EXERCISE 9: CONVERTING FUSION FILES TO ARCGIS FORMAT

Document Updated: July 2007
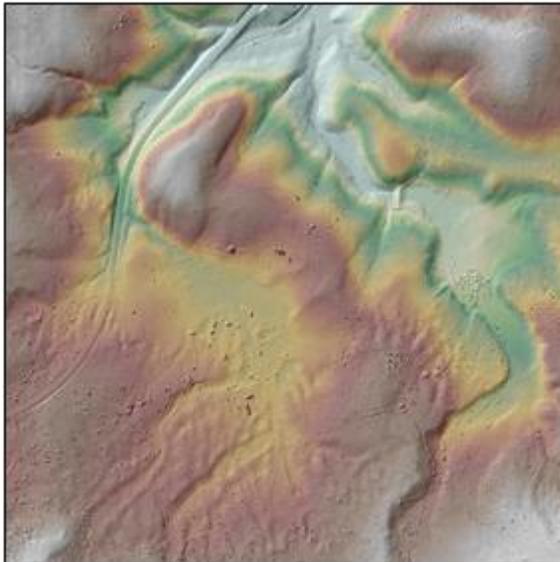
Introduction

In this exercise, you will export your LIDAR surface and tree canopy models from Fusion software into ArcGIS and then derive additional surface information from these data for analysis.

Prerequisites

- The data files produced in exercises 6, 7 and 8
- **lub_samples.shp** (a shapefile of random sample locations)
- Spatial Analyst Extension loaded in ArcMap

Overview of Major Steps

I. Export .dtm files using Fusion DTM export utility
II. Load Spatial Analyst Extension
III. Import Fusion export files into ArcGIS (DTM files & XYZ file)
IV. Create analysis surfaces in ArcGIS (Slope, Aspect & Curvature)
V. Optional: Drilldown attributes using sampling techniques

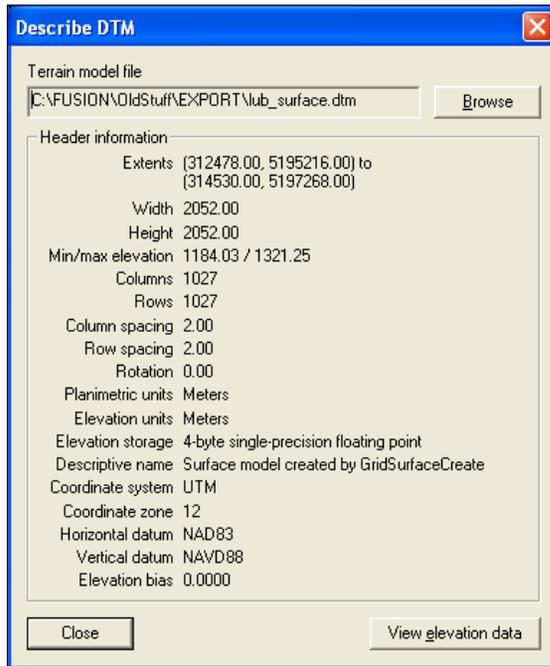## Procedure

I.) Export Fusion DTM Files (BE Surface Model & Tree Canopy Height Model)

1. Start Fusion: click **Start | Programs | FUSION | FUSION**
2. Click the **Image** button on Fusion side-toolbar and select the **lub_ref.bmp** that you created in Exercise-6, click **Open**.
3. Activate the check box next to the **Image** button to see the loaded reference image.
4. Click the **Bare Ground** button on the Fusion side-toolbar and browse to select the **lub_surface.dtm** you created in exercise 7. Accept default settings and click **OK**.
5. Activate the check box next to the **Bare Ground** button to see the loaded surface DTM.
6. Let's export the ground surface DTM, and then the tree canopy height DTM, for use in Ar-cGIS, but first we'll explore a Fusion utility that describes our surface DTM. Click **Tools | Terrain Model… | Describe Terrain Model…** to open the **Describe DTM** dialog box:
    7. Click the Browse button and navigate to the **lub_surface.dtm** file and click

The FUSION-generated Bare Earth Model displayed in ArcMap.

