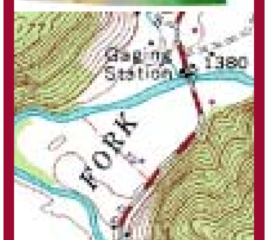
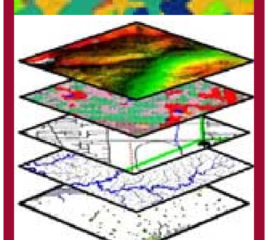
The Virginia Geospatial Newsletter

Showcasing GIS, Remote Sensing and GPS Supported Products and Services in the Commonwealth

Volume 2, Number 3 — Summer, 2004

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





For more information contact:

The Virginia Geospatial Extension Program
(540) 231-2428
www.cnr.vt.edu/gep
jmcg@vt.edu

The Extension Agent GPS Program

by: Charlie Stallings
Extension Dairy Scientist
Virginia Tech

and

John McGee
Virginia Geospatial Extension Specialist
Virginia Tech

Virginia Cooperative Extension (VCE), in partnership with the Virginia Geospatial Extension Program, the Virginia Tech Department of Forestry, and the Virginia Tech College of Natural Resources, launched an innovative program designed to provide GPS receivers and GPS supporting software and training to each of Virginia's 107 local extension offices, the Agriculture Research and Extension Centers (AREC's), and the 4-H Centers through the *Extension Agent GPS Program*.

> *Through the Extension Agent GPS Program, Virginia's citizens will gain increased access to geospatial information. This information will support innovative products and services to facilitate effective decision making for Virginians.*
>
> -Dr. Patricia Sobrero, VCE Director

It is anticipated that the Extension Agent GPS Program will generate indirect benefits throughout Virginia. By providing more accurate area measurements of agricultural fields, for example, farmers will be able to more accurately estimate fertilizer or herbicide application rates, or to more accurately support the delineation of riparian buffer zones as well as support other best management practices. These measures can potentially result in reduced agricultural runoff, and improvements in water quality.

The *Extension Agent GPS Program* is not only intended to support the day-to-day application demands of Agriculture and Natural Resource (ANR) extension agents. Family and Community Sciences (FCS), Food, Nutrition and Health (FNH), and 4-H program areas are also included under the *Extension Agent GPS Program* umbrella.

Jim Riddell, the Assistant Director of VCE's Agriculture and Natural Resources, maintains that "the Extension Agent GPS Program will not only enhance VCE's capabilities, but the program will also

(Continued on Page 3)

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

Youth Education Through The Meaningful Bay Experience

by Jeff Kirwan
4-H and Youth Extension Specialist
Virginia Tech

Chesapeake Bay is North America's largest and most biologically diverse estuary. It has sustained the region's economy and defined its traditions and culture for over 300 years. Accordingly, in 1983 and 1987, the states of Virginia, Maryland, Pennsylvania, the District of Columbia, the Chesapeake Bay Commission and the U.S. Environmental Protection Agency signed historic agreements to protect and restore the Chesapeake Bay. In 2000, the agreement called for a new kind of goal. Beginning with the class of 2005,

Through this program, teachers use GPS and GIS to meet key educational goal of the Chesapeake 2000 Agreement...

states are to "provide a meaningful Bay or stream outdoor experience for every school student in the watershed before graduation from high school."

Earth science class has emerged as a key place to implement the Meaningful Bay Experience (MBE). In Virginia, this is where students are introduced to GPS, aerial photography, satellite images, and how humans affect water quality. As a consequence, Virginia Cooperative Extension, with funding from the National Oceanic and Atmospheric Administration (NOAA), and with help from the Virginia Department of Forestry and Soil and Water Conservation Districts, has embarked on a program to teach earth science teachers how to use GPS and GIS to direct a MBE. Key components of that program follow.

Targeting Schools and Watersheds. GIS is used to identify specific watersheds where kids can make a difference. Looking at the 60 meter buffer surrounding streams and rivers, the analysis provides a list of water systems that are less than 50% forested (in need of restoration) and greater than 2% residential (where kids live). Schools that serve these watersheds are then targeted for teacher training and restoration projects. Free hardwood seedlings are also provided.

Teacher Training. Earth Science teachers in targeted watersheds are invited to participate in four days of training over a one-year period. They receive a free GPS receiver and instruction. They learn how to use free software to obtain maps and aerial photography of study sites. Historic and aerial photographs are provided so that students can calculate land use change over time, and determine its affect on water quality. These images are geo-referenced so that they can use an overhead projector to create a simple GIS.

