The Virginia Geospatial Newsletter

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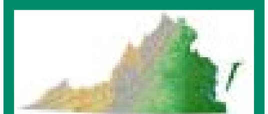
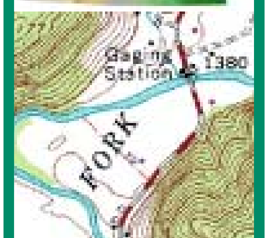
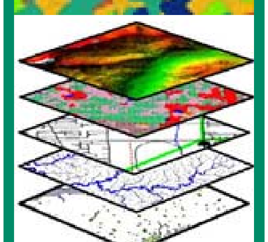
The Virginia Geospatial Extension Program is a partnership between the Virginia Space Grant Consortium and Virginia Cooperative Extension





For more information contact:

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Montgomery County Region Goes LIDAR

By:
Travis Elkins, GIS Coordinator, Town of Christiansburg
Bob Pearsall, GIS Manager, Montgomery County
Katherine Smith, GIS Coordinator, Town of Blacksburg

The Towns of Christiansburg and Blacksburg and Montgomery County are embarking upon a very significant project. The project includes creation of a new countywide topographic database and updating of existing orthophoto base maps in the towns and partial updating in county areas. The project became increasingly more important when existing data and orthophotos would no longer support various project specific applications. Another force driving the need for the project was stormwater management. Along with new orthophotos and topography, the project will also provide a highly accurate digital terrain model (DTM) for the entire county.

As population and urban development have increased, so has the risk of severe damage and/or loss of life by flooding, storms, and other related events. Mapping floodplains helps to identify what areas are in danger under varying flood conditions.

Regional GIS participation is a hallmark for Montgomery County and the Towns. In 2003, the Towns and County worked together with Timmons, Inc. to create an enterprise geodatabase foundation. For some time they had discussed a regional topographic and orthophoto update project and in early 2004 the Town of Christiansburg began putting together a plan to issue a Request for Proposals (RFP) to professionally select a contractor. All agreed that going through a professional selection process gives a higher comfort level in the investment being made. Professional selection also helps assure the success of the project translates into useful and quantifiable benefits.

Each jurisdiction had many reasons for initiating the project but for Christiansburg and Montgomery County specific areas of concern were stormwater management and floodplain mapping. As part of the Virginia Pollutant Discharge Elimination System,

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The Virginia Geospatial Newsletter is a quarterly publication developed through the Virginia Geospatial Extension Program, a partnership between the Virginia Space Grant Consortium (VSGC) and Virginia Cooperative Extension (VCE). The newsletter is published in conjunction with The Virginia Geographic Information Network (VGIN).

The purpose of the Virginia Geospatial Newsletter is to highlight innovative geospatial products and services throughout the commonwealth and to widely disseminate geospatial knowledge and awareness throughout Virginia.

If you have suggestions or comments, or if you would like to contribute to the newsletter, please contact John McGee at the Virginia Geospatial Extension Program (jmcg@vt.edu or [540] 231-2428).

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Precollege Education

Introducing GIS to the Next Generation

By:
Bob Kolvoord
Professor, Integrated Science and Technology and Educational Technology
James Madison University

At James Madison University, we've been developing training and activities to help K-12 teachers and students learn about geospatial technologies. In this article, we'll introduce our various projects and in future articles we'll provide more details.

Throughout our work with students and teachers in grades 4-12, our focus is on building spatial thinking and analysis skills, not just learning how to push buttons in a particular software package. This is an important distinction from how many software packages are used in school settings.

> *...our focus is on building spatial thinking and analysis skills, not just learning how to push buttons....*

For students in younger grades (grades 4-7), we've developed a series of basic activities that use ESRI's Arc Explorer – Java Edition for Education (http://www.esri.com/aejee). This free software package has many of the basic features of standard GIS software but with a simplified interface. For example, in one activity students explore the use of buffers as they examine how well a small city is covered by the current fire stations (and where a new fire station would be most needed). The activity goes on to explore which streets would need to be closed should a presidential visit be planned for this town. This activity and others we've developed are available at http://www.esri/com/arclessons.

For students in middle grades (grades 6-9), we've developed activities that go with field study in Shenandoah National Park. These activities focus on the risk of fire and how you decide which parts of the Park are most at risk from fire. These activities (and relevant data) are available at http://www.isat.jmu.edu/common/projects/godi/

For students in high school, we've been working with Technology Education teachers and the Virginia Department of Education (especially George Willcox) to develop a new course for high school students. This year, the first offerings of a geospatial technology course began across the state. We're excited about the possibilities of growth in this area and look forward to more schools adding this coursework.