Note: you actually don't need to load anything into FUSION to use the export commands from the Tools menu.

Describe DTM

Terrain model file

C:\FUSION\OldStuff\EXPORT\lub_surface.dtm   Browse

Header information

Extents (312478.00, 5195216.00) to
         (314530.00, 5197268.00)
Width   2052.00
Height   2052.00
Min/max elevation 1184.03 / 1321.25
Columns 1027
Rows   1027
Column spacing 2.00
Row spacing   2.00
Rotation   0.00
Planimetric units Meters
Elevation units   Meters
Elevation storage 4-byte single-precision floating point
Descriptive name   Surface model created by GridSurfaceCreate
Coordinate system UTM
Coordinate zone   12
Horizontal datum   NAD83
Vertical datum   NAVD88
Elevation bias   0.0000

Close   View elevation data

⚠ *Note: There is **NO** indication of processing while the **Export Model** utility is running.*
You will receive a message of successful completion after the process has finished.

fusion

⚠ Created ASCII raster grid format file:
C:\FUSION\OldStuff\EXPORT\EX-09Arc\lub_surfgrid.asc

OK

Open.

8. View the contents of this dialog box, these are the parameters for the surface DTM. Click **View Elevation Data**, set the **Contour Interval** to **10**, click **Redraw**.

9. Query around with the mouse cursor by moving it over contours within the display window and observe changes in coordinates and elevations.

10. Bump the **Contour Interval** down to **1**, click **Redraw** (this step and the previous are strictly for observation of the DTM files). Now let's export our surface.

11. Click **Close** twice to close the **View model elevation** and **Describe DTM** dialog boxes.

12. Click **Tools | Terrain Model | Export Model**.

13. Click the first (upper) browse button and navigate to **lub_surface.dtm** (input)

14. Click the second (lower) browse button and navigate to an output directory, call the output file **lub_surface.asc**.

15. Select **ASCII grid file** for the output format

16. Click **Export**. Click **OK** to close the notification dialog.

17. Again, click **Tools | Terrain Model | Export Model**.

18. Click the first (upper) browse button and navigate to **lub_CHM.dtm** (input)

19. Click the second (lower) browse button and navigate to an output directory, call the output file **lub_CHM.asc**.

20. Select **ASCII grid file** for the output format

21. Click **Export**. Click **OK** to close the notification dialog.

Note: There is also a command line program called DTM2ASCII that does the .DTM to Arc ASCII raster conversion from the command line. This tool will select integer or float formats depending on the precision in the .DTM file.

You have now exported both the bare ground surface DTM and the Tree Canopy Height Model DTM from the previous Fusion exercises. Now let's import these ASCII grid files into ArcGIS
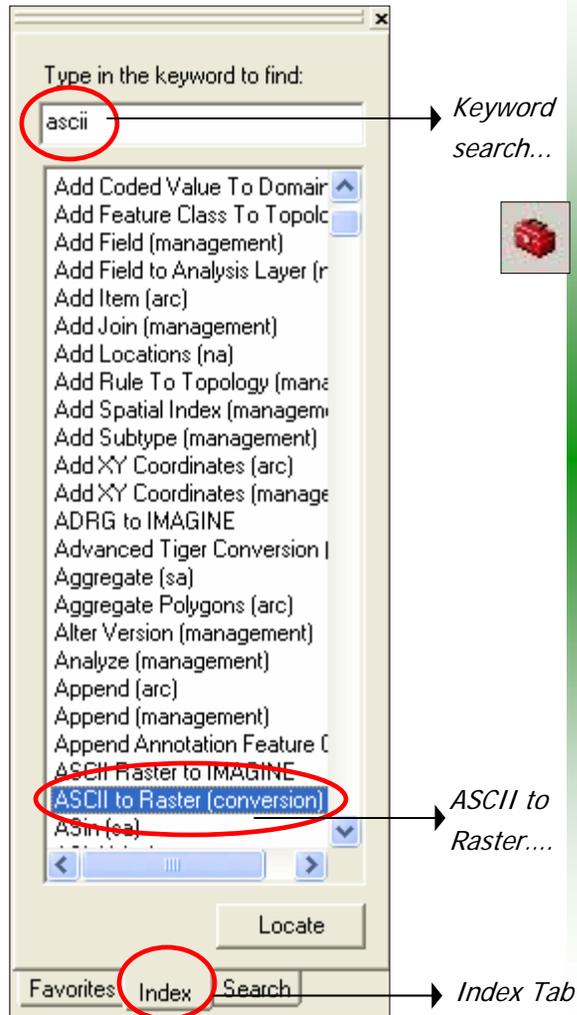
II.) Load the Spatial Analyst Extension

