The Vermont Lidar Program:
Using VCGI's NEW Lidar Services in ArcGIS:
Hillshade and Digital Elevation Model

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Overview

• **The Vermont Lidar Program** ([vcgi.vermont.gov/lidar](http://vcgi.vermont.gov/lidar))
  - The Plan: VT State LiDAR Plan under umbrella of the EGC
  - The People: The EGC’s LiDAR Workgroup (~ “VTeam LiDAR” )

• **The Enterprise GIS Consortium (EGC)** is a voluntary consortium of state government organizations focused on effective management of the State’s Enterprise GIS.
  - **Lidar workgroup**: USGS, NRCS, UVM SAL, VAPDA, VT Agencies: ACCD, AFM & AOT, LCBP, USFS, VELCO, VSJF and the VGS.

• **Lidar web services**...
Image Services

• An image service provides access to raster data through a web service.
• You can access an image service the same way you would any other service.
• How you use the image service depends on the source data.
  1. A published mosaic dataset can be used like a single raster (image) or catalog;
  2. A published raster dataset can be used like a raster;
• VLP services created from Mosaic Datasets, organized thematically
Point Cloud

First Returns

Interpolation

DSM

nDSM

Query

Interpolation

Subtraction

Ground Class

DEM

...plus

• ASPECT
• CONTOURS
• HILLSHADE
• SLOPE
Digital Surface Model (DSM)
Normalized DSM (nDSM)
Aspect (Azimuth)
Hillshade

Legend
Hillshade (1.4m)
Value
High : 254
Low : 0

1:4,800 Meters
# VCGI LiDAR Data Delivery Services

## Table 4: VCGI LiDAR Data Delivery Services

<table>
<thead>
<tr>
<th>Access Options</th>
<th>Datasets*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DEM</td>
</tr>
<tr>
<td>External Drive Product</td>
<td>✓</td>
</tr>
<tr>
<td>Direct Download</td>
<td>✓</td>
</tr>
<tr>
<td>Map Services</td>
<td>✓</td>
</tr>
<tr>
<td>Image Services</td>
<td>✓</td>
</tr>
<tr>
<td>VT Interactive Map Viewer</td>
<td>✓</td>
</tr>
</tbody>
</table>

* Where available; coverage is not currently statewide

** Derivatives (where available): Aspect, Normalized DSM (nDSM) and Slope rasters

***Hillshade combined with contours as map service

Harvest time!

Scale 1:20,000

Vertical Accuracy: 10m & 30m NED = 2.44m (8’); QL2 0.7m Lidar = 9.25cm (< 4”!)
Mosaic Datasets

- Mosaic datasets facilitate management of large data collections;
- Simultaneously used to publish web services.

Mosaics:
- CONTOURS
- DEM (last returns)
- DSM (first returns)
- nDSM (DSM-DEM; height of feature)

Referenced Mosaics:
- ASPECT
- HILLSHADE
- SLOPE

- Mosaics and “Parent Mosaics”, i.e., Mosaics-of-Mosaics
- Mosaics can be “referenced” to create other mosaics via functions
Talking to a Web service?

Web Services ➔ SOAP or REST

**SOAP** = communication **protocol** (set of rules) for XML-based message exchange

**REST** = architectural **principles** by which data can be transmitted over a standardized interface (such as HTTP)

**Examples**

- ArcGIS Desktop ➔ **SOAP**
- ArcGIS Online / Web Apps ➔ **REST**
Types of geospatial web services

Esri

- **Map Services** = access MXD map content
- **Image Services** = access to raster data
- **Feature Services** = web editing
- **Geoprocessing Services** = perform geoprocessing task
- **Geocoding Services** = find addresses
- Etc...

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
Types of geospatial web services

OGC -> Open Geospatial Consortium

- **WMS** = Web Map Service (like an Esri Map Service)
- **WCS** = Web Coverage Service (like an Esri Image Service)
- **WFS** = Web Feature Service (like an Esri Feature Service)
- **WPS** = Web Processing Service (like an Esri Geoprocessing Service)

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
EGC Services hosted by VCGI

VT Enterprise Geospatial Consortium (EGC) Services

- **Map Services (MAP_*)**
  - Contours
  - VT Parcels

- **Image Services (IMG_*)**
  - Imagery (orthophotos)
  - Terrain (Lidar)

