**. Click **OK**.

- Save your project by clicking the **Save** button  or by clicking **File → Save**. When prompted for a location, browse to the location where you will store the files for this project. Save the project as **n_carroll_county_hs.mxd**.

- Right click on the empty section next to the **Help** button and select **CITYgreen for ArcGIS.** Then select **Editor, Spatial Analyst,** and **Advanced Editing** .

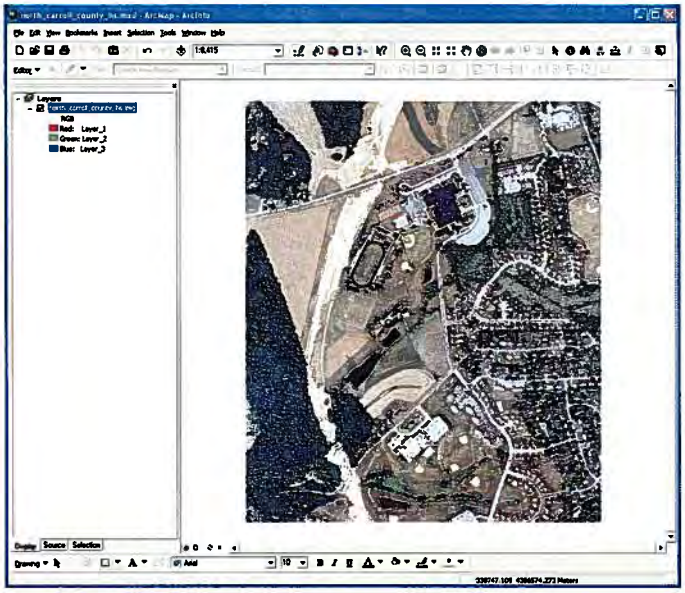


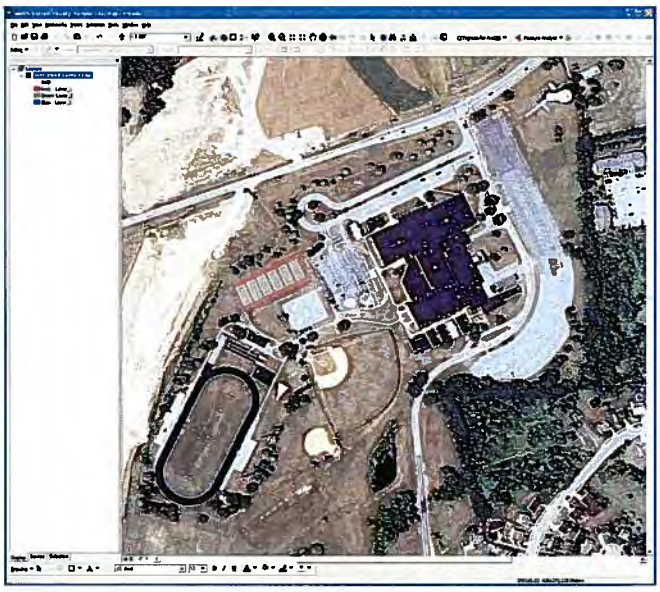
Loading your Basemap Image

- Click the **Add Data** (yellow diamond with a black plus sign). Browse to \\...***Small_Area_Analysis******imagery*** and click on **north_carroll_county_hs.img** (once). Then click **Add**.

or

You can also drag-and-drop **north_carroll_county_hs.img** from Windows Explorer to the **ArcMap** viewer.



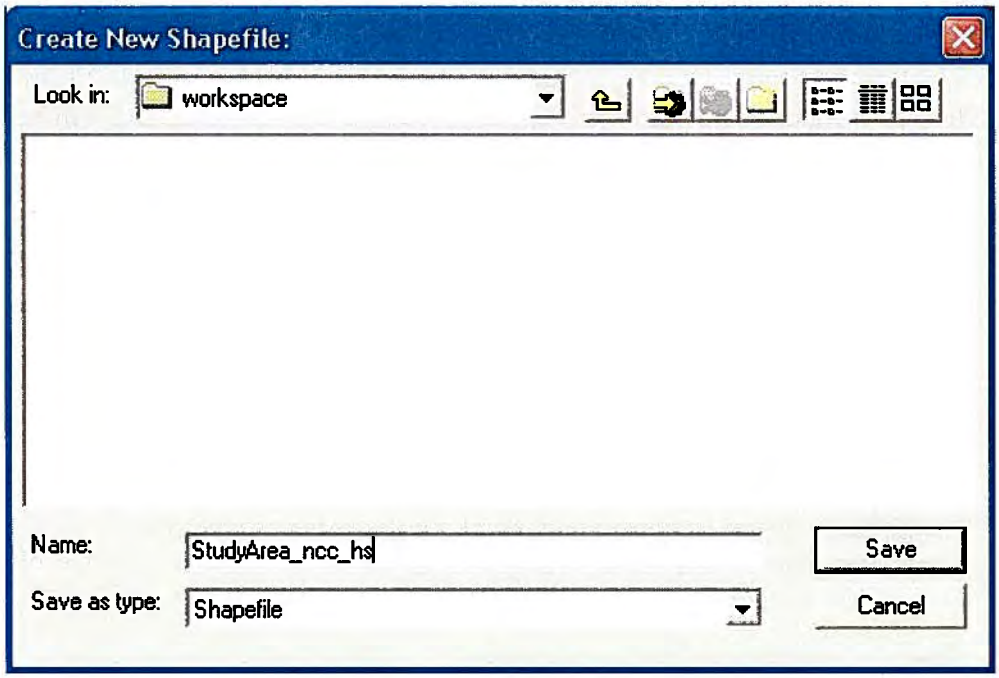


- Click on the **Zoom** button  to zoom in closer to the school.