We're piloting a new project starting in Fall 2005. The Geospatial Semester project will

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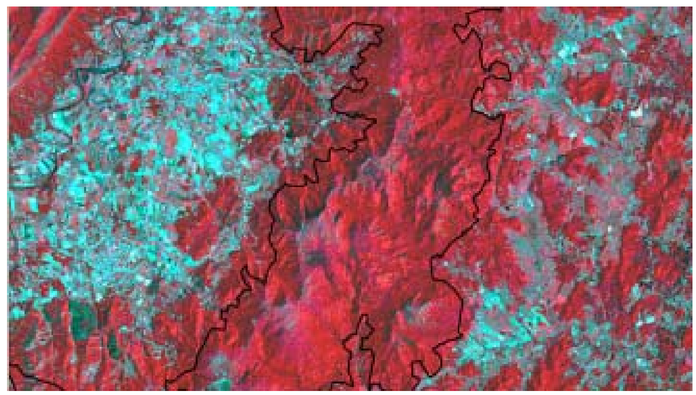
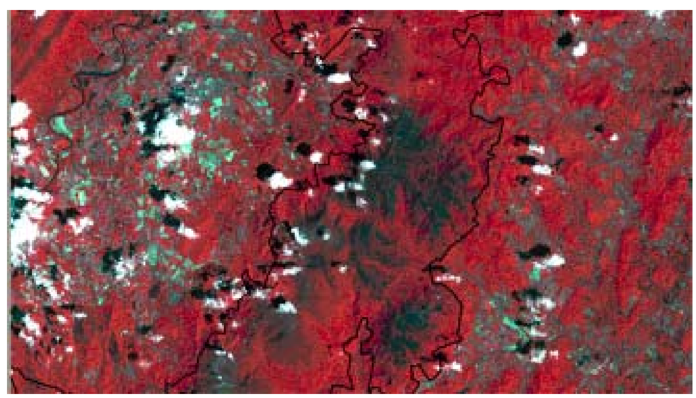
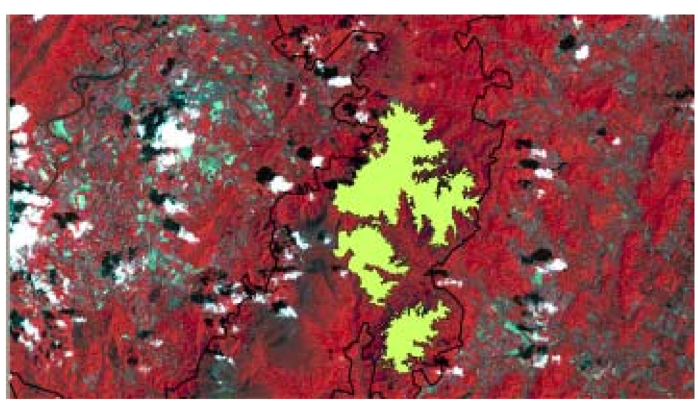


A Landsat image of the central part of Shenandoah National Park. Luray, VA is visible on the left side of the image. This image was taken prior to the fires in 2000.



Landsat image after the fires of 2000.



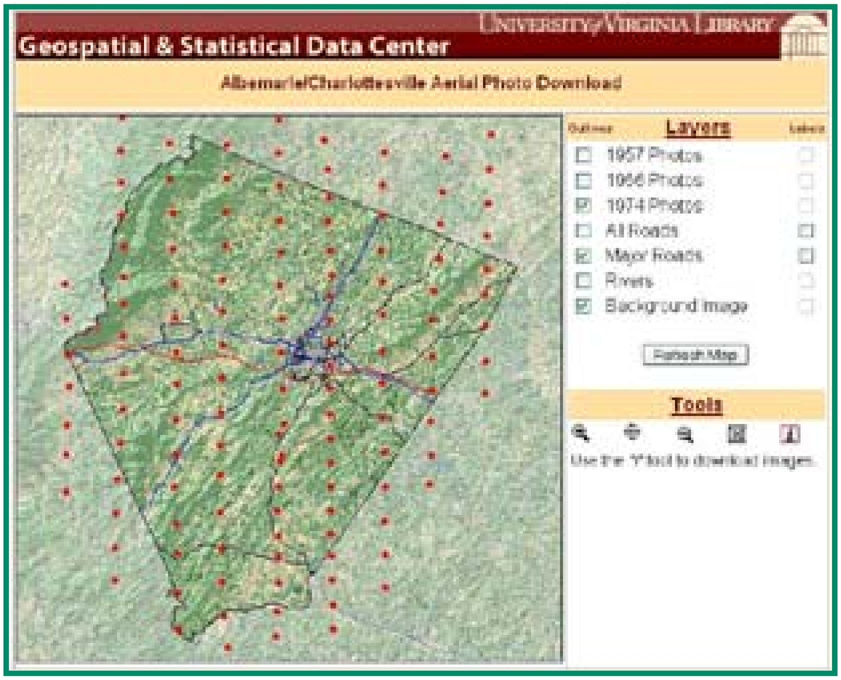
Student work tracing the perimeters of the fires (they also calculate the damaged acreage and compate with work done by park personnel).

