A newsletter of the NJ Department of Agriculture in collaboration with the NJ Department of Education

Summer 2006
Volume 1, Issue 2

GIS ✍ GPS ✍ REMOTE SENSING ✍ SPATIAL ANALYSIS

In the Field with GIS

eSchool News Offers FREE GIS Resource Center

The online education news services, eSchool News, recently announced the launch of a new FREE Resource Center (http://www.eschoolnews.com/resources/reports/gis/index.cfm) that will allow users to:

- ***Discover*** how GIS technology aids school planning;
- ***Examine*** how students create 'biomaps' using GIS software; and
- ***Learn*** how Google Maps inspire creativity.

The advent of affordable geospatial technology is already having a profound effect on daily life, but it offers substantial promise for the classroom. Global Positioning Systems (GPS), Geographic Information Systems (GIS), and remote sensing (RS) tools are revolutionizing the armed forces, navigation, information systems, and communications in general. When applied to the classroom however, the possibilities are endless--which is good, as the career opportunities requiring geospatial skills are just as numerous. Fields as diverse as law enforcement, environmental management, business, public safety, health, and agriculture are critically dependant on this technology and the skills it requires. In the classroom, teachers of social studies and various sciences, most especially earth, environmental, biological, and general sciences are increasingly incorporating geospatial technologies into their lessons.

These tools are becoming increasingly vital as community leaders use them to address a variety questions with local and global implications. In today's marketplaces and classrooms, the ability to think spatially isn't just a nice skill to have, it is a necessity.

Leveraging geospatial technologies for maximum effect is difficult, for two seemingly contradictory reasons. First, they can be applied in obvious, but broad ways. It may be easy to envision the utility of the technology, but the implementation of it proves daunting. Or, this technology can be used in novel, less obvious ways, but applied on a small scale. Coming up with the idea is the hard part, while applying it is relatively simple. Whether you are stymied by implementation, or face a drought of ideas, our **FREE** online resource center, GIS and Geographic Inquiry can help you answer the question: "How can we best integrate geospatial technology into both the classroom and district?"

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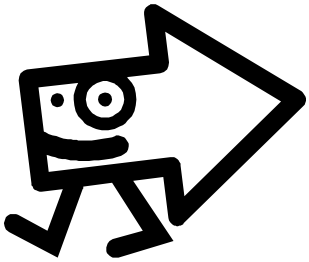

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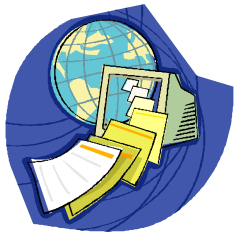

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Here are a few more samples of what you'll find in this Resource Center:

- How to "Chart the Past" of geographic exploration
- Discover a way to access royalty free geography video
- Materials on mapping out a GIS career

(Information in this article was taken directly from the eSchool News e-mail of April 20, 2006, released by Roger Riddell, Online Editor, announcing the launch of the GIS Resource Center.)

Sixth Annual ESRI Education User Conference - NEXT MONTH

Connect, learn, and share with GIS users in education **August 5-8, 2006**, in San Diego, California.

Latest News

- Register online
- Get more information on your abstract
- Download the 2006 EdUC Brochure [PDF 3.9 MB, 2 pages]

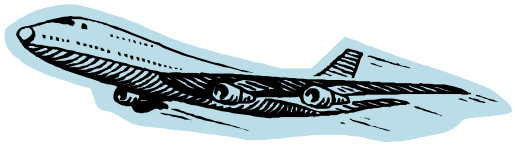
Explore the Possibilities of Geographic Learning

The conference provides a forum for members of the education community to come together and share their experiences and knowledge. The EdUC covers everything you need to know to start or to grow GIS activities and programs.

Who Should Attend

Educators of all types and levels are encouraged to participate, including

- Primary and secondary educators
- College and university faculty and staff
- Librarians
- Museum and science center professionals
- GIS professionals who are interested in becoming involved with education



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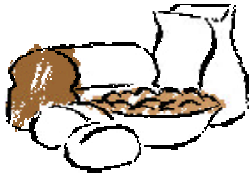
Geospatial Technology and Food Safety



We are all well aware of the international nature of our economy and we readily purchase a wide range of products and services originating from states other than our home state and from other countries. This has become so commonplace to us that we don't think about it even when the products that we are purchasing are for our own health and nutrition. We are fortunate to be able to enjoy a delicious fare of food selections from around the country and around the world. However, we have seen through the 'Mad Cow Disease' (bovine spongiform encephalopathy or BSE) health crisis that knowing the origin of the foods we eat can be critical to our health.

