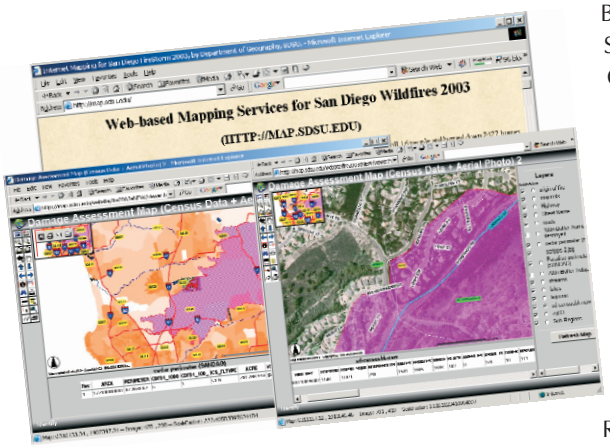
CSU Geospatial Review
GEOGRAPHIC INFORMATION SCIENCE IN THE CALIFORNIA STATE UNIVERSITY SYSTEM VOL. 2, NO. 1 • SPRING 2004

San Diego

Tracking the 2003 San Diego Wildfire

Southern California encountered a horrendous firestorm in October, 2003. Thousands of homes were destroyed and twenty people were killed. At first, very little geospatial information about the fire-affected areas was available to the public. The Department of Geography at San Diego State University created an Internet GIS Web site (**http://map.sdsu.edu**) to provide the interactive Web mapping of wildfires in the San Diego region, featuring animated images of fire spread, research notes and daily updates about fire perimeters and hot spots.



Internet GIS is a new technology that can provide the public with online, integrated access to geospatial information via a simple Web browser. At SDSU's wildfire Web site, a user can create a fire damage assessment map on the Web by overlaying the fire perimeters *(from the USGS data sites)*, hot spots locations *(from the NASA MODIS Web site)*, administration boundaries *(from the SANDAG map servers)*, and population density *(from the U.S. Census Bureau)* and make it accessible to anyone with a computer connected to the Internet.

SDSU created this Web site **(http://map.sdsu.edu)** on Oct. 27, 2003 to provide Web-mapping services for the local community. Most maps on this site were created by the faculty, staff, and students in the Department of Geography, at SDSU. Local agencies found this site very useful. Both the City of San Diego and the County's emergency fire information center created links from their home pages to the SDSU Web site, and the Southern California Burned Area Emergency Response (BAER) team (**http://baerteam.net/updates/**) highlighted the SDSU Web site on its Nov. 11 update. Transaction logs show that more than 24,000 people visited the Web site during the first week of wildfires.

The SDSU wildfire Web site demonstrates a great potential for utilizing Internet GIS in natural hazard management, homeland security tasks, and real-time emergency response systems. This GIS Web site will become a living document for the San Diego wildfire of 2003. More information and new Web services will be added in the future, including ecological impact assessment, mobile GIS applications, short-term post fire recovery, and long-term recovery management efforts.

MORE INFORMATION:
Ming-Hsiang Tsou, Ph.D., Department of Geography, San Diego State University, mtsou@mail.sdsu.edu

PHOTO BY GERALD AND BUFF CORSI
COURTESY OF CALIFORNIA ACADEMY OF SCIENCES

Humboldt

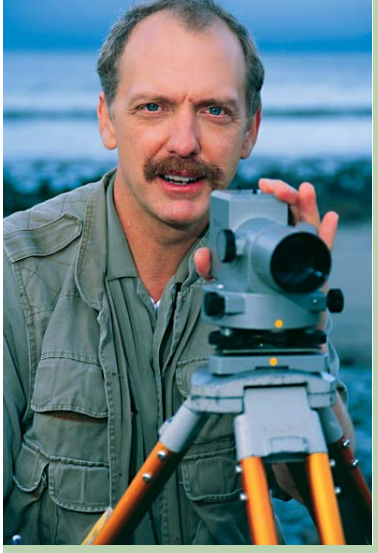
Modeling Marten Habitat for Conservation

In the Advanced Spatial Analysis Facility (ASAF) at Humboldt State University, researchers are modeling the effects of landscape pattern, forest composition, and fragmentation levels on the distribution of forest carnivores. Graduate student Thomas Kirk, Dr. Steven Steinberg, and Dr. William Zielinski of the U.S. Forest Service Pacific Southwest Research Station are developing a spatially explicit habitat model for the American marten *(Martes americana)* using GIS and remote sensing techniques. The goal of this study is to assist conservation planning for native forest carnivores by identifying critical thresholds in landscape pattern and fragmentation at the regional or landscape level.