Colleges and Universities

GIS in the Academic Library: It's Not Just for Scientists Anymore

By:
Donna J. Tolson
Associate Director
Geospatial and Statistical Data Center
Alderman Library, UVA

Remember back to your college days – what was your major? Who taught you how to use GIS? You probably majored in geography or another science, and learned from a science faculty member. But over the past ten years, GIS has grown well beyond the reaches of traditional science departments. At the University of Virginia, researchers in disciplines as varied as history, landscape architecture, epidemiology, and religion are mapping data and using GIS in their research, and many of them come to the library for help.



GIS projects have a long history of interdisciplinary cooperation at the University of VA. Dave Phillips (Planning) and Wally Reed (Environmental Science) were early adopters of GIS who partnered with the University Library to establish a central location for geospatial resources and activities on campus. With significant support from the Academic Computing Department and the Provost, the Geographic Information Center (GIC) opened in the early 1990s. An early successful interdisciplinary effort in improving access to technology and services, the GIC later merged with the Social Science Data Center to form the Geospatial and Statistical Data Center, more informally known as the Geostat Center.

The Geostat Center is located in Alderman Library, the main library of the College of Arts and Sciences. The Center supports a divided lab and classroom space with 22 high-end work stations equipped with oversize monitors and a variety of GIS applications (ArcGIS, ArcView, Imagine, etc.) and data (ESRI StreetMap, Geolytics CD+Maps, local GIS data). However, providing the infrastructure is only the beginning. Interacting with users is the most essential support we provide.

The GIS community at UVA spans many disciplines and levels of technological expertise. We teach architecture undergraduates how to use ArcMap to overlay planimetric data with topography. We help engineering graduate students acquire data and develop GIS projects to support their research. We show nurses and medical researchers how to georeference data and analyze trends. We collaborate with history faculty to develop maps and interactive modules for digital scholarship.

We also try to make geospatial data more interesting and accessible to people who have limited GIS technical skills. For example, we recently scanned aerial photos of Albemarle County from three decades, and made them available online. The traditional thumbnails used to preview images aren't much help with aerial photos, so we developed an interactive index map that allows the user to locate specific photos by their proximity to county roads and water systems (see http://fisher.lib.virginia.edu/collections/maps/aerials/data/). These photos are used by planners, historians, systems engineers, and archaeologists.

Some of the projects that the Geostat Center has recently developed include the Virginia Gazetteer (http://fisher.lib.virginia.edu/collections/gis/vagaz/), and the mapping component of the Historical Census Browser (http://fisher.lib.virginia.edu/collections/stats/histcensus/). Examples of faculty projects we have assisted with include the Valley of the Shadow (http://valley.vcdh.virginia.edu/) and an interactive map of Tibet (http://lewis.lib.virginia.edu/arcims4/Tibet/viewer.htm).

The Library's mission is to facilitate research, teaching, and learning by providing easy access to superb collections, information and services. Supporting this range of activity among so many departments for GIS has its challenges, and our expertise is necessarily broad rather than deep. But centrally locating the Geostat Center has promoted GIS use in many disciplines, and continues to encourage interdisciplinary collaboration among faculty and students.

State Government

Site-Specific Flood Modeling

What's in your toolbox?

By:
Michael Vojta
GIS Manager
Virginia Department of Emergency Management

The summer storm season is rapidly approaching. National Weather Service and others are predicting a vigorous hurricane season due to warmer waters in the Atlantic. We have seen on the East Coast how active the past two hurricane seasons have been. On top of that 2004, posted one of the most active tornado counts recorded. Well, if you are in the field of emergency management, or an organization that tracks or is responsible for assets potentially as risk for flooding, then I pose the question to you: what's in your geo-spatial toolbox?

Commonly, the two most frequented data sets for storm related flooding would be the FEMA Q3 Flood Data and the USGS National Elevation Dataset. These datasets will service those looking to model on a county or smaller scale, however … Does Q3 cover the spatial extent you are interested in? Will the NED resolution be accurate enough? Can other spatial data corroborate those medium scale data? What data can you use for site-specific events?

I beg these questions as I recall September of 2003 when Hurricane Isabel passed over the Commonwealth. Virginia Department of Transportation was faced with determining how the Rt.58 Mid-Town Tunnel over the Elizabeth River flooded. VDOT management sought site-specific intelligence on the nature of the flooding. There were no remote sensor missions (to our knowledge) scheduled for that time and traditional imagery would not have been much use through the cloud cover. So the GIS team at VDOT put together a plan to model the flooding using those geospatial 'tools' that happened to be on already operational.

