

Lidar and GIS - Classification and Feature Extraction

Lindsay Weitz

Dan Hedges



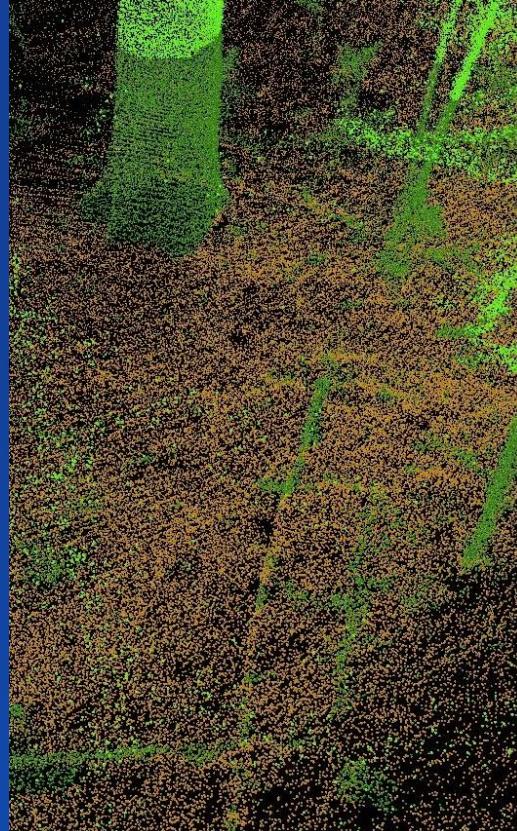
SEE
WHAT
OTHERS
CAN'T

ArcGIS Supports

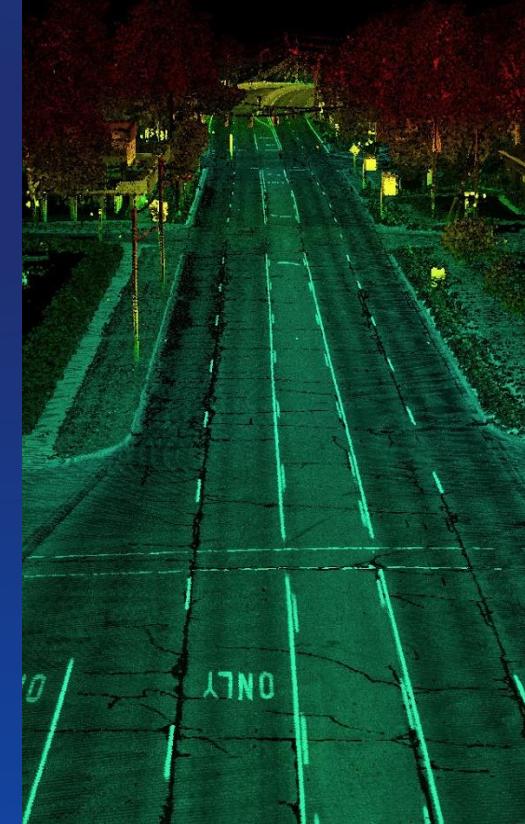
Airborne



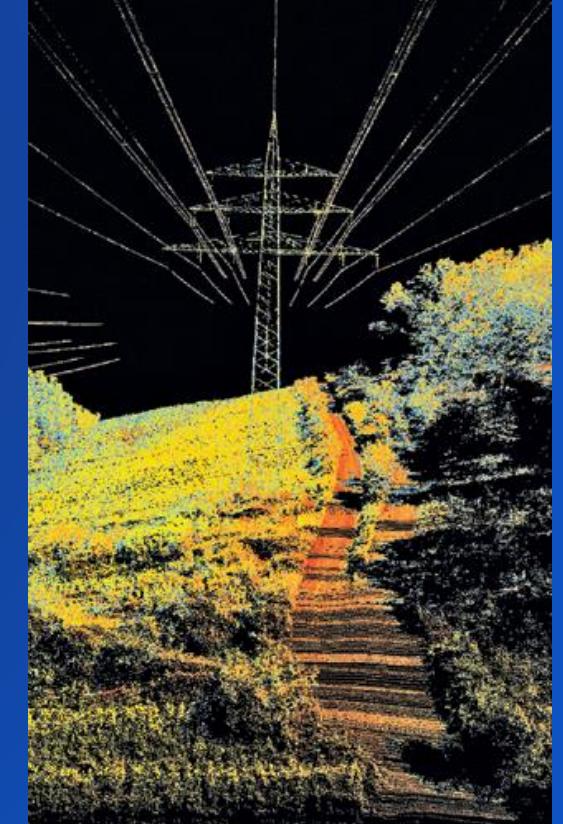
Terrestrial



Mobile



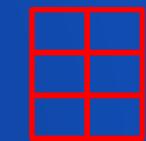
Drone/UAV



Data Structures for lidar support in ArcGIS

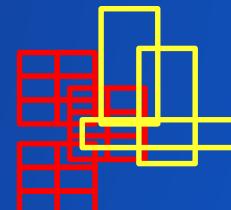


Analyze and Update



**LAS dataset /
Terrain dataset**

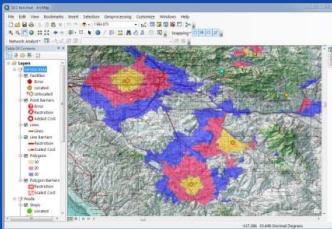
Manage and Share



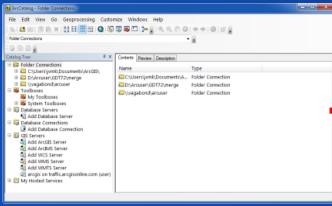
**Mosaic dataset /
Point cloud scene
layer**

