COASTAL CONNECTIONS

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COASTAL MANAGEMENT PROFILE

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Education: BA from the University of Colorado, Boulder, with a double major in anthropology and environmental, population, and organismic biology; master of marine affairs from the University of Washington with emphases in marine resource management and marine policy
Most fulfilling aspect of your job: I am part of a team working to develop the sanctuary's new management plan.
Most challenging aspect of your job: Balancing a high level of community involvement with a national resource management perspective is a goal that I feel is well

Continued on Page 2

THIS ISSUE'S FOCUS

Topographic Data

What is topography and why is it so important to the field of coastal management? Land surface elevation, or topography, is the general form or shape of a surface including its arrangement of features and relief. This information has many benefits for coastal management, especially if multiple elevation measurements are accessible over time. Issues including flood hazards, subsidence, and shoreline change can be addressed if high-accuracy, high-resolution elevation data are available. These data can help save beaches, dunes, buildings, and property.

The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, in partnership with local and state governments, has contracted with the private sector for high-resolution topographic data to meet coastal management needs since 2001. The goal is to work with the coastal resource management community and supply relevant information and data through remote-sensing technologies.

Maine Concern

Topography is recognized as one of the National Spatial Data Infrastructure (NSDI) foundation data themes and has been used for a variety of purposes for many years. The following is an example of how Maine incorporated topography into its coastal management process.

In 2004, NOAA conducted a light detection and ranging (lidar) survey for the Maine Geological Survey to help determine whether various beaches along the coast of Maine were located within erosion hazard areas and what the future danger levels were. The shoreline in the region had periodically been eroding and scalloping, and the state needed to establish whether potential projects within that impact area needed to be elevated on posts in order to avoid flooding and establish site stability.

"We're collecting beach profile data and surveying sandbars offshore to develop a better understanding of sand volume change over seasons and years," explains Stephen Dickson, state marine geologist for the Department of Conservation's Maine Geological Survey.

The survey was designed to enhance the methods and tools used to gather shoreline positions, existing site topography, and past storm invasion within mapped flood zones.

"We have not yet attained the step of having a full sand budget constructed for each beach [in Maine], but doing so in the future will help us better understand the dynamics of future shoreline change and take us beyond the static flooding method we currently use," adds Dickson.

Continued on Page 2

Profile continued from Page 1

worth working towards but one that is not always easily accomplished.

One work-related accomplishment you're proud of: I compile and edit the "Sanctuary Manager's Report," a report issued six times per year that highlights sanctuary activities for the prior two-month period.

One personal accomplishment you're proud of: When I was 22, I planned and carried out a primarily solo excursion around the world for three months. I visited Spain, France, Italy, Greece, Hong Kong, Macao, Thailand, and Japan.

Things you do in your spare time: I enjoy making pottery, traveling and planning new adventures, knitting, making jewelry, hiking and running, and sailing with my family. I've also been re-teaching myself how to play the flute after a 15-year hiatus.

Family: My mother was an award-winning amateur surfer in the 1960s and, more recently, a fierce outrigger canoe steersman. She and my stepfather, who is chair of the Santa Barbara Harbor Commission, have focused their leisure time on preparations for sailing off into retirement. My sister is a fellow world traveler, a diver, and former outrigger canoe paddler. She also happens to work for NMS.

Favorite movie: Lately, I find myself referencing *Office Space*.

In your CD player right now: I'm actually listening to a Web cast of KBCO radio from Boulder, Colorado.

Topographic Data continued from Page 1

To plan for the future, the state had to determine what each impact zone would look like over time, the shape it would maintain, and the steps needed to ensure its safety.

"One of the key things we do is add two feet of sea level rise to the lidar elevations and "flood" the dunes to see what the future 100-year storm will bring in terms of sand transport," explains Dickson.

These active areas "are ones [in which] Maine wants to keep open dynamics for maintaining the health of the beach and dunes. Consequently, buildings that are new or significantly altered in this erosion hazard area must be elevated three feet or more over the dune."

The more data that are available, the easier it will be to plan for problems that have yet to occur. The data from the 2004 lidar survey helped show which beaches were located within hazard zones and needed protective measures.

"Anticipating sea-level rise and erosion trends also helps to place buildings in safer locations so they will be less likely to be damaged by storms," adds Dickson.

Peter Slovinsky, coastal geologist for the Maine Geological Survey and a former NOAA Fellow, and Dickson use the data consistently to help determine appropriate courses of action.

"The data is used to issue advisory opinions to our sister state agency, the Department of Environmental Protection, on Erosion Hazard Areas [state-defined] and influence decisions about building along beaches," explains Dickson.

"We issue about two of these advisory opinions each week and make a much more convincing and site-specific case using the lidar data," adds Dickson.

Currently, Slovinsky is developing a Beach Scoring System that uses data from the 2004 survey, a 2000 lidar survey, and historical shoreline change data (flood zones and other factors) to perform geographic information system analysis and rate hazards within areas in need of beach nourishment or dune restoration.

"There is even more we can and will do with the data related to sand volume changes, sand budgets, and beach profiles in the future," explains Dickson.

"Our goal is to lay the framework for an on-line Maine coastal atlas that will provide both the science and management needs [such as the best dune restoration areas] back to all levels of users—from homeowners to government agencies—via a mapping portal on the Web," concludes Dickson.

TOPOGRAPHY TECHNOLOGY

Over the past decade, new technologies for collecting high-accuracy, high-resolution topography over large areas have matured and become commercially workable. In particular, significant advances have been made in light detection and ranging (lidar), interferometric synthetic aperture radar (IfSAR or InSAR), and digital stereo imaging. The following will discuss the pros and cons of these three growing technologies.