The data and application tools used included the usual suspects: VIMS shoreline situation reports (a bit dated but otherwise excellent resource), FEMA Q3, VBMP 2002 Aerial Imagery, NWI wetlands, and VDOT Road Centerlines. This left one important feature: the surface of the earth! 10 meter USGS DEMs were not going to be sufficient. We reviewed the VBMP DTM collection. VDOT's GIS shop had the foresight to convert the VBMP DTMs from their native micro station format to ArcINFO point coverage along with hydro line features and map join to flight lines creating few albeit larger tiles. A batch processing script was developed and run until the conversion and compilation of the DTM were processed by flight lines.

While the study area was unfortunate in flood potential, it was lucky in DTM availability. VBMP 1=100 scale resolution was flown for the area so the DTM mass points were better than what would be available at the other VBMP scales, and better than USGS NED.

Next stop – spatial analysis with ArcGIS Spatial Analyst. Surfaces were created based on the Z values. Now we know the surface of the Earth around the Tunnel entrance at least in happier times. What was the progression of the flood on that day?

NOAA tide data from W-2 hourly tide reports for nearby gauges was collected from their website (http://www.co-ops.nos.noaa.gov/coastline.shtml?region=va) (Figure 1) and the tide height (above mean sea level) values were used to 'sink' the surface GRID. Recalculations of the surface GRID were

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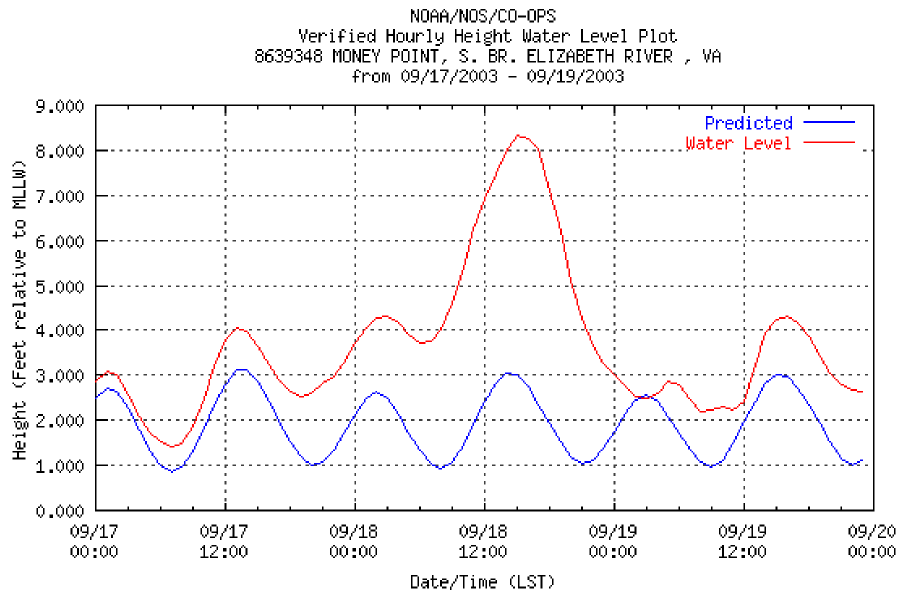


Figure 1: Hourly Tide Reporting Data

Attributes of DTM Mass Points (VBMP)

IGDS_LAYER	IGDS_ZVALU	storm1200z	storm1500z
MASSPOINTS	2.92	-2.42	-3.83
MASSPOINTS	2.35	-2.99	-4.4
MASSPOINTS	1.36	-3.98	-5.39
MASSPOINTS	3.82	-1.52	-2.93
MASSPOINTS	3.66	-1.68	-3.09
MASSPOINTS	4.4	-0.94	-2.35

Figure 2: Table showing recalculations of the surface GRID

Flood Modeling

(Continued from Page 4)

made over the time frame to show the progression of the floodwaters (Figure 2). We were able to model the depth of the water with this. The normal time frames created (Figure 3), the advancing flood frame at 1200 hours (Figure 4), and the peak flood frame at 1500 hours (Figure 5). As with all modeling a report citing potential errors and other caveats was generated as well. Remember, this is not what happened rather a spatial and mathematical interpolation of what we believed happened with data available at the time.

Physical assets can be evaluated for hazard risk potential with the right tools. While full mitigation planning would require survey quality building plans, remote identification of risk potential can be estimated. Pro-vided you have access to those data needed to build the event model.