If you already have Spatial Analyst loaded you may skip this section and move on to the next section.

1. Open a new empty ArcMap Document. Click **Start | All Programs | ArcGIS | ArcMap**.

2. Click **Yes** to a '**New Empty Document**'

3. Click on **Tools | Extensions**, in the list of extensions find **Spatial Analyst** and place a check mark next to the name by clicking the box. Click **Close**.
4. Right click anywhere on the ArcMap toolbar and find Spatial Analyst in the list of toolbars, place a check mark by the name. The Spatial Analyst toolbar should now be loaded to your ArcMap document.

III.) Import Surface DTM and Tree Canopy Height DTM into ArcGIS
1. We will import our DTM surface grid and tree canopy models using the Arc ASCII import utility.
2. Start ArcToolbox by clicking on the **Toolbox Icon**. Click on the **Index** tab at the bottom of the ArcToolBox tree (*see graphic on left*). In the keyword search box, type in '**ascii**.'
3. Your search should return two ASCII tools. Highlight **ASCII to Raster (conversion)** and click **Locate**.
4. Once located in the main toolbox, double click the **ASCII to Raster** tool
   5. Set the **Input ASCII raster file** to lub_surface.asc
   6. Change the **Files of type** to **File (*.ASC)**
   7. Navigate to your output directory and call the output grid file **lub_surfgrid**
   8. Set the output data type to **Float**. Click **OK**
   9. Before closing the **ASCII to Raster** tool, repeat steps 5 thru 8 for the tree canopy height model **lub_CHM.asc** and call the output raster **lub_CHMgrid**.
   10. Close the **ASCII to Raster** tool.

You have successfully imported two ASCII Grids into ArcGIS. These grids represent the ground surface DTM and the tree canopy height DTM from the original LIDAR dataset.
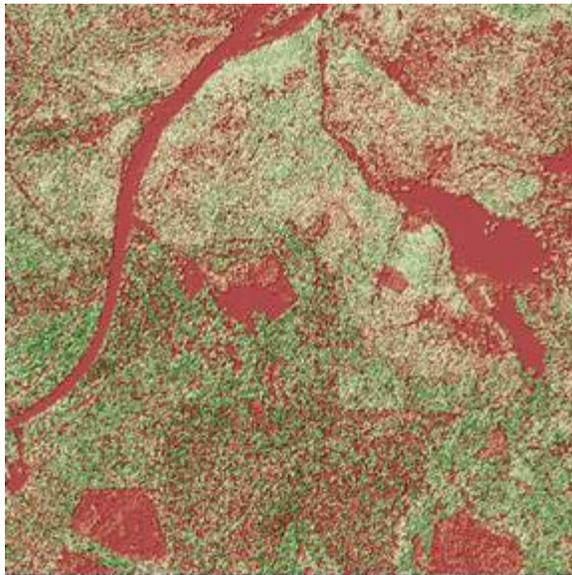
Exercise 9 continues on the following pages...