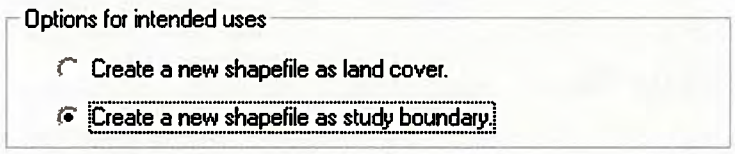
Creating a Boundary Shapefile

- Click **CITYgreen for ArcGIS** toolbar, then **Create New Shapefile….**

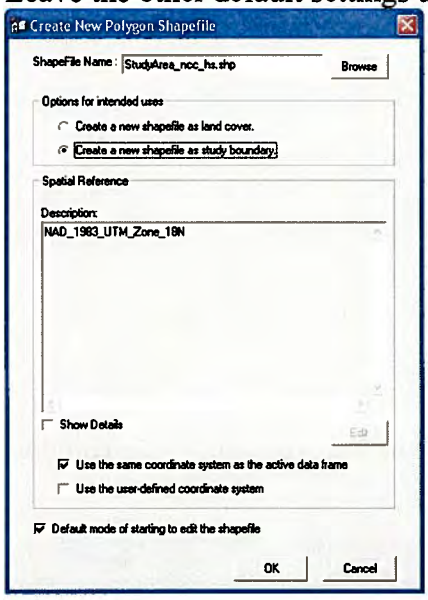
- Browse to the location where you will store the boundary shapefile and give it the name **StudyArea_ncc_hs.** Click **Save**.



- Click the option **Create a new shapefile as study boundary**. By selecting this option a new field in the attribute table is created called **StudyArea_ncc_hs** where you will eventually enter a unique name for your area of interest.



- Leave the other default settings unchanged. Click **OK**.

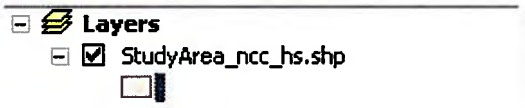


- The new boundary shapefile will appear in the table of contents and will be in edit mode.

- To create a study area boundary, draw polygon around the site you want to study with the **Sketch** tool, which looks like a pencil and is next to the pointer in the **Editor** toolbar.

- Start digitizing (drawing) the polygon by slowly clicking around an object. When finished, **double click** on the last point, which will end the drawing. A polygon will appear in the Viewer.

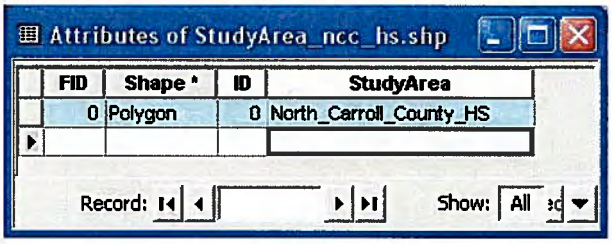
- Change the polygon to transparent. Click on the **color** box below **StudyArea_ncc_hs.shp** in table of contents.



- A **Symbol Selector** will open. On the **Options** click on **Fill Color** drop down menu and select **No Color**. Then click on **Outline Color** drop down menu and select a red color. Lastly, on **Outline Width**, increase the size to **2**. Click **OK**.

- Right-click on the shapefile in the Table of Contents. Click **Open Attribute Table** from the menu of options. This will display a table showing a record of the study area boundary you just created.

- Click in the **Studyarea** field and enter the name of your study site **North_Carroll_County_HS** (don't need ~~parenthesis~~ when typing in directly) and hit **Enter**.