Application Fusion: ArcGIS Pro

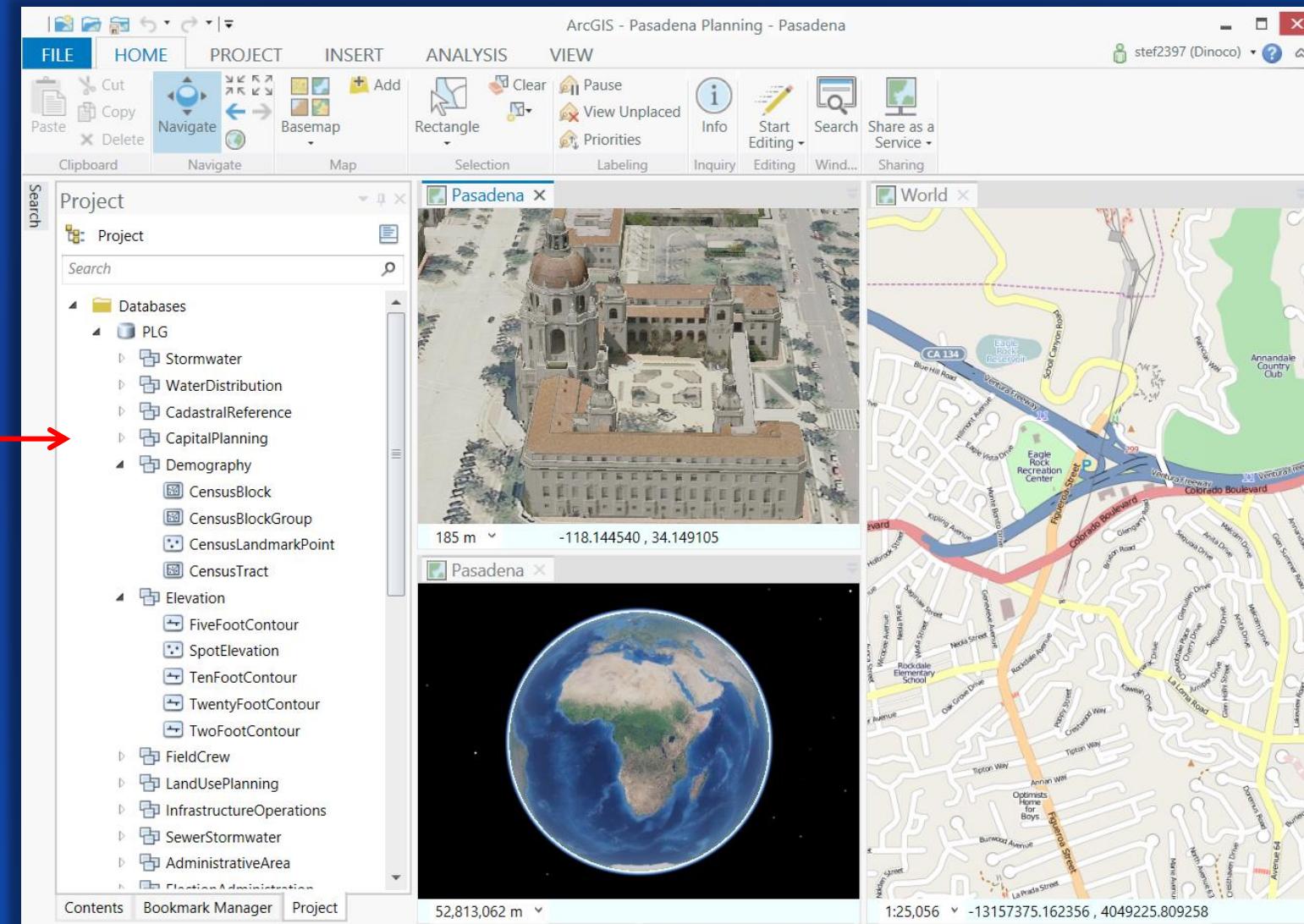
ArcMap



ArcCatalog

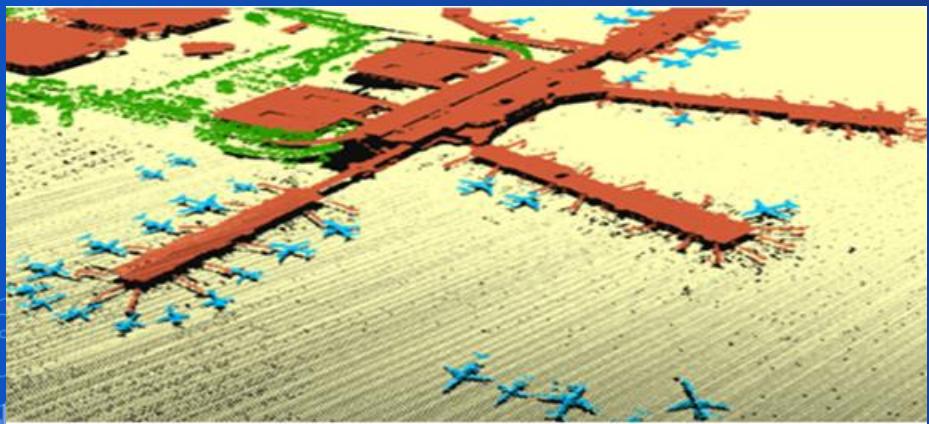
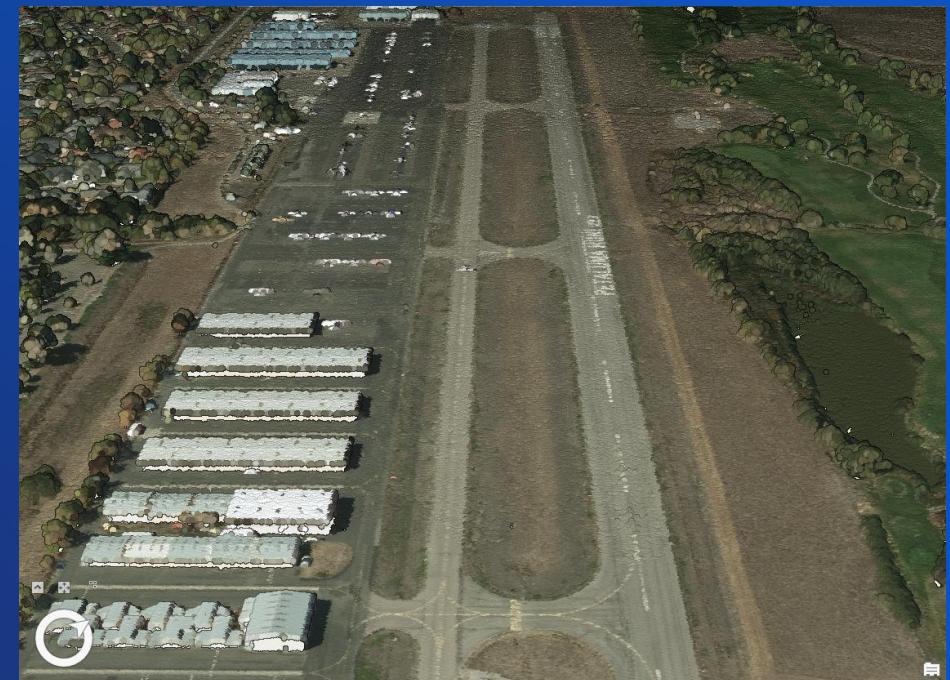


ArcGlobe / ArcScene



Lidar data with a LAS dataset

- Direct read of LAS or zLAS format lidar
- File based
- QA/QC tools
- Stores references to LAS/zLAS files on disk
- Optionally reference breakline and control point data
- Treats a collection of LAS/zLAS files as one logical dataset (“Project”)



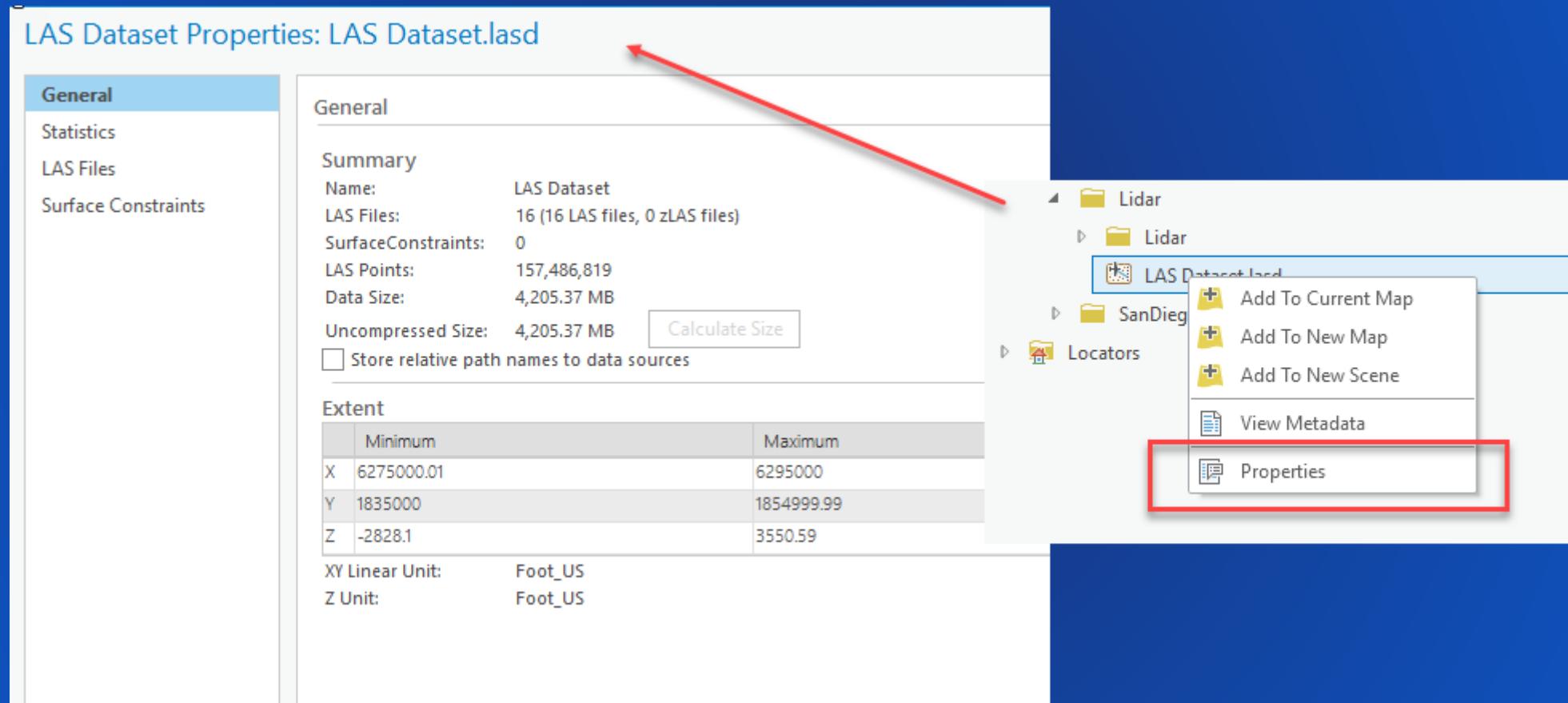
Classification codes

- Every lidar point can have a classification that defines the type of object that has reflected the laser pulse.
- Lidar points can be classified into a number of categories.
- The different classes are defined using numeric integer codes in the LAS files.

Classification	
■	0 Never Classified
■	1 Unassigned
■	2 Ground
■	3 Low Vegetation
■	4 Medium Vegetation
■	5 High Vegetation
■	6 Building
■	7 Noise
■	8 Model Key / Reserved
■	9 Water
■	10 Rail
■	11 Road Surface
■	12 Overlap / Reserved
■	13 Wire - Guard
■	14 Wire - Conductor
■	15 Transmission Tower
■	16 Wire - Connector
■	17 Bridge Deck
■	18 High Noise



LAS Dataset Properties



The screenshot shows the ArcGIS Pro interface with the 'LAS Dataset Properties' dialog open. A red arrow points from the title bar of the dialog to the context menu. The context menu is displayed over a folder structure in the background. The menu items are:

- Lidar
- Lidar
- LAS Dataset.lasd (highlighted with a blue box)
- SanDiego
- Locators
- Add To Current Map
- Add To New Map
- Add To New Scene
- View Metadata
- Properties (highlighted with a red box)

LAS Dataset Properties: LAS Dataset.lasd

General

Statistics
LAS Files
Surface Constraints

General

Summary

Name: LAS Dataset
LAS Files: 16 (16 LAS files, 0 zLAS files)
SurfaceConstraints: 0
LAS Points: 157,486,819
Data Size: 4,205.37 MB
Uncompressed Size: 4,205.37 MB Calculate Size

Store relative path names to data sources

Extent

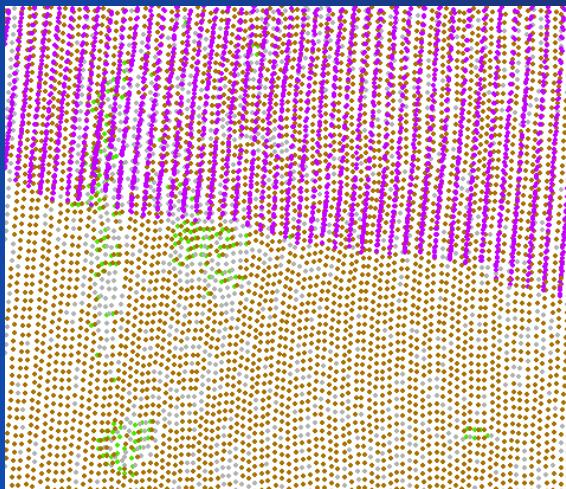
	Minimum	Maximum
X	6275000.01	6295000
Y	1835000	1854999.99
Z	-2828.1	3550.59