THROUGH THE MEANINGFUL BAY EXPERIENCE, STUDENTS MEASURE LAND USE CHANGE USING AERIAL PHOTOGRAPHY

Broad Run High School, 1950

Broad Run High School, 1995

Students use GPS as part of a Meaningful Bay Experience

GPS Teaching Kits. Cooperative Extension has six kits of 20 Garmin E-trex GPS receivers available for loan to teachers and 4-H club leaders who want to teach the basics of GPS and land navigation. GPS has proven to be a fun, hands-on way to teach geography and physical science.

Satellite Photos. Satellite photos for most counties are available on-line and on poster board upon request. These photos give students an opportunity to see what their communities look like from space, how true and false color images are used to obtain land-use information, and to see if they can locate their homes using only natural features.

Despite these innovative ways of using GPS and GIS, teachers are still looking for more ways to integrate the technologies into watershed education. If you have ideas to share, please contact Jeff Kirwan at jkirwan@vt.edu.

VCE's GPS Program

(Continued from Page 1)

serve as a catalyst to encourage the adoption and application of additional geospatial tools (i.e. geographic information systems [GIS] and remote sensing) by the extension community and their constituents."

...[this] program will serve as a catalyst to encourage the adoption and application of additional geospatial tools (i.e. geographic information systems [GIS] and remote sensing) by the extension community and their constituents.

In addition, the program will support the vertical integration of the extension agent's day-to-day activities with partnering state agencies (e.g. Virginia Department of Agriculture and Consumer Services, The Virginia Department of Forestry, etc.) and federal programs (e.g. Natural Resources Conservation Service, Homeland Security, etc.).

The GPS receivers were distributed to extension agents through a circuit of seven regional GPS workshops held during the Spring of 2004. Through these workshops, approximately 130 extension faculty received training. Through the "train the trainer" model, trained extension agents are providing training to fellow extension agents at their local offices. Moreover, other local extension personnel, as well as extension specialists, will be provided with follow-up training opportunities through the Geospatial Extension Program.

In addition to offering a free GPS receiver and training for every local extension office, the *Extension Agent GPS Program* also provides funding for a GPS Lab Kit. The GPS Lab Kit contains GPS receivers and training material to support the educational and training venues. The GPS Lab Kit is available on a check-out basis to extension agents, extension specialists, and other extension staff to support their individual workshop requirements.

The Garmin eTrex Legend GPS receiver was identified as an appropriate GPS receiver to support the *Extension Agent GPS Program*. This GPS receiver calculates area and perimeter measurements "on the fly",

Mike Clifford emerges from retirement (yet again) to provide a valuable service for VCE.

is user-friendly, durable, and relatively inexpensive. In addition, the unit supports application scalability, which will support the future needs of Virginia's extension community. This GPS receiver, for example, can be fully integrated with desktop GIS software, web-mapping GIS applications, as well as handheld devices (i.e. iPAQ's).

Additional information about the *Extension Agent GPS Program* is available online: http://www.cnr.vt.edu/gep/GPS_Workshops

VCE and the Geospatial Extension Program would like to acknowledge Mike Clifford and Staci England for their valuable support and contributions to this program.

How Can Virginia's Extension Community Use GPS?

- Support reporting responsibilities after disasters
- Measuring lots for Animal I.D. Program
- Estimating fertilizer application needs
- Rotational grazing plans
- Estimating lengths of fence lines
- Evaluating soil compaction issues over time
- Estimating production yields
- Developing urban tree inventories
- Identifying drainage issues in fields
- Crop insurance declarations
- Estimating areas of proposed riparian zones
- Identifying point and non-point pollution sources
- Estimating area (acreage) for timber harvests
- Establishing and locating silviculture research plots
- Livestock tracking
- Tracking of other animal diseases, including avian influenza
- Monitoring endangered plants
- Estimating pesticide/fungicide program application needs

The Extension Agent GPS Program combines hands-on GPS training tailored with lab-based instruction in order to meet the needs of Extension Agents.

Community College Initiatives

Geospatial Workforce Development Opportunities Offered Through the Virginia Community College System

by: Bob Bailey
Director, Institute of Excellence of Applied Technology
Virginia Community College System

and

Paige Baldassaro
Geospatial Applications Developer
The Virginia Geospatial Extension Program

The Virginia Community College System (VCCS), in collaboration with the Virginia Geospatial Extension Program, sponsored a series of hands-on GIS workshops throughout the state during the Spring 2004. These two-day intensive GIS workshops provided participants with the opportunity to gain exposure to ArcGIS software using a Virginia-based curriculum, exercises and geospatial data. The workshops were developed by the Geospatial Extension Program in consultation with the VCCS targeting the beginning user.

Several VCCS institutions sponsored this initial circuit of workshops, including:

- Piedmont Virginia Community College (Charlottesville)
- Danville Community College
- New River Community College (Dublin)
- Tidewater Community College (Virginia Beach)
- Thomas Nelson Community College (Hampton)

Through this partnership, each community college provided instructional facilities for the workshop. The Virginia Geospatial Extension Program awarded ten scholarships to VCCS faculty and staff at sponsoring institutions. The goal of these workshops was to not only stimulate interest in GIS applications, but to also demonstrate that individual VCCS institutions can serve as effective technical regional training facilities for GIS instruction that can support workforce development for both the public and private sectors in Virginia.