Lidar

Lidar has existed since the 1960s, but its use for mapping topography is far more recent. The fundamental idea behind lidar topographic mapping is to transmit a laser pulse from an airborne platform (usually a plane) and time how long it takes the pulse to come back. A distance from the laser to the ground can then be determined (using the known speed of light). Two additional technologies are required to conduct this type of mapping. The Global Positioning System (GPS) is required to provide accurate information about the location of the laser, and an inertial measurement unit is needed to tell what direction the laser is pointing.

After processing, the product is a series of points (x, y, z or longitude, latitude, elevation). These points may have come from the ground, trees, buildings, or some other material in the path of the laser pulse, so algorithms have been developed to classify the points into groups such as bare earth, vegetation, and other categories. However, human intervention is often required to verify points in order to create a high-quality product. After the points have been classified, other products can be generated. Common products are digital elevation models (essentially a grid of elevation points) and contour lines.

The accuracy of lidar depends on many factors, including flying height, atmospheric effects on GPS accuracy, and platform stability. Lidar is generally more costly per unit area than the other technologies, and low cloud cover can be a problem; however, it has significantly better vertical accuracy.

IfSAR

Like lidar, IfSAR is an active sensor. IfSAR compares the return signals at two radar antennae and performs much more complex processing compared to lidar. Like lidar, it also requires both a GPS and an inertial measurement unit to determine the position and attitude of the antennae. IfSAR is designed to provide topographic information quickly for large areas. A number of products are produced by an IfSAR system, including orthorectified radar imagery and first-reflective-surface digital elevation models.

Current commercial IfSAR systems use a radar wavelength of around 3 centimeters. This wavelength does not penetrate trees, although some processing can be done to identify and remove small tree clumps and buildings to produce a digital terrain model. Other wavelengths of around 85 centimeters can penetrate trees; these systems, however, will not be commercially available for several years.

IfSAR does offer some significant advantages for data collection, since it can be operated at night, see through clouds, and cover a large area rapidly; however, it is cost-prohibitive to collect information over a small area, and IfSAR produces less vertical accuracy than lidar.

Digital Stereo Imaging

Determining elevation using stereo photography has a long history. Unlike lidar and IfSAR, stereo imaging is a passive sensor that takes two overlapping pictures from different vantage points. The resulting area of overlap creates a three-dimensional image. Most of the U.S. Geological Survey (USGS) National Elevation Dataset was derived from stereophotography. Sensors include digital frame cameras, as well as "push-broom" type sensors that collect a single row of pixels at a time and then reassemble the image later.

Digital imagery has some of the same limitations that exist in traditional photography. Imagery must be "flown" during the day, may have additional sun-angle restrictions, may be difficult or impossible to see in dark shadows, and can't see through clouds. Accuracies are comparable to IfSAR.

TOPOGRAPHIC TOOLS

Shape of the Future

The Center has developed software tools to help utilize elevation data within a geographic information system and convert data between a number of datums and projections.

Lidar Data Handler – This ArcView extension provides tools to manipulate light detection and ranging data; it requires the use of the ESRI Spatial Analyst extension.

Point Converter Tool – This Web-based tool allows "x, y, z" point data to be projected or transformed to a number of different projections and datums.

The NOAA Coastal Shoreline Mapping Web site provides the ocean and coastal resource management community with data and information about shoreline mapping. It contains links to digital data, references on the legal and technical aspects of the shoreline, and organizations that are working to support the collection of shoreline data.

For more detailed information on topography, or to view the tools, please visit the Web site at *www.csc.noaa.gov/crs/tcm/*.

Coastal Connections is a publication of the National Oceanic and Atmospheric Administration Coastal Services Center, produced for the coastal resource management community. Each issue of this free bimonthly newsletter focuses on a tool, information resource, or methodology of interest to the nation's coastal resource managers.

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NEWS AND NOTES

Project Proposal Deadline Approaching for Fellowship

The NOAA Coastal Management Fellowship program is now accepting project proposals from all mainland states and Caribbean jurisdictions with federally approved coastal zone management programs for the 2006–2008 fellowship. For more information and to see examples of previous state proposals, visit *www.csc.noaa.gov/cms/fellows/stateproject.html* or contact *csc.fellowships@noaa.gov.*

Upcoming Events

Submerged Lands Conference to Be Held in Virgin Islands

The 24th International Submerged Lands Management Conference will be held Oct. 16 through 21 at the Westin St. John Resort and Villas in the U.S. Virgin Islands. Seminar participants will include local, territorial, state, national, and international private-sector and government organizations. Topics of interest include beach management and public access, pollutant impacts on submerged land habitats, and assessing sediment deposition on coral reefs. For more information, visit *www.islc2005.org.*

Accolades

Two APEX Awards of Excellence were presented to the NOAA Coastal Services Center's *Coastal Services* magazine in the categories of magazine design and layout, and one-of-a-kind government publications. The Awards for Publication Excellence (APEX) are based on "excellence in graphic design, editorial content, and the ability to achieve overall communications excellence." The competition saw close to 5,000 entries this year.

Transitions

Dr. Jonathan R. Pennock has been named program director of New Hampshire Sea Grant... **Chris Chung** has departed the Hawaii Coastal Program and is now working with the NOAA Pacific Services Center... **Tony MacDonald** will be leaving the Coastal States Organization (CSO) to run the Urban Coast Institute at Monmouth University... **Dr. James Mahoney** has announced his plans to retire from his position as assistant secretary of commerce for oceans and atmosphere and NOAA deputy administrator... **Carolyn Boltin** has been named deputy commissioner for the South Carolina Office of Ocean and Coastal Resource Management.

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