XY Linear Unit: Foot_US
Z Unit: Foot_US

Classify LAS Overlap

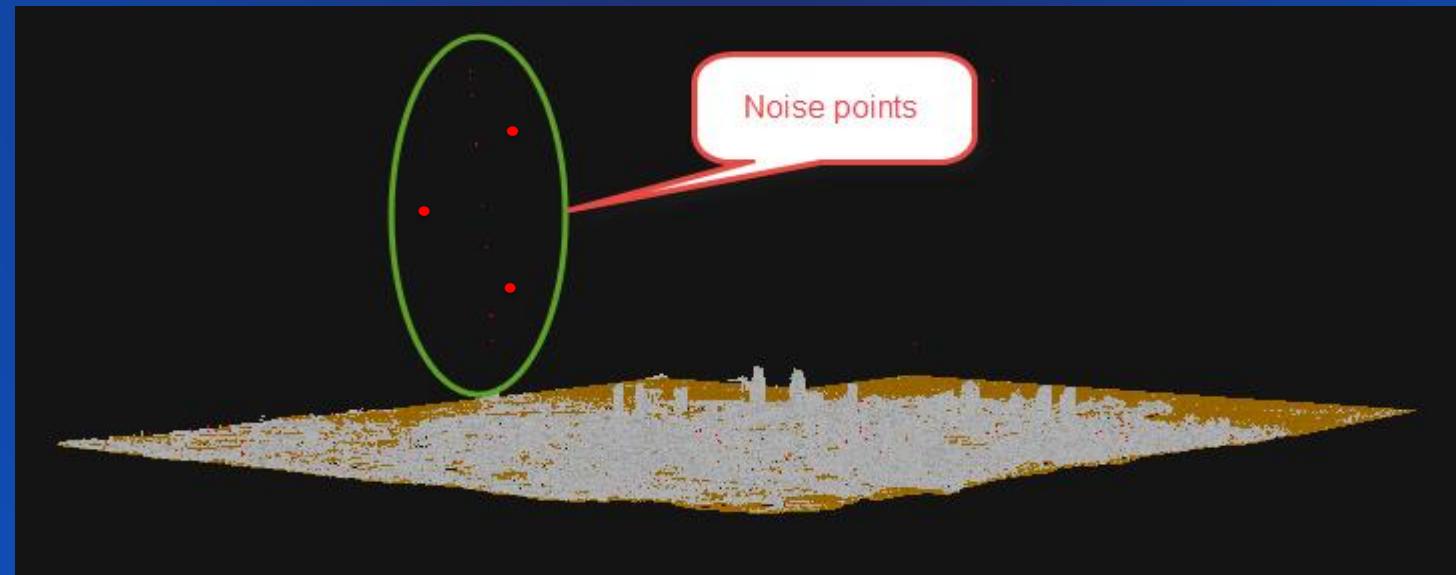
- Geoprocessing tool to assign the overlap flag/code to points in areas of overlap between flight lines.
- Area of overlap introduces high frequency noise to ground which interferes with creation of high quality DEMs. It's therefore desirable to exclude the overlap.
- Tool helps improve quality of DEMs ArcGIS can produce.

Overlap in purple



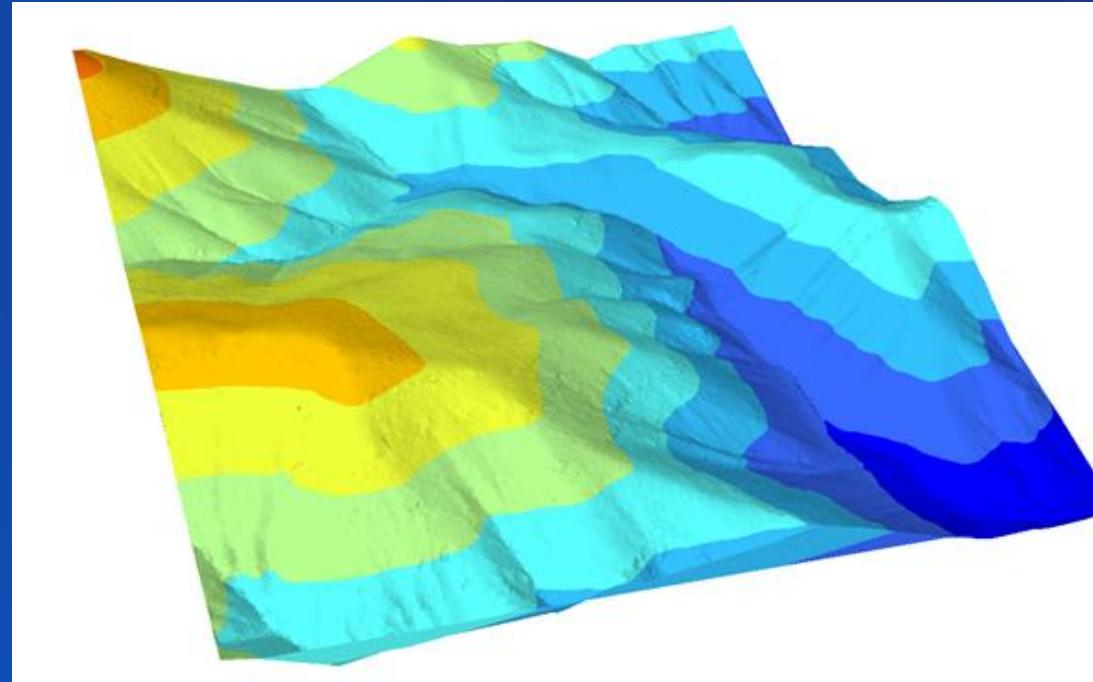
Classify LAS Noise

- Tool to classify noise points in lidar.
- Erroneous points are caused by a variety of things such as haze, birds, and water.
- Present at least to some degree in all lidar collections.
- Noise interferes with display and processing of the data.
- This is a fundamental capability.



Classify LAS ground

- Classifies ground points in lidar data
- Only the last return of LAS points with class code values of 0, 1, or 2 will be considered for reclassification as ground.



Classify LAS Ground

Parameters | Environments

* Input LAS Dataset

Ground Detection Method

Reuse existing ground

DEM Resolution Meters

Compute Statistics

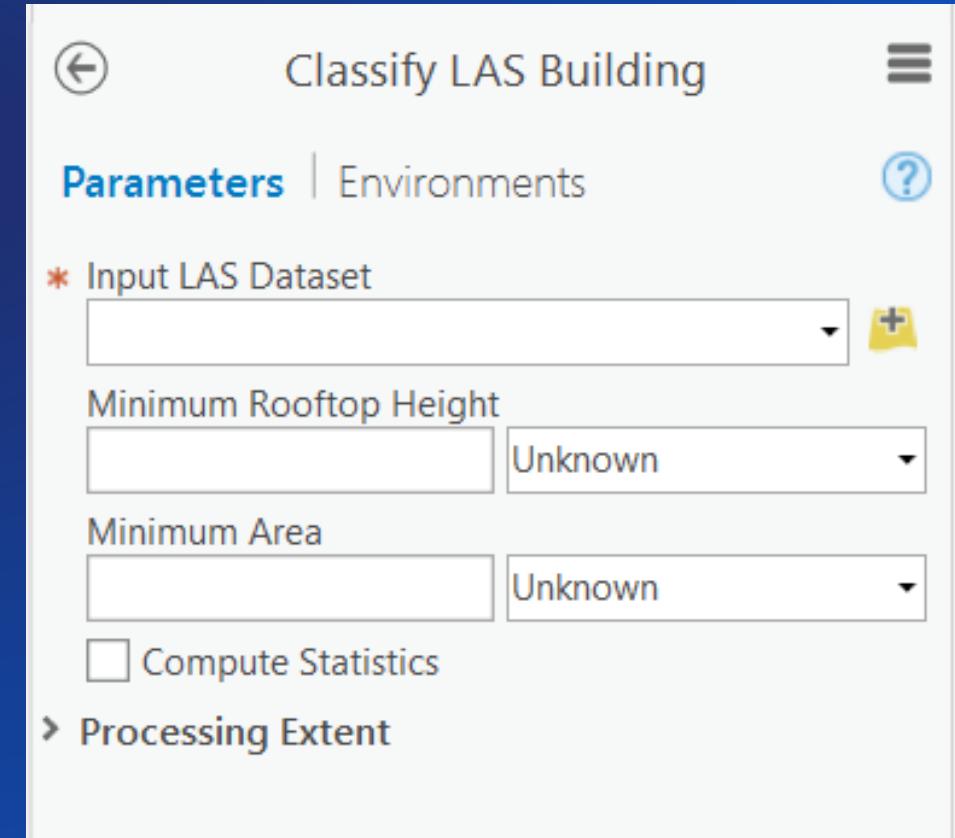
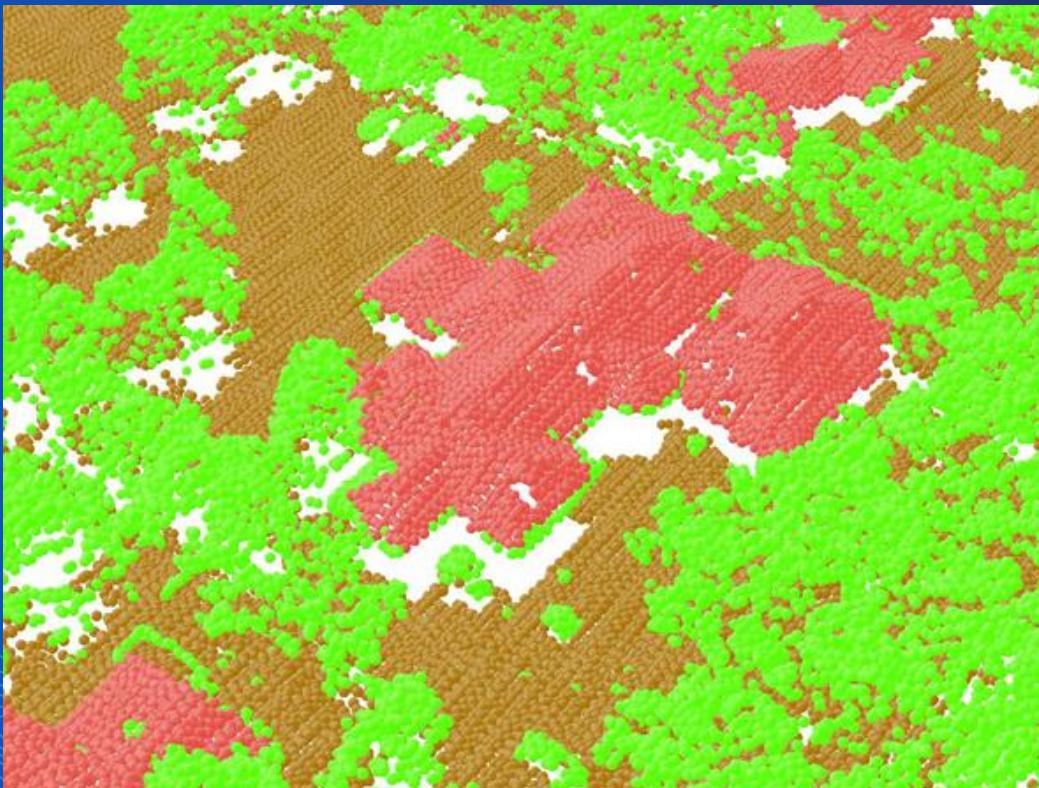
Processing Extent