"The U.S. food supply is a critical element of homeland security, but it faces threats from many sides. One such threat results from the mobility of modern livestock. In an effort to ensure the safety of the U.S. food supply from...cattle-borne diseases...the Kansas Animal Health Department (KAHD) has begun a pilot project to conduct geospatial traceback of any animal all the way to its birth—and all within 24 hours." (GeoIntelligence, September 1, 2005, www.geointelmag.com.) The KAHD project uses a variety of geospatial technologies, including Global Positioning System (GPS) and Geographic Information Systems (GIS). To read more about the KAHD project, go to: http://www.geointelmag.com/geointelligence/article/articleDetail.jsp?id=300387.

To learn more about geospatial technologies, food safety, and agricultural traceability (or trace-back), visit the sites below:

- *Bioterrorism and the Food Supply* (http://www.directionsmag.com/article.php?article_id=667)
- *PA Farms Fact Sheet* (http://www.pafarms.org/documents/PaFarmsFactSheet.pdf)
- *Tracking Cattle in the Heartland* (http://www.geospatial-online.com/geospatialsolutions/article/articleDetail.jsp?id=177059)

Agricultural Geospatial Careers

The one criticism of geospatial technology —and it's not necessarily negative—is that the technology is so broadly applicable to a wide range of fields that it's hard to get a handle on just what it is and how it can be applied. What exactly does a person do with it in the work world? Specifically, how does one prepare for an agricultural geospatial career?

For a glimpse at the types of geospatial careers available in agriculture, and accompanying plans of study, visit:

- http://faculty.kirkwood.edu/bjohnso/model/instructors.htm; and
- http://faculty.kirkwood.edu/bjohnso/model/parents.htm.

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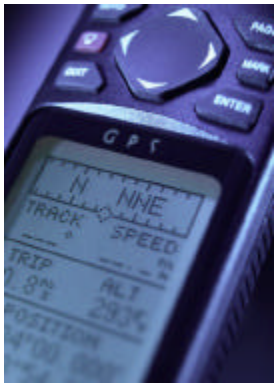
Agricultural Geospatial Careers *continued from page 3*

Be sure to follow the links available on these pages for more industry information.

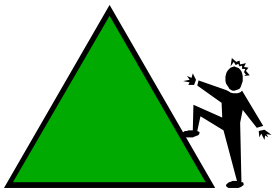
The following **four key agricultural geospatial careers** are highlighted:

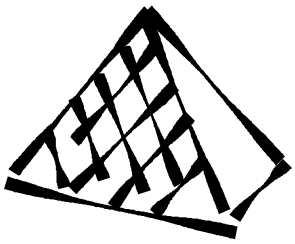


1. GPS Field Data Collector (http://faculty.kirkwood.edu/bjohnso/model/plans/datacollect.htm)
2. Ag GPS/GIS Sales (http://faculty.kirkwood.edu/bjohnso/model/plans/gissales.htm)
3. Precision Farming Technician (http://faculty.kirkwood.edu/bjohnso/model/plans/precag.htm)
4. Agriculture GIS Analyst (http://faculty.kirkwood.edu/bjohnso/model/plans/gisanaly.htm)

Of course, this is not the full range of agricultural geospatial career opportunities, but these examples give a practical sense of what specific careers are available and how to prepare for them.

GPS 101





How is your handheld GPS receiver able to tell you where in the world you are? It can tell by **trilateration**. "Trilateration refers to the trigonometric law by which the interior angles of a triangle can be determined if the lengths of all three triangle sides are known. GPS extends this principle to three dimensions." (David DiBiase, Ph.D., Penn State University, 2006, GEOG 482) Think of the triangle on the left above as a 3-D pyramid; then, turn the pyramid upside down as in the image on the right above. Each of the four corners of the inverted pyramid represents a satellite that your GPS receiver would use to determine your location. The tip of the pyramid (now facing downward in our image above) would represent your location on Earth, as determined by the process of trilateration—a kind of "you are here" indicator.

A GPS unit needs to be able to 'see' only three satellites (i.e., three corners of the pyramid base) to give you back longitude and latitude coordinates for your location on Earth. In the case of the inverted 3-D pyramid above, you'll notice that there are four 'satellite corners.' With a fourth satellite, the GPS receiver can determine not only where you are horizontally on the Earth (i.e., your longitude and latitude coordinates, it can also tell you your elevation (vertical distance). (It's a little more complicated than this, but this is the gist of it.) So, three satellites can give you X and Y coordinates, and a fourth satellite can give you a Z value—or elevation value.