- **Geocoding Services (GCS_*)**
  - Derived from E911 data

- **Open Data services (OPENDATA_*)**
  - Supports geodata.vermont.gov

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
How they are built

• ArcMap MXD → Map Service
• Raster Dataset → Image Service
• Locator file → Geocoding Services
• Python Script / Model → Geoprocessing Service

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
Things to consider

**Use Case?**
- Custom maps with ArcGIS Desktop / QGIS?
- Web mapping application?

**Performance?**
- Type/Speed of internet connection?
- Performance of service itself?

**Life Cycle Support Policy?**
- Guarantee availability?
- What if services changes or goes away?

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
Finding services

Geodata Portal
- Web Services section

ArcGIS Desktop
- Add “ArcGIS Server” connection

REST endpoint
- http://maps.vcgi.vermont.gov/arcgis/rest/services/EGC_services

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
Using in Arcgis

Add Connection to VCGI Web Services
- ArcMap → Add Data → GIS Servers → Add ArcGIS Server
- http://maps.vcgi.vermont.gov/arcgis

Browse ./EGC_services folder
- Add “ArcGIS Server” connection

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
Using in QGIS

QGIS Desktop

→ Add Layer from WMS/WMTS layer
→ Create a new WMS connection
→ Connect + Image encoding

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
create a web map

ArcGIS Online

- Add
- From Web

- Adjust settings
- Save Map and Share

Courtesy of: Steve Sharp, Geospatial web services webinar March 3, 2017
Working With Services

Adding Services Using:

1. “Add Data”
   a) Within ArcGIS, click the Add Data button on the Standard toolbar to open the Add Data dialog box.
   b) In the “Look in:” list, choose GIS Servers to see a list of servers you have previously used, e.g., use “Add ArcGIS Server” to connect to a GIS server.
   1. Add ALL services! Type/Paste in “http://maps.vcgi.vermont.gov/arcgis/rest/services/”
   2. Under “EGC_services” cherry pick Lidar services to add:
      • IMG_VCGI_LIDARDEM_SP_NOCACHE_v1/ImageServer;
      • IMG_VCGI_LIDARHILLSHD_SP_CACHE_v1/ImageServer

2. ArcGIS Online – via ArcGIS File menu

3. Using ArcGIS Services Directory
   a) In Web Browser navigate to http://maps.vcgi.vermont.gov/arcgis/rest/services/”, click on desired service to reach directory and select from “add options”.

Adapting/Analyzing Service Data:

1. Applying Functions/Function Chains (2 or more)

Extracting/exporting data

• Extract by Data Frame Extent
• Extract by Selected Features
• Extract by Mask (Spatial Analyst)

Integrating Services/Applications:

• ArcGIS API for JavaScript – try the sandbox!
Questions?

Resources:

ArcGIS Online Help – Keywords Search
• “About using ArcGIS services in ArcGIS for Desktop”
• “About adding an image service layer to ArcMap”

Vermont LiDAR Initiative Homepage: http://vcgi.vermont.gov/lidar

VCGI YouTube channel (https://www.youtube.com/user/Vtgeospatial)

• Connecting to VCGI Web Services in ArcGIS and QGIS
• Geospatial Web Services at VCGI: a Look Under the Hood
• Vermont's New Open Geodata Portal
• VT Open Geodata Portal Videos
• The Vermont Open Geodata Portal: Finding Data, Services, and Apps
• Downloading and Connecting to Data and Services at the Vermont Open Geodata Portal

The Vermont Open Geodata Portal: Finding Data, Services, and Apps
## ArcGIS Licensing Requirements

<table>
<thead>
<tr>
<th>Functionality</th>
<th>ArcGIS for Desktop Basic (or higher)</th>
<th>ArcGIS for Desktop Standard (or higher)</th>
<th>ArcGIS 3D Analyst extension</th>
<th>ArcGIS Spatial Analyst extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create LAS dataset</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create a mosaic dataset containing LAS data</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Convert LAS into a multipoint feature class</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>View LAS data (via LAS dataset/mosaic dataset/terrain dataset)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Convert LAS to raster</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Run raster-based analysis against LAS (via mosaic dataset)</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Use the LAS dataset toolbar tools in ArcMap or ArcScene</td>
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<tr>
<td>Editing LAS class codes</td>
<td></td>
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<tr>
<td>Editing mosaic datasets</td>
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<tr>
<td>Editing terrain datasets</td>
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