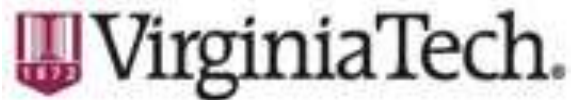


Web3D Showcase – March 25, 2014

Virginia Tech - Arlington, Virginia

Next Generation Spatial Data Infrastructures



Peter Sforza

Virginia Tech

Director, Center for Geospatial Information Technology

<http://www.cgit.vt.edu/>

sforza@vt.edu

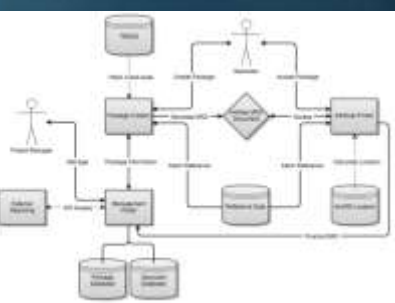
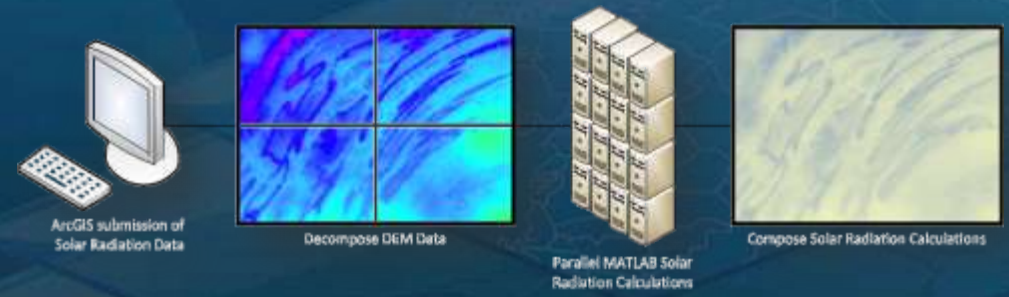
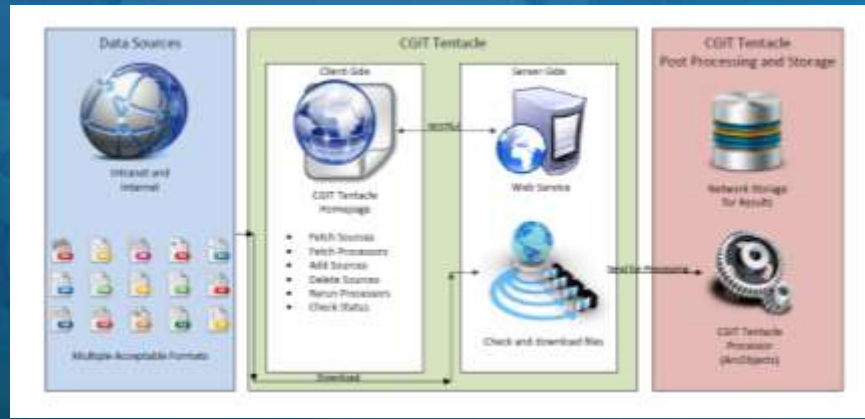
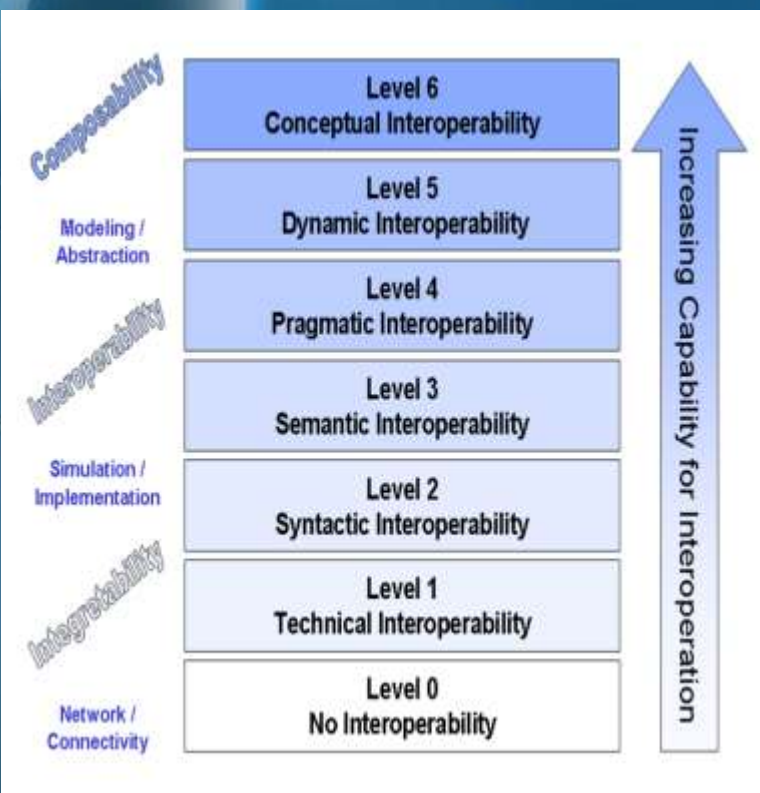
Ph: (540) 231-8940

Next Generation Spatial Data Infrastructures

- 3D Blacksburg was created to harmonize the various users and producers of 3d city models.
- VT CGIT is engaged in several applied domains for local to global SDI research
 - Campus CAD-GIS-BIM
 - TOB WiFi design and optimization
 - Regional 911
 - VA DSM, Parcel, RRCL
 - VA / National Broadband Mapping
 - VA Dept of Motor Vehicle crash records
 - VA Dept of Emergency Management
 - Eastern US Site Assessment
 - Global Agroclimate
 - International Charter for Space and Major Disasters

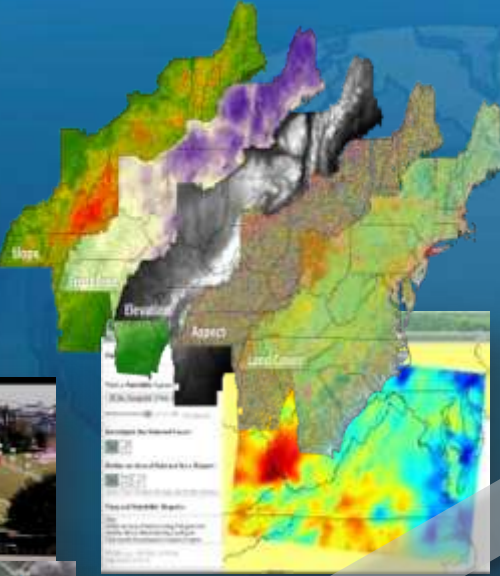
Peter Sforza, Director
sforza@vt.edu

Source Name	URL	Last Updated	Recurrence	Status	Action
1 US Drought Monitor	http://drought...	06/05/2012 7:00:00 AM	Weekly	●	Delete

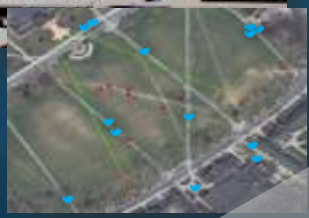


Website for "3D Blacksburg collaborative" with navigation links: Home, Contact, About, Register. The page features a 3D cityscape background and sections for "Learn", "Explore", and "Get Involved".

A colorful infographic titled "ADVANCED PLANNING AND ANALYSIS BROADBAND TOOLBOX FOR VIRGINIA'S STATE BROADBAND INITIATIVE". It includes logos for CGIT, VGN, and Geospatial, along with various data visualizations and text boxes.

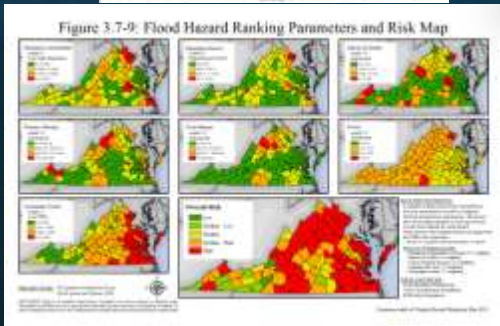
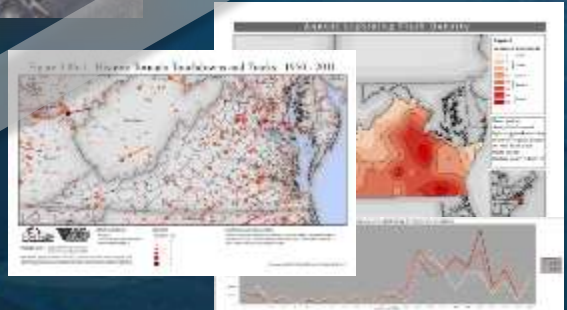


Global



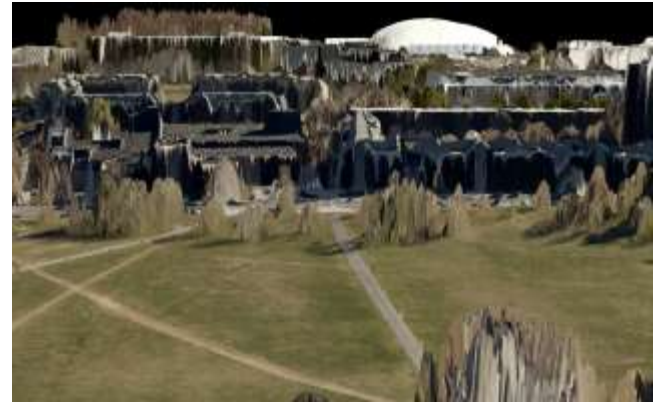
www.cgit.vt.edu

Local



New Statewide Digital Surface Model (DSM) for Virginia

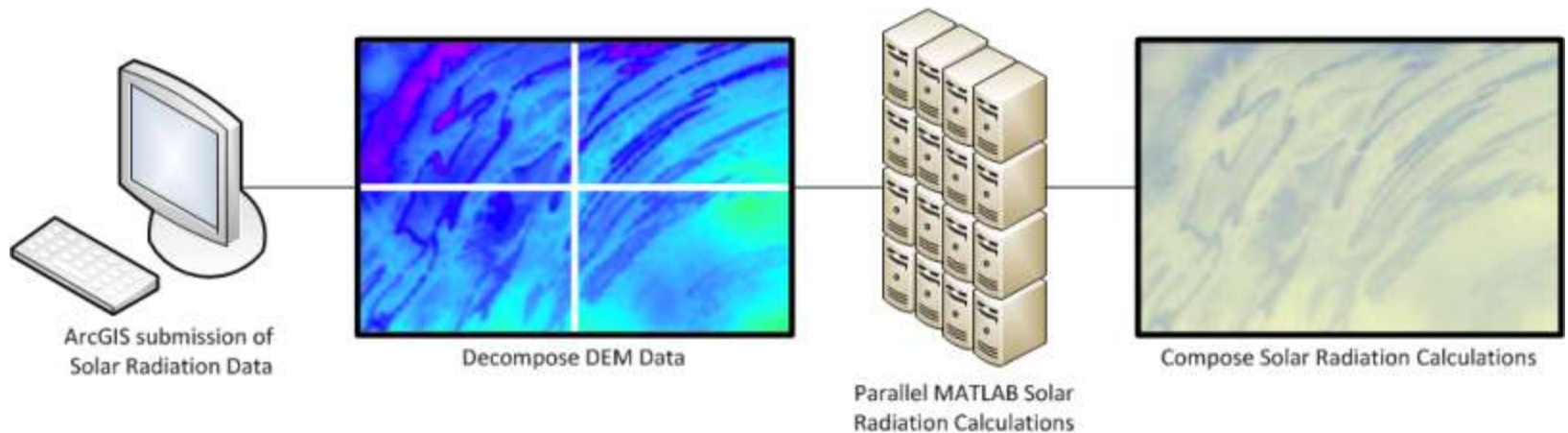
from LiDAR and Photogrammetry



- Proposed by VT-CGIT and VGIN to support development of 3D Spatial Data Infrastructure and the Advanced Broadband Analysis and Planning Toolbox for the Commonwealth of Virginia Broadband Mapping Initiatives
- A digital surface model (DSM) is a digital representation of all natural and artificial features that are visible on the surface of the earth. It includes exposed ground and above-ground features, such as vegetation, buildings and other cultural features. It is useful in geospatial analysis and applications that require line-of-sight, viewshed or vegetation analysis. Applications of DSM data are found in telecommunications, forestry, community planning and renewable energy.
- A statewide DSM for the Commonwealth will be created to support wireless broadband mapping efforts such as vertical assets identification and wireless broadband propagation modeling. The statewide seamless DSM will also provide the basis for analysis and visualization that may support policy and business investment decisions related to broadband and communications infrastructure in the Commonwealth of Virginia.
- As a part of the final product deliverable, a qualitative accuracy assessment will be performed by the DSM developer. This assessment will conform to the National Standard Accuracy (NSSDA) <http://www.fgdc.gov/standards/projects/FGDC-standards/projects/accuracy/part3/chapter3>

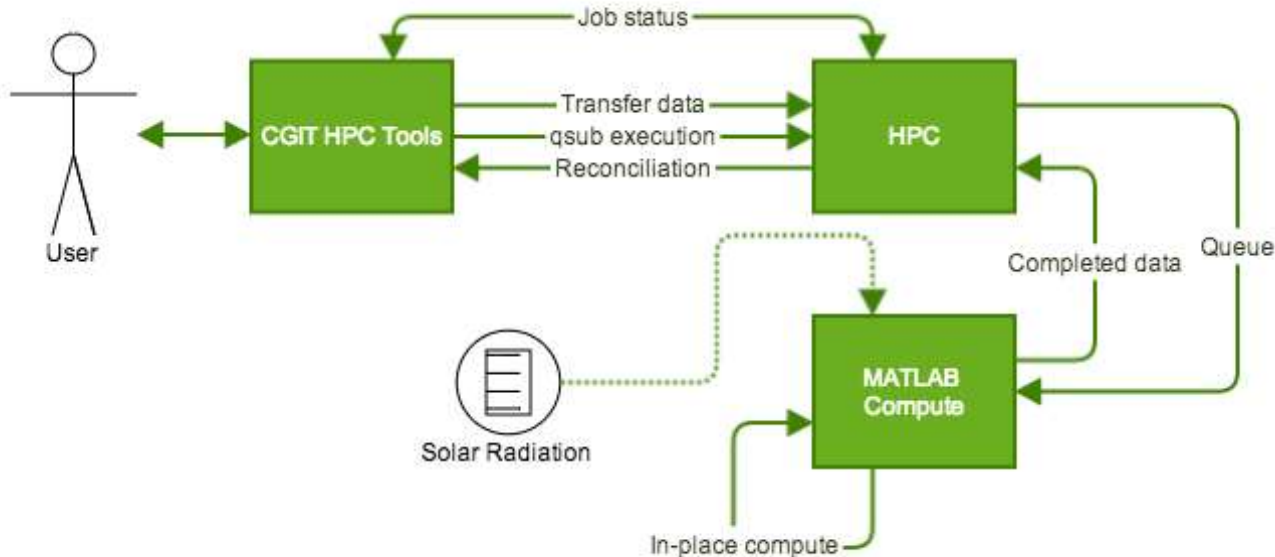
Architecture Overview

- ESRI C#.NET AddIn
- Parallelized Solar Radiation
 - Felix Hebler on MATLAB Central File Exchange
 - Parameterized
- SSH and SFTP command line