The VCCS Institute for Excellence in Advanced Technology (IE-AT), through a statewide software license, has provided each of the 23 VCCS colleges with access to ESRI's ArcGIS software package. Kathy Williams, with Virginia Tech's Information Systems and Computing (IS&C), serves as the central point of contact to coordinate software license information with individual VCCS institutions.

This initial circuit of workshops was designed by the Geospatial Extension Program to be hands-on, application oriented, and geared towards real world problem solving in the Commonwealth. Many of the exercises that are covered in this workshop are associated with public safety issues that are of primary interest to the citizens of Virginia. This serves as a catalyst in the learning process.

These entry-level GIS workshops were designed by the Geospatial Extension Program to provide Virginians with a cost effective opportunity to gain insight into the power of practical GIS applications. The workshops provided participants with an overview of GIS software and data. The exercises used in the workshop integrated data collected by state agencies with remote sensing data collected in Virginia by the federal government to support decision making. The workshops also integrated a GPS component as well. A majority of the examples, exercises, and applications associated with this workshop were based on public safety issues.

Several VCCS colleges are already moving forward with the development of GIS training programs and courses. To learn more, contact the workforce development office of the community college in your region.

Don't forget...

The 2004

Virginia GIS Conference

November 8-9, 2004

Hotel Roanoke

For additional information:

http://www.rvarc.org/vagis/

Co-sponsored by the VAPDC and VAMLIS

4-Year Colleges and Universities

Remote Sensing of Environmental Indicators in Coastal Bays

by:
Dr. Tom Allen
Old Dominion University

Dr. George Oertel
Old Dominion University

Wetlands, estuaries, tidal creeks, and coastal bays act as receptacles for pollutants from human activities. If pollutant delivery is not buffered, or if pollutants are not "flushed" from these environments, loading may cause severe damage to natural resources. Pollutant and sediment loading in estuaries is related to *flushing*, particularly tides and basin hypsography (relationship between elevation and surface area), affecting marsh loss, flooding, and vegetation buffers. Coastal bays that are stagnant will tend to accumulate pollutants from anthropogenic input and are more vulnerable than bays that have rapid water exchanges. Potential pollutant loading input is related to the watershed land surface area, number of tributaries, and length of shoreline. These important flushing characteristics of basins have not been widely considered in coastal management. Yet, these characteristics are amenable to mapping and modeling in a GIS.

Figure 1: Research Area

Research at Old Dominion University, supported by NASA's Virginia Access/MAGIC (Mid-Atlantic Geospatial Information Consortium), has developed a remote sensing approach to address these problems and improve coastal management using earth observing satellites (Landsat, MODIS, and AVHRR.) The project is studying coastal bays along the Mid-Atlantic seaboard from Delaware south to North Carolina (Fig. 1) using coastal morphology, flushing, and pollutant and watershed profiles. A set of coastal bay health indices are being tested with the goal of helping managers make better decisions affecting ecosystem health in relation to development of coastal basins. A geographic information system (GIS) provides the database and reporting system for input and analysis of remote sensing data. The project uses satellite spectral signatures to map the exchange of bay water with ocean water (flushing by tidal plumes) (Fig. 2.) Thermal distinctions between ocean and bay waters in ebb-tidal, flood-tidal, and seasonal conditions are used to calculate the amount of flood penetration into a bay and the amount of water that exchanges during each tidal cycle. Residual waters with higher input loading and longer residence time reveal "risk zones" in coastal bays in concert with distance-to-inlet and signature gradients (Fig. 3.) The result is a prototype system for evaluating environmental risks to the numerous coastal bays on the eastern seaboard.