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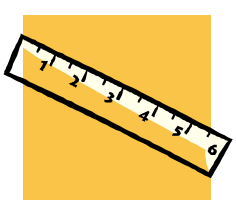
GPS 101 *continued from page 4*

So, how is your GPS receiver actually determining your position using the satellites? Simply, "GPS receivers calculate distances to satellites as a function of the amount of time it takes for [the] satellites' signals to reach the ground. To make such a calculation, the receiver must be able to tell precisely when the signal was transmitted [by the satellite], and when it was received." (DiBiase, 2006) To do all of this, your handheld GPS receiver is made up of "a radio receiver and internal antenna, a digital clock, some sort of graphic and push-button interface, a computer chip to perform calculations, memory to store waypoints, jacks to connect an external antenna or [to] download data to a computer, and flashlight batteries for power." (DiBiase, 2006)

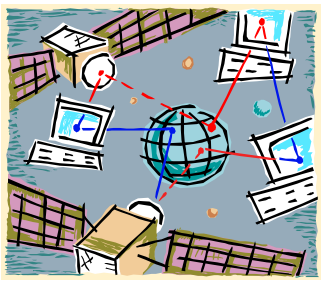


To learn more about GPS and the constellation of satellites that circles our Earth every day, visit the links below. Also, don't forget to refer to the user guide that accompanies your handheld GPS receiver. Most guides are clear and user-friendly—even to those new to GPS.

- The Fundamentals of GPS - http://www.directionsmag.com/article.php?article_id=228&trv=1
- Trimble GPS Tutorial - http://www.trimble.com/gps/
- What is GPS? - http://www.geoplane.com/gps.html
- Fundamentals of GPS - http://www.wamis.org/agm/pubs/agm8/Paper-7.pdf
- GPS in Agriculture/Precision Farming, Montana State University -http://www.montana.edu/places/gps/3Applications/slide12.html
- The Use GPS and Mobile Mapping for Decision-Based Precision Agriculture - http://www.gisdevelopment.net/application/agriculture/overview/agrio0011.htm

Integrated GPS and GIS

How are GPS and GIS related? At its simplest, GPS is a data gathering tool, and GIS allows you to store, visualize, and manipulate data provided to it through GPS and other data collection tools. You'll remember from the "GPS 101" article above that most handheld GPS receivers include a 'jack' to allow data downloading to a computer. The following is an excerpt from the USDA Farm Service Agency, Montana State Producer Handbook, about GIS, GPS and the integration of the two technologies.



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Integrated GPS and GIS *continued from page 5*

"GIS is a computer-based tool for mapping and analyzing geographic information. GIS stores spatial and geographic information for three different types of areas:

- Places that have areas, like farms, wetlands, and neighborhoods;
- Places without area, such as the location of a grain bin, building, or tractor; and
- Places that have a beginning and end, such as a major highway, private roads, and streets.

GIS stores this and other data and uses satellite imagery or aerial photography as a basemap for the overlay of these layers. Each layer can store vast amounts of information, such as soil types, crops, land boundaries, place names, and populations.

GPS is an accompanying technology that can be integrated with GIS for even greater analysis of real world information to increase the efficiency, accuracy, and timeliness of FSA [Farm Service Agency] administration. GPS data layers, orthophotography, soils layers, public land survey data, and many other data layers can be placed on top of each other inside one GIS project.

GIS and GPS help [the] FSA store and utilize information on field boundaries of land and attributes for each field, such as field number, crop type, and producer information. Each of these layers...has a database associated with it which stores detailed information."

To read the full article, click on the first link below. Other resources on the integration of GPS and GIS are also provided as links below.

- GIS and GPS, USDA Farm Service Agency Fact Sheet, Montana State Producer Handbook - http://www.fsa.usda.gov/MT/GIS%20Fact%20Sheet05.pdf
- Potential for Integrated GIS-Agriculture Models for Precision Farming Systems - http://www.ncgia.ucsb.edu/conf/SANTA_FE_CD-ROM/sf_papers/goddard_tom/960119.html
- GPS/GIS Mapping of Vegetable Insect Pests to Improve IPM, Rutgers Cooperative Extension - http://www.pestmanagement.rutgers.edu/IPM/Vegetable/Pest%20Maps/gpsgiscompiled.htm

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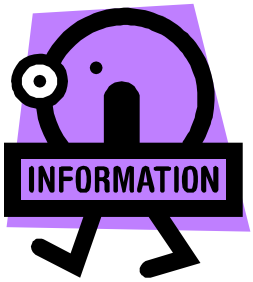
Other WEB Links

The Institute for the Application of Geospatial Technology
http://www.iagt.org/resources/resources.asp

Geographic Information Technology Association
http://www.gita.org/



For more information on geospatial technologies from the NJ Department of Agriculture or Department of Education, or to provide feedback on this newsletter and/or suggestions for future articles, please contact:

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- Lori Thompson, NJ Department of Education, lori.thompson@doe.state.nj.us.