Implementation Overview

- Read and extract raster metadata
- Split raster grid-wise and convert to ASCII GRID
- Transfer data to ARC staging
- Execute qsub job to queue MATLAB computation
- Retrieve job ID and status
- Reconcile and regenerate complete raster



CGIT HPC Portal

Server Calculation Job Status

Raster Dataset
90m_srtm_va

Matrix Size:

Solar Radiation Settings
Latitude: Low High

Cellsize Timestep

Reflectance

Solar Radiation Day Range
 to

Actions
Job Name:

CGIT HPC Portal

Server Calculation Job Status

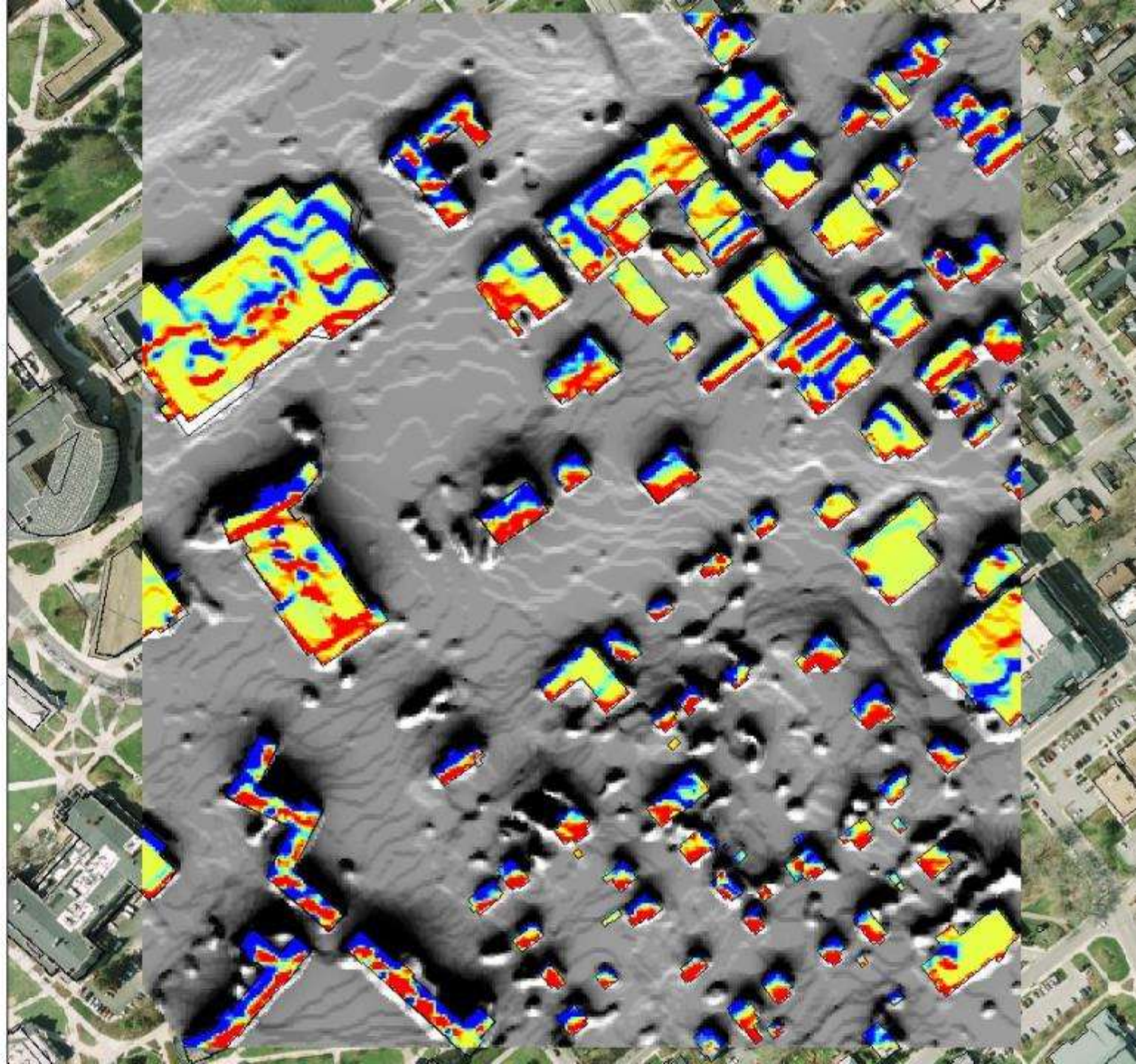
Current Jobs

Completed Jobs
 Rebuild Raster



Incoming solar radiation using a 5-m DSM produced using the SimActive Correlator 3D software with the 1-m VBMP stereopair imagery and metadata as input.

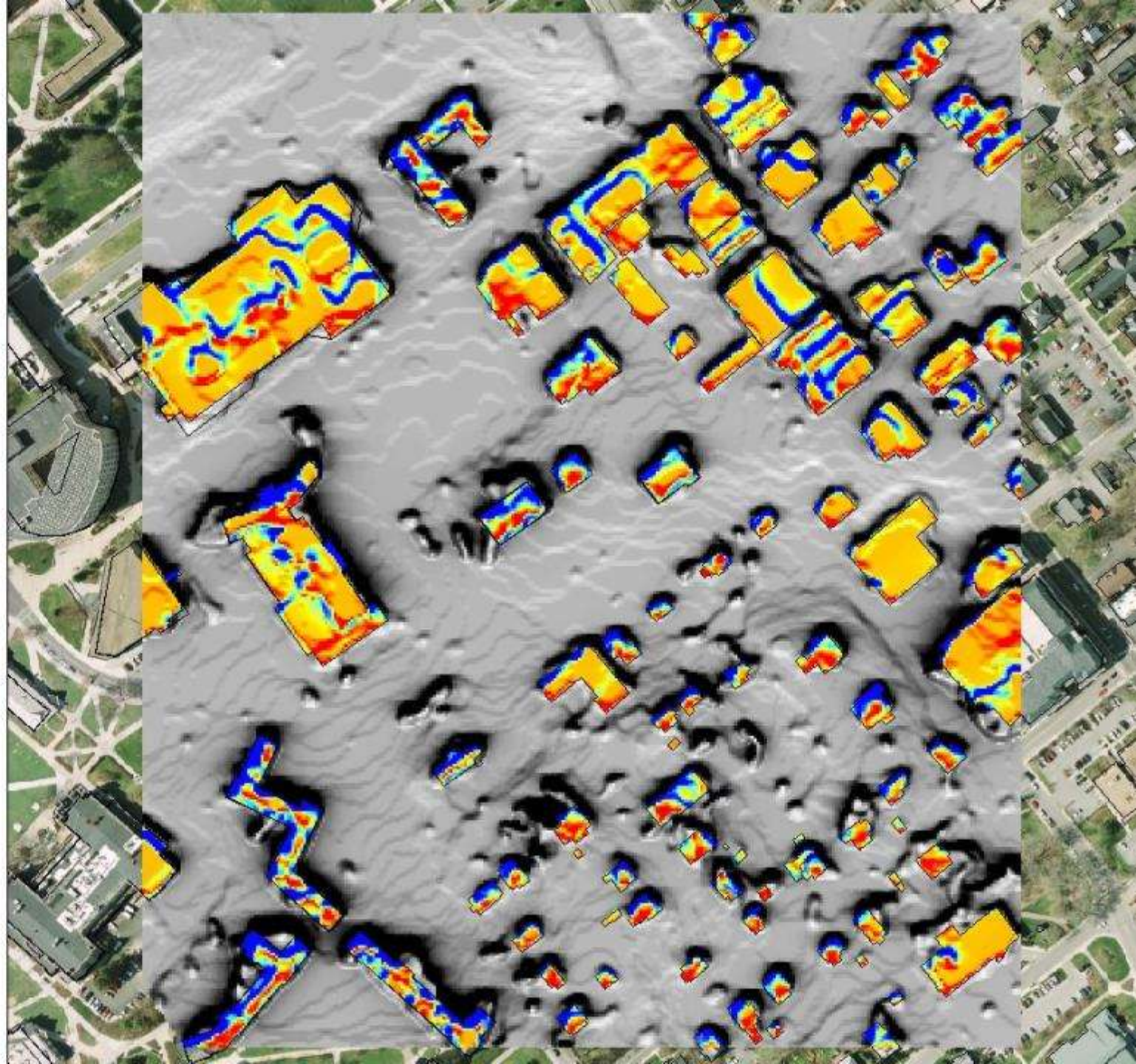
CGIT 02/10/2011
sforza@vt.edu





Incoming solar radiation using a 5-m DSM produced using the SimActive Correlator 3D software with the 1-m VBMP stereopair imagery and metadata as input.

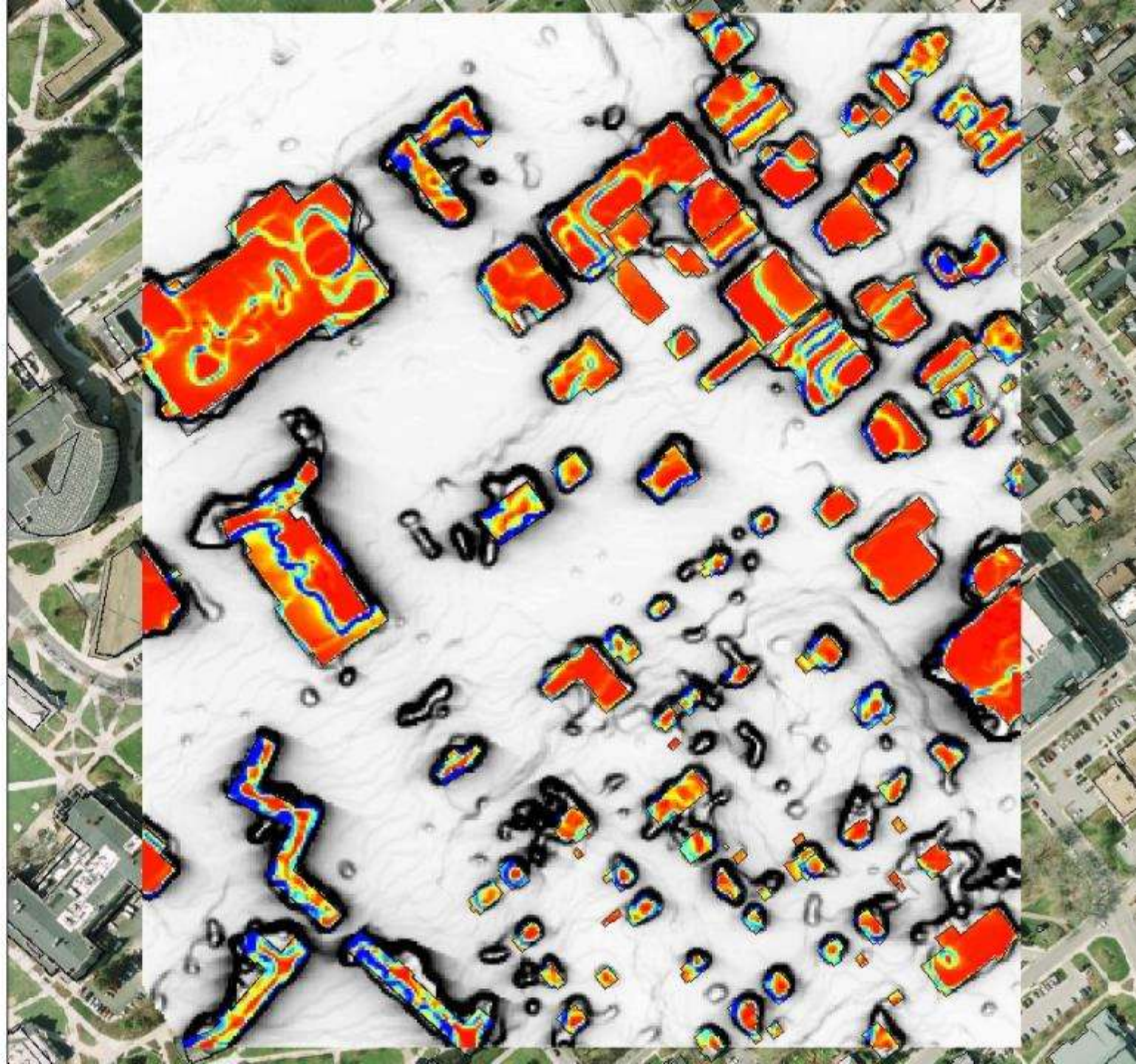
CGIT 02/10/2011
storza@vt.edu





Incoming solar radiation using a 5-m DSM produced using the SimActive Correlator 3D software with the 1-m VBMP stereopair imagery and metadata as input.

CGIT 02/10/2011
storza@vt.edu



GARDEN

Geospatial Archive Resource and Data Exchange Network



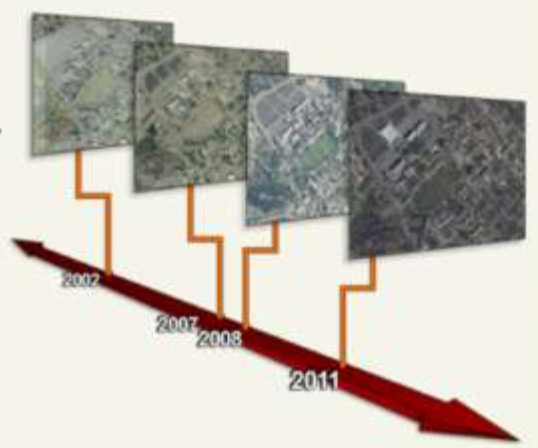
- About GARDEN - Home
 - GIS Data
 - Instructions for Use
 - Terms of Service
- Enterprise GIS
2000 Torgersen (0197)
Blacksburg, VA 24061
- Email the FGIS
or call us at (540) 231-2178

GARDEN

VA Geospatial Archive Resource and Data Exchange Network

The GARDEN project is a joint initiative between the Virginia Geographic Information Network (VGIN) and leading universities in the Commonwealth of Virginia. Through GARDEN, participating universities serve as a "mirror" for VGIN's datasets, providing a locally hosted, faster performing set of map layers to faculty, staff and students, while providing redundancy and geographic diversity of off-site storage locations to VGIN.

Virginia Tech's GARDEN node is hosted at <http://garden.gis.vt.edu>.



ADVANCED PLANNING AND ANALYSIS BROADBAND TOOLBOX FOR VIRGINIA'S STATE BROADBAND INITIATIVE



Broadband Coverage Data



The Virginia Broadband Availability Map is an interactive map available by location that aims to highlight the availability/availability of broadband internet service. <http://mapping.virg.org/virginia/broadband/>

The National Broadband Map is a tool to search, analyze, and map broadband availability across the United States. The map is maintained by the NICTD, in collaboration with the FCC and in partnership with 30 states, five territories and the District of Columbia. <http://www.broadbandmap.gov/>

Verification & Analysis



The ability to model wireless coverage accurately is extremely important in our increasingly wireless world. Detailed 3-D physical models enhance data collection efforts for speed testing and network capacity planning, and enable wireless propagation estimates that closely match real-world experience.