Figure 2: Identifying spectral signatures

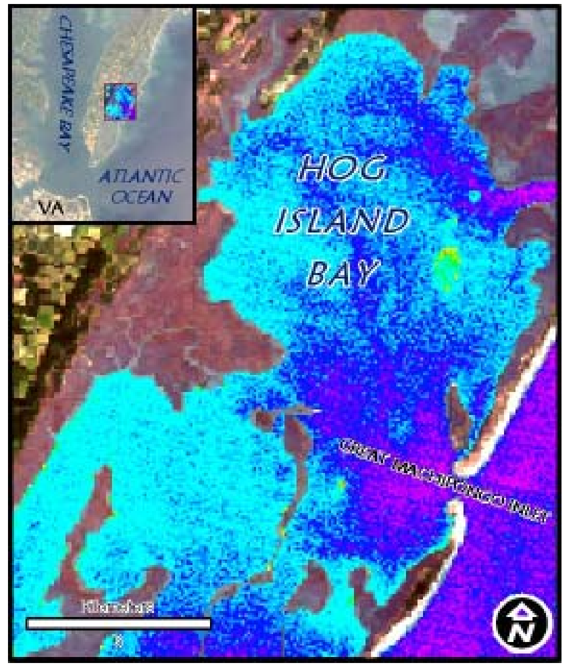

Figure 3: Residual water risk zones

To date, the project has analyzed seven bays, ranging from small, urbanized watersheds in Rehoboth Bay (DE) and Lynnhaven Bay (Virginia Beach, VA), to bays flushed by dual inlets (Chincoteague and Sinepuxent Bays, VA/MD), to the extensive Albemarle Sound in North Carolina. Each bay has been delineated, bathymetrically modeled, and characterized for water volume calculations (proportion of tidal flushing to total volume) and extent of tidal plumes. The spatial extent of flushing vs. potentially stagnant water bodies is ongoing, with the aim of revealing patterns and corroborating site-specific environmental monitoring.

The project hopes to encourage planning for sustainable development of coastal

(continued on page 7, column 3)

State Government

The Virginia Conservation Lands Needs Assessment: DCR Develops a Tool for Guiding Land Protection

by: Steve Carter-Lovejoy
Natural Heritage Information Manager
VA Dept of Conservation and Recreation

and

Joe Weber
GIS Projects Manager
VA Dept of Conservation and Recreation

Virginia's natural lands need more protection from the sprawling growth that is fast converting Virginia's landscape into parking lots and subdivisions. Rural landscapes, including "working lands" like farms and harvested forests, are also in serious need of protection, especially on the outskirts of Virginia's fastest growing regions. If current trends continue, Virginia will develop more land in the next 40 years than it has in the past 400 years.

But what resource lands should be protected? The General Assembly has provided $5 million in the current biennial budget to the Virginia Land Conservation Foundation (VLCF) for the purchase of conservation lands and easements – a tiny fraction of the money ultimately needed to accomplish land conservation at this scale. How can we spend these precious few dollars most effectively?

Choosing exactly which properties to protect is more critical when you consider conservation needs from a landscape level. Natural lands protect ecosystem functions that can often break down and disappear as a landscape is fragmented. Similarly, agriculture and forestry lose their economic viability in a region as key resource lands are broken up and reduced below critical size thresholds. Clearly some sort of guidance is necessary for private citizens and conservation groups as well as local, state and federal agencies if their efforts to protect Virginia's natural and cultural heritage are going to be successful.

Working on behalf of the VLCF, the Virginia Department of Conservation and Recreation has been developing such guidance. The Virginia Conservation Lands Needs Assessment (VCLNA) is intended as a flexible, widely applicable tool for integrating and coordinating the needs and strategies of different conservation interests, using GIS to model and map land conservation priorities and actions in Virginia. The VCLNA allows the manipulation of issue-specific data sets that can be weighted and overlaid to reflect the needs and concerns of a variety of conservation partners – issues like:

- unfragmented natural habitats
- natural heritage resources
- outdoor recreation
- prime agricultural lands
- cultural and historic resources
- sustainable forestry
- water quality improvement
- drinking water protection

DCR, with funding assistance from the Department of Environmental Quality's Virginia Coastal Program, has just completed the first phase of this effort – preparation of a Natural Landscape Assessment for Virginia's Coastal Zone,

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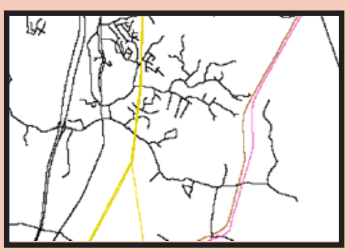
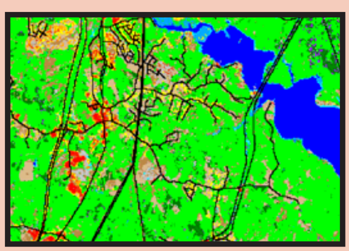
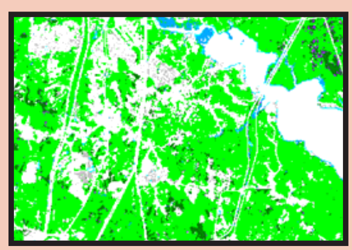
Development of VCLNA Cores



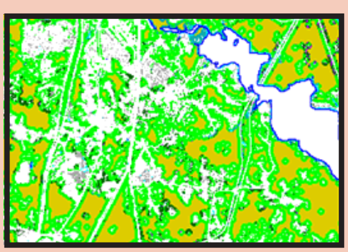
1. A fragmentation layer was generated (roads, powerlines, railroads, etc.)