The American marten is an elusive, forest-dwelling weasel that lives in mountainous regions of California. Most people have never seen a marten. However, this secretive member of the mustelid family and its cousins are often the focus of conservation efforts. Our research focuses on the compositional and structural elements of the forest vegetation and their influence on the distribution and movements of martens. The study area lies in northeastern California and includes the southern portion of the Cascade Range and the northernmost portion of the Sierra Nevada, encompassing some 19,000 square kilometers. The majority of the region is managed by the U.S. Forest Service and Lassen Volcanic National Park.

Distribution data was obtained for martens and other mesocarnivores over the course of four summer field seasons using track plates and remote camera systems. *—continued on page 2*

INSIDE



FROM THE DIRECTOR

EVENTS during 2003 demonstrated the maturity of geographic information science (GISci). From battlefield to disease outbreak to firestorm, the power of satellite imagery and digital maps came to the forefront of public attention, with imagery and GIS maps repeatedly presented on the nightly news. The US Department of Labor identified geotechnology as "one of the three most important emerging and evolving fields, along with nanotechnology and biotechnology." (Gewin, V. Mapping opportunities. *Nature* 427: 376-377, 22 January 2004). GISci is one of the rare areas in our economy currently experiencing job growth in both the public and private sectors which focuses new attention on university-based activities in GISci education and research.

The CSU has long been a leader in advancing GISci methods and educating practitioners. Featured articles in this issue illustrate the important role our campuses play in this field. In *Tracking the 2003 San Diego Wildfire* we learn how San Diego State distributed information to the local community on wildfires threatening the San Diego region. Elsewhere, foresters at Humboldt State studied the increasing fragmentation of forest carnivore habitat due to development. At CSU, Monterey Bay GIScientists used high-resolution multibeam bathymetric data to generate cost-effective rockfish habitat suitability maps for use in developing regulations to protect this fishery. These and other stories clearly illustrate the multidisciplinary nature of geotechnology in the CSU.

With this expanded issue we cover the breadth of GISci research and curricular innovations in the CSU, but we are not able to present some of the accompanying figures or all of the stories in full. These may be found on our Web site: **http://www.calstate.edu/gis.**

Enjoy this issue. Use it as a starting point to learn more about what's happening on your campus, get ideas from other campuses, and understand how the CSU contributes to GISci in our state and region.

Jerry Davis
Director, CSU GIS Specialty Center
San Francisco State University

Monterey Bay

Protecting Rockfish Habitat

Protecting marine resources and regulating their use are of paramount importance to the long-term viability of both our economy and coastal ecosystems. Rockfish constitute one of the most important commercial fisheries on the west coast. Declines in catch volumes over the past several decades have led to increased regulation of this fishery aimed at rebuilding rockfish stocks. Yet to design effective regulations, fisheries experts need species-specific habitat maps. These can be very expensive to produce.

In an effort to develop a cost-effective means of producing species-specific habitat maps, the National Oceanic and Atmospheric Administration (NOAA) funded the Seafloor Mapping Lab at CSU, Monterey Bay (the Lab) to develop a set of tools capable of using high-resolution multibeam bathymetric data to generate habitat suitability maps. The Lab used high-resolution (2-meter) multibeam bathymetry data collected from the Del Monte Shale Beds in the southern region of Monterey Bay, in combination with Remotely Operated Vehicle (ROV) video data from transects documenting species-habitat interactions, to generate and evaluate a habitat suitability model that can predict probable locations of high rockfish density, as well as preliminary stock estimates.