Processing Boundary

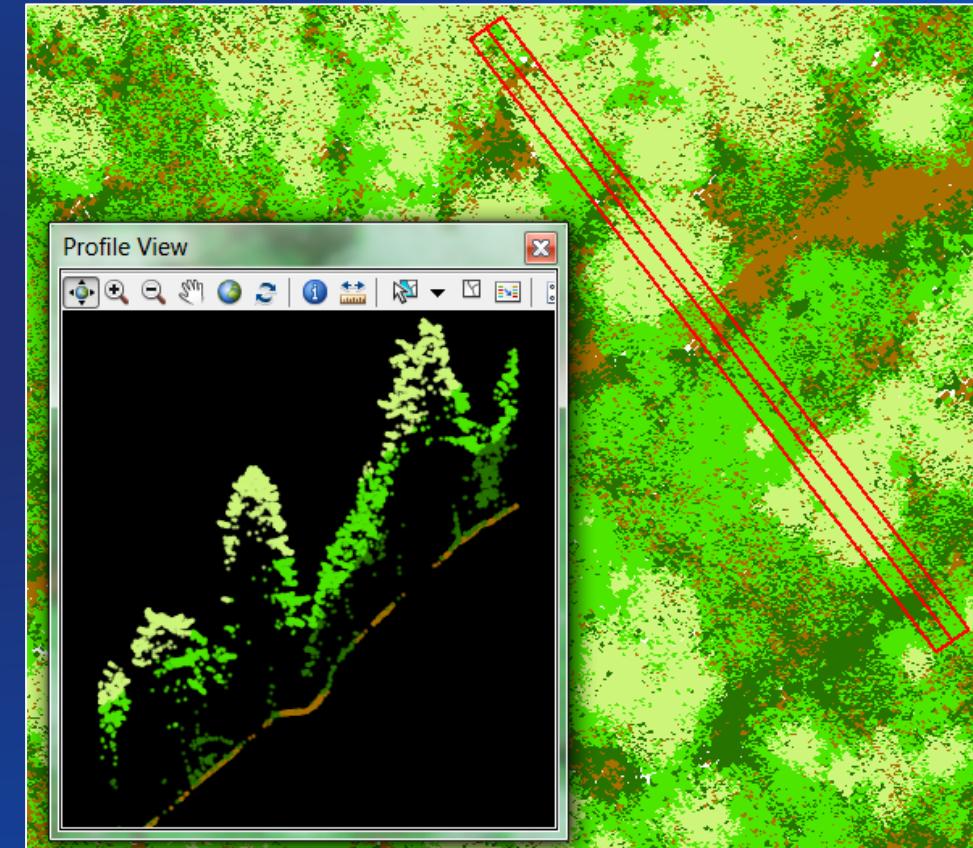
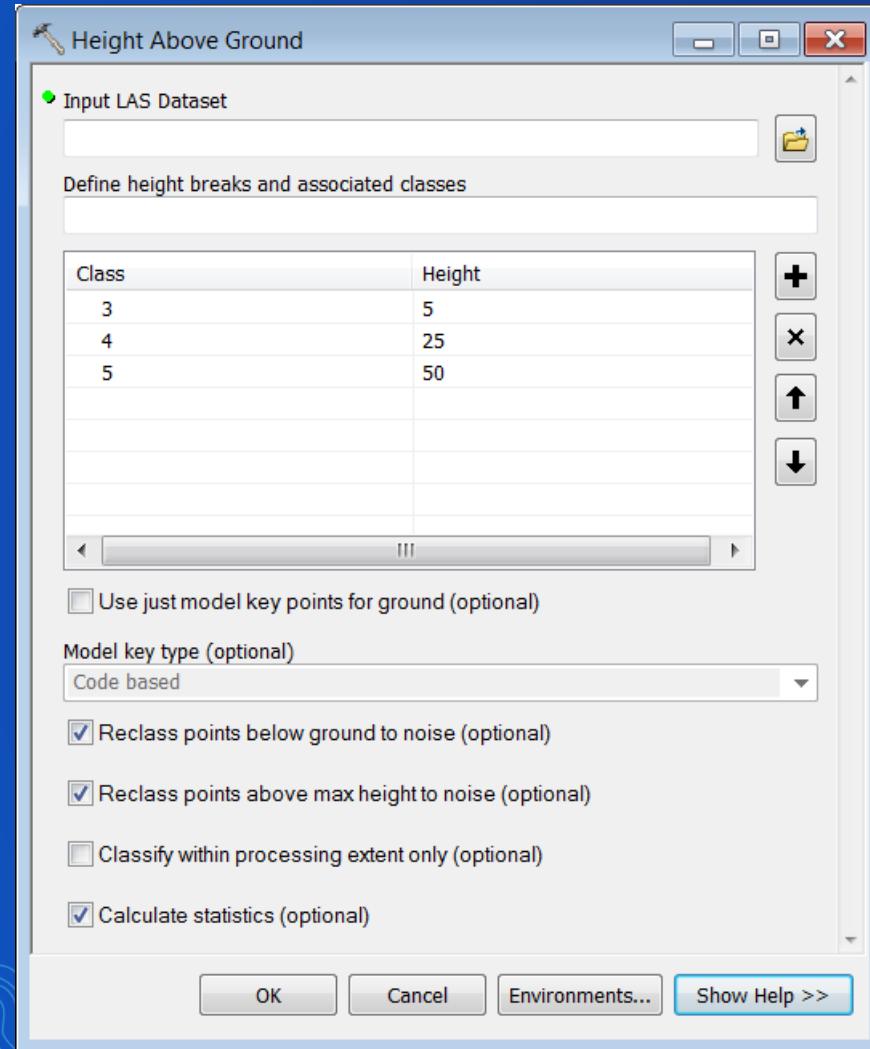
Process entire LAS files that intersect extent

Classify LAS buildings

- Classifies building rooftop points in aerial lidar data
- The lidar data must have ground points that are assigned a class code value of 2.