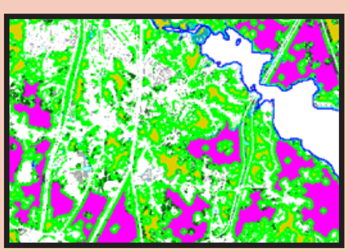
2. The fragmentation layer was used to eliminate from the analysis any intersecting pixels in the NLCD.



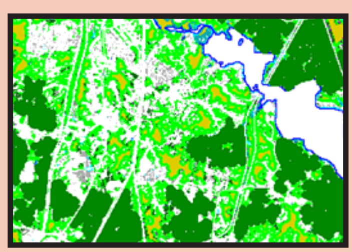
3. Only the natural cover types (forests, wetlands and barrens) were extracted to create a natural land cover layer.



4. Interior natural areas (>100 meters from disturbance) were identified (illustrated in gold).



5. Interior natural areas (> 100 acres in size), are selected (illustrated in magenta)



6. The 100 meter transition zone was added back to create the core areas, shown in dark green

7. Completed cores.

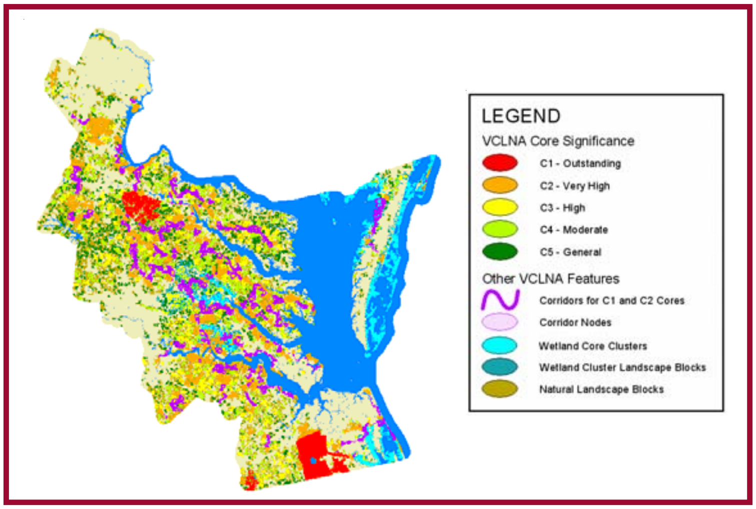
DCR's Land Protection Tool

(continued from page 6)

those counties and cities that touch on tidal waters. Starting with land cover data derived from 2001 NLCD satellite imagery, DCR used ESRI GIS products to identify and prioritize natural lands and the habitat corridors necessary to support and enhance them. The primary focus of the Natural Landscape Assessment is ecological prioritization, which are the most important natural, unfragmented lands, based on considerations of biological and ecological value and integrity?

DCR has produced a number of maps that display the results. These maps show over 2200 "cores" - unfragmented natural areas - prioritized according to their ecological significance, with natural "corridors" that can be restored to provide critical connectivity between key natural landscape fragments. Other maps show the cores in relation to other features - lands that are already in some sort of protective ownership or management, regions that are most vulnerable to future growth and development, and natural heritage sites that harbor rare plants and animals and significant natural communities. The data and maps are available on DCR's website at http://www.dcr.virginia.gov/dnh/vclna.htm, or can be requested on CD from the authors.

The Natural Landscape Assessment is a fundamental complement to other conservation interests and needs. It considers only a subset of the many issues that can determine the importance of a specific property, however. DCR has begun assembling the additional GIS datasets that are needed to make the VCLNA a comprehensive tool for the varied needs of all of Virginia's conservation partners. DCR is also extending the VCLNA Natural Landscape Assessment to the rest of the state.



Natural Landscape Assessment for the Coastal Zone

Remote Sensing in Coastal Bays

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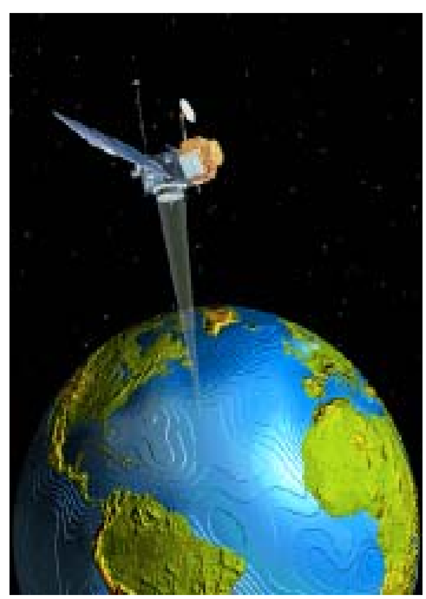
watersheds, protection of living aquatic resources, recreation, and restoration schemes. The byproducts of the research provide new decision support and information for coastal managers.