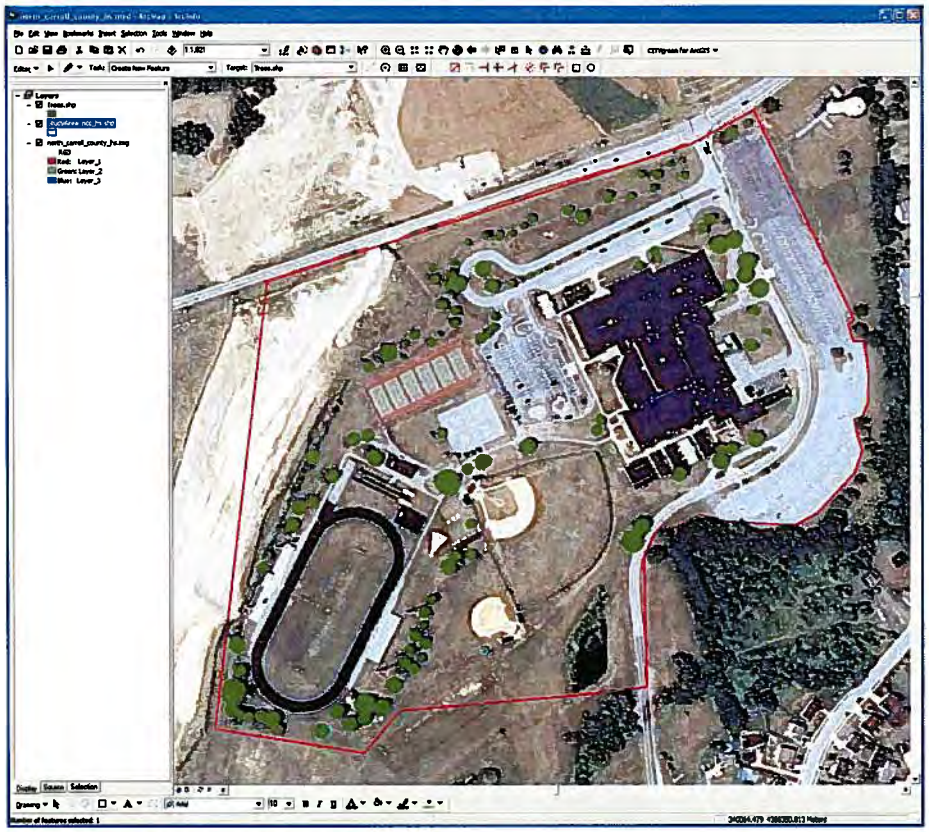
- Click on the **Editor** toolbar drop-down menu → click **Stop Editing**

- Save Edits and close the **Attribute Table**.

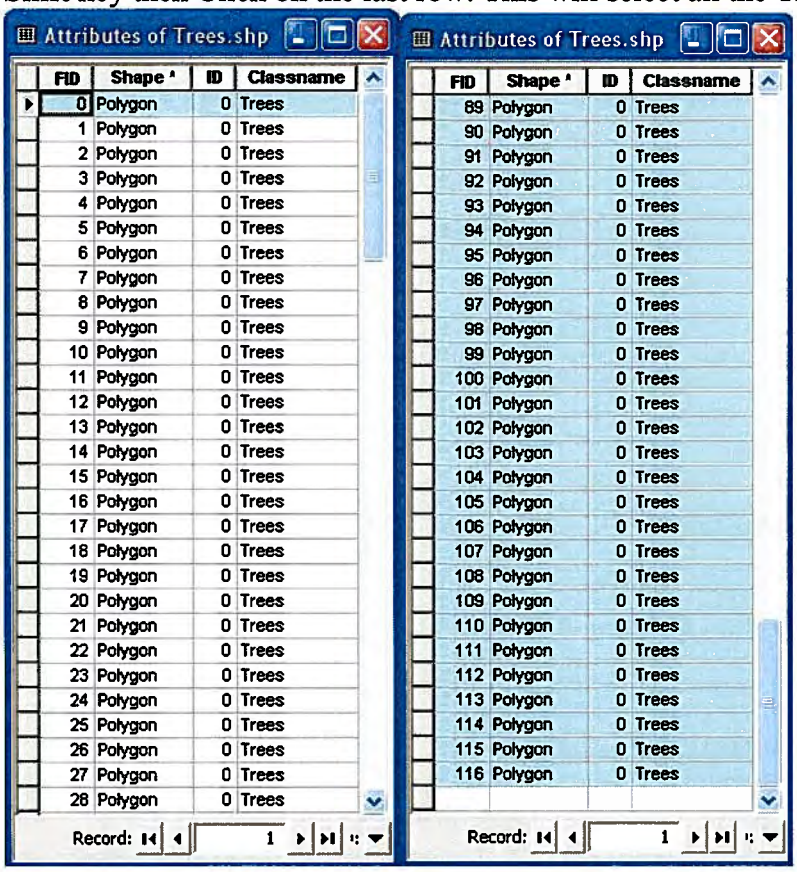
Create Canopy Layer

- Click **CITYgreen for ArcGIS** toolbar then click **Create New Shapefile…**
- Browse to the folder where the boundary shapefile is saved.
- Enter the file named **Trees** and click save
- Click **Create a new shapefile as land cover** under **Options for intended uses**.
- Leave the **Default** settings
- Click **OK**
- A new **Trees.shp** appears in the Table of Contents
- Click on the **Color box** under Trees.shp and choose a Green color.
- Click on the **Circle** tool from **Advanced Editing** toolbar.