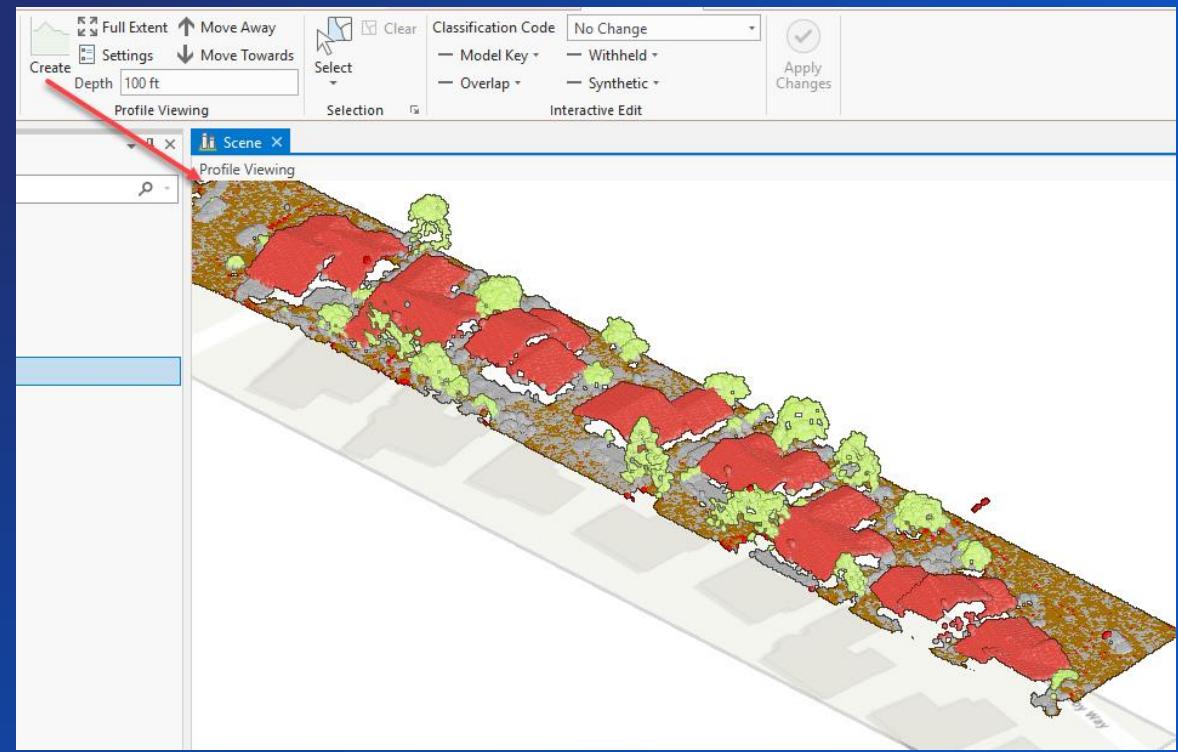
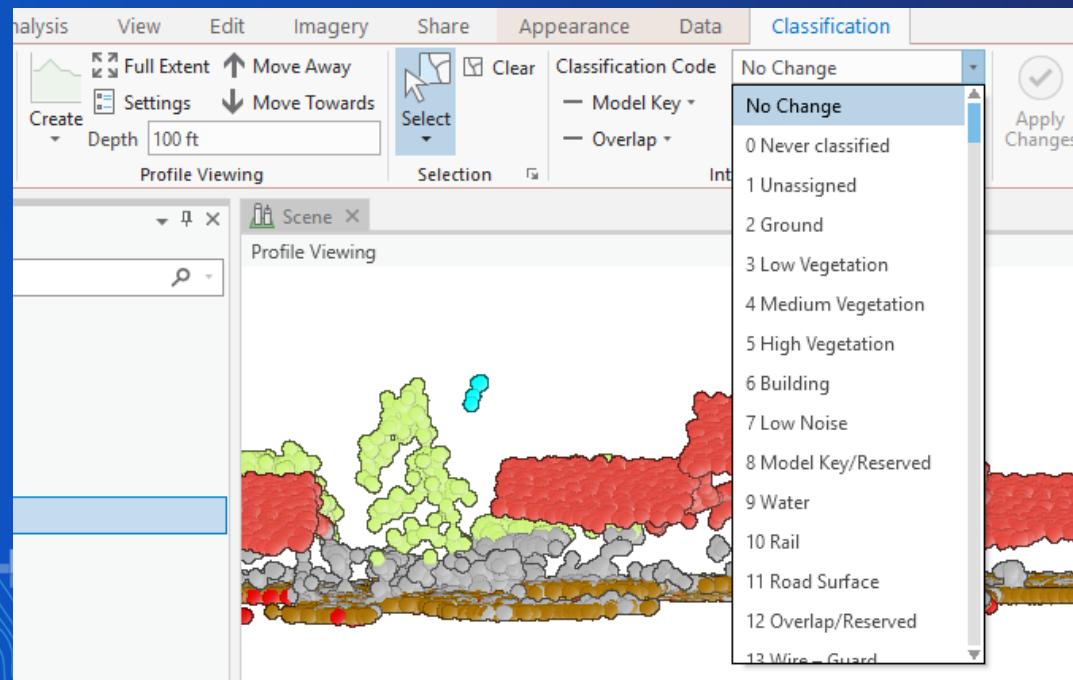


Classify LAS by Height



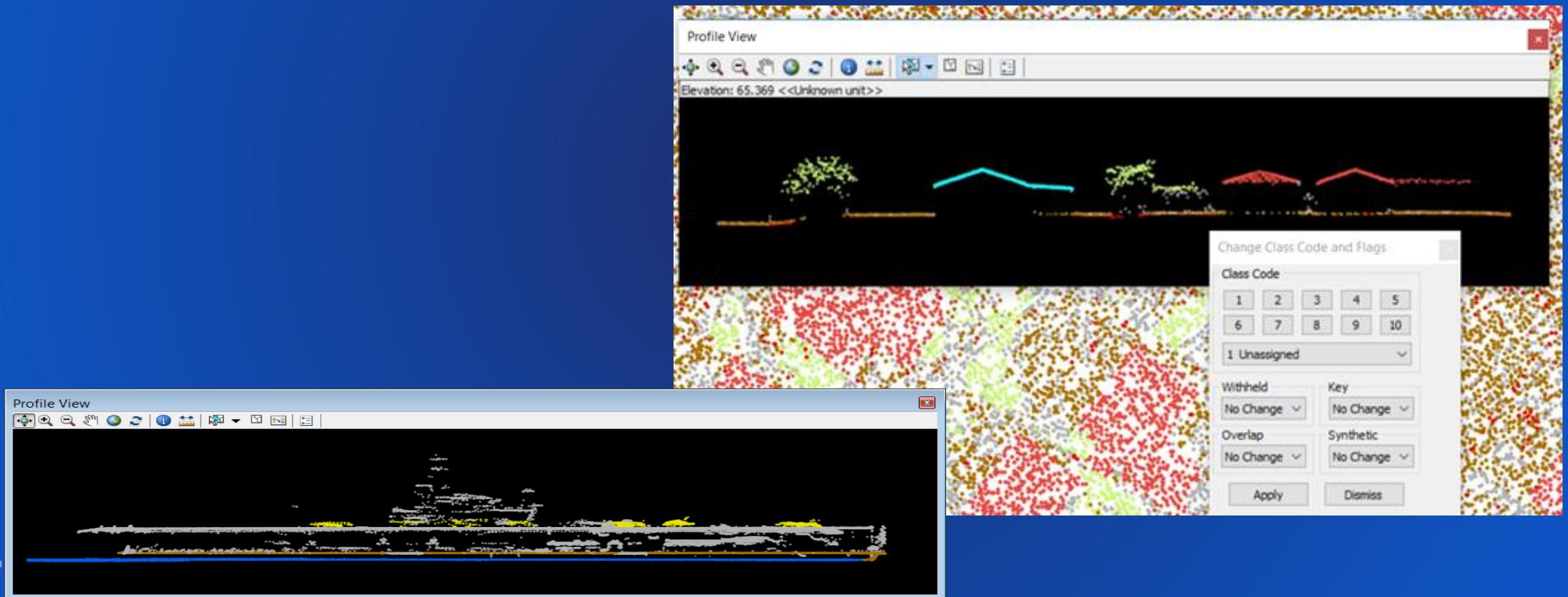
Profile Viewing: Pro

- New for 3D views is the ability to create a profile viewing state.
- For lidar this helps in fixing data anomalies and misclassifications.
- You can interactively add a profile line in the scene, and the view automatically shifts to display a vertical slice of the content.