Figure 3: Flooding potential of the route 58 tunnel

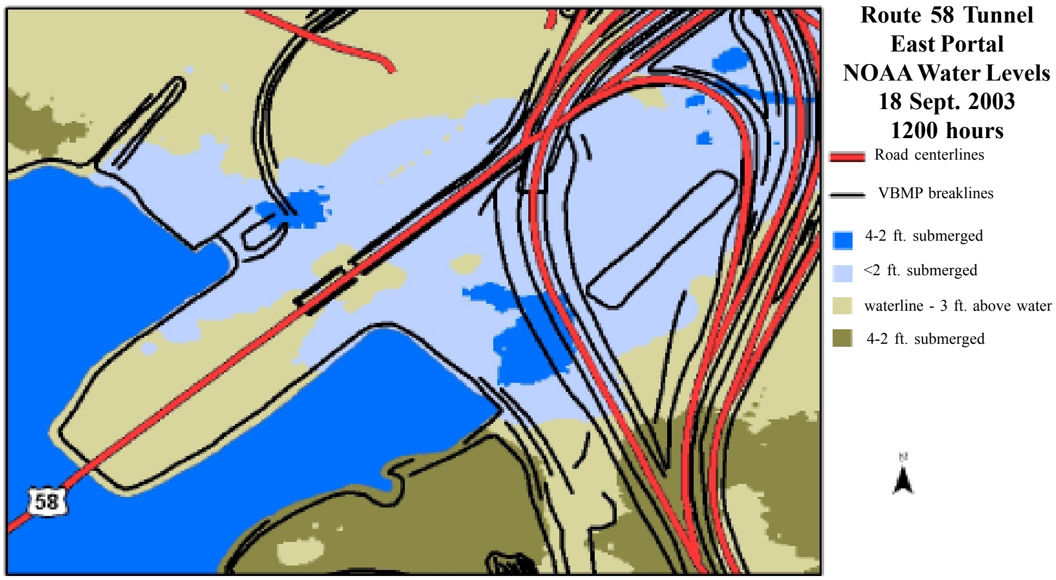


Figure 4: The advancing flood at 1200 hours

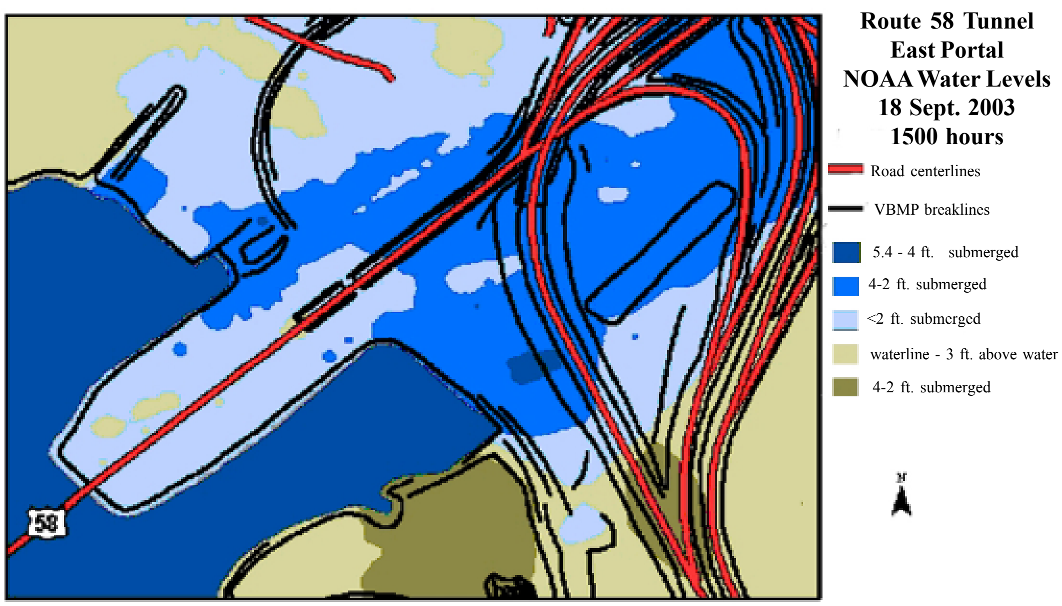


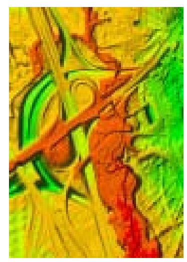
Figure 5: The peak flood at 1500 hours

LIDAR

(Continued from Page 1)

(VPDES) program all jurisdictions are responsible for storm water management. The Town of Christiansburg was committed to the development of a stormwater system map. Accurate base mapping and topographic data are essential in the delineation of drainage basins and determination of capacity of stormwater channels and piping systems. Christiansburg intends to combine the new topographic data and orthophotography with field mapping efforts to create a map showing the location and size of all major stormwater outfalls within the town limits.

The Towns and Montgomery County have strived for many years to become "disaster resistant". Local flood plain managers have championed this by initiating numerous actions to better protect the residents from the effects of natural disasters and substantially reduce disruption and loss. Efforts have focused on employing a doctrine of pre-disaster awareness, preparedness and planning rather than post-disaster reactive actions that often occur. Early on it became apparent that too much land development and too few map changes or amendments to our 1978 Flood Insurance Rate Maps (FIRM's) meant that they were becoming less reliable to accurately predict flood prone areas. The FIRM is an important part of a long-term county-wide hazard mitigation strategy. As population and urban development have increased, so has the risk of severe damage and/or loss of life by flooding, storms, and other related events. Mapping floodplains helps to identify what areas are in danger under varying flood conditions. The FIRM maps provide an excellent source that is easily understood to help government planners and emergency management professionals identify areas of risk and prioritize their mitigation and response efforts. Floodplain maps provide not only detailed lists of threatened structures, but also form a cornerstone for a flood mitigation policy.