Using a variety of geospatial tools in ArcGIS, we derived four grids from the multibeam bathymetric data to generate the suitability model: depth, slope, rugosity and Topographic Position Index (TPI). Analysis of the data showed that distance to peaks defined by a 50-meter radius TPI predicted a high percentage of eight species of *Sebastes* spp. found in the survey area: blue rockfish, olive/yellowtail rockfish, brown rockfish, gopher rockfish, canary rockfish, vermilion rockfish, rosy rockfish, and flag rockfish. Using species-specific depth parameters to refine the model, members of the project were able to predict 89 percent of olive/yellowtail rockfish in the Shale Beds area. Performance of the model was validated by applying independent fish observations not included in the generation of the model. Although the model has yet to be applied to alternative sites, the methods developed for this project provide a cost-effective means of producing high-resolution, semi-automated, non-subjective, species-specific habitat maps. To see an example of these habitat maps visit **http://www.calstate.edu/gis.**

MORE INFORMATION:
Erica Summers-Morris, The Seafloor Mapping Lab, CSU, Monterey Bay, erica_summers@csumb.edu

Marten Habitat continued from page 1

Land cover, landscape metrics, climate, topography, and Landsat TM spectral data will be assessed for use as explanatory variables in logistic regression analyses of marten occurrence. Landscape ecologists have recognized that the spatial arrangement of landscape elements can produce variations in ecological patterns and processes. Our research models landscape structure and spatial patterns at multiple scales, as factors affecting marten distributions appear to operate at the home-range scale and above. We believe that combining a landscape perspective with geospatial technologies will improve ecological modeling and result in better conservation planning for this species.

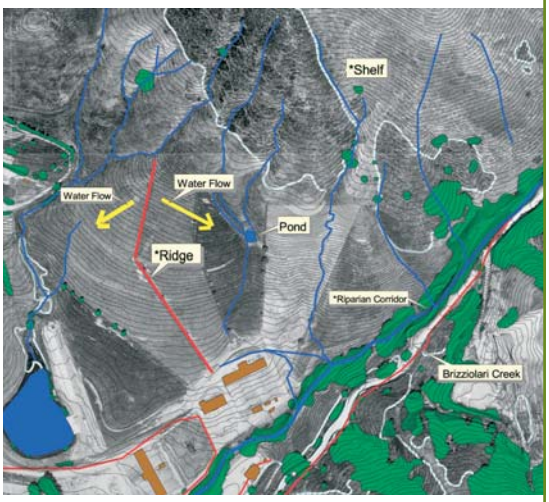
MORE INFORMATION: *Steven J. Steinberg, Ph.D., Environmental and Natural Resource Sciences Department, Humboldt State University, sjs7001@humboldt.edu*

San Luis Obispo

Students Learn GIS for Site Analysis

Last fall, Sariya Talip Clay and Gary Clay at California Polytechnic State University, San Luis Obispo taught site analysis skills to undergraduate students in the Landscape Architecture and City and Regional Planning Departments using ArcView GIS in the Library's electronic classroom. Their new course introduced students to environmental and cultural site attributes, demonstrated the interconnected nature of those attributes, presented GIS as a desirable alternative to traditional manual mapping techniques, and familiarized students with digital and traditional data resources available at the University's Library. Teaching with GIS (as opposed to teaching GIS) introduced analytical and critical thinking skills seamlessly into existing course work.

MORE INFORMATION: *Sariya Talip Clay, M.L.S, Robert E. Kennedy Library, sclay@calpoly.edu. Gary R. Clay, Ph.D., Department of Landscape Architecture, gclay@calpoly.edu. California Polytechnic State University, San Luis Obispo*



View from GIS analysis of drainage patterns in the Brizziolari Watershed in order to identify suitable building sites by Cal Poly, San Luis Obispo students Andy Black, Gino Macaluso, Mike Eshleman, and Bobby Latino.

Sacramento

GIS and Criminal Justice

Law enforcement agencies are increasing their reliance on GIS to develop spatial analysis tools such as crime maps for use by investigators, patrol officers, citizens, political leaders and the media. To better train criminal justice students in response to this trend, Dr. Donald R. Dixon at CSU, Sacramento has developed a course entitled "Fundamentals of Crime Mapping" which introduces upper division students to GIS applications specific to the needs of police and investigators. At CSU, Sacramento, as at many campuses, GIS training primarily resided in the geography department. This criminal justice class and a graduate criminal justice class on crime mapping that Dr. Dixon has planned for fall 2004 illustrate how many disciplines are successfully incorporating geospatial techniques into their curricula.