DTM & DSM 3-D Viewer

A monthly DTM and DSM will be produced by VGIN and its partners from the latest available sources, including data in various Virginia and out-of-state formats. The resulting products have a 10m resolution. The current 3-D viewer is available for VGIN and CIT. A monthly 3-D viewer will be available for all users. The 3-D viewer will be available for all users. The 3-D viewer will be available for all users.



RF Modeling



The RF modeling tool will use the data from the 3-D physical models to generate a 3-D model of the wireless environment. The model will be used to generate a 3-D model of the wireless environment. The model will be used to generate a 3-D model of the wireless environment.



Map Books



The Map Book project consolidates the various data layers from Virginia's interactive broadband availability map for each county as well as to create new views of related information.

Policy Database

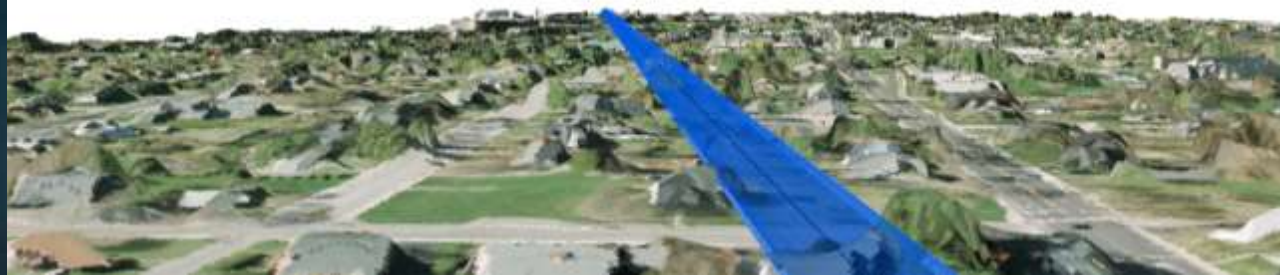
The Policy Database provides a central location for all policy documents related to broadband. The database includes information on state and local policies, as well as information on federal and international policies.

Vertical Assets

The Vertical Assets Inventory Toolkit allows owners and managers of desirable sites to be found more easily by WISPs looking to develop their services in a specific area. Having this information readily available can speed up the siting process, and lower the costs of system development and deployment.

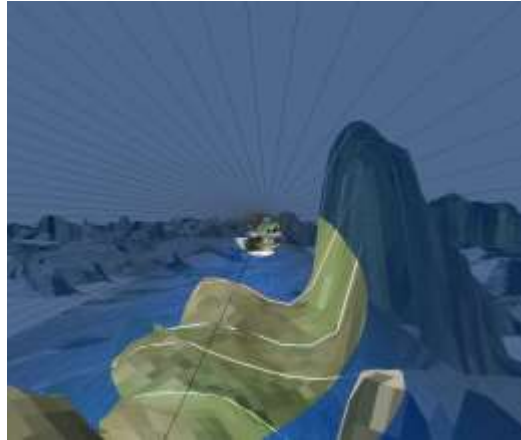


ECET produces wireless propagation estimates that use a closer match with real-world experience. The resulting RF propagation models help the probability that a given area would receive sufficient signal for their use for the applications required.



Microwave Transmission Corridor Mapping and Analysis

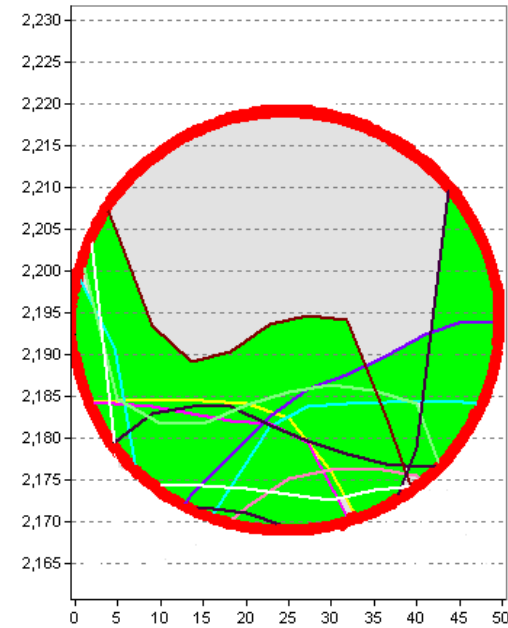
Peter Sforza, Thomas Dickerson, Matej Muza
CGIT Virginia Tech - May 2011



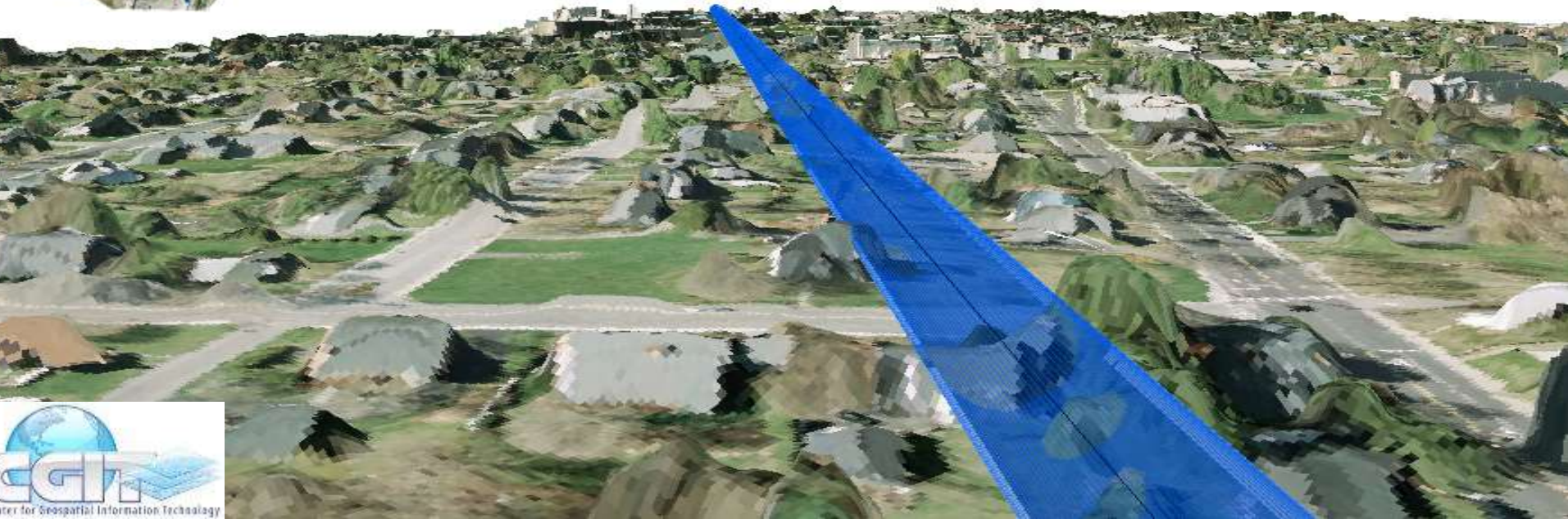
Analysis using TINs:

Volume = 248966.77 ft³; 3DArea = 51005.54 ft²; 2DArea = 31429.18 ft²

Cross-sectional obstruction profiles



Sample of 10 cross-sectional profiles of corridor obstructions



3D NAVIGATION

Turn Orientation Sensor Off | Invert Orientation Sensor | Move rotation point to center of viewpoint

Viewport: Focus on upload

33.7

Number of Tests

0 10 20 30 40 50

SELECT OBJECTS TO RENDER

Display 3D markers Display graph Display average upload markers

DATA CONTROLS

Redraw Signal Plot | Redraw Graph | Autoupdate 2D Graph

Rotate graph

Move reference plane 12568 / 213253 1 kbit/s

Change Map Transparency

Show Reference Planes Black-green scale

GEOLOCATION

Turn Device Geolocation On | Turn Device Geolocation Off

Lat: 37.2364535 | Lon: -80.3934859 | Accuracy: 218 meters

Map | Satellite

SCALE 3D GEOMETRY

Scale top markers

Scale bottom markers

Scale global

Square Root Scale

DEVELOPER TOOLS

Run FPS Test

Device orientation angles

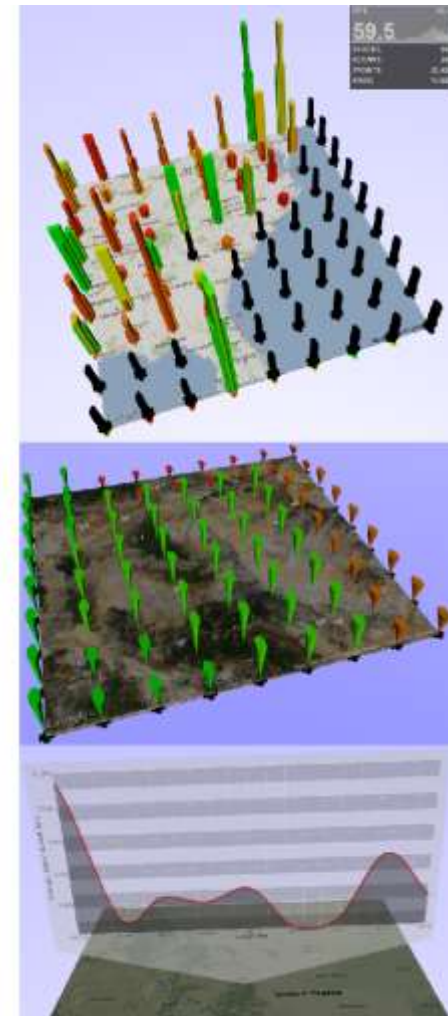
Alpha

Beta

Gamma

Axis-angle representation

HELP



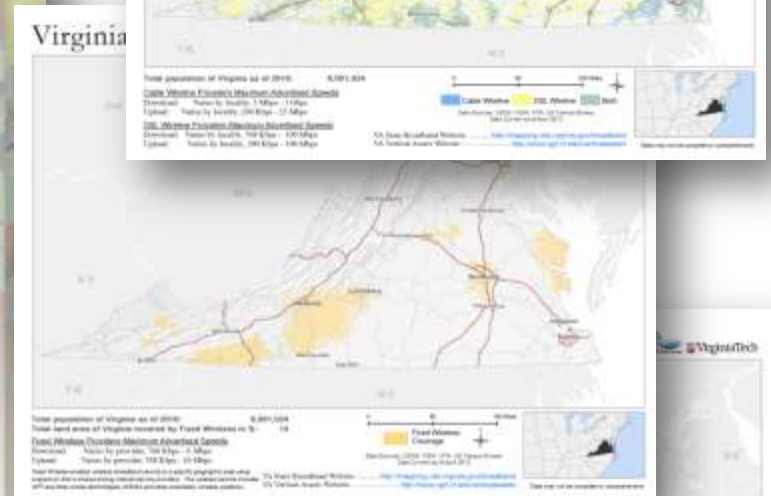
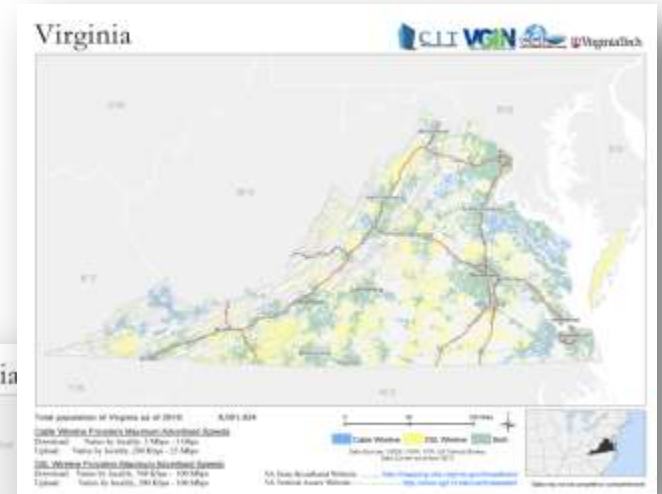
User interface, left, and various display options for maps and broadband visualization, right
 SpeedSpy – Sharakhov et al (2013) <http://dl.acm.org/citation.cfm?id=2534931>

Broadband Planning and Analysis Toolkit Demos

1 – Broadband Mapbook Portal:

<http://www.youtube.com/watch?v=pzt0-29InLQ>

The screenshot shows the Virginia Broadband Map Book Portal website. The header includes the Virginia Tech logo and the tagline "Invent the Future". The main content area is titled "Virginia Broadband Map Book Portal" and features a search bar, navigation links (Home, About Us, Contact), and a "SAMPLE MAPS" section. The "Geographic Area" section allows users to select a geographic area (Statewide, County/City, or Planning District) and a planning district. The "Mapbook Theme" section offers various themes such as "Statewide Theme 2012" and "Statewide Theme 2010". The "Mapbook Theme 2010" section provides a list of planning districts and their corresponding mapbook themes.



Broadband Planning and Analysis Toolkit Demos

2 – Broadband Policy Database: Generates a report based on user-selected location. The report highlights policies at multiple jurisdictional levels that may affect broadband deployment at that location.

Virginia Telecommunications Policy Database
Spatial Decision Support for Tower Siting

VirginiaTech
CGIT | Virginia's State Broadband Initiative

Tower Site Selection Tool

1. Zoom to your site on the map.
2. Click the "Select Location" button, then click the location of the potential tower.
3. Click "Get Report." Your report generation may take a few minutes to complete.

Select Location Get Report

Click here to view site report.

The Virginia Broadband Policy Database application allows users to select a point on a map that represents a potential wireless tower or equipment installation site, then obtain a report on the national, state, and local policy guidelines or restrictions that may be applicable for that location. This information is of critical importance in planning the placement of wireless towers or other wireless equipment installations. This web application was created by the Center for Geospatial Information Technology at Virginia Tech, as a part of the Virginia Statewide Broadband Initiative.

To begin: Click on the Policy Tool menu, then select the Site Report Tool. Follow the instructions provided to generate your site's Policy Report.

Disclaimer: The local, state, and national policies referenced in this report are intended to showcase the types of policies important for siting broadband infrastructure. Most of these policies have been paraphrased from the actual codes. In addition, there may be other policies that regulate the siting of broadband infrastructure that have not been reflected in these reports. For more detailed information concerning the policies please refer to the appropriate legislation.

CGIT | CAPRI/OWENS

Questions/Contact | Disclaimer

VGIN | CIT

Policies for Siting Broadband Infrastructure

This report provides information on National, State, and Local policies for the siting of broadband infrastructure, including telecommunications towers and antennas as well as wireless cell structures. The FCC requires that communications towers be environmentally compliant under the National Environmental Policy Act and may not negatively impact a historic property under the National Historic Preservation Act. Other than these regulations, state and local authority takes precedence over zoning and land use decisions for the siting of broadband infrastructure. This report was generated by: <http://virginia.cgit.edu/Broadband-Policy/>

Disclaimer: The local, state, and national policies referenced in this report are intended to showcase the types of policies important for siting broadband infrastructure. Most of these policies have been paraphrased from the actual codes. In addition, there may be other policies that regulate the siting of broadband infrastructure that have not been reflected in these reports. For more detailed information concerning the policies please refer to the appropriate legislation.