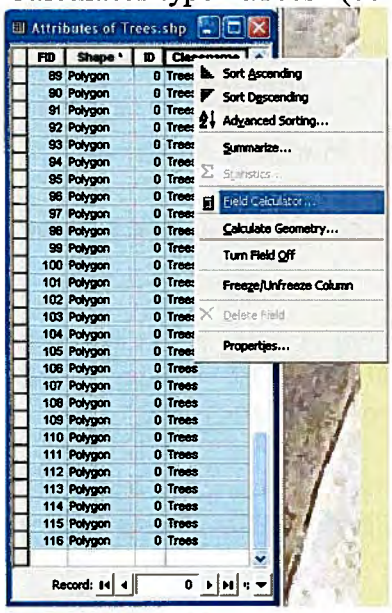
- Draw circles on top of all the tree crowns in the study area. When drawing, start from the middle of the tree canopy, drag the circle out to the desired size and click once to end the drawing.

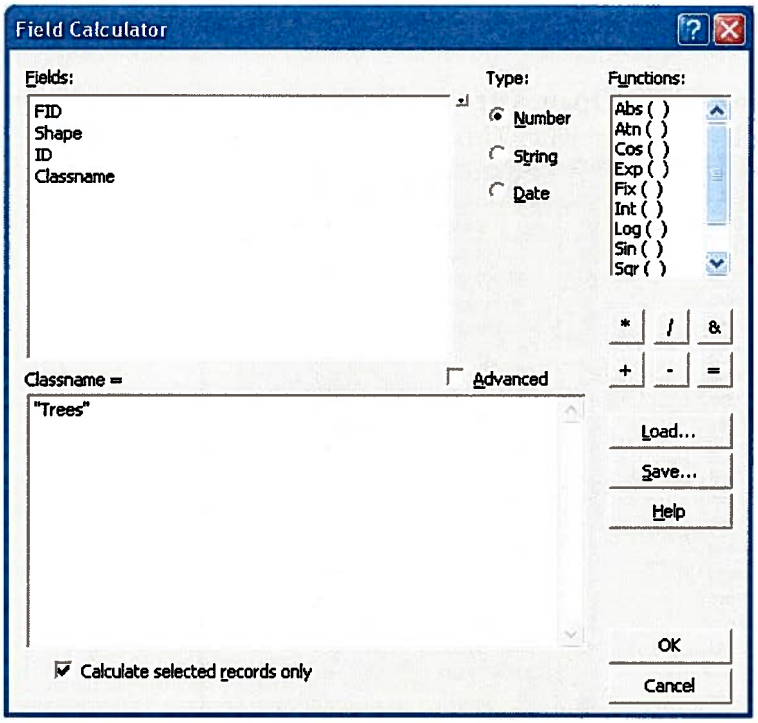


- Right click on **Trees.shp → Open Attribute Table →** Click on the 1st row. Hold **Shift** key then Click on the last row. This will select all the Tree features.



- Right click on **Classname** column → select **Field Calculator…** → in the **Field Calculator** type **"Trees"** (be sure to include the parenthesis). Click **OK**.





- Select **Editor → Stop Editing →** Save Edits.

Creating Non Canopy Layer

- Click **CITYgreen for ArcGIS → Create New Shapefile… →** Browse to the work folder and name it **non_canopy**. Leave checked **Default** settings. Click **OK.**

- New **non_canopy.shp** appears in the Table of Contents.

- Select the **Pencil** tool on **Editor** toolbar and digitize all the buildings. Start from one corner of the house and trace around it.

- Double click to finish each drawing, continue to draw all the buildings.

- Once all buildings are digitized, Right click on the **non_canopy.shp** in the Table of Contents and open **Attribute Table**.

- Click on the 1st row and press **Shift** key and **down arror** to select all the rows → Right click on **Classname** column → **Field Calculator →** "buildings" (be sure to include the parenthesis) → Click **OK**. Close the **Attribute Table**.

- Digitize sidewalks and pavements → Open **Attribute Table →** Select newly formed rows → Right click on **Classname → Field Calculator →** "pavement" (be sure to include the parenthesis). Click **OK.**

- Close **Attribute Table**.

- Digitize bare grounds like baseball diamonds. → Open **Attribute Table** → Select all new rows → Highlight **Classname** column → Right click → **Field Calculator** → "bare" (be sure to include the parenthesis). Click **OK.**