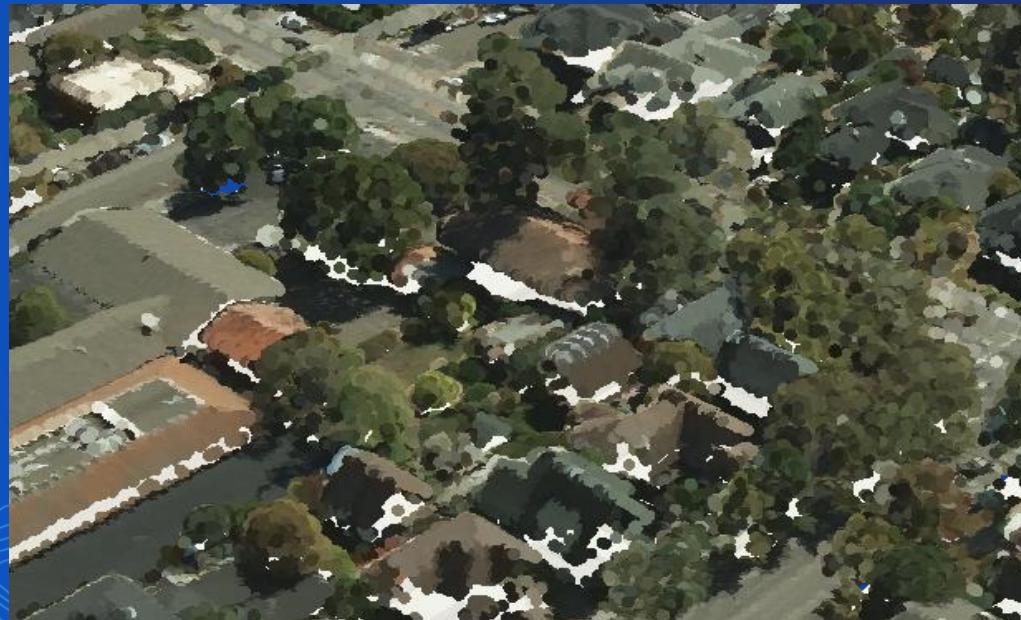
Profile Viewing: ArcMap

- Fixing data anomalies and misclassifications via point profile window

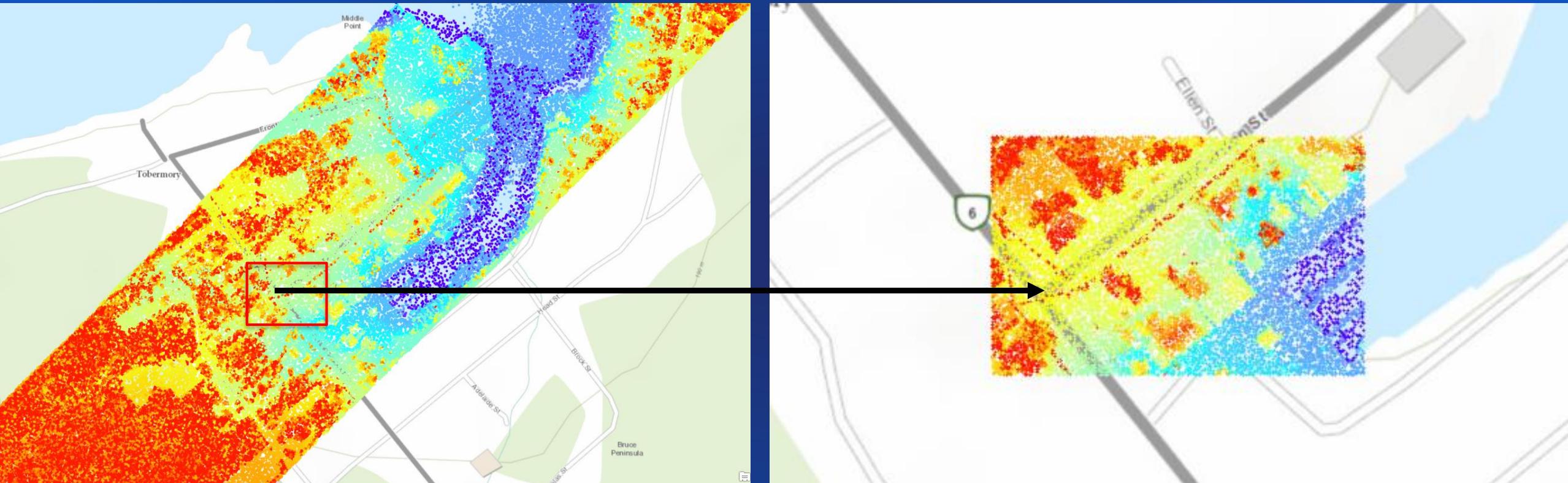


Colorize LAS

- Applies colors and near-infrared values from orthographic imagery to LAS points.
- Displaying LAS points using RGB information can provide a photorealistic display that delivers a unique display experience.



Extract LAS



Data courtesy of Optech



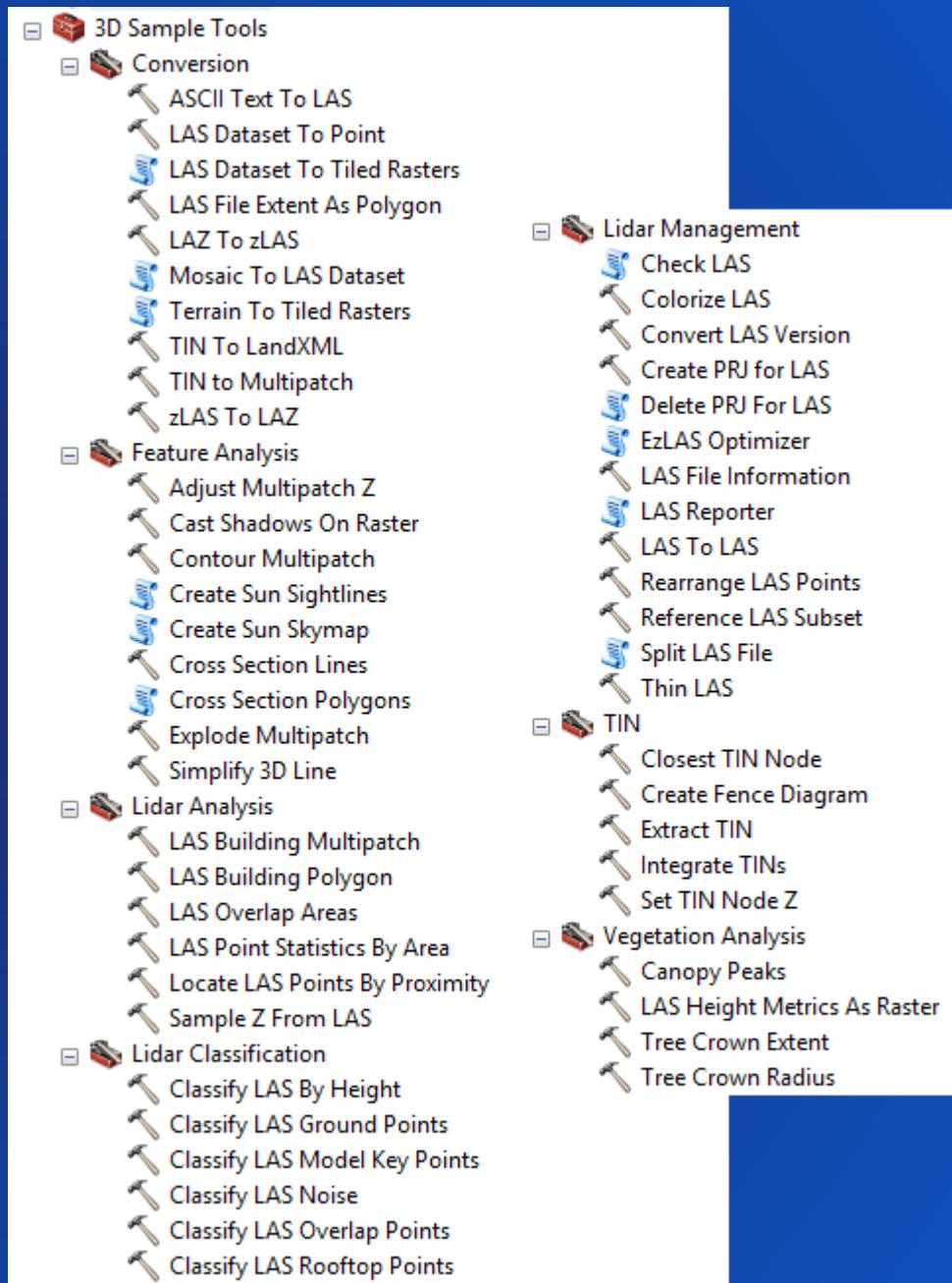
Point Cloud Classification

Lindsay Weitz



Lidar/3D Sample Tools

- Available in ArcGIS 10.2 – 10.7
- Sample geoprocessing tools
 - <http://links.esri.com/3dSamples>



What Do We Mean by “Feature Extraction”?

- **Using analytical methods to identify geographic features from remote sensing data**
- **Different types of remote sensing data can be used in conjunction to identify features**
- **Extracted features can be points, lines, polygons, or volumes (i.e. multipatches)**