Spatial Decision Support

Policies associated with the siting of broadband infrastructure are complex, involving many different levels of government. This tool organizes these policies into a database, adding a spatial component for siting analysis.

Below is an example of a spatial decision support layer for telecommunications tower siting in Virginia.

Data Source: 2012 National Map Service Data; State Plane Topography System; VGIN Administrative Boundaries

Legend

- Critical Facilities
- Wilderness Areas
- Nat. Register of Historic Places (within 1/2 mile)
- Conservation Easements
- Nat. Wildlife Refuge System
- Mount (within 10,000 or 20,000')
- Penitentiaries
- Approach (within 1 mile)
- National Radio Quiet Zone
- Wildlands

USGS | Protected Areas Database of the United States (PAD-US) version 1.2 - 11/2009 | Download from <http://geodata.crk.usgs.gov/pad-us/>

Local Data

Foot of Broadband Siting Information Report #1 | Released by: 1/17/11; Map Data: National Wetlands Inventory (within 1000'); Foot of Broadband Siting Information Report #1; Data Source: <http://www.fws.gov/wetlands/>; <http://www.fws.gov/wetlands/>

Foot of Broadband Siting: Code of Ordinances; <http://www.cityofvirginia.gov/codes/>

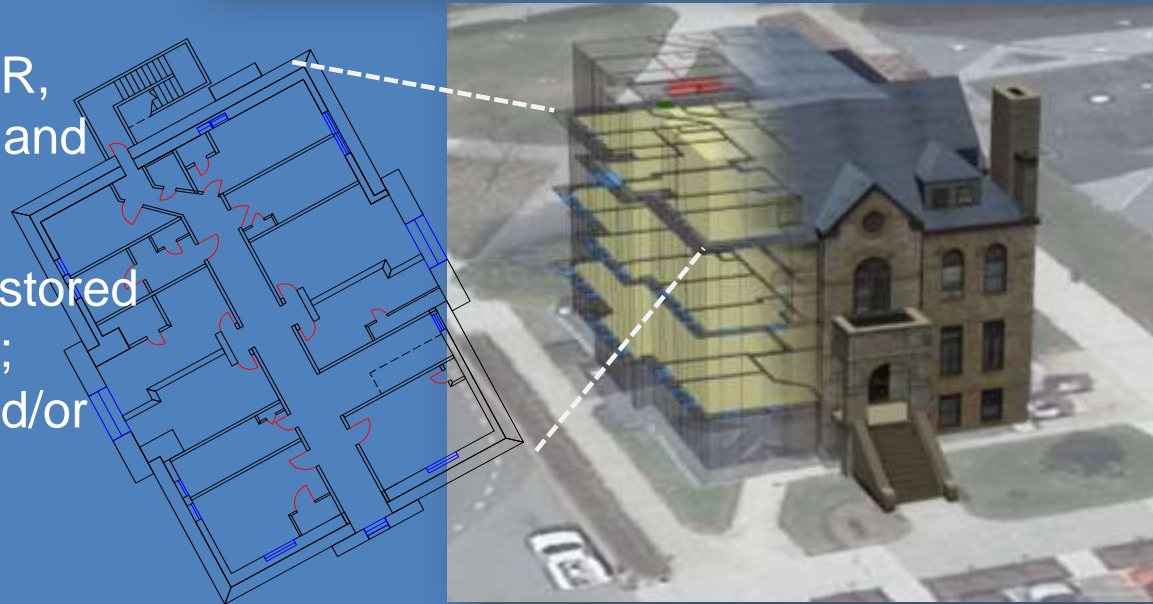
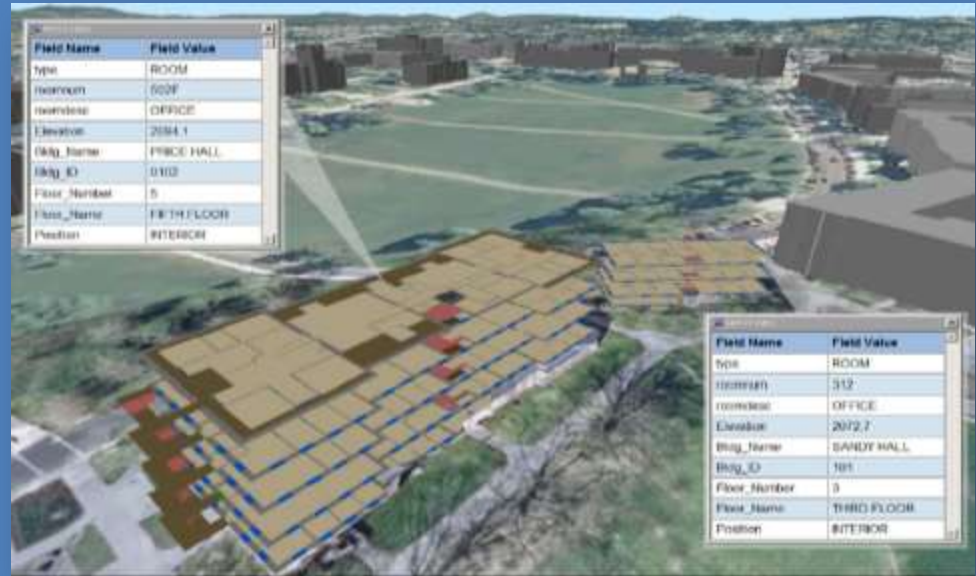
CGIT | VirginiaTech | CIT | VGIN

Selected Project: Campus Interior Space

The campus interior space project was initiated to provide a foundation for campus-wide space management, indoor navigation, safety, and other applications.

Spatial representations of building interiors and exteriors are created using CAD floorplans, orthophotography, aerial LiDAR, close-range photogrammetry, and other reference data.

The results of this project are stored in an enterprise geodatabase; authorized users may view and/or edit the dataset.





3D Blacksburg

- .Web-published GIS and 3D collections, services
- .Standards-based, cross-platform web visualization
- .Internal and public (CC-A) use versions
- .Goals:
 - A vibrant, engaged and informed community
 - A durable and interoperable platform with which to conduct studies on planning, environment, energy, safety, transportation and economy



X3D VT



3D Blacksburg collaborative

<http://www.3DBlacksburg.org/>

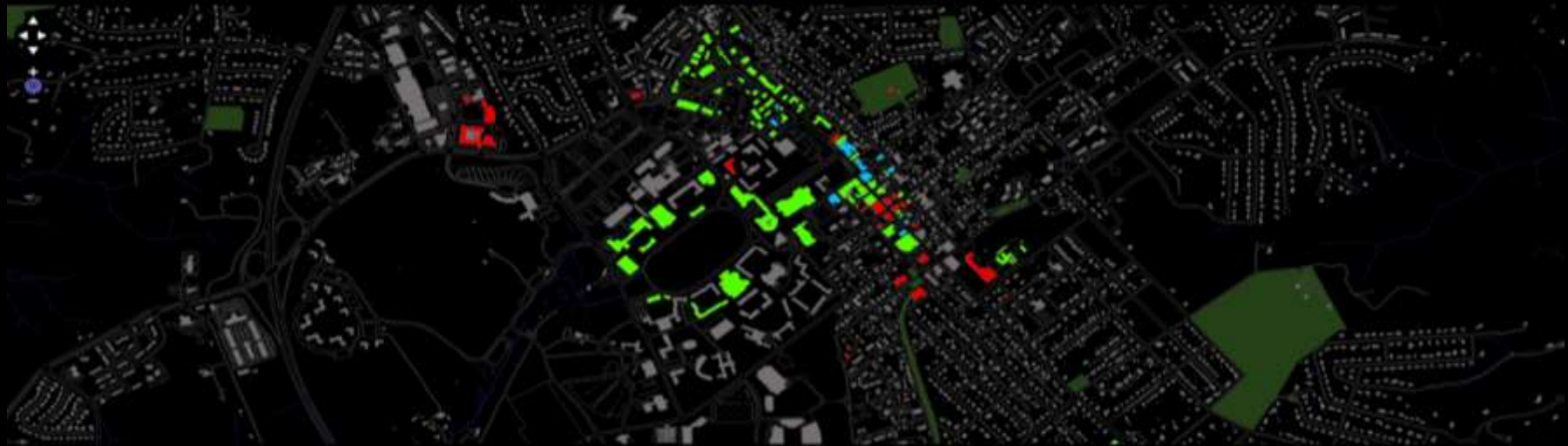
Home Contact About Register

Search...



Project Status Map

3D Blacksburg collaborative



LOD 1:



LOD 2:



Textured:



Unfinished:



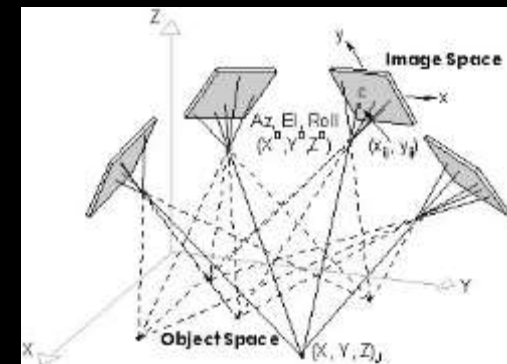


Interior-Exterior *Geometric* and *Information Model* Convergence

3D Modeling Workflows



Bundle adjustment from 34 photos
 – using Canon Rebel Ti
 Initial results for Virginia Tech
 Performing Arts Building

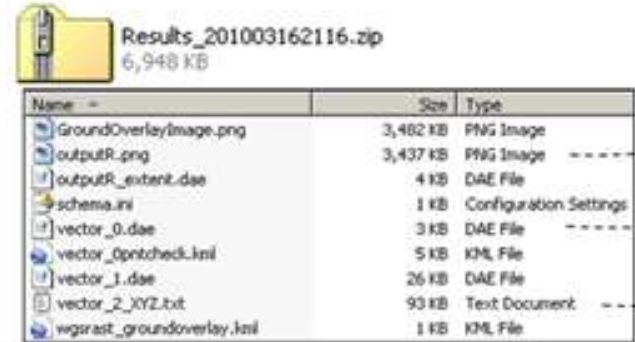


Collaborative 3D City Modeling

Data Download Website



Individuals Receive Reference Data Zip File

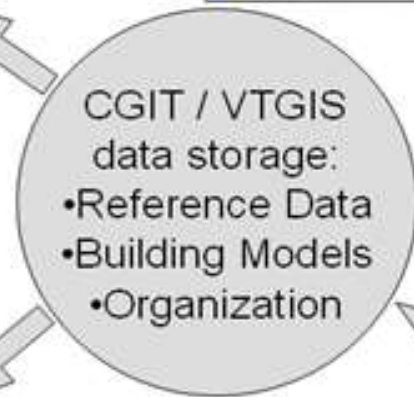


Aerial photo

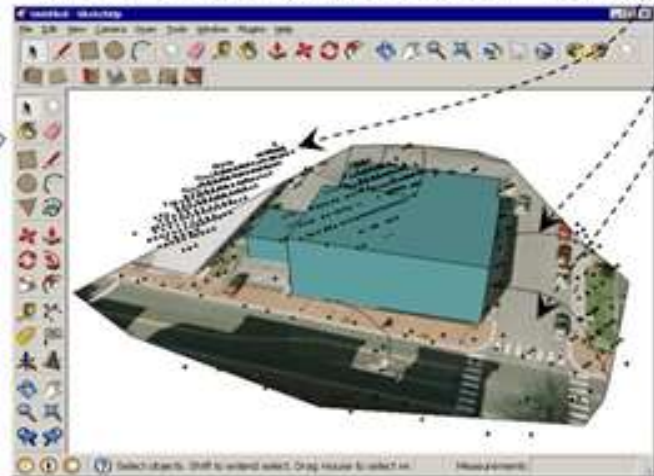
Contours

LIDAR*

*LIDAR not yet eligible for public release



3D Modeling Based on Data



Virtual 3D City Model



Other Creative Uses:

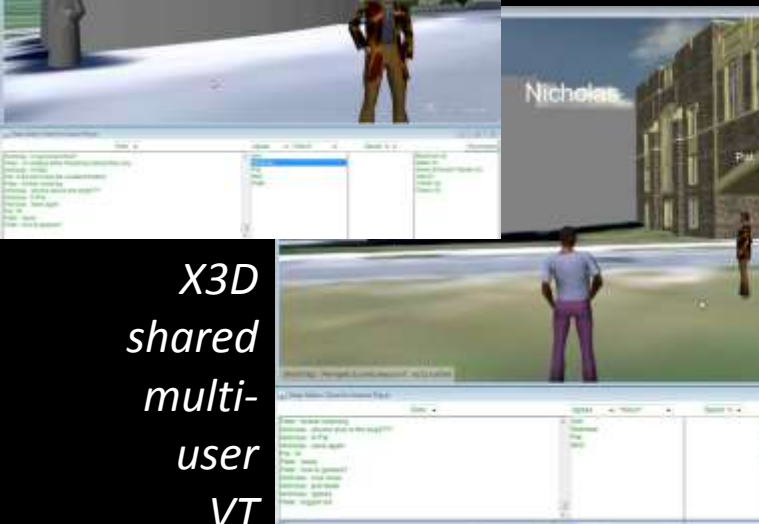
- GIS analysis and modeling
- Artistic visualization