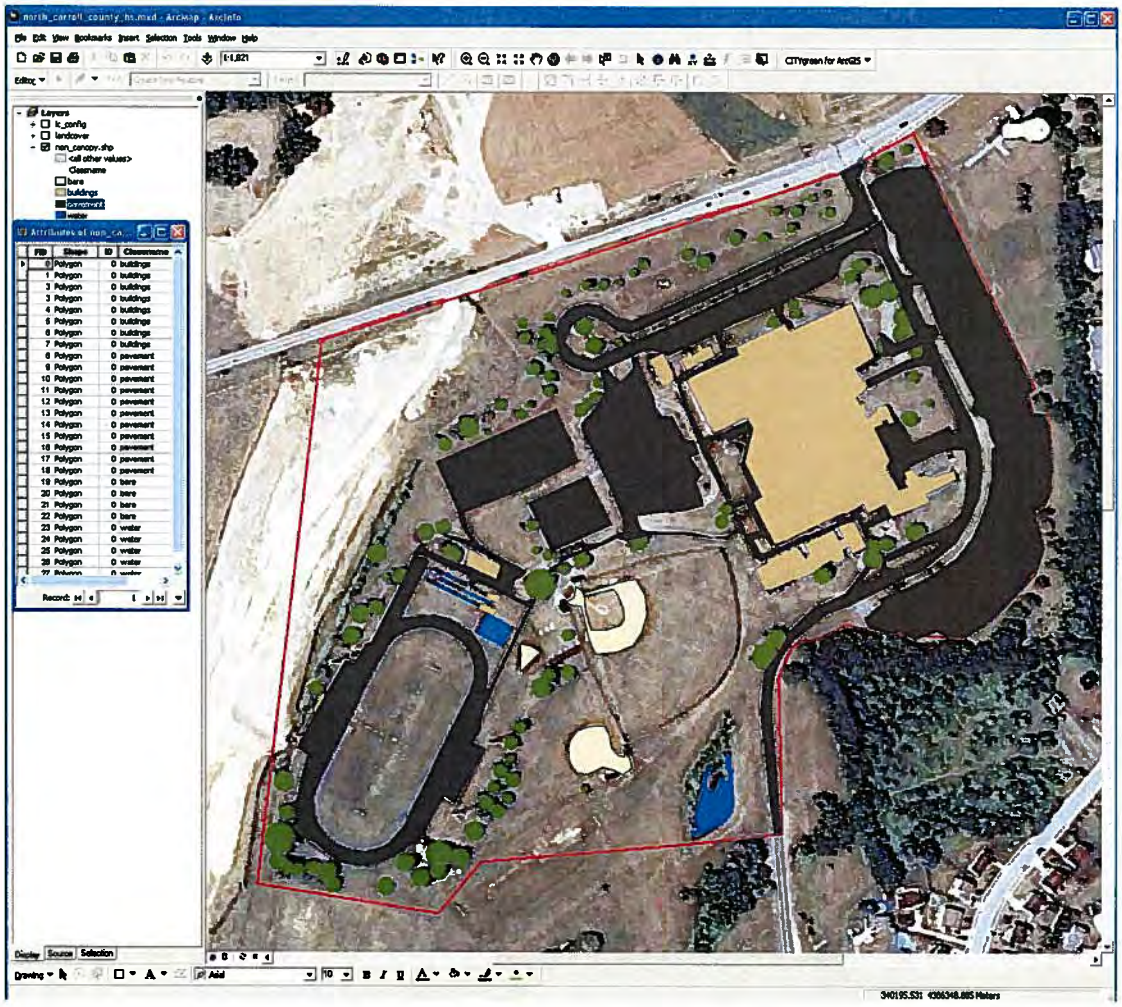
- Close **Attribute Table**

- Digitize all the water features → Open **Attribute Table** → Select all new rows → Highlight **Classname** column → Right click → **Field Calculator** → "water". Click **OK**.

- Close **Attribute Table.**

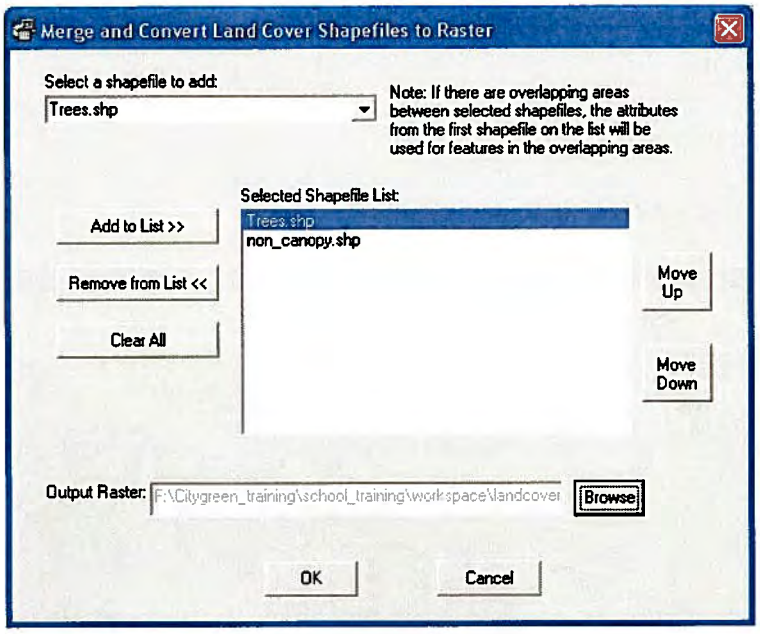
- Leave dominant landcover (grass) undigitized.