Drs. Thomas Allen, geographer, and George F. Oertel, oceanographer, are co-directors of the Program for Spatial Analysis of Coastal Environments (SpACE) at Old Dominion University. They encourage parties interested in applying and collaborating in this research to contact them.

For more information, contact:

Program for Spatial Analysis of Coastal Environments (SpACE)
Department of Ocean, Earth, and Atmospheric Sciences
Old Dominion University
Norfolk, VA 23529
URL: http://www.odu.edu/al/larsea/space_home.htm
Tel. (757) 683-5977
E-mail: TAllen@odu.edu, or
Goertel@odu.edu



Federal Government

USGS Initiatives in Virginia's Shenandoah Region

by: Roxanne H. Lamb
Eastern Region Geography
United States Geological Survey
Virginia Liaison

Cities in the Commonwealth of Virginia are facing many environmental issues which are being addressed by a broad range of USGS data and information, including geographic base information, assessments of natural hazards, and information on water and biological resources. In addition, USGS data and information around urban centers are aiding in emergency management and defense functions.

View of the Shenandoah

The current projects in progress in the Shenandoah Region of Virginia are:

- Comprehensive Urban Ecosystem Studies (CUES)
- Shenandoah Valley Regional Assessment

CUES utilizes *The National Map* to bring USGS scientific data and expertise to bear on critical issues in Shenandoah National Park. The objective of this project is to identify priorities, provide access to *The National Map* data sets, develop methodologies for monitoring, and explore applications using *The National Map* data on National Park Service lands.

The USGS can make a variety of contributions to strengthen partnerships and encourage the sharing of data needed to build *The National Map,* including:

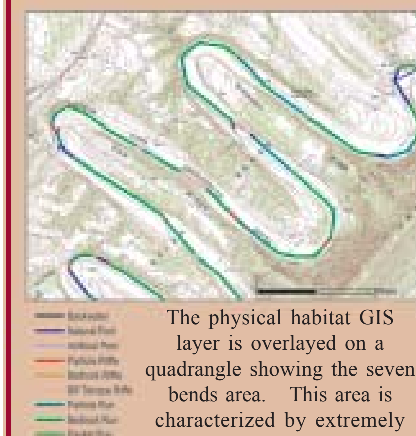
- Data sharing—aerial photography, Landsat, IKONOS, LIDAR
- Guidance on metadata and standards
- Data Quality Assurance/Quality Control
- Networking with diverse expertise—water quality, hazards risk, human health, biodiversity, flood risk, and invasive species

The National Map is a consistent framework for geographic knowledge needed by the Nation. It provides access to high quality geospatial data and information from multiple partners to help support decision making by resource managers and the public. The vision of the USGS is to work with partners for development of the data framework layers and the science applications which support *The National Map*.

The Shenandoah Valley Regional Assessment began in January of 2003, as USGS and its cooperative partners formed the Great Valley Water-Resources Science Forum. The purpose of the forum is to enhance the regional integration of USGS Science Programs to address the availability, vulnerability, and quality of water resources in the Great Valley of the eastern United States.

The objective of the Shenandoah Valley Regional Assessment is to better characterize the aquifer system and provide relevant hydrogeologic information that can be used to guide the development and management of the water resources in the valley. The regional assessment utilizes hydrologic, geologic, geographic, and biologic information to improve understanding of the aquifer systems and their relation to surface-water features and potential hazards over a multi-county area of Virginia and West Virginia.

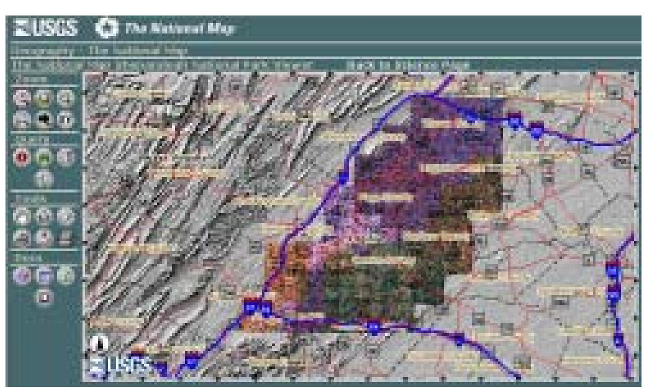
Habitat Mapping for Instream



The physical habitat GIS layer is overlayed on a quadrangle showing the seven bends area. This area is characterized by extremely narrow meanders that cut

Habitat Mapping—North Fork Shenandoah River, VA

Current Program activities include habitat mapping, aquifer appraisals, sinkhole mapping, and geologic mapping. The habitat inventory describes the physical characteristics of the entire North Fork Shenandoah River and accompanies a detailed hydrologic study of low-flow habitat relations on the river. An improved understanding of the complex aquifer system in Frederick, Warren, and Clarke counties is required for its development and management as a sustainable water supply. Hydrogeologic information generated by aquifer appraisals provides useful



The National Map has a user-friendly web interface

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Questions From the Field

How do you generate a DEM using the Virginia Base Mapping Program's DTM?