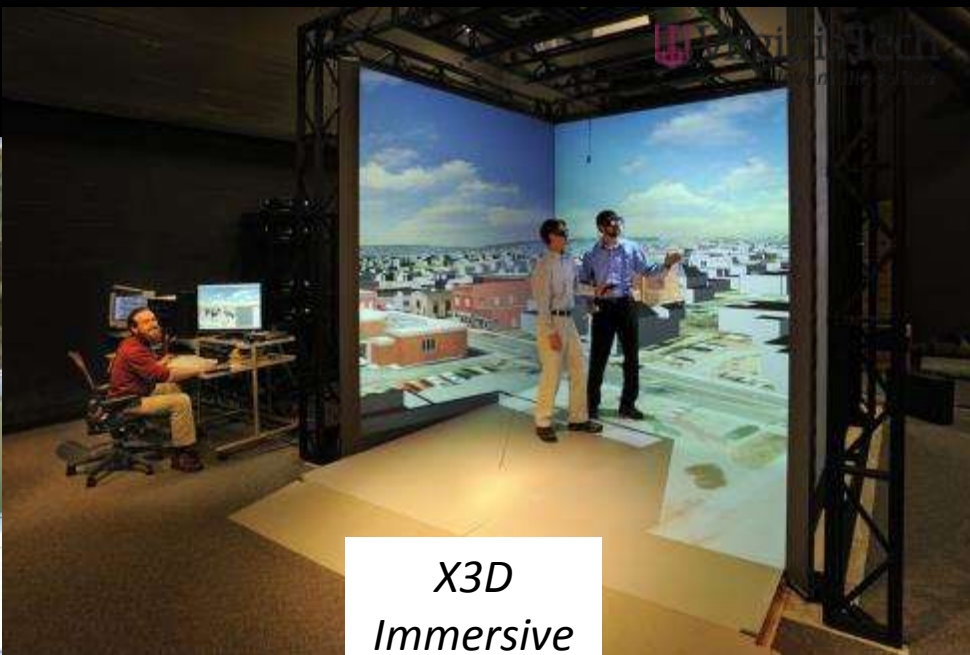
3D Blacksburg



*Town & Building
LODs*



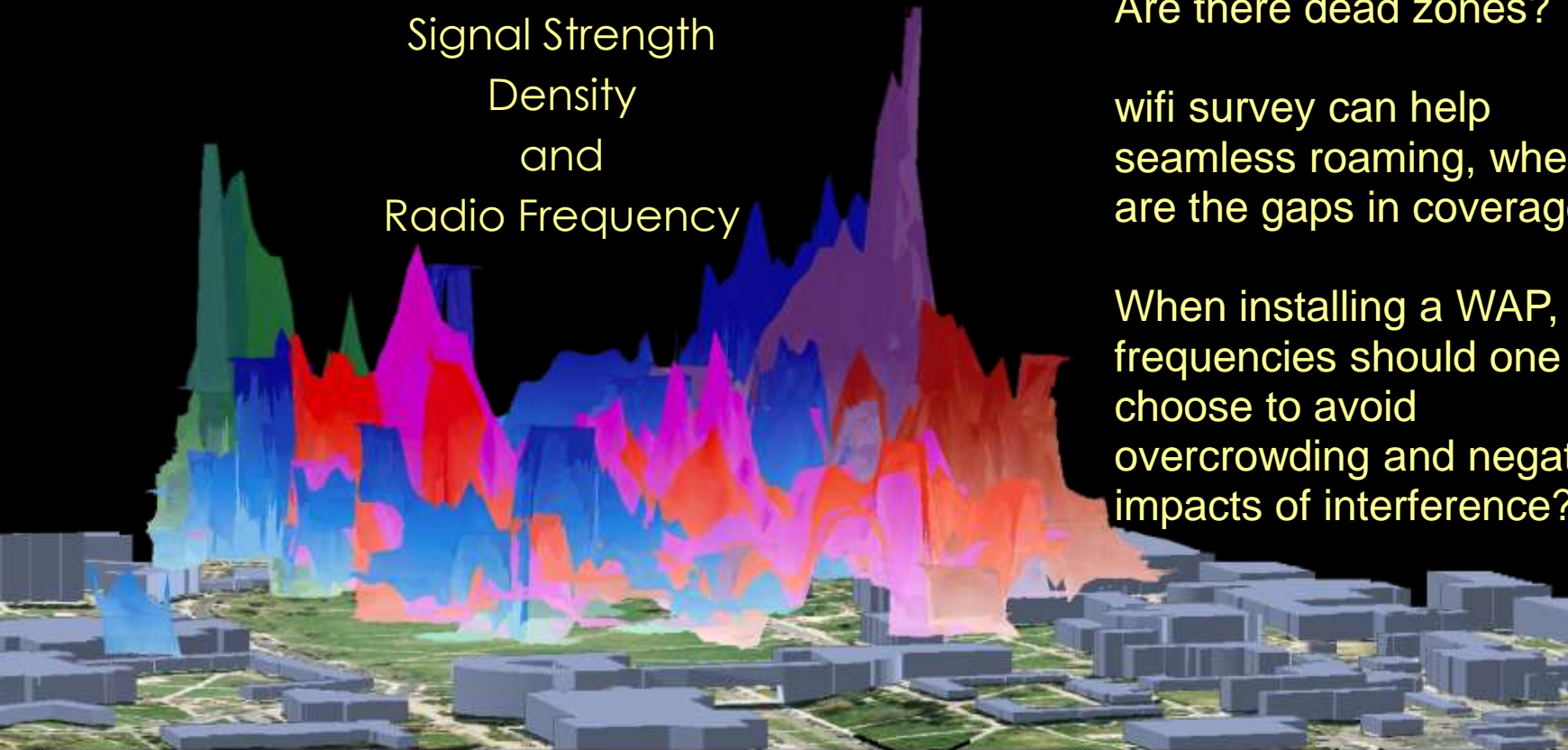
*X3D
shared
multi-
user
VT
Campus*



*X3D
Immersive*

WiFi Signal Mapping

2D and 3D Interpolations:
Signal Strength
Density
and
Radio Frequency



where can I get wifi access?
Are there dead zones?

wifi survey can help
seamless roaming, where
are the gaps in coverage?

When installing a WAP, what
frequencies should one
choose to avoid
overcrowding and negative
impacts of interference?

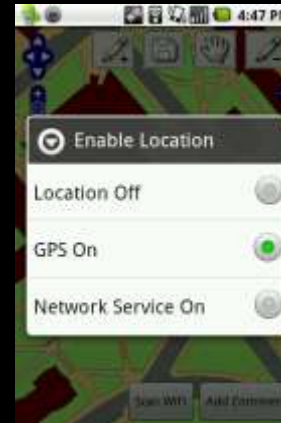
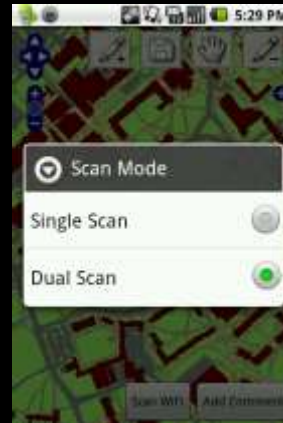
Interior location and navigation

Network security diagnostics and forensics.

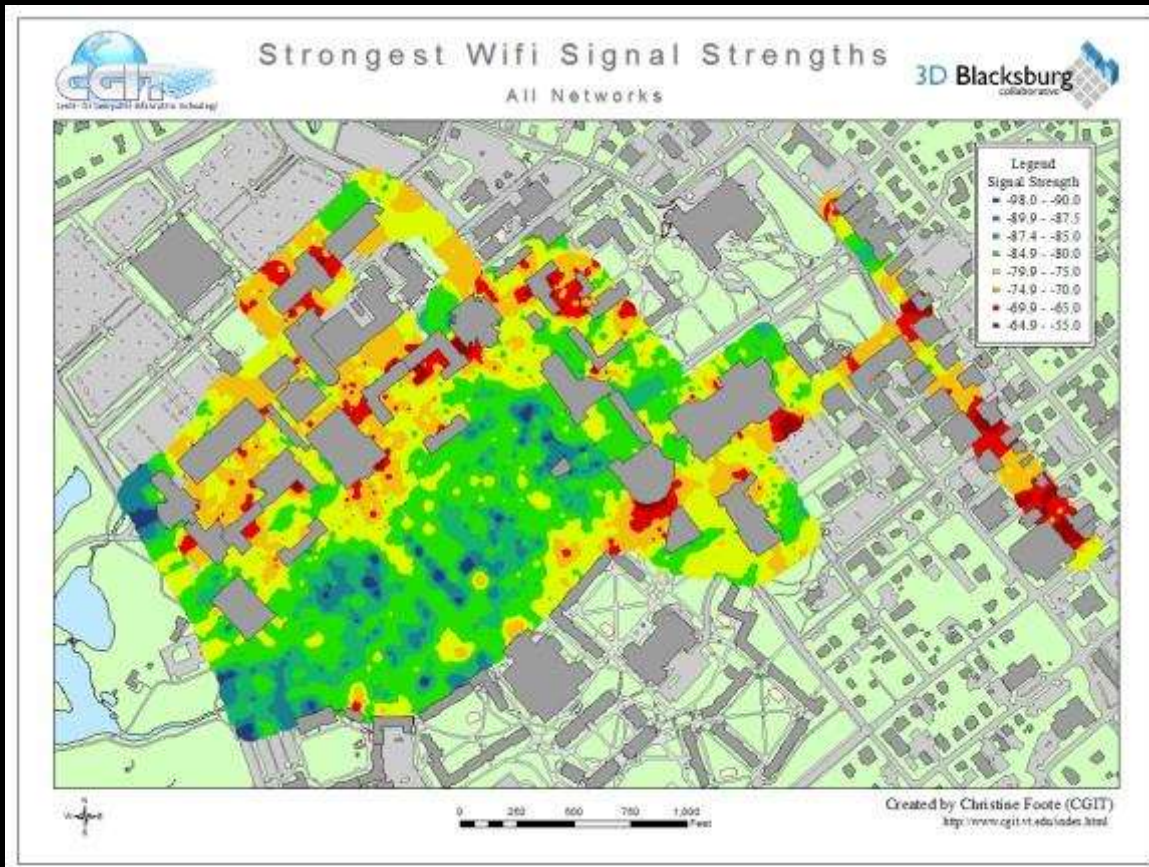
Identify anomalies such as rogue networks, or
networks that violate FCC regulations.

WiFi Scanner Application (Android)

Set scan mode to “Dual Scan”, enable GPS, zoom in, pinpoint location, initiate the scan, repeat



All Networks: Best Signal Strengths

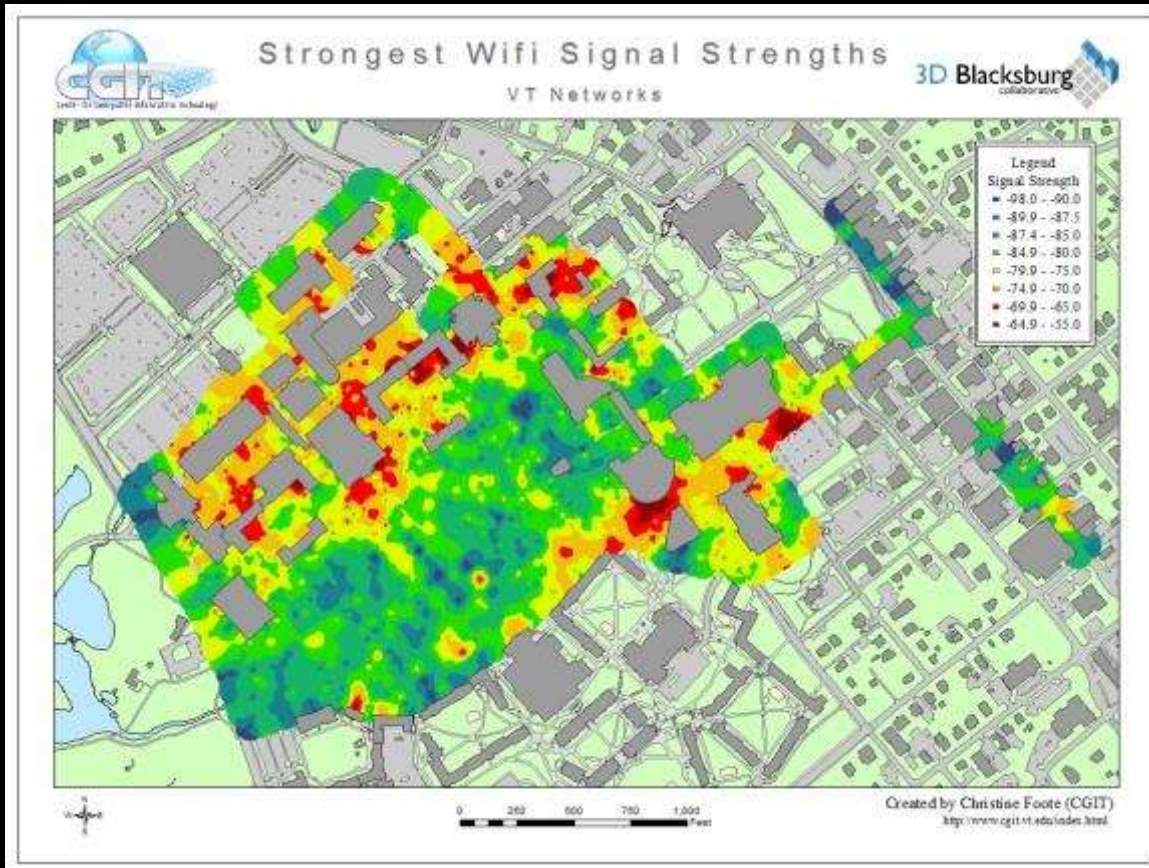


This map displays the strongest signal strength viewed at each scan location, regardless of its network, security type or channel.

Throughout the Drillfield and continuing on toward Alumni Mall, signals are weak. The southern end of main street shows the largest areas of very good signal strength.

On this map, there are two spots of strong signals that can likely be attributed to large windows in nearby buildings. The first is the area just outside of Newman Library's café, and the second fans out of Squires' main entrance on College Ave.

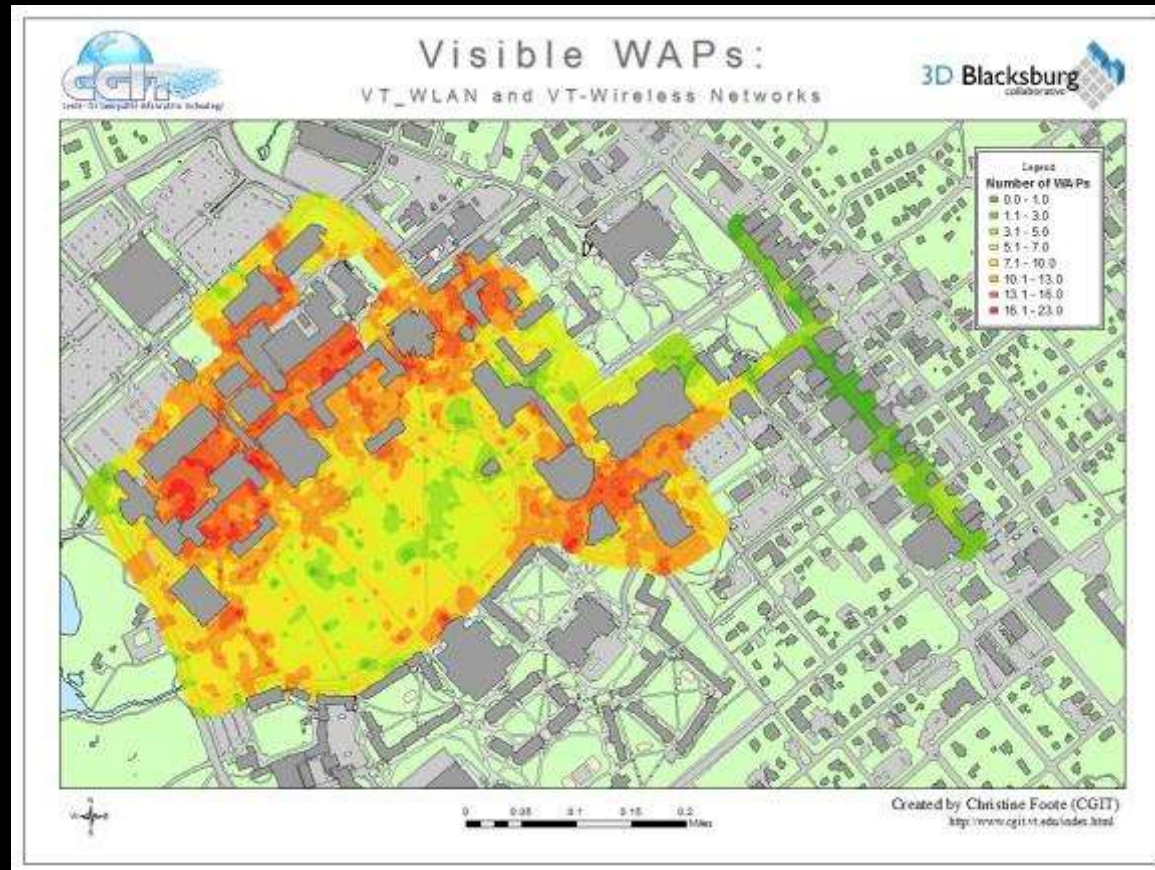
Combined VT Networks



This map shows the maximum signal strength visible at each scan location for the VT_WLAN and VT-Wireless networks. The strongest signals here are located very close to the buildings on campus. The Drillfield, Mall, and Main Street have much weaker signal strengths, though further south along Main Street the strength increases.