- Select **Editor → Stop Editing →** Save Edits



Convert Vector to Raster for Analysis

- Select **CITYgreen for ArcGIS → Merge and Convert Shapefile to Raster …**
- From **Select a shapefile to add:** drop-down menu select **non_canopy.shp → Add to List →** select **Trees.shp → Add to List →** Move up **Trees.shp → Output Raster:** Browse to your work folder and name the output raster to **landcover**. Click **OK**



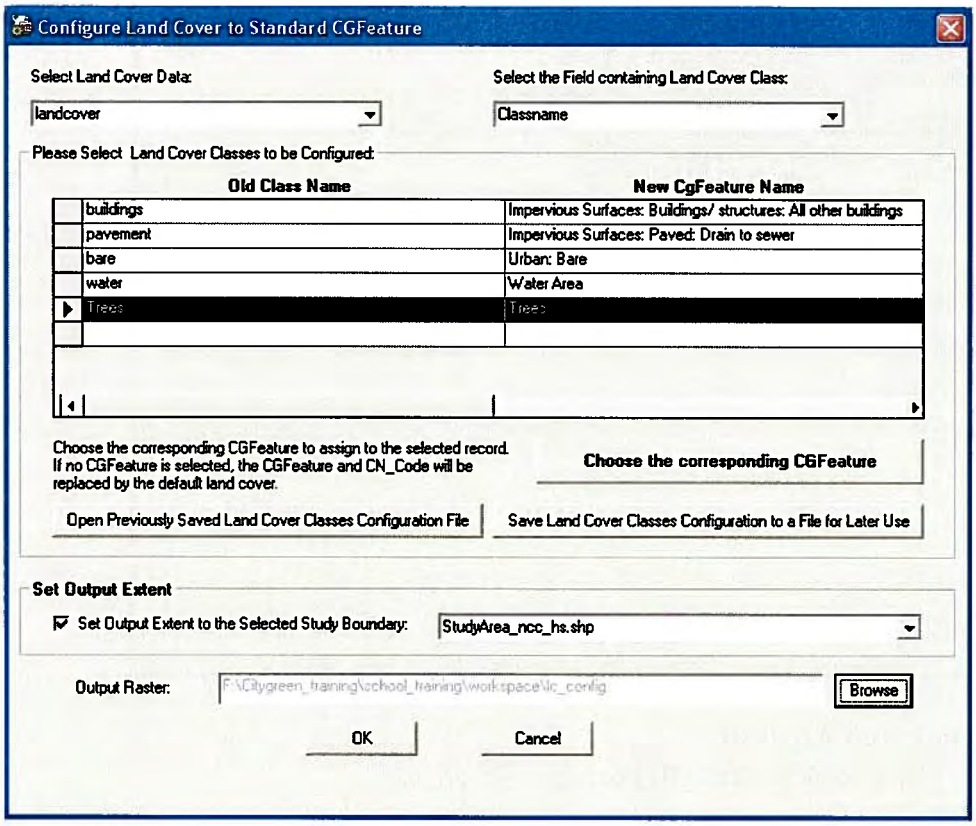
- New **landcover** raster classification will appear in the viewer.
- Select **CITYgreen for ArcGIS → CITYgreen Preferences …**
- Click **Land Cover Types**
- Set **Default Land Cover Description** to **Open Space – Grass/Scattered Trees** (most of the times, it is already selected by default). Click **OK**.