Converting the VBMP Digital Terrain Model to a Digital Elevation Model for Raster Analysis Applications

by: Mike Futrell,
Draper Aden Associates
Blacksburg VA

and

Peter Sforza,
Virginia View Coordinator
Virginia Tech

The USGS 1/3arc-second NED DEM is the highest resolution DEM readily available, however it does not yet provide statewide coverage and is still only a ten-meter grid. For large scale applications requiring higher resolution datasets there have been few inexpensive alternatives. Some jurisdictions have invested in 2- or 5-foot contours, for example. But lacking this, the alternative has been to hire a photogrammetry company at great cost. The VBMP digital terrain model (DTM) data presents the opportunity of a middle ground.

Included with the VBMP aerial photography are MicroStation DTM files of 3D break lines and mass points. Though this data was initially created to support the orthorectification of the photography and is **not** suitable for the generation of contours to national standards, it does provide the highest resolution terrain model currently available statewide. In this article we will demonstrate a method to convert the raw terrain model data to a useful TIN and DEM product.

Depending on one's goals and available resources a TIN and/or DEM offer great opportunities for tasks such as hydrologic modeling, landform analysis, slope and aspect determination, and soil erosion and slope stability analysis. But it all starts with acquiring the data and converting it into a useful format.

A Procedure for converting VBMP- DTM to a DEM

1. You can work directly from the .dgn line and point features or you can export to either shapefile or geodatabase format. Either way you need to select or create a subset of the features. Bridges and bridge aprons, layers 5 and 7, need to be excluded. Review the numbered layers as described in the VBMP handbook available on the VGIN website, http://www.vgin.vipnet.org/VBMP/VBMPHandbook_r2.pdf, for details. It is also good idea to take a quick look at these files in 3D-Analyst before going any further because obvious errors do exist. For example, breaklines have been found floating hundreds of feet above or below the actual terrain. These also need to be removed. Be sure to work with an area larger than needed because of edge anomalies inherent in any terrain model generation.

2. Now build a TIN. In 3D-Analyst toolbar: Create/Modify TIN – Create TIN from Features. In the dialog box select the layers. For each the height source is 'Feature Z Values'. For points, triangulate as 'mass points', and for lines, triangulate as 'hard line'. Type an output name for the TIN. Keep in consideration the size of the files generated from this operation. It is easy to create a TIN layer that is unmanageable with given hardware. Experience will help determine at what point a given task needs to be broken up into subsets. The new TIN is, of course, an approximation of the true terrain.

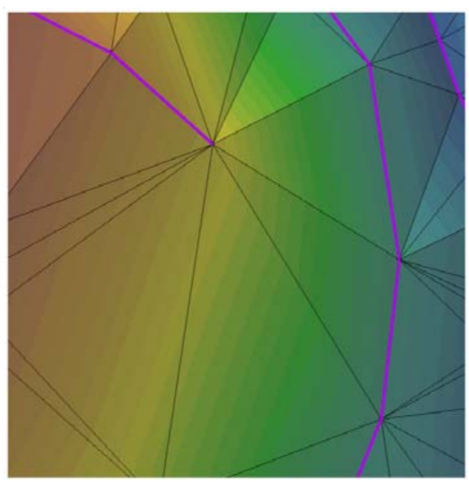

Figure 1: TIN Original breaklines are purple. Elevation has been colored for visualization purposes.

3. Next convert the TIN to a Raster. In 3D-Analyst toolbar: Convert – Convert TIN to Raster. Select the TIN. The Attribute is 'Elevation'. The Z factor is 1 since all VBMP data is in feet. The cell size is up to you, see discussion below. Type an output name for the raster, in this case an ESRI grid. Notes on the cell size, aka DEM grid size: The goal is to generate a grid spacing that is consistent with the DTM resolution and suitable for the intended purpose. It will be an approximation of the TIN.

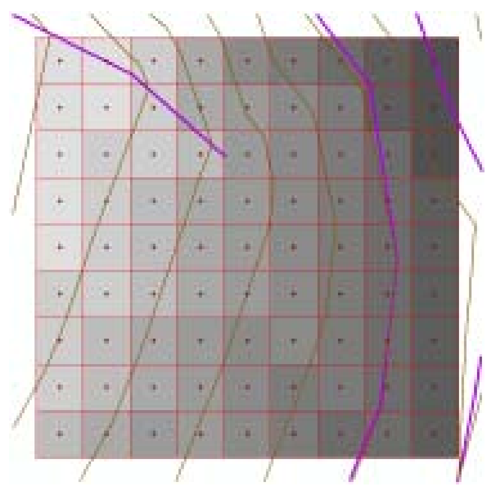

Figure 2: DEM Gridlines, center points, and contours have been added for visualization.