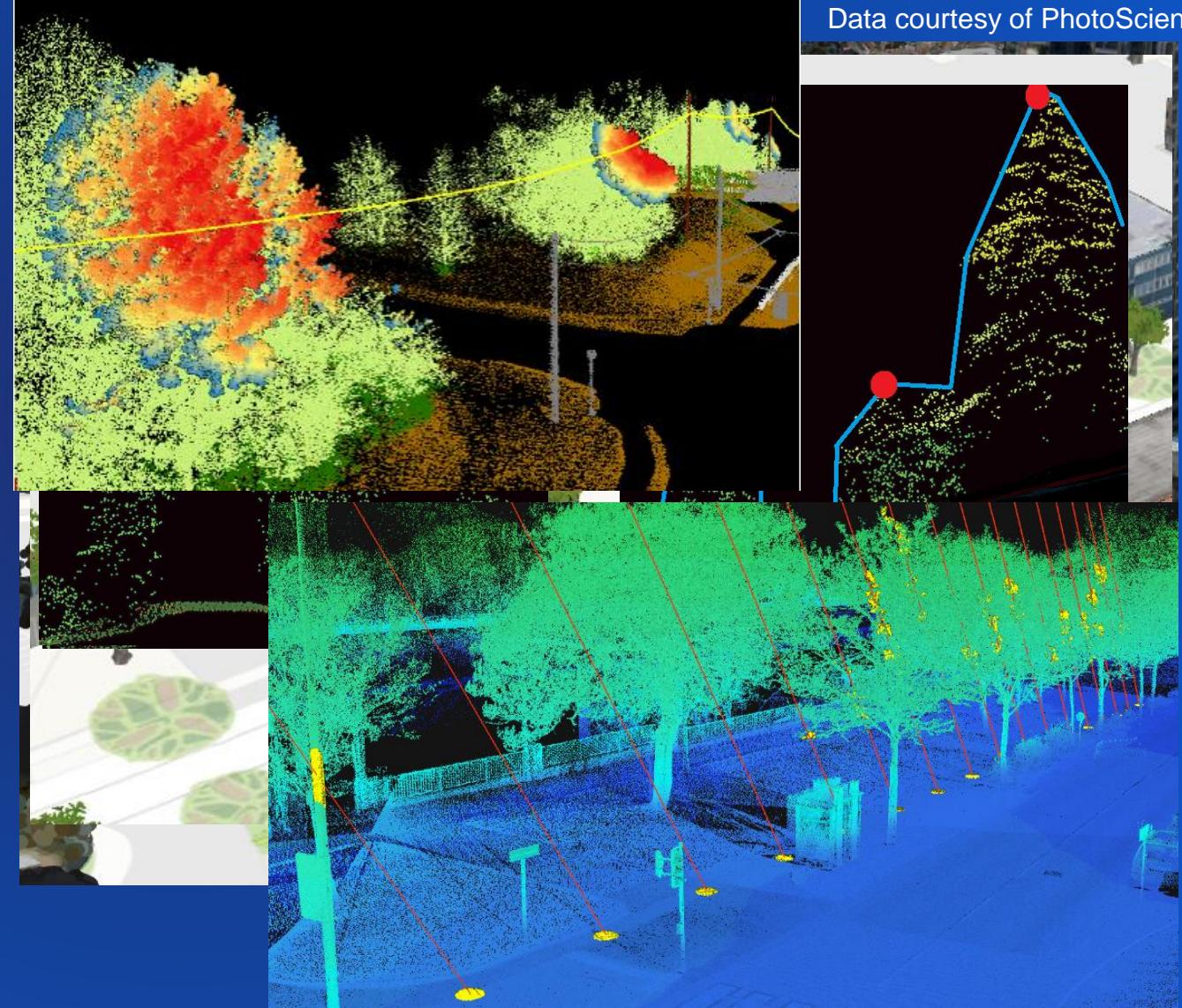
Feature Extraction Examples - Points

LAS Points as features

- Points within proximity of features
 - Locate LAS Points by Proximity
- Colorized Vegetation
 - Colorize LAS

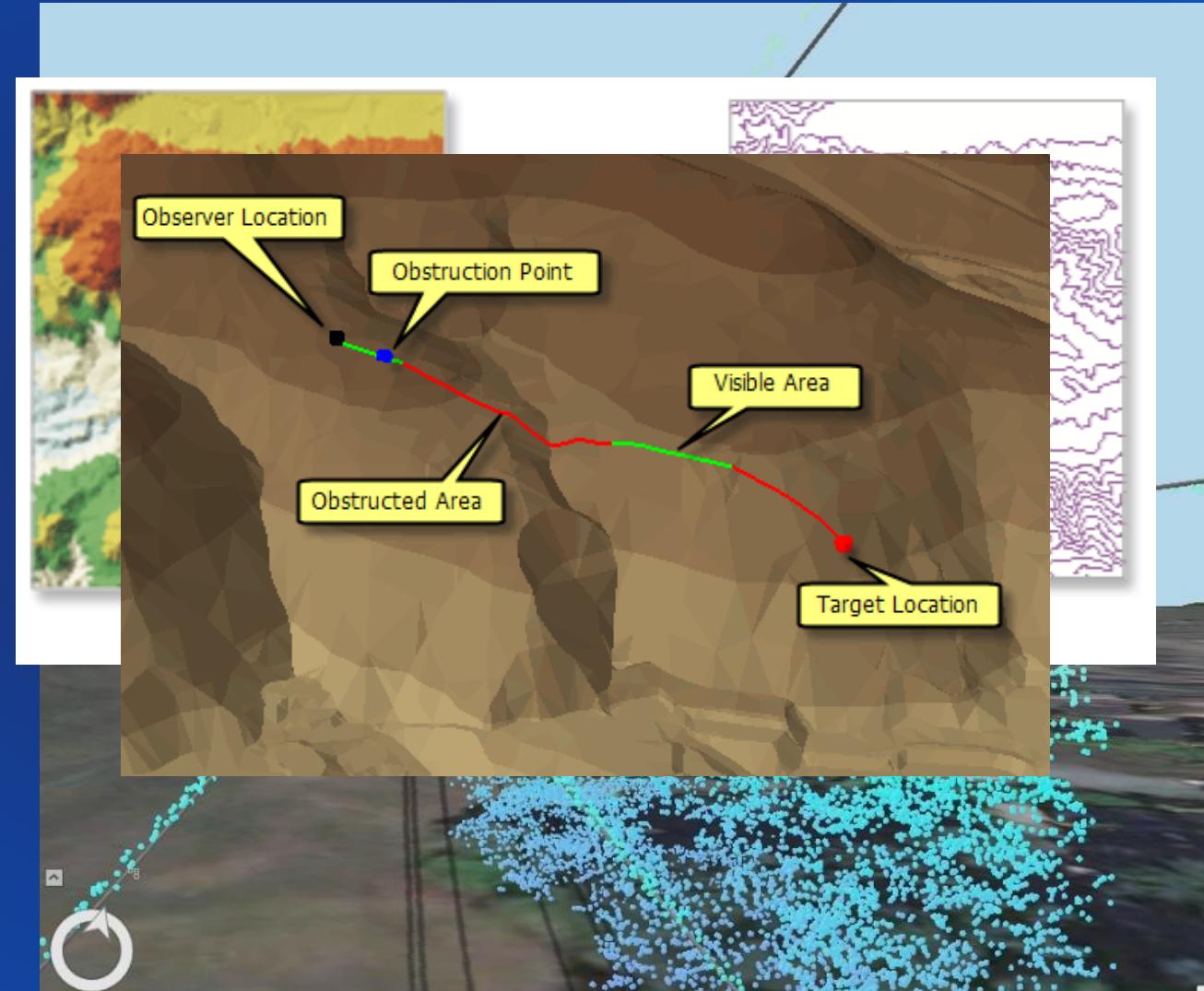
Derived Points

- Tree Crown Points
 - Flow Accumulation on inverted DSM
 - NDVI ensures only vegetation captured
- Procedural 3D tree symbol



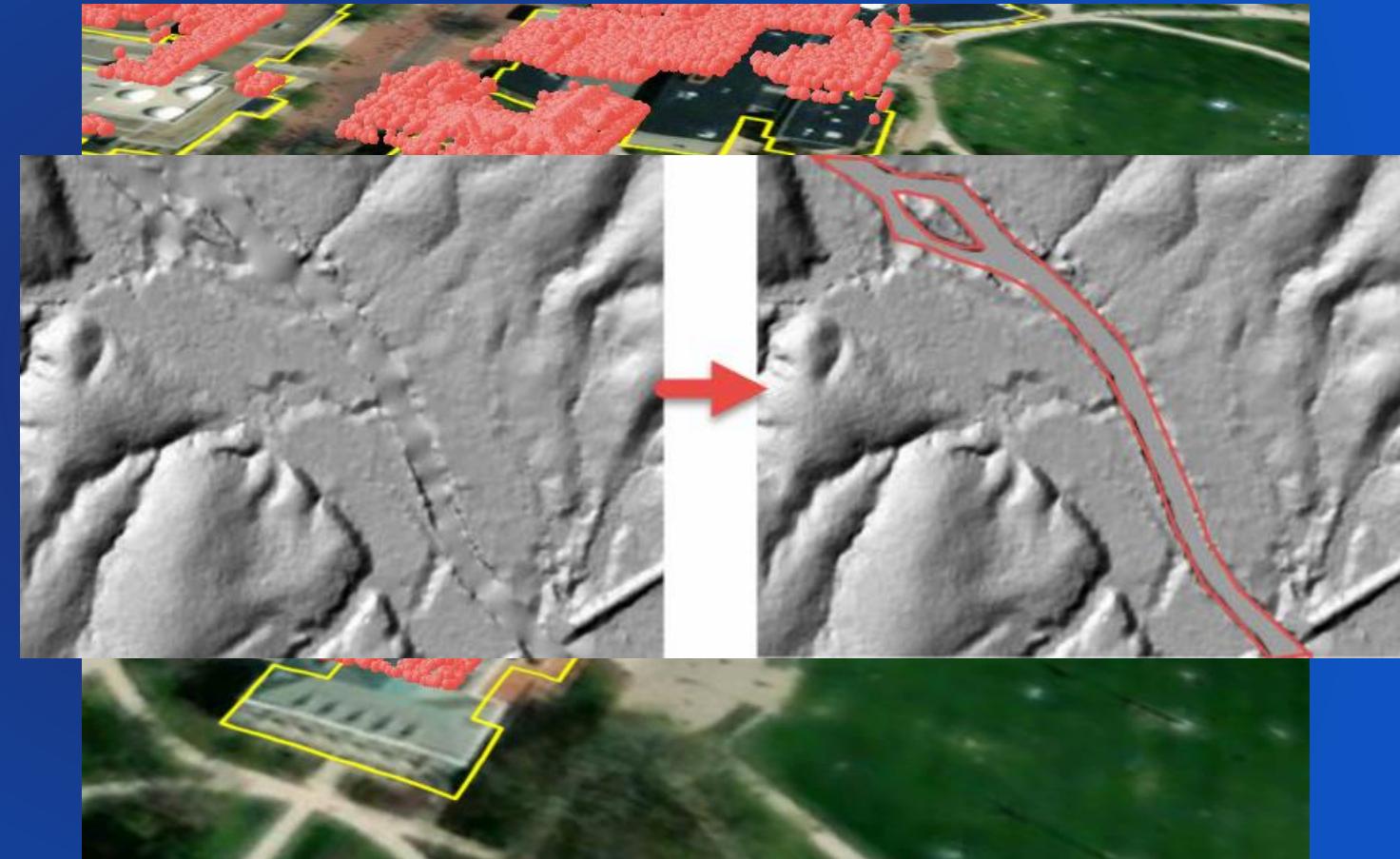
Feature Extraction Examples - Lines

- **Contours**
 - **Contour tool**
- **Lines of Sight**
 - **Line of sight tool**
- **Powerline Catenaries**
 - **Solution under development**