Configure Land Cover Map

- Select **CITYgreen for ArcGIS → Configure Land Cover Map …**

  Select Land Cover Data: landcover

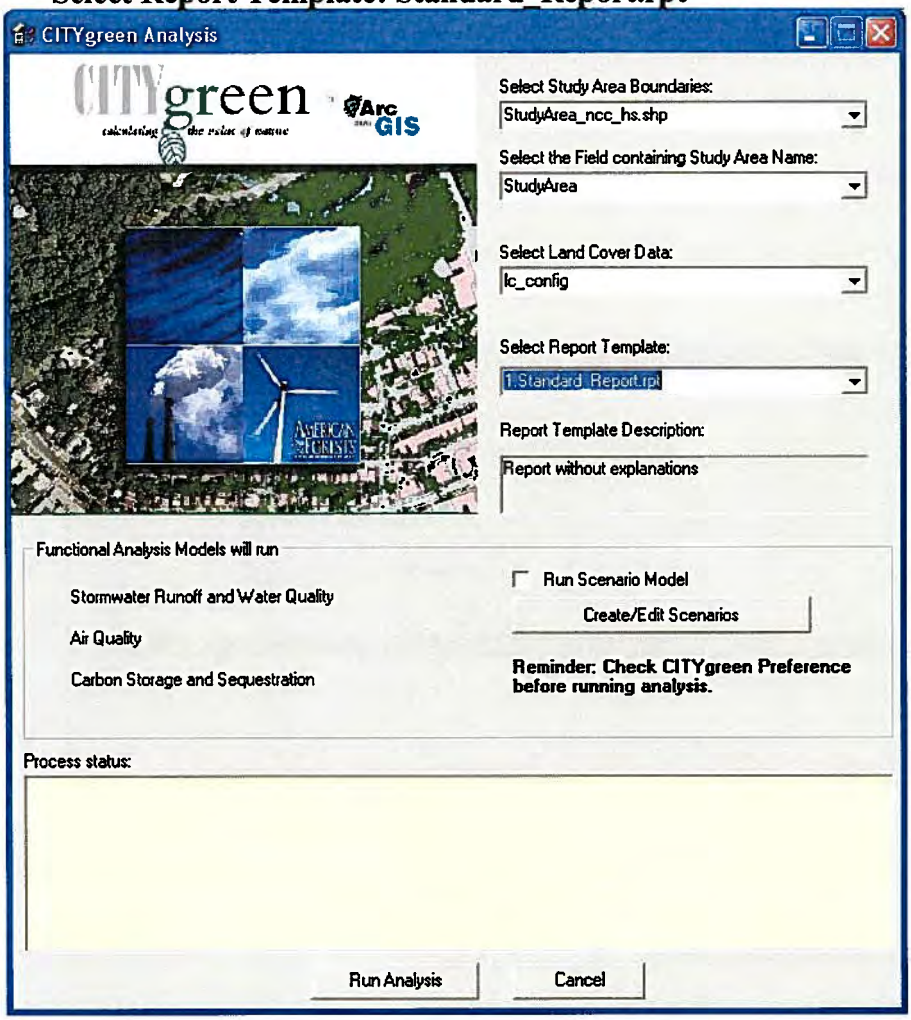
- **Select the Field containing Land Cover Class: Classname**
- Click on **buildings** row → Click **Choose the corresponding CGFeature → buildings = Impervious Surfaces: Buildings/structures: All other buildings** → Click **OK.**
- Click on **pavement** row → Click **Choose the corresponding CGFeature → pavement = Impervious Surfaces: Paved: Drain to Sewer** → Click **OK.**
- Click on **bare** row → Click **Choose the corresponding CGFeature → bare = Urban: Bare** → Click **OK.**
- Click **water** row → Click **Choose the corresponding CGFeature → water = Water Area** → Click **OK.**
- Click **Trees** row → Click **Choose the corresponding CGFeature → Trees = Trees** → Click **OK.**
- **Set Output Extent** to **StudyArea_ncc_hs.shp**
- Save output to your work folder as **lc_config**
- Click **OK.**



- New **lc_config** land cover will appear in the Table of Contents and viewer.

CITYgreen Analysis

- Select **CITYgreen for ArcGIS → CITYgreen Analysis**
- **Select Study Area Boundaries: StudyArea_ncc_hs.shp**
- **Select the Field containing Study Area Name: StudyArea**
- **Select Land Cover Data: lc_config**
- **Select Report Template: Standard_Report.rpt**



- Click **Run Analysis**
- CITYgreen **Standard_Report.rpt** will appear.

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Analysis Report
for
North_Carroll_County_HS

CITYgreen

Land cover in acres and percentages

Impervious Surfaces: Buildings/ structures: All other buildings	3.9	8.7%
Impervious Surfaces: Paved: Drain to sewer	11.7	26.3%
Open Space - Grass/Scattered Trees	25.9	58.1%
Trees	2.2	5.0%
Urban: Bare	0.6	1.3%
Water Area	0.3	0.7%
Total:	44.6	100.0%

Tree Canopy: 2.2 acres (5.0%)

Air Pollution Removal

Nearest air quality reference city: ***Baltimore***

	Lbs. Removed/yr	Dollar Value/yr.
Carbon Monoxide:	6	$3
Ozone:	79	$278
Nitrogen Dioxide:	53	$188
Particulate Matter:	73	$172
Sulfur Dioxide:	26	$22
Totals:	**236**	**$663**

Dollar values are based on 2009 dollars

Carbon Storage and Sequestration

Tons Stored **(Total)**:	**95**
Tons Sequestered **(Annually)**:	**1**

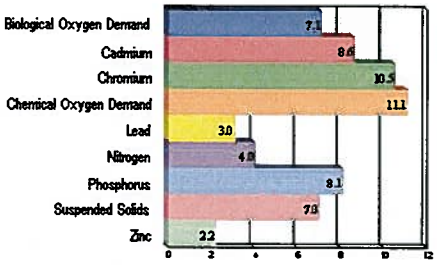
Stormwater Management

Water Quantity (Runoff Volume)

2-yr, 24-hr Rainfall in inches:	3.25
Curve Number reflecting existing conditions:	79
Curve Number of replacement land cover:	81
Dominant Soil Type: **B**	
Replacement land cover type used: Impervious Surfaces: Buildings/ structures	
Additional cu. ft. storage needed:	17,849
Construction cost per cu. ft.:	$2.00
Total Stormwater Savings:	**$35,699**
Annual Costs (based on 20-year financing at 6% interest)	**$3,112**

Water Quality (Contaminant Loading)

Percent change in contaminant loadings



- Click **Export** on the upper left hand corner of the report and save the report as **north_carroll_county_hs_report.pdf**