source: www.kucera-gis.com

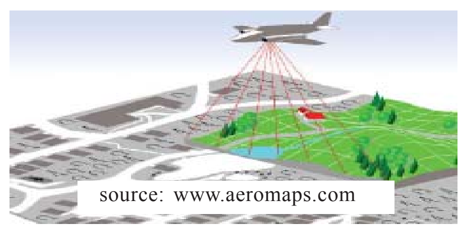
Many factors can influence flooding, but probably none more than topography. Varying changes to topography through land development, road construction, utilities, and environmental factors can lead to significant problems and the potential of dangerous flooding. Accurate and up-to-date elevation data is essential for initial and revised flood forecast models in order to reasonably predict areas that are or will be affected by flooding.

Why choose LiDAR rather than traditional methods?

With limited dollars to invest in the project, the jurisdictions looked for an approach that would not only produce a highly accurate and uniform product, but give the end users more flexiability when resmapling of the source data was needed. Early on it became apparent that LiDAR (Light Detection and Ranging) fit everyone's needs and would be the best approach. The jurisdictions also realized that LiDAR could be used for much more than stormwater management and floodplain mapping. The source data would be useful for capital and facilities construction projects, economic revitalization, site plan reviews, public utility design and construction, and environmental modelling applications.

An Introduction to LIDAR

What is LIDAR?



source: www.aeromaps.com

LIDAR is an acronym for Light Detection And Ranging. We've all heard about RADAR. LIDAR is similar to RADAR. Both instruments transmit energy towards a source (this is known as active remote sensing). Using either RADAR or LIDAR, the emitted energy hits a feature on the earth's surface, and is reflected back to the sensor. While RADAR instruments transmit energy in longer wavelengths (radio waves), LIDAR instruments transmit energy in shorter wavelengths (near visible). LIDAR instruments record the amount of time it takes this energy to leave the instrument, interact with a target (building, tree, bare ground) and return to the sensor. This is how LIDAR is used to generate z-values.

What products can be generated using LIDAR?

LIDAR provides a cost effective means to collect digital information about the earth's surface. Using LIDAR, we can obtain several "layers" of information from the landscape, through a series of LIDAR returns. The first return of information to a LIDAR sensor, would, for example, be associated with the highest features in the landscape (typically tree tops, tops of buildings, etc.). Following data returns would be associated with understory vegetation below the initial tree or vegetation canopy. The final return would be associated with the bare earth. This is how LIDAR is used to generate DEM's!

source: www.loc.gov

LIDAR is used to generate elevation maps, and identify other landscape characteristics, including slope, and aspect (through a TIN) as well as volume. A variety of products can be developed using LIDAR data, including highly accurate contours which can be used to generate Special Flood Hazard Areas (SFHA) and Flood Insurance Rate Maps (FRIM's). Flood risk assessments are increasingly being conducted using LIDAR. Vegetation and forestry inventory assessements are conducted with LIDAR. Urban areas use LIDAR to generate 3 dimensional maps showing structures and landforms. These data support a variety of planning needs (i.e. viewsheds, emergency management plans, storm water runoff management plans, etc.).

Planning District Commissions

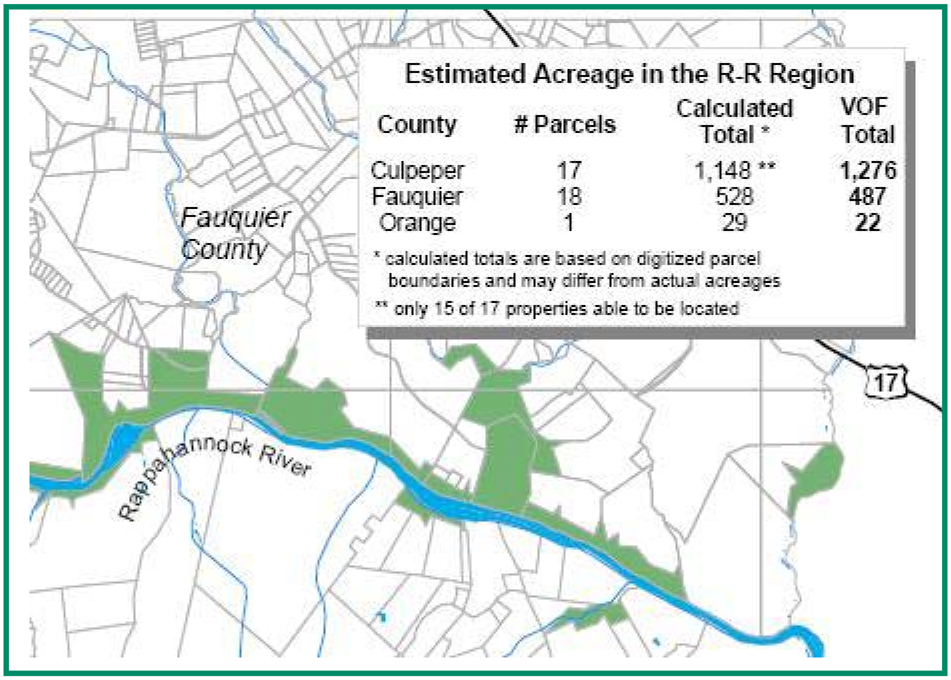
RRRC Provides GIS Analysis Across Its Region