Left panel annotations:

Type in the keyword to find:

ascii

Keyword search...

Add Coded Value To Domair
Add Feature Class To Topolo
Add Field (management)
Add Field to Analysis Layer (r
Add Item (arc)
Add Join (management)
Add Locations (na)
Add Rule To Topology (mana
Add Spatial Index (managemi
Add Subtype (management)
Add XY Coordinates (arc)
Add XY Coordinates (manage
ADRG to IMAGINE
Advanced Tiger Conversion |
Aggregate (sa)
Aggregate Polygons (arc)
Alter Version (management)
Analyze (management)
Append (arc)
Append (management)
Append Annotation Feature (
ASCII Raster to IMAGINE
ASCII to Raster (conversion)
ASin (sa)

ASCII to Raster....

Locate

Favorites Index Search

Index Tab

IV.) Create Surface Files for Analysis

We will now create landform characteristics from our LIDAR ground surface DTM. You will need the Spatial Analyst extension to perform tasks in this section.

1. Click **Spatial Analyst | Surface Analysis | Hillshade**.
    2. The *Input Surface* should be **lub_surfgrid**.
    3. Call the *Output Raster* **lub_hlshd**
    4. Accept all other defaults, click **OK**.
5. You will repeat steps 1 through 4 for your canopy model as well (**lub_CHMgrid**), calling the output file **lub_CHMhlshd**.
6. Display the surface layers in the ArcMap table of contents from top to bottom like:
    - lub_CHMgrid,
    - lub_CHMhlshd,
    - lub_surfgrid,
    - lub_hlshd.

We will look at the lub_CHMgrid and lub_surfgrid with hillshade relief.

7. Activate all 4 datasets by placing a check mark next to each in the ArcMap table of contents.
8. Right click on **lub_CHMgrid** and select **Properties**. On the **Symbology** tab select a **Color Ramp** of any color, but that is some color of **Green** on the right side.
9. On the **Display** tab set the transparency to **40%**, click **OK**.
10. Repeat step 8 for **lub_surfgrid**.
11. First, observe the display of lub_CHMgrid draped over lub_CHMhlshd notice the gradient of elevations between the trees and tree tops to the ground beneath.
12. Next, deactivate lub_CHMgrid and lub_CHMhlshd by unchecking the boxes by their names in the ArcMap table of contents, so that you may now observe **lub_surfgrid** and **lub_hlshd** (both should already be active in your ArcMap display). Now let's derive additional layers from our surface DTM...
13. Click **Spatial Analyst | Surface Analysis | Slope**
    14. Set the input surface to **lub_surfgrid**
    15. Choose to compute **Percent** slope values
    16. calling the output file **lub_slope**
    17. Accept default values, click **OK**.
18. You will repeat this for **Aspect**, calling the output **lub_aspect.**
19. The last surface you will create is **Curvature**. Open the ArcMap Toolbox by clicking on

The Fusion-generated Canopy Height Model displayed in ArcMap with a hillshade model accentuating the appearance of relief.

We use 'Transparency' settings to make our data appear as though it has relief (height, or elevation), by draping it over a hillshade dataset.
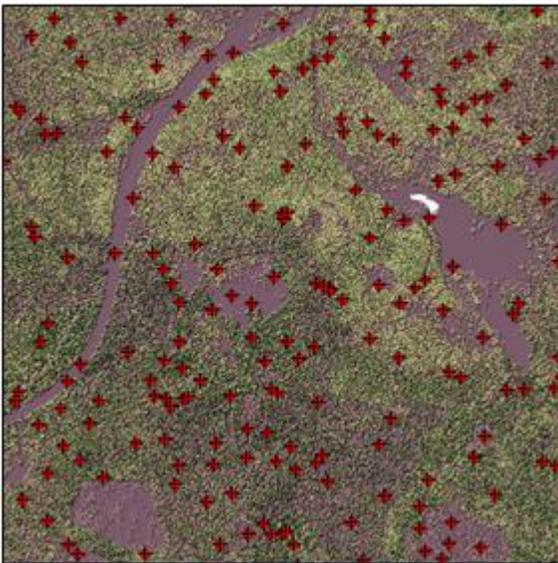
the toolbox icon.