CITYgreen Workshop Attendees					
Name		Representing	Phone	E-mail	**Lunch**
Kyle Conboy	GIS Coordinator	King George County	540-775-8558	kylec@co.kinggeorge.state.va.us	chicken
Susan Williams	GIS Analyst	Stafford County	540-358-4008	SWilliams@co.stafford.va.us	chicken
Mary Bullington	GIS Analyst	Stafford County	540.658.8668	mbullington@co.stafford.va.us	chicken
Mike Sienkowski	GIS Analyst	Stafford County	540-658-4137	msienkowski@co.stafford.va.us	chicken
Barbara White	Urban & Community Forestry Partnership Coordinator	DOF	434-220-9041	Barbara.White@dof.virginia.gov	beef
Dave King	Assistant Director of Public Works	City of Fredericksburg	(540) 372-1023	dking@fredericksburgva.gov	beef
Tina Kolodziej	GIS Specialist	Spotsylvania County	(540) 507-7432	TKolodziej@spotsylvania.va.us	chicken
Sandra Palmer	GIS Technician	Spotsylvania County	(540) 507-7279	spalmer@spotsylvania.va.us	beef
Andrew Deci	Planner	Spotsylvania County	(540)-507-7434	adeci@spotsylvania.va.us	chicken
Mike Lehman	Director of CITYgreen Software	American Forests	(800) 368-5748 ext. 212	mlehman@amfor.org	beef
Binesh Maharjan	GIS/Image Analyst Specialist	American Forests	(800) 368-5748 x211	bmaharjan@amfor.org	chicken
Angeline Pitts	County Planner	Caroline County	(804) 633-4303 ext 1195	apitts@co.caroline.va.us	chicken
Ted Lambert	Environmental Inspector	Caroline County	(804) 633-4303	tlambert@co.caroline.va.us	chicken
Samantha Kinzer	Regional Planner	NVRC	703-642-4636	skinzer@novaregion.org	chicken
Jamie Brunkow	Stewardship Coordinator	FOR	540-373-3448	jamie.brunkow@riverfriends.org	veggie
Kevin Byrnes	Director of Regional Planning	GWRC	(540) 373-2890	byrnes@gwregion.org	beef
Laurel Hammig	Regional Planner	GWRC	540-373-2890	hammig@gwregion.org	chicken
Maria Gannett	Intern/Student	GWRC/UMW	540-373-2890	gannett@gwregion.org	veggie

CITYgreen Class Roster

CITYgreen™ Training Workshop Evaluation
Fredericksburg, VA 3/5/2010

Please give us your feedback on this training. Consider the level of information, time spent on various subjects, equipment, software, etc.

1. WHAT DID YOU LIKE ABOUT THE TRAINING?

- I liked how interactive the training was. I also liked that the data was local.
- The training was very logical- provided a good background on what the software could do, how it was formulated, and how to use it.
- warm and knowledgable instructors. Hands on training with software. Step-by-step instruction. Using real-life scenarios.
- I liked the hands on part of the training and the fact that it went efficiently and fast.
- Simple orientation to the science behind the tool and focus on using the tool analytically to measure/forecast impacts of different land use/land cover policies (e.g. reducing impervious surface area or increasing tree canopy)

2. WHAT COULD BE IMPROVED?

- Nothing comes to mind.
- Having trainees provide their own data and/or project areas for analysis
- I don't see a great deal to improve.
- I feel like I could now successfully run the citygreen software, except for the fact that we did not go over how to retrieve the necessary data files at all. That is often one of the most difficult parts of GIS and I think it would be useful to cover.
- Integration of some of NOAA's intro class on the basics of remote sensing so that people have some rudimentary understanding of the science behind the data capture.

3. IS THERE ANYTHING THAT YOU WOULD LIKE TO SEE ADDED TO CITYgreen SOFTWARE?

- Not at this point.
- A stand-alone software option, outside of ArcGIS. Not all of our potential users have access or the experience to use the add-on for ArcGIS.
- we know that trees cool the air temperature. Any way to translate that into real dollars (e.g. electrical energy savings)?
- I like the software, the only thing I can think of that would be good to change is the comparative storm water management number. The negative sign when there is money saved could be confusing to explain. Maybe the way that statistic is defined could be redone.
- If impervious surface areas could sub-classified into paved and other, having some way of estimating differential water quality impacts from these areas (roads and parking lots as opposed to building rooftops) would be helpful.

4. HOW DID YOU LIKE THE FACILITY AND THE ARRANGEMENTS?

- Facilities were top notch.
- The facility was great. The computer lab was appropriate and worked well for the type of training that took place. Lunch was great.
- Facility and arrangements, including lunch, were excellent.
- The UMW classroom was very nice. I liked how the room was set up in a semicircle and I enjoyed the lunch.
- Very comfortable & accommodating.

OTHER COMMENTS:

- Workshop was informative and interesting.
- I appreciated the vendor providing copies of the software to our host facility. It was a nice way of providing compensation for the use of the space.
- Great workshop.
- I liked the training and the software overall, I am excited to try and use it on my own.
- American Forests staff has been very helpful in revising imagery data to help present a consistent time-series of data for regional and local analysis.