Feature Extraction Examples - Polygons

- **Building Footprints**
 - LAS Point Statistics as Raster (Predominant Class)
 - Raster to Polygon
 - Regularize Building Footprint
- **Water bodies**
 - LAS Point Statistics as Raster (Point Count)
 - Raster Calculator (value < threshold)
 - Raster to Polygon
 - Select large polygons
 - Set LAS Class Codes Using Features



Feature Extraction Examples - Volumes

3D Buildings

- **Procedurally created using roof form values extracted from LiDAR**
 - Local Government 3D Basemap Solution
- **Direct TIN representation of building LAS points**
 - LAS Building Multipatch





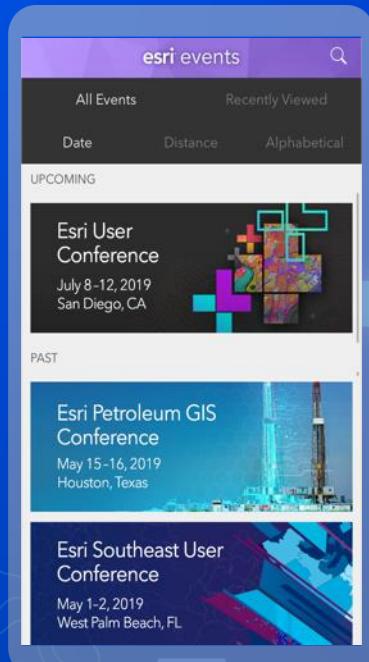
Extracting 3D Buildings from Classified LiDAR

Dan Hedges

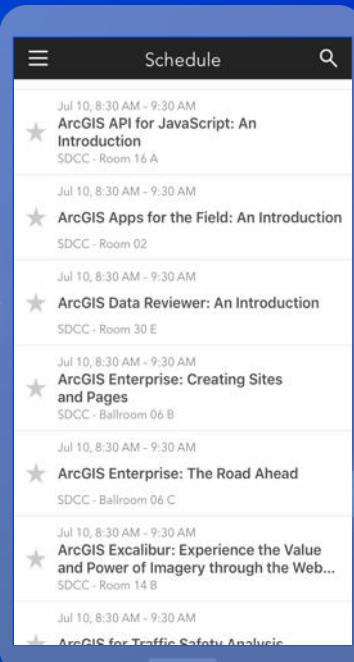


Please Share Your Feedback in the App

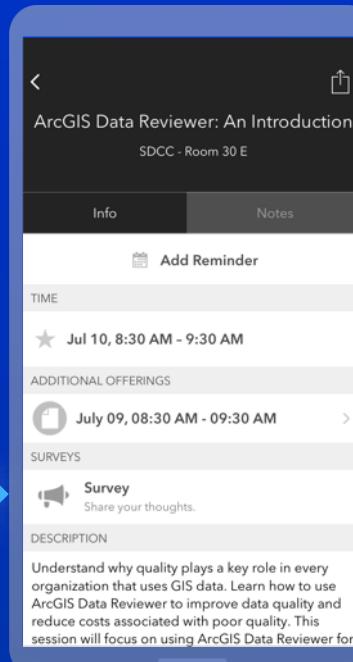
Download the Esri Events app and find your event



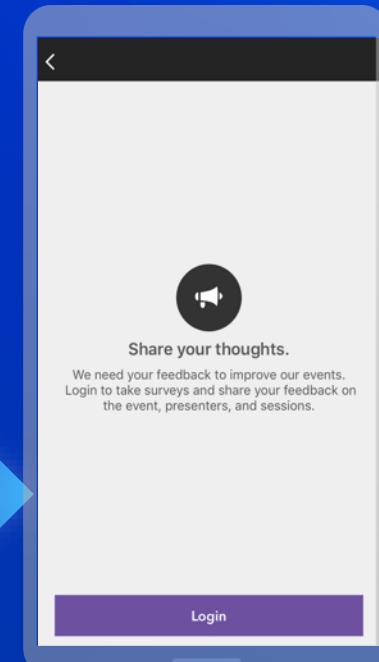
Select the session you attended



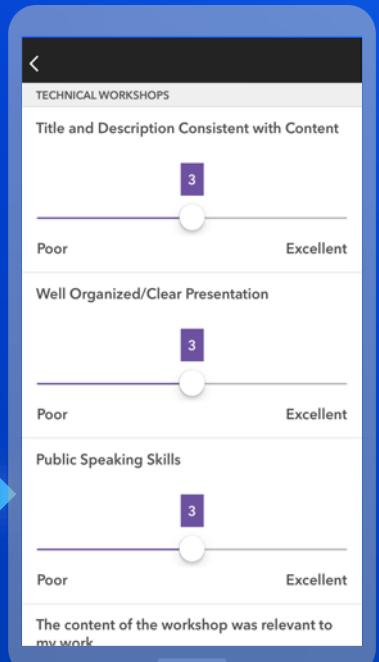
Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"



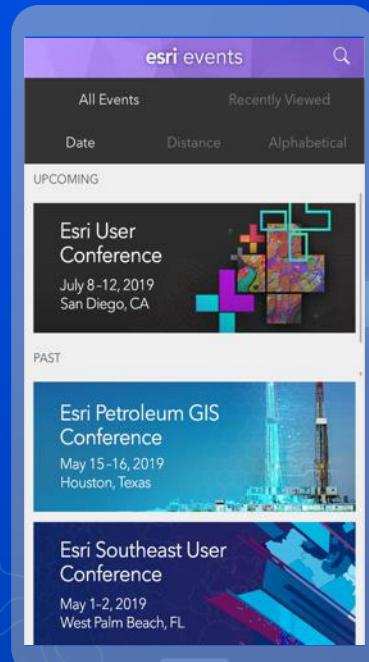


esri

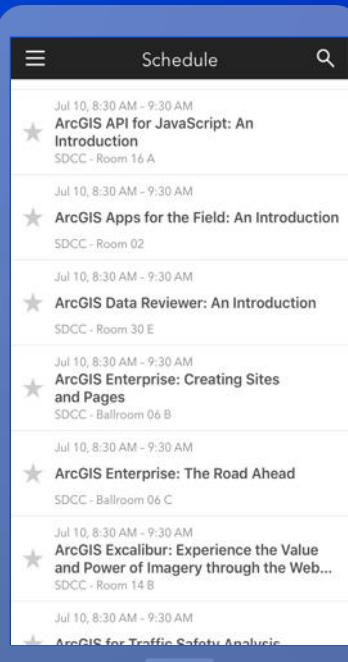
THE
SCIENCE
OF
WHERE

Please Share Your Feedback in the App

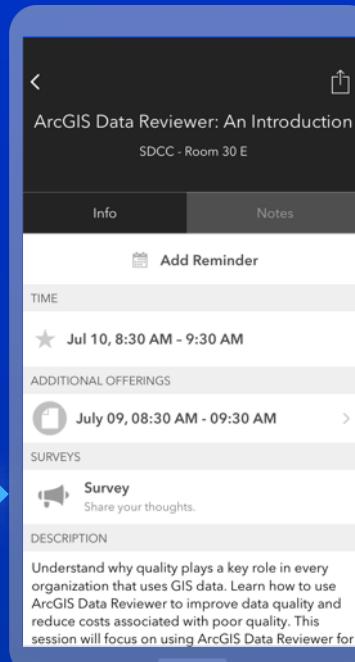
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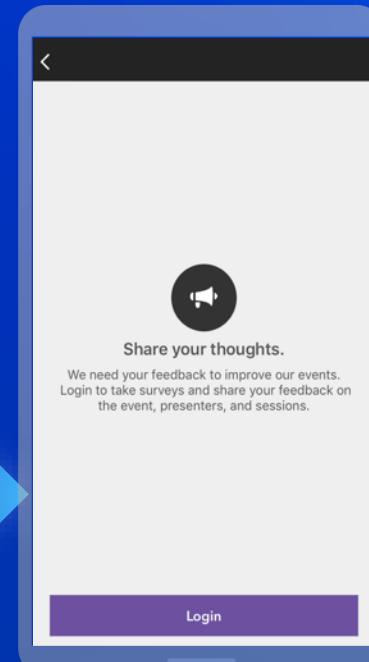
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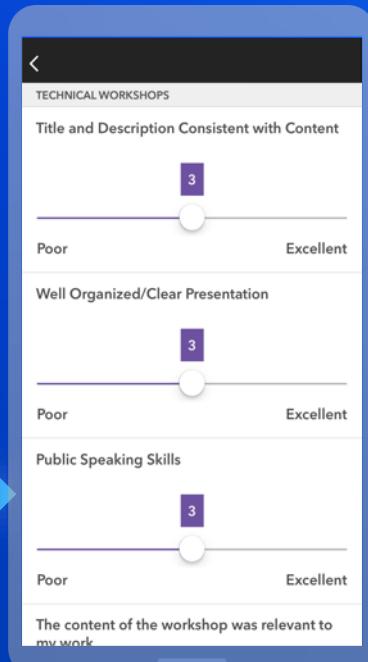
Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"





Presentation Title

Presenter Names

A blue-toned background featuring abstract white line art representing topographic maps and a grid of colored squares in the bottom left corner, suggesting a digital or spatial theme.

SEE
WHAT
OTHERS
CAN'T

Section Header

Section Subhead

Demo Title

Presenter(s)