20. Click on the **Spatial Analyst** toolbox and then click on **Surface** then double click **Curvature**. Set the input raster to **lub_surfgrid** and call the output **lub_curve**, click **OK**.
21. Set the following datasets to **40%** transparency: lub_curve, lub_aspect, lub_slope.
22. Save your ArcMap document to your output directory, and call it **Surfrun.mxd**. You will open this document to start Exercise 10.

Congratulations, you've successfully derived landform characteristics originating from a LIDAR dataset. Now lets append these surface characteristics to a random sample of locations across our study area.

V.) Optional: Drilldown Attributes Using Sampling Techniques

You've been given a shapefile of random sampling locations, these may be generated from a random sample/number generator. We will do a quick 'drill down' to force attributes from our surface analysis layers and adjoin them to our sampling locations... this is essentially a one-click process using the Spatial Analyst sampling tool.

1. In the Spatial Analyst toolbox, click on **Extraction**. Double click the **Sample** tool. Enter the following raster surfaces in the input rasters:
    - **lub_surfgrid** (LIDAR ground surface DTM)
    - **lub_aspect** (Aspect)
    - **lub_slope** (Slope)
    - **lub_curve** (Curvature)
    - **lub_CHMgrid** (Tree Canopy Model)
2. Set the *Input raster location or point feature* to **lub_samples.shp**. Call the output table **lub_tempanalysis.dbf**, and set the resampling technique to **Bilinear**.
3. On the ArcMap main menu, click **Tools | Add XY Data...** enter **lub_tempanalysis** as the input table, entering columns **X** and **Y** respectively for the XY coordinate fields. Click **OK**.
4. ArcMap will automatically load this data set into your ArcMap table of contents as an *Event Theme*. Once loaded, right click on **lub_tempanalysis events** and select **Data | Export Data...**
5. Navigate to your output directory and call the output **lub_surfanalysis.shp**

Tree canopy model shown with graduated color draped over the surface grid relief and a random sample matrix...

6. You will be asked if you would like to add the new shapefile to your ArcMap document, click **Yes**.
7. Once added, right click on **lub_surfanalysis.shp** and select **Open Attribute Table**. Observe the surface attributes appended to your sample locations....we will revisit the sample tool in the next exercise.

Congratulations, you've successfully imported LIDAR data into ArcGIS from your Fusion software and derived additional layers for analysis and imputed them to a random sample of point locations. In the next exercise we will derive surface water runoff and stream network characteristics.

Attributes of lub_surfanalysis

FID	Shape*	mask	x	y	lub_surfgrid	lub_chmgrid	lub_aspect	lub_slop
0	Point	0	313670.510202	5197141.8936	1192	1213.814	309.2445	
1	Point	0	313492.302255	5196948.51585	1221	1221.955	97.68365	
2	Point	0	313924.498962	5196180.09358	1245	1252.912	257.2866	
3	Point	0	313141.648433	5197143.34853	1227	1230.323	30.2367	
4	Point	0	314242.549978	5196929.7927	1259	1266.904	232.0657	
5	Point	0	313365.850965	5195616.99704	1242	1260.489	-1	
6	Point	0	313123.746408	5196892.03862	1219	1219.67	316.7454	
7	Point	0	313807.847906	5196841.20568	1234	1247.108	239.1231	
8	Point	0	313816.964503	5196049.74883	1250	1268.543	109.5482	

Record: 1   Show: All | Selected   Records (0 out of 200 Selected.)   Options ▾