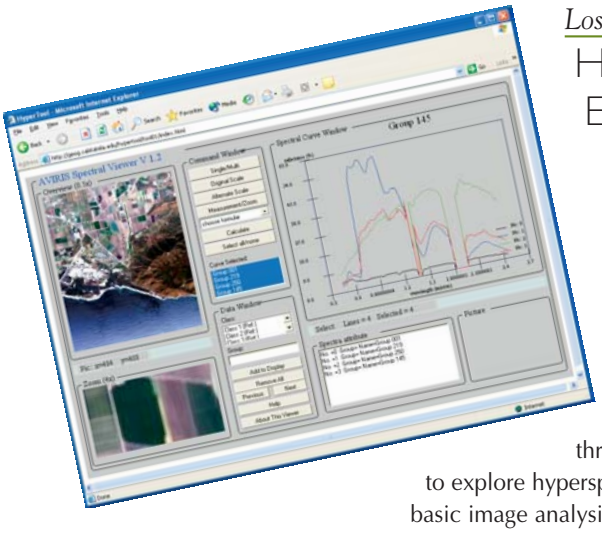
MORE INFORMATION: *Donald R. Dixon, Ph.D., Department of Criminal Justice, CSU, Sacramento, drdixon@csus.edu*

Chico

GIC at CSU, Chico Develops Web-based Public Access Guide

Public access information for the Sacramento River is now available at **http://www.sacramentoriver.org.** The Geographical Information Center at California State University, Chico developed the Sacramento River Recreation and Public Access Guide (RecWeb) which offers an inventory of public lands and publicly accessible private property such as resorts, marinas, and private campgrounds along the river between Colusa and Red Bluff. Visitors to the Web site can search on over twenty-five criteria, including available launching ramps, sites with rest rooms, and hunting and fishing access. The Web site uses GIS maps in conjunction with an SQL database of access sites. RecWeb has received good reviews from private individuals and public agency personnel who use it. Coverage on the Web site will expand north to Redding and south to Sacramento by 2005.

MORE INFORMATION: *Chuck Nelson, Director, Geographical Information Center, CSU, Chico, cwnelson@csuchico.edu.*



Los Angeles

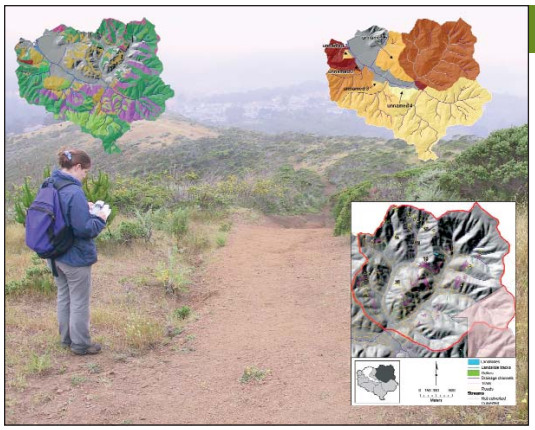
HyperTool–A Web-based Teaching Module for Exploring Hyperspectral Remote Sensing Data

The Center for Spatial Analysis and Remote Sensing (CSARS) at Cal State, Los Angeles has designed and developed HyperTool, a Web-based teaching module that provides interactive tools through a JAVA applet for students to explore hyperspectral image data and to perform basic image analysis tasks within a Web browser. The module consists of two Airborne Visible/Infrared Imaging Spectrometer scenes from NASA (AVIRIS scenes) and a JAVA applet. The JAVA-based user interface allows students to visualize an AVIRIS scene in different band combinations, explore spectral profiles of different surface features within the image, and compute spectral indexes including NDVI, PRI, and WBI for any feature class. Students can access this teaching module from home computers with an Internet connection. The tight integration between the hyperspectral image data and specialized functions and tools has made this module an attractive tool for teaching students the unique capabilities of hyperspectral remote sensing. This teaching module may be found at **http://geog.calstatela.edu/hypertool/.**

MORE INFORMATION: *Hong-Lie Qiu, Ph.D., Department of Geography & Urban Analysis, CSU, Los Angeles, hqiu@calstatela.edu*

The CSU GIS Specialty Center

In 1992 the CSU GIS Specialty Center was established to promote the use of geographic information systems (GIS) and other geographic techniques for spatial analysis within the CSU. Member campuses participate in software site licenses with ESRI for GIS software, and Leica Geosystems for remote sensing and image processing software. Benefits of these two programs include among other things training, technical workshops, and membership in the University Consortium for Geographic Information Science (UCGIS). Perhaps most importantly, the GIS Specialty Center promotes intercampus dialogue on teaching, research and application issues within the field of Geographic Information Science. For more information regarding the GIS Specialty Center and the programs it offers, please visit **http://www.calstate.edu/gis** or contact Debra Dwyer, the site license administrator, at gis@sfsu.edu or 415/338-6140.