(continued on page 10, column 2)

USGS and the Shenandoah

(continued from page 8)

information to better address questions about:

1. Water quantity available for use
2. Effects of increased pumpage on ground-water levels and instream flows
3. Relation between the surface-water and ground-water flow system, and
4. Quality of the groundwater supply and its vulnerability to current and potential future sources of contamination

For additional information on the projects described in this article, please visit the following Websites:

Comprehensive Urban Ecosystems Studies (CUES):
http://ergwms.er.usgs.gov/Website/shenandoah/ERG/scopeshen.asp

The National Map:
http://nationalmap.usgs.gov/

The Great Valley Forum:
http://va.water.usgs.gov/GreatValley/Index.htm

North Fork Shenandoah River Project:
http://va.water.usgs.gov/projects/va111.html

Frederick County Project:
http://va.water.usgs.gov/projects/va134.html

Warren County Project
http://va.water.usgs.gov/projects/va142.html

Clarke County Project:
http://va.water.usgs.gov/projects/va146.html

Virginia Water Resources Information:
http://va.water.usgs.gov/

Raster Analysis With the VBMP

(continued from page 9)

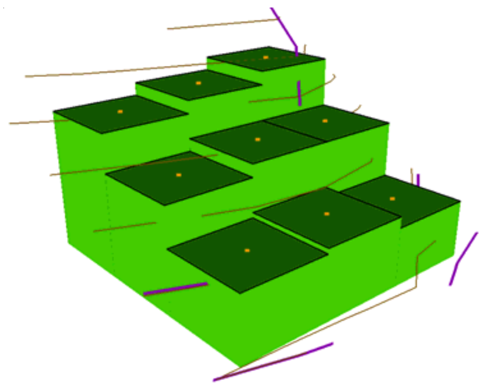

Figure 3: 3D conceptual view of DEM with breaklines and contours.

If the grid is made too large, information will be lost generating a loose approximation of the TIN. If the grid is overly small no additional benefit is achieved, while the file size and related overhead increases, yet the approximation of the TIN will be much closer. A non-statistical approach is to review the TIN, particularly the areas of interest, and imagine grid cells overlaying the smaller triangular areas that need to be represented. Use the measure tool and keep in mind these limitations of the data.

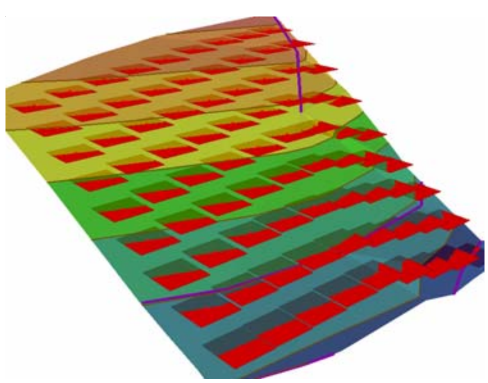

Figure 4: 3D view of the DEM cells (from Figure-2) intersecting the TIN

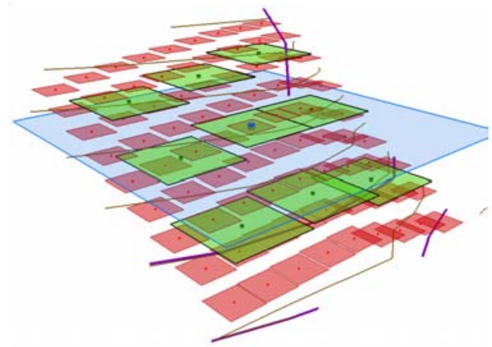

Fig 5: 3D view showing three different DEM size selections

Conclusion

The VBMP terrain model may be the best model available, especially in rural areas. It is not only a tremendous asset for planning and visualization, but has great potential for traditional terrain analysis applications. These gains can be achieved by converting it to a TIN or DEM or both. However, keep in mind there are three scales of VBMP mapping and multiple companies' technicians have produced some variability.

Though we illustrated the use of contours here, an excerpt from the VBMP FAQ states that "…additional work on the DTM would be required to produce contours to national standards". This warning should be interpreted to apply to large scale derivatives. Be sure to read your metadata and happy modeling.

Look for these articles in upcoming editions of the Virginia Geospatial Newsletter:

Developing Virtual 3-D Fly-throughs using VBMP data.

New Geospatial Initiatives at the Virginia Department of Transportation (VDOT).

The Center for Geospatial Information Technology.

GIS Supports Wind Power Initiatives in Virginia!

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The Virginia Geospatial Extension Program
319 Cheatham Hall (0324)
Blacksburg, VA 24061
(540) 231-2428
http://www.cnr.vt.edu/gep