By:
Jeffrey Sturman
GIS Planner
Rappahannock Rapidan
Regional Commission

The GIS program at the Rappahannock Rapidan Regional Commission (RRRC), also known as Planning District 9, fills a special role by providing technical analytical services for the five counties and their towns that it serves. Some jurisdictions have viable GIS departments, others have their data available online for public viewing and querying (many at http://www.onlinegis.net/), while others have little to no in-house GIS capabilities. RRRC serves as a leveling agent so that all jurisdictions can have access to digital spatial analysis and also facilitates such analysis to be performed in a regional context.

In the past year, RRRC was able to provide GIS analysis to all its jurisdictions while completing its Regional Hazard Mitigation Plan. Analysis was done in-house and by a consultant to inventory and provide location analysis of point features such as emergency response facilities, past storm events, and dams. A large component of the plan also focused on the mapping of floodplains for each community, the structures that were located therein, and the resulting damage that could occur during future storm events.

For some locations, damage loss estimates were calculated using FEMA's HAZUS-MH software. This software overlays ESRI's ArcGIS software and provides advanced floodplain, wind, and earthquake modeling to help estimate potential losses from these natural disasters. The GIS coordinator had received training through FEMA on the HAZUS-MH software and advanced training on the Flood module. To complement RRRC's hazard mitigation efforts, it conducted a two-day accelerated HAZUS-MH training program offered to all RRRC jurisdictions, VA Planning District Commissions, and some non-affiliated organizations.



As with many of the Planning District Commissions, ongoing GIS work at the RRRC is often related to transportation planning. Many different types of mapping analysis are utilized in the Rural Transportation program. Data used include: annual traffic counts, future road improvements, alternate transportation modes (blueways and greenways mapping), and scenic roads mapped with historical features and details. Because it affects transportation planning, the RRRC tracks commercial and residential growth through an often-visited webpage on the RRRC site known as the Regional Growth Information System. It consists of a static ArcMap layout that dynamically links to text information for each development, allowing for easy updates as well as quick public access to growth information on a regional scale.

GIS is used to a lesser extent in RRRC's other programs, including workforce development, housing and eldercare, and tourism programs. On occasion, RRRC has performed GIS analysis for non-affiliated organizations when the project is deemed to provide value to RRRC. Past projects include address geocoding and displays highlighting healthcare facilities within the region.

More information on the GIS program at the Rappahannock Rapidan Regional Commission can be found online at http://www.rrregion.org or by contacting Jeffrey Sturman, GIS Planner (540) 829 - 7450.

GPS Adventure 2005!

By:
Mike Clifford
Extension Agent Emeritus

"Bubba the Lost Hunter" was saved again! For the fifth consecutive year, intrepid teams of "wilderness rescue rangers" used GPS receivers and topographic maps in a race to locate the hypothermic Bubba in the howling wilds of the Appomattox-Buckingham State Forest.

The Bubba hunt is the culminating field exercise in the annual GPS workshop for adults and older teens held in late winter at Holiday Lake 4-H Educational Center. Twenty-five hardy souls took part in *GPS ADVENTURE 2005* on March 4th and 5th. The Friday evening-all day Saturday course covered basics of the Global Positioning System, GPS applications for work and play, using topographic maps and magnetic compasses in combination with GPS, digital mapping programs, GPS equipment updates, and other related topics.

Workshop participants included 4-H leaders and members, educators, foresters, natural resource professionals, real estate agents, and folks from several other backgrounds.
...But they all ended up with one common goal - *find Bubba!*

The instructors for the workshop were Dick "Ol' Grizz" Higgins and Mike "Snake Man" Clifford, neither of whom are related to Bubba.

For information about future workshops, contact Mike Clifford via email (preferred) at ***mjc4h@vt.edu*** or by phone at 804/561-5411 .

Bubba the Lost Hunter (on back row, clinging to tree) was saved by several teams of "wilderness rescue rangers" during the March 4-5 GPS Adventure 2005 workshop. Not all participants are pictured; some are still wandering around in the state forest.