Field and GIS investigation of erosion sites.

San Francisco

Watershed Sediment Source Analysis: Integrated GIScience and Field-based Analysis

SFSU faculty and students are leading a study to identify sediment sources impacting steelhead trout *(Oncorhynchus mykiss)* in San Pedro Creek, San Mateo County, California. Steelhead trout are important but threatened members of coastal stream ecosystems in California. They are anadromous, migrating up freshwater streams and spawning in gravel streambeds. Turbid (muddy) streams are poor habitat for steelhead as mud clogs their gills. Using a combination of GIScience and field study, this group is analyzing the background erosion processes and the effect of different land-uses on the stream. Initial results suggest that both upland sources and channels continue to contribute significant fine sediments to the stream with landslides being the major source.

With these results, the project team is recommending treatments by government land managers and private property owners throughout the watershed. Efforts such as this can greatly improve the situation for both the fish and neighboring residents, who benefit from having a healthy riparian landscape they can see and hear every day.

MORE INFORMATION: *Jerry Davis, Ph.D., or Stephanie Sims, Institute for Geographic Information Science, San Francisco State University, jerry@sfsu.edu.*

San Marcos

Exhibit for Children's Museum Uses GIS

The Escondido Children's Museum (ECM), in collaboration with the City of Escondido, CSU, San Marcos, and SanGIS, features an exhibit designed to teach children about their local community through GIS technology. Children's perceptions of space are enhanced by 'viewing' the world from different perspectives. "Your Community" uses ArcGIS, ArcPublisher, and ArcReader software to present five points of view, each offering an interactive activity.

- In "From Space," children see 20 hotlinks spread across the globe. As hotlinks are opened, a NASA satellite image of that location appears. For example, a hotlink over the island of Monserrat in the Caribbean opens a satellite image of ash and steam hovering over the Soufriere Hills Volcano in Monserrat.
- In "From an Airplane," bookmarks indicate local points of interest such as the San Diego Wild Animal Park, Sea World, Del Mar, the Birch Aquarium, Balboa Park and ECM.
- The view "From a Street Corner" captures downtown Escondido at the intersection of Grand and Broadway Avenues and shows the locations of sewer lines, stoplights, and other infrastructure. Hotlinks bring up digital pictures taken at street level.
- "As a Field Mouse" uses an infrared image to highlight local species, such as mountain lions, coyotes, and horned lizards, as well as some vegetation.
- "As a Rock" shows local area soils. The view also includes illumination and elevation grids and the city boundaries to give the user a sense of the terrain.

This project has been an exciting one for ECM in that it embodies the museum's mission, reinforces the National Geography Standards, and introduces many children to GIS technology.

MORE INFORMATION: *Kim Knowles-Yánez, Ph.D., Liberal Studies Department, CSU, San Marcos, kyanez@csusm.edu*

What is Geographic Information Science (GISci)?

GEOGRAPHIC INFORMATION SCIENCE is the synthesis of spatial theory, methods and technologies used to study and map geographic relationships, distributions, networks, temporal change and other spatially aware information in order to better understand and manage limited earth resources. It includes:

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Comprehensive databases tied to location, with an integrated set of tools for querying, analyzing, and displaying information. Important classes of GIS tools include those that support: **1)** logical map overlay, **2)** proximity analysis and spatial buffering; **3)** network analysis (e.g. of roads or streams); **4)** geocoding and address matching; and **5)** three-dimensional surface modeling.

REMOTE SENSING

Analysis of the earth's surface and interpretation of its features using imagery collected from air or space platforms. Image processing methods use visible and invisible (e.g. ultraviolet and infrared) parts of the electromagnetic spectrum to interpret land cover patterns of vegetation, soil, land use, and environmental systems, including up-to-the-minute changes in these systems.

CARTOGRAPHY

The art and science of making maps. Cartographical theories and methods focus on information content, symbolization and design to appropriately communicate the results of studies.

GLOBAL POSITIONING SYSTEMS (GPS)