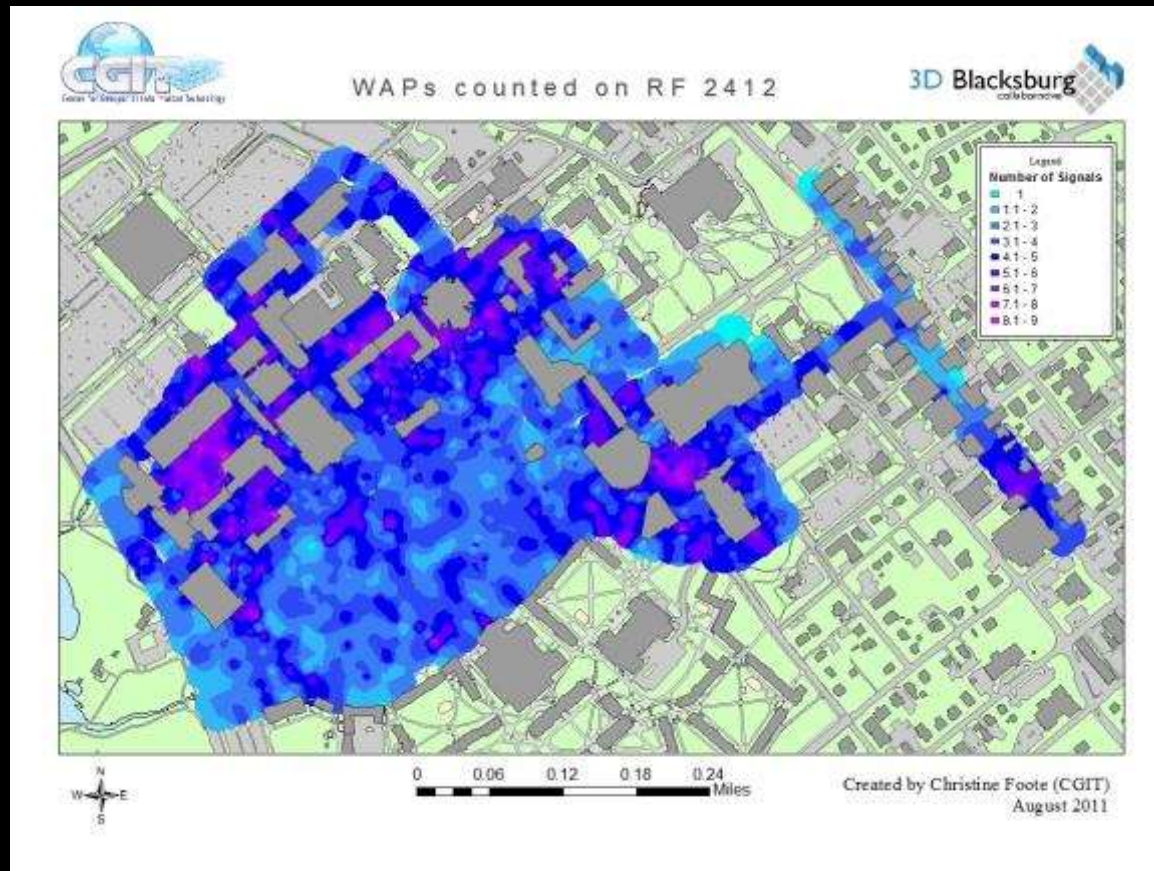
Number of WAPs: VT Networks

This map depicts the number of wireless access points counted at each scan location for both the VT_WLAN and VT-Wireless Networks. While no or very few signals were visible along Main Street, the most are seen between buildings in the northern part of campus, as well as in the vicinity around the bookstore, reaching up to 23 signals detected in a single location. The Drillfield, Torgerson and Brodie Halls, as well as the mall do tend to see signals, though on average less than 10 per location.



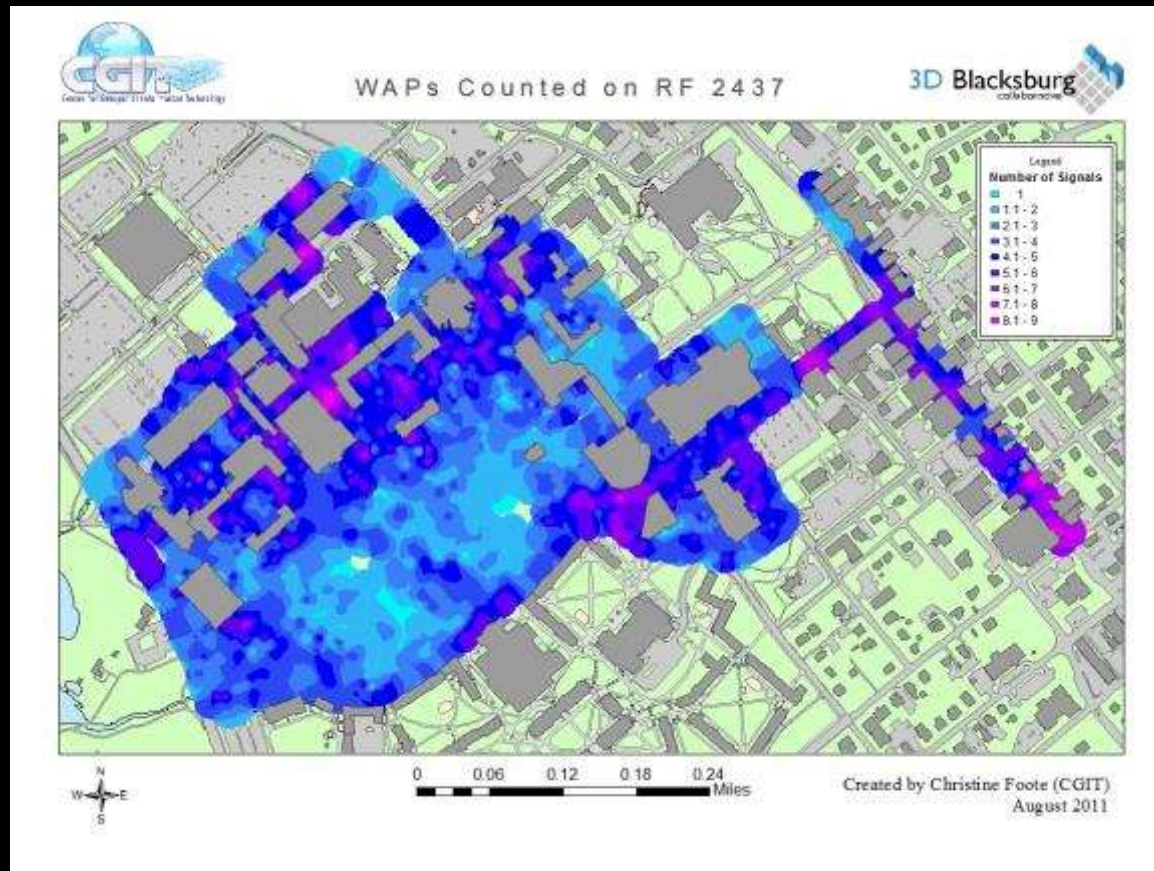
RF: 2412

The area behind Pamplin and Robeson Halls saw consistent large numbers of signals on this channel. This is also true of the areas surrounding Holden and Norris Halls, as well as the Squires Plaza.



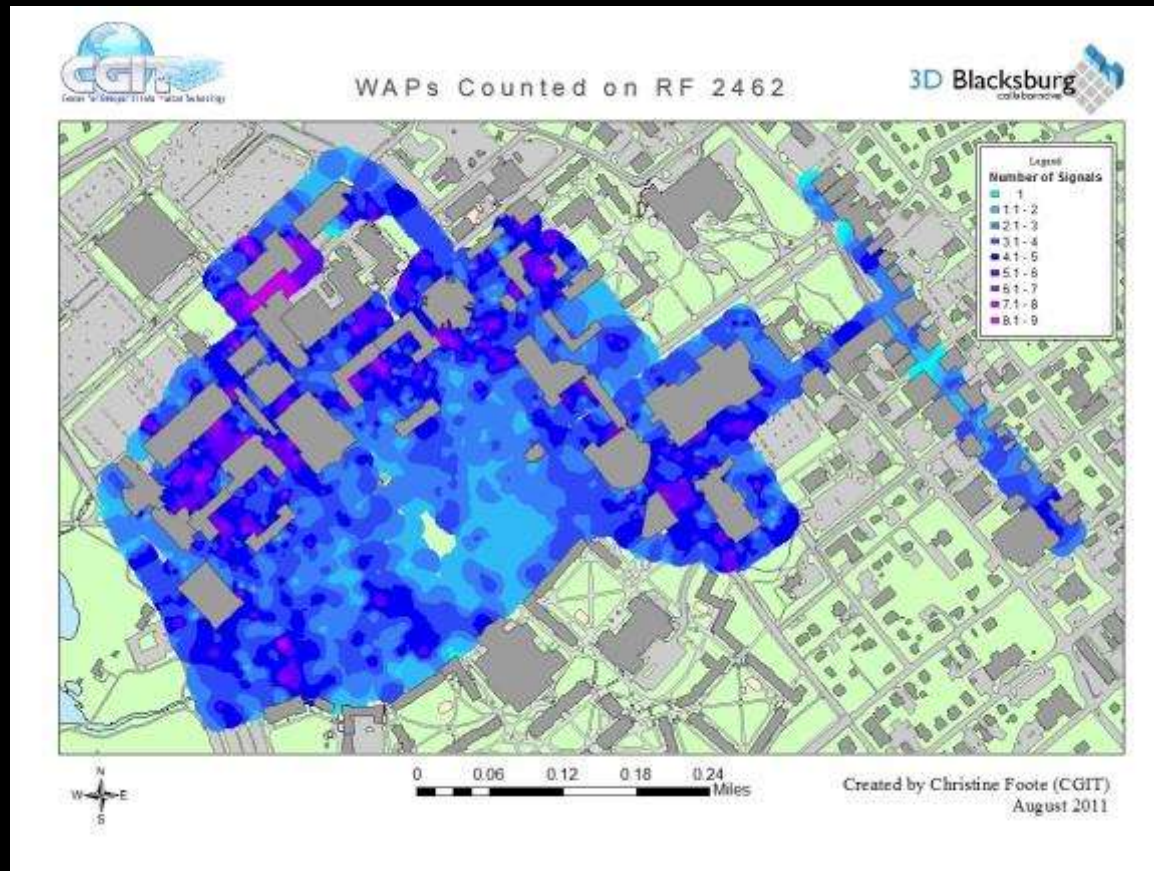
RF: 2437

There are some gaps in the Drillfield where no signals were observed from any network on this channel.



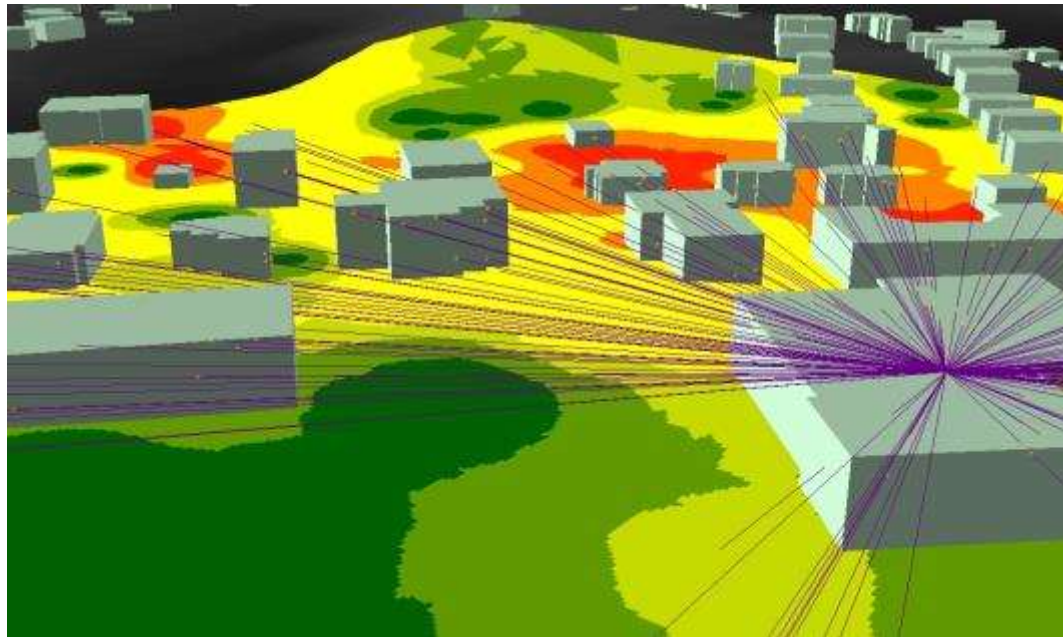
RF: 2462

There is a large gap in the center of the Drillfield where no signals were detected broadcasting on this channel. Consistently the most signals were seen surrounding Wittemore Hall.