GIS for the Next Generation

(Continued from Page 2)

initially work with five high schools across Virginia to introduce geospatial technology and geospatial research to students and while they do their projects, they'll earn up to 15 credit hours at JMU. We're looking forward to connecting with geospatial professionals near these schools to advise on the projects. This project holds the promise of building geospatial skills with many students across the state. We're very excited about it and you'll hear more about it in the coming months.

As you can see, my colleague, Kathryn Keranen, and I have been very active working across the range of K-12 grade levels. One point we want to stress is the importance of professional development for

the teachers and in providing data sets for them to use. Think of your own experience in learning how to use GIS and you can appreciate why teachers need to have some help. If we want to bring this exciting technology to the next generation, we all need to help. For more information about our projects, please contact me at kolvoora@jmu.edu.

Federal Government

The Federal Geographic Data Committee

By: Milo Robinson
Framework & Partnership Coordinator
Federal Geographic Data Committee

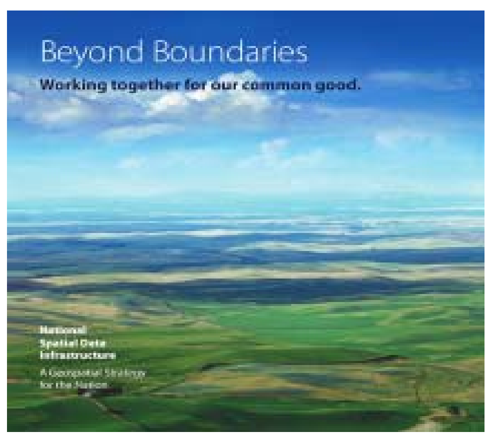
The Federal Geographic Data Committee (FGDC) is an interagency committee that promotes the coordinated development, use, sharing, and dissemination of geospatial data on a nationwide. This national data sharing effort is known as the National Spatial Data Infrastructure (NSDI). The Office of Management and Budget (OMB) established the FGDC in 1990 and re-chartered the committee in its August 2002 revision of Circular A-16, *Coordination of Geographic Information and Related Spatial Data Activities.* The FGDC is a 19 member interagency committee composed of representatives from the Executive Office of the President, Cabinet level and independent federal agencies. The Secretary of the Department of the Interior chairs the FGDC, with the Deputy Director for Management, OMB as Vice-Chair. The FGDC Secretariat is located in The National Geospatial Program Office, US Geological Survey, Department of Interior.

Federal Geographic Data Committee Members

- Department of the Interior -Chair
- Department of Agriculture
- Department of Commerce
- Department of Defense\
- Department of Energy
- Department of Health and Human Services
- Department of Housing and Urban Development
- Department of the Interior
- Department of Justice
- Department of State
- Department of Transportation
- Environmental Protection Agency
- Federal Emergency Management Agency
- General Service Administration
- Library of Congress
- National Archives and Records Administration
- National Aeronautics and Space Administration
- National Science Foundation
- Office of Management and Budget
- Tennessee Valley Authority

Coordination Responsibilities
Federal agencies have specific coordination responsibilities:

·Prepare, maintain, publish, and implement a strategy for advancing geographic information.
·Collect, maintain, disseminate, and preserve spatial information such that the resulting data, information, or products can be readily shared with other federal agencies and non-federal users, and promote data integration between all sources.
·Coordinate and work in partnership with Federal, State, tribal, and local government agencies, academia and the private sector and to building upon local data wherever possible.
·Use FGDC data standards, FGDC Content Standards for Digital Geospatial Metadata, and other appropriate standards, documenting spatial data with the relevant metadata, and making metadata available online through Geospatial One-Stop (http://www.geodata.gov)
·Provide leadership and facilitate the development and implementation of a plan for nationwide population of each data theme.
·Publish information online showing the current extent and status of the spatial data themes for which they have the lead, and encourage all other sources of data for those same themes to provide access to their data through Geospatial One-Stop (http://www.geodata.gov)
·Use spatial information to enhance electronic government initiatives, to make federal spatial information and services more useful to citizens, to enhance operations, to support decision-making, and to enhance reporting to the public and to the Congress.



Cooperative Agreements Program (CAP)
The FGDC is currently engaged in conducting a program to support cooperative agreements for advancing NSDI. Approximately $1.2 million is made available to applicants. These cooperative agreements are focused on metadata training, NSDI development, and web mapping services. Broad participation from state and local, tribal and federal governments, academia, and the private and not-for profit sectors is encouraged. For further CAP information, contact:

David Painter
703.648.5513
dpainter@fgdc.gov
http://www.fgdc.gov

Beyond Boundaries
FGDC created a flyer to explaining our common uses of geographic information called Beyond Boundaries. It is available in soft copy from: http://www.fgdc.gov/publications/documents/geninfo/Beyond_Boundaries_Lo.pdf. The pamphlet describes the common benefits of sharing geospatial information.

For more information on the FGDC or to receive the FGDC newsletter, please email fgdc@fgdc.gov or visit the FGDC website at www.fgdc.gov

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