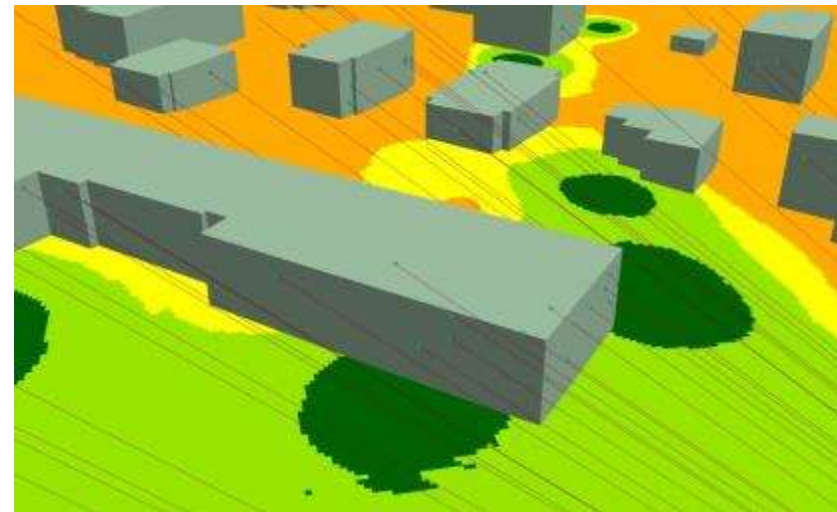
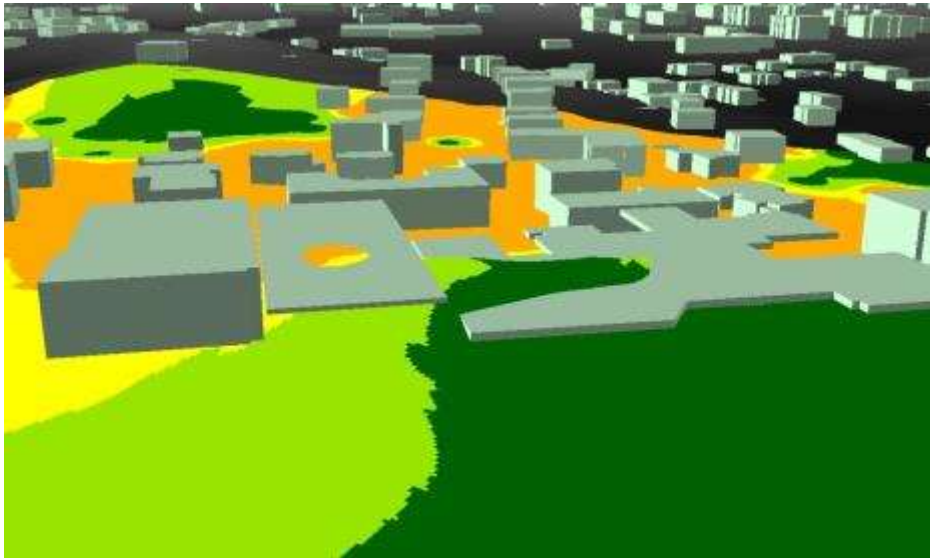
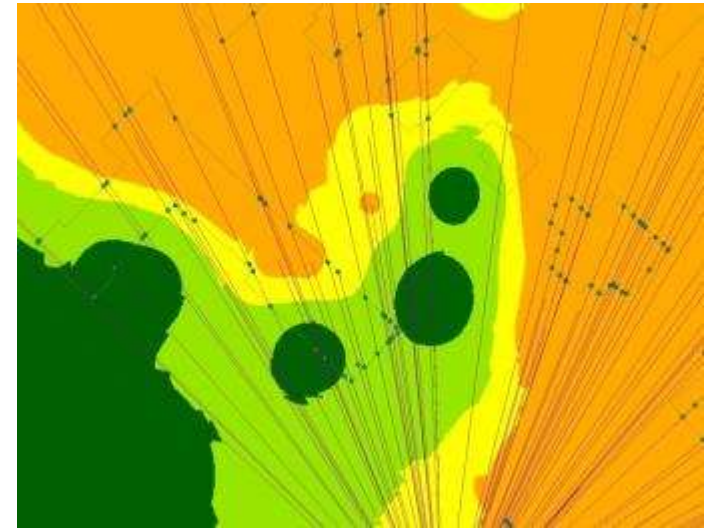
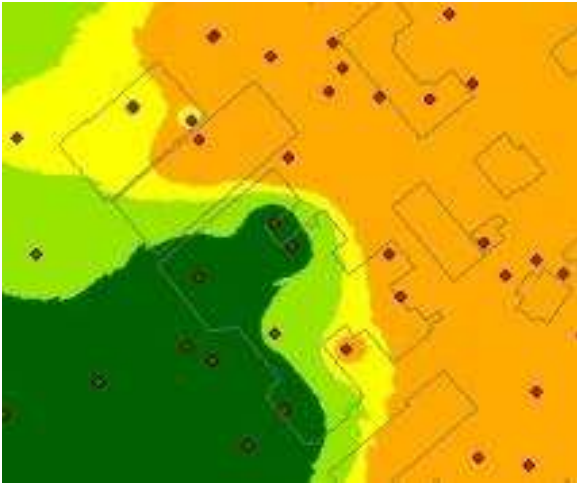


Motivation

- Wireless Planning
- Optimization
- Movement toward Smaller Cells
- Public Health and Safety

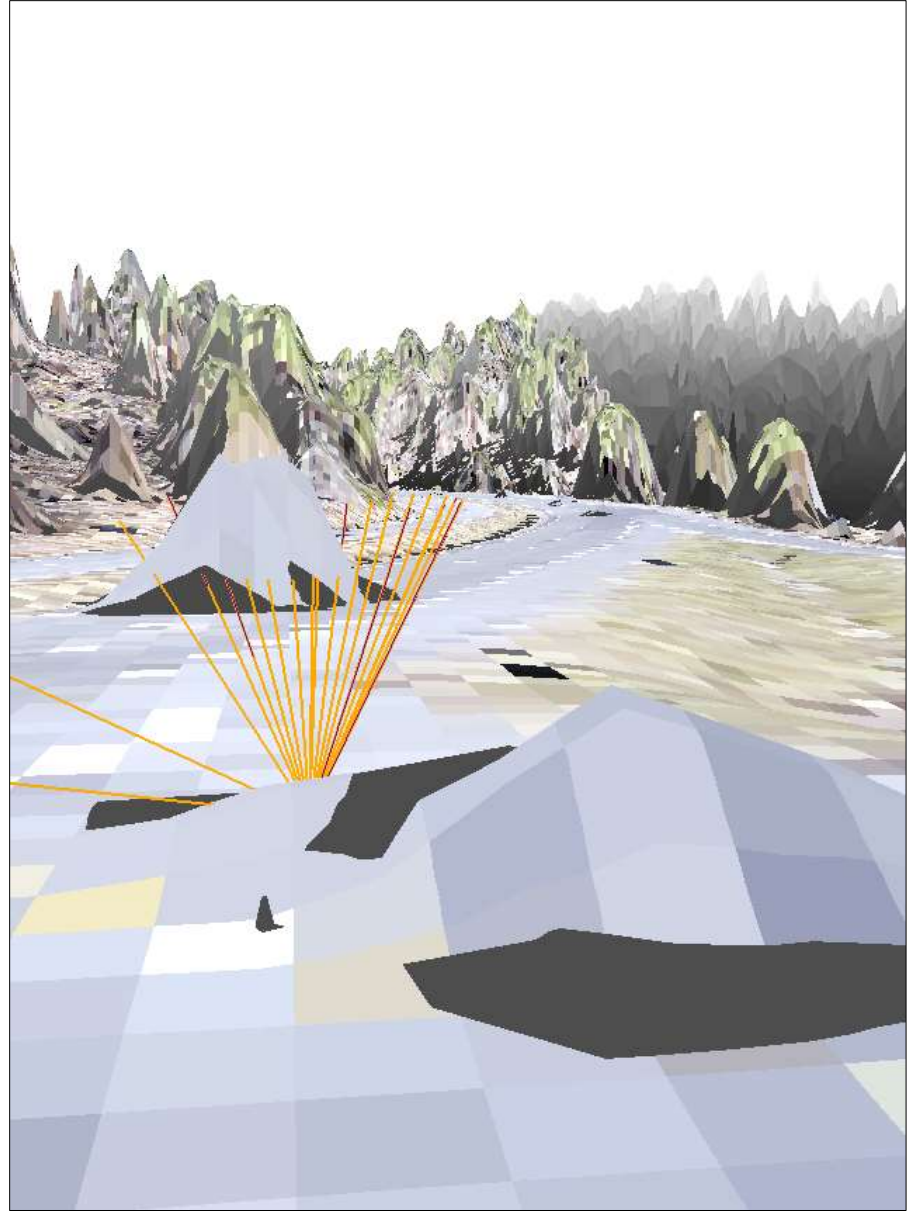
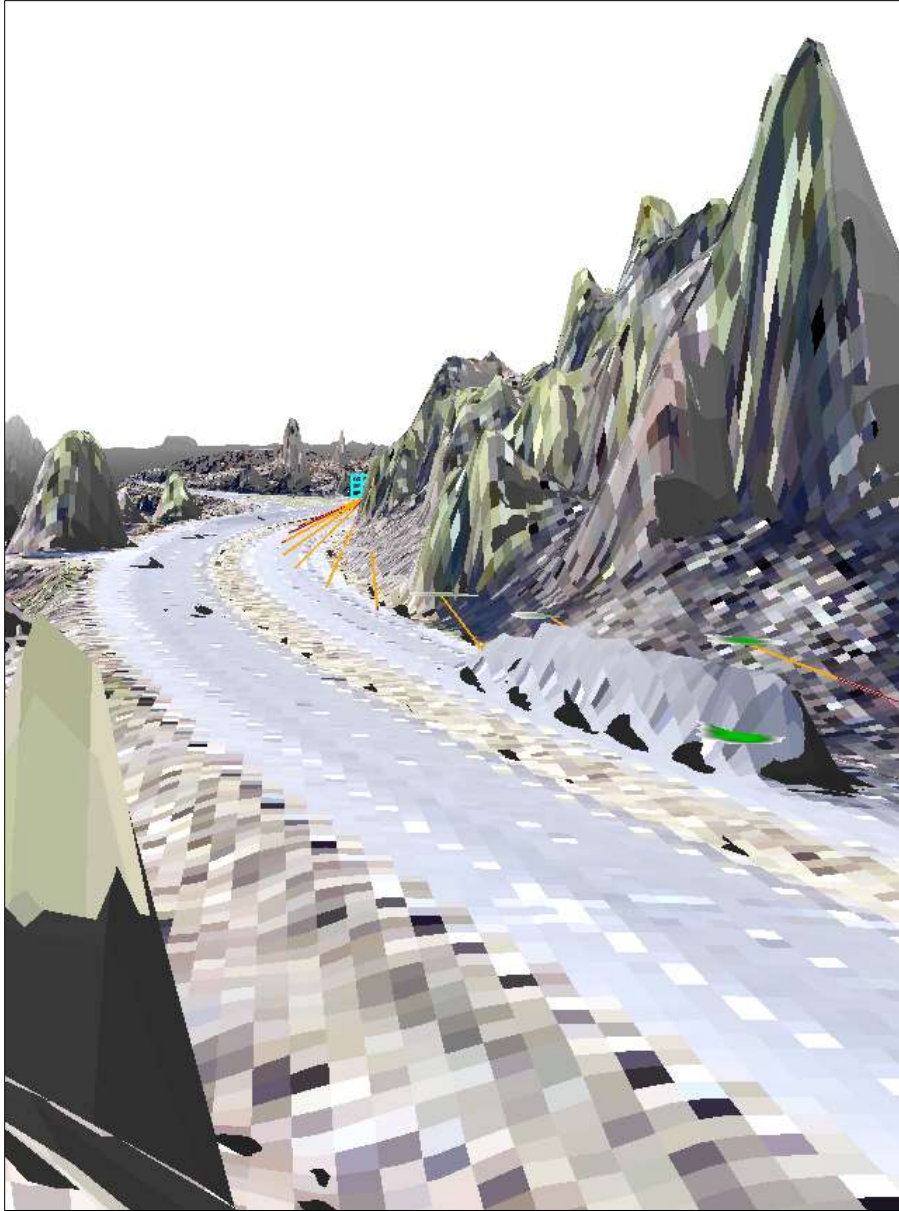


Urban Scale RF Model





Transportation





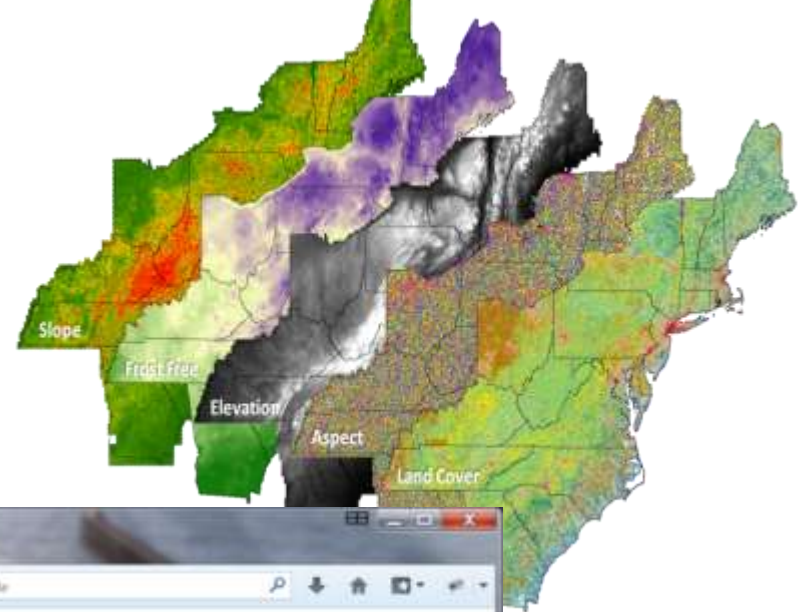
Eastern U.S. Web-based GIS Tool for Vineyard Site Evaluation

Virginia Tech Center for Geospatial Information Technology

2010-2015. USDA SCRI project (PI: Dr. Tony Wolf, Prof of Viticulture and Director of AHS AREC) "Improved Grape and Wine Quality in a Challenging Environment: An Eastern US Model for Sustainability and Economic Vitality". The project spans 19 states in the Eastern US with both variety trials (NE1020), economic and Geospatial objectives for matching site x variety.

Site Assessment example:

<http://www.cgit.vt.edu/vineyards/>

A screenshot of a web browser window displaying the 'Grape & Wine Quality Eastern U.S. Initiative' site assessment tool. The browser address bar shows the URL 'http://vmdex.cgit.vt.edu/ecvineyards/'. The page title is 'CGIT | Virginia Tech'. The interface includes a 'Legend' and 'Details' tab, a search bar for 'Find address or place', and a 'Site Report Generation Tool' dialog box. The tool provides instructions: '1. Zoom to your site on the map.', '2. Draw a polygon around the site.', and '3. Click "Get Report" and be patient.' There are 'Draw Polygon' and 'Get Report' buttons, and a link to 'Click here to view site report.' The map shows an aerial view of a rural area with a polygon drawn around a field. The ESRI logo is visible in the bottom right corner.

Firefox

http://vmdex.cgit.vt.edu/ecvineyards/

vmdex.cgit.vt.edu/ecvineyards/

CGIT | Virginia Tech

Legend Details

Layers Measure GP Tools Identify Find address or place

GRAPE & WINE QUALITY EASTERN U.S. INITIATIVE

This web application is used to display maps and geoprocessing tools built for the USDA funded project, "Improved grape and wine quality in a challenging environment: An eastern US model for sustainability and economic vitality." This is a prototype / work-in-progress.

Site Report Generation Tool

1. Zoom to your site on the map.
2. Draw a polygon around the site.
3. Click "Get Report" and be patient.

Draw Polygon Get Report

Click [here](#) to view site report.

POWERED BY esri

The screenshot shows a Firefox browser window displaying a web application. The address bar shows the URL `http://vmdev.cgit.vt.edu/ecvineyards/`. The page header includes "CGIT | Virginia Tech" and navigation tabs for "Legend" and "Details". The main interface features a map with a search bar, "Layers", "Measure", "GP Tools", and "Identify" options. A "Site Report Generation Tool" popup is active, providing instructions: "1. Zoom to your site on the map.", "2. Draw a polygon around the site.", and "3. Click 'Get Report' and be patient." Below the instructions are "Draw Polygon" and "Get Report" buttons, and a link to "view site report". The map shows a vineyard area with a black polygon drawn around a specific site. A scale bar and the "POWERED BY esri" logo are visible at the bottom of the map area.

Legend Details

Layers Measure GP Tools Identify Find address or place

GRAPE & WINE QUALITY EASTERN U.S. INITIATIVE

This web application is used to display maps and geoprocessing tools built for the USDA funded project, "Improved grape and wine quality in a challenging environment: An eastern US model for sustainability and economic vitality." This is a prototype / work-in-progress.

Site Report Generation Tool

1. Zoom to your site on the map.
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Click [here](#) to view site report.

POWERED BY esri

Vineyard Evaluation Report

Your Site Description:

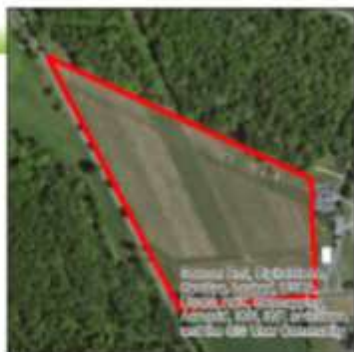
Size in Acres: ~20.6 acres

Geographic Location (latitude, longitude):

38.8355, -78.1163

Description of Site:

Sample Site Comment



Baseline Source: ESRI World Imagery

Overview of Site Conditions

Soils

For further information see the in depth discussion of these parameters on the following pages.

Parameter	Average	Minimum	Maximum
Saturated Hydraulic Conductivity (Ksat) (inches/hour)	1.68	0.32	3.34
Bulk Density (g/cm ³)	1.38	1.3	1.46
Soil pH	5.18	5.0	5.29
Soil Organic Matter	0.55	0.54	0.56
Soil Depth (cm)	200.0	200.0	200.0
Available Water Capacity (AWC) (in./in. soil 30" profile)	0.13	0.13	0.16

Climate

These precipitation climate conditions are averages based on 30 years of data analyzed by the PRISM Group at Oregon State University. The other climate factors use PRISM layers as a base for calculations completed at Virginia Tech's Center for Geospatial Information Technology

Parameter	Value
Average Growing Season Temperature (Celsius)	18.44
Average Length of Growing Season (frost-free days)	177
Annual Precipitation (inches)	44.58
Growing Season Precipitation (inches)	26.3
Average Growing Season Degree Days (C)	1843.96
Spring Frost Index	April: 12.0 May: 12.6

Topography

These topographic conditions are determined using the best available public data. Use the in-depth discussion provided on the following pages to further understand how these conditions can effect vineyard production in your area.

Parameter	Average	Minimum	Maximum
Slope (percent slope)	4.05	0.02	14.22
Elevation (feet)	800	768	823
Solar Aspect:			
North (16.3%), NE (25.9%), East (9.0%), SE (21.7%), South (15.7%), SW (8.1%), West (1.4%), NW (1.8%)			

Topographic Features

Elevation in feet

Elevation has a profound influence on the minimum and maximum temperatures in a vineyard, particularly in hilly and mountainous terrain. Because frosts and freezing temperatures can so dramatically reduce vineyard profitability, elevation is one of the most - perhaps the most - important features of vineyard site suitability. The physics of topographic effects on air temperature are well documented (Geiger, 1966) and its horticultural significance generally well appreciated.

Maximum	823
Average	800
Minimum	768



Sources: Esri, DeLorme, NAVTEQ, TerraByte, Swiremap, GEBCO, USGS, FAO, NPS, NRCAM,

Slope

The change in elevation over a horizontal ground distance, is expressed here as a percent. Gentle to moderate slopes are best-suited for vineyard production as they protect against damaging frosts (Wolf & Boyer, 2009). Cold air has a higher density than surrounding air, causing it to sink with gravity and move downhill. As a result, vineyards planted on slopes at higher elevations benefit from fluid cold air drainage away from vines and the resulting warm air displacement upwards.



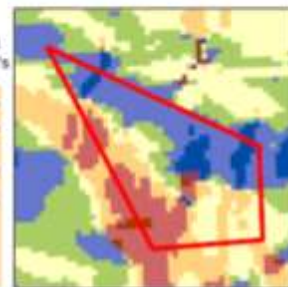
0% - 2%	Poorly Suited
2% - 5%	Fairly Well-Suited
5% - 15%	Well-suited
> 15%	Poorly Suited

Minimum	0.02 %
Average	4.05 %
Maximum	14.22 %

Aspect

Aspect describes the direction a slope faces, which relates to the sun angle and amount of sunlight that reaches the ground. According to Dr. Tony Wolf, Virginia's State Viticultural specialist (p.16), aspect is one of the least influential factors related to a vineyard's overall suitability; however, choosing a site with a favorable aspect can enhance grape taste and facilitate efficient disease and pest management.

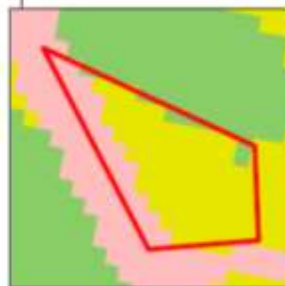
Northern 315° - 45°	North-facing	16.3%
	Northeast-facing	25.9%
Eastern 45° - 135°	East-facing	9.0%
	Southeast-facing	21.7%
Southern 135° - 225°	South-facing	15.7%
	Southwest-facing	8.1%
Western 225° - 315°	West-facing	1.4%
	Northwest-facing	1.8%



Land Cover

The Multi-Resolution Land Characteristics Consortium National Landcover Database (NLCD 2006) is a land cover classification that was generated using Landsat imagery.

Open Water	Barren Land	Grassland/Herbaceous
Open Space	Deciduous Forest	Pasture/Hay
Developed-Low Density	Evergreen Forest	Cultivated Crops
Developed-Med. Density	Mixed Forest	Woody Wetlands
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Soils

Information

"Soil affects grapevine productivity and wine quality. Confounding influences of vineyard management, climate, varieties and clones, fertilizer and irrigation practices, as well as variation in fruit harvest and winery practices, may easily obscure the more subtle, unique soil contributions to wine quality. Soils cannot be evaluated independently of the other vineyard site considerations, and some compromises in soil quality may be necessary so that the vineyard site selection process does not become too exclusive." - Wolf and Boyer, 2009

Soil Conditions

Organic Matter Avg. 0.55 Min: 0.54 Max: 0.96

Organic matter is generated by the decomposition of plant and animal waste by the communities of soil arthropods and microbial decomposers that it supports. Organic matter improves soil fertility, structure, aeration and drainage. In large quantities, organic matter releases excess Nitrogen that can lead to vigorous vine growth.

Suitability Info: Unsuitable: < 1% or > 3% Suitable: 1% - 3%

Soil Depth (cm) Avg. 200.0 Min: 200.0 Max: 200.0

Deep soil depth acts as a protective buffer against drought as it allows for greater volume of potential soil moisture and ample space for cultivation of large, healthy, perennial root structures.

Suitability Info: Unsuitable: < 75 cm (30 in.) Suitable: > 75 cm (30 in.)

Available Water Capacity (AWC - in./in.)

Avg. 0.13 Min: 0.13 Max: 0.16

This describes the quantity of water available for uptake by plants after gravitational forces have removed excess water from a saturated soil. The ability of a soil to hold water is a function of soil texture and organic matter content.

Suitability Info: Poorly Suited: > .14in./in. Fairly Suited: .10 - .14in./in. Well Suited: < .1 in./in.

Saturated Hydraulic Conductivity (Ksat - in./hr)

Avg. 1.68 Min: 0.32 Max: 3.34

Ksat is a measure of the rate at which water moves through a column of saturated soil also described as permeability. Soils with Ksat values above 0.6 inches per hour tend to be better-suited for viticultural production.

Suitability Info: Poorly Suited: < 0.6 in./hr Fairly Suited: 0.6 - 2.0 in./hr Well Suited: >2.0 in./hr

Bulk Density (g/cm³)

Avg. 1.38 Min: 1.3 Max: 1.46

Bulk density describes the relationship between soil solids and pore space where air and water can be stored in a given volume of soil. Bulk density is a key factor in productive viticulture because bulk densities higher than 1.6 g/cm³ indicate compacted soil, restricted water movement, poor root development and loss of soil aeration.

Suitability Info: Unsuitable: > 1.6 g/cm³ Suitable: < 1.6 g/cm³

Soil pH Avg. 5.18 Min: 5.0 Max: 5.29

Soil pH is easily amended, but the cost of amendment whether through lime or gypsum applications may be cost prohibitive for some growers if pH is above 7.5 or below 4.0.

Appropriate soil pH levels are critical to vine health. Low pH values are especially detrimental to grapevines as Aluminum and Copper are made plant available which can lead to stunted growth and toxicity.

Suitability Info: Unsuitable: pH < 4.0 or > 7.5 Suitable: pH = 4.0 - 7.5

For more soils information: <http://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/>



Soil Series Details

Dyke loam, embosd sloping phase

Dyke loam, gently sloping phase

Meadonville loam

Warsham stony silt loam

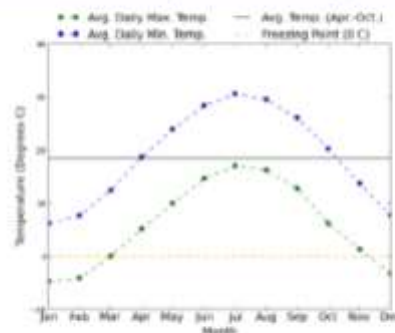
Climate and Weather

Information

Grapes can be exposed to environmental stresses that can reduce crop quality and yields and injure or kill grapevines. Damaging winter temperatures, spring and fall frosts, extremes of rainfall, and higher than optimal summer temperatures occur with regularity in some regions. Climate refers to the average course of the weather at a given location over a period of years and is measured by temperature, precipitation, wind speed and other meteorological conditions. "Weather" is the state of the atmosphere at a given moment with respect to those same meteorological conditions.

- Wolf and Boyer, 2009

Seasonal Temperature Analysis



Grapevine Climate/Maturity Groupings



Climate and Weather Conditions

Basic Climate Factors

- Average Growing Season Temperature (Mean Temperature April - October)
 - °C: 16.44 °F: 50.44
- Average Growing Season Degree Days (C) (Avg. Daily Mean Temp. - Base Temp. 1°C)
 - °C: 1043.96 °F: 3319.13
- Length of Growing Season - frost-free days 177
- Annual Precipitation in inches 44.58
- Growing Season Precipitation in inches 28.3
- Spring Frost Index in °F April: 12.0 May: 12.6 (Avg. Daily Mean Temp. - Avg. Daily Min Temp.)

Extreme Low Temperature Risk Factor

(Number of winters < threshold in a decade)

Threshold:	5°F	0°F	-5°F	-10°F	-15°F
Winters:	3.0	0.0	0.0	0.0	0.0

Other information:
The length of the growing season will determine whether grapes will ripen or not. A minimum of 180 frost-free days is recommended.

Grapevines can be injured or killed by winter cold. See chart above for statistics on average number of winters with extreme cold temperatures.

Overview of Site Conditions

Soils

For further information see the in depth discussion of these parameters on the following pages.

<u>Parameter</u>	<u>Average</u>	<u>Minimum</u>	<u>Maximum</u>
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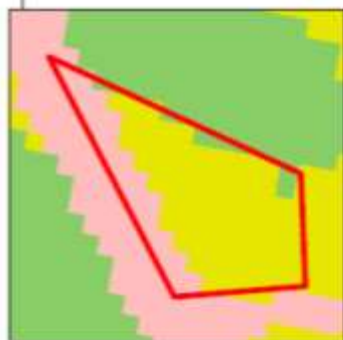
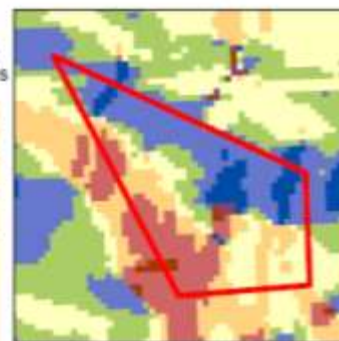
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Suitability Info: Unsuitable: < 1% or > 3% Suitable: 1% - 3%



Soil Series Details

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- Dyke loam, gently sloping phase
- Meadowville loam
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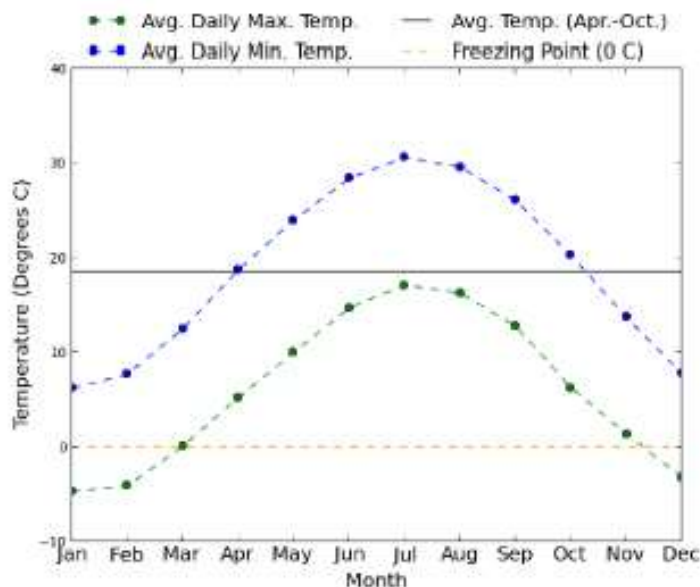
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Seasonal Temperature Analysis

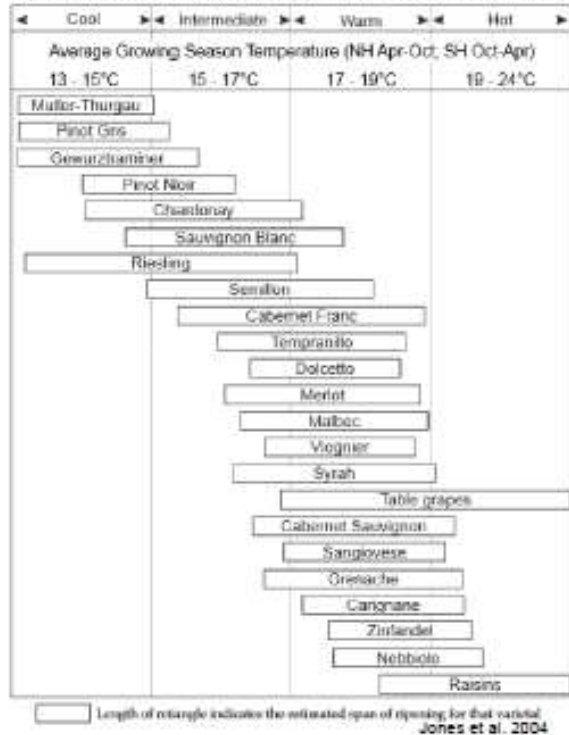


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Grapevine Climate/Maturity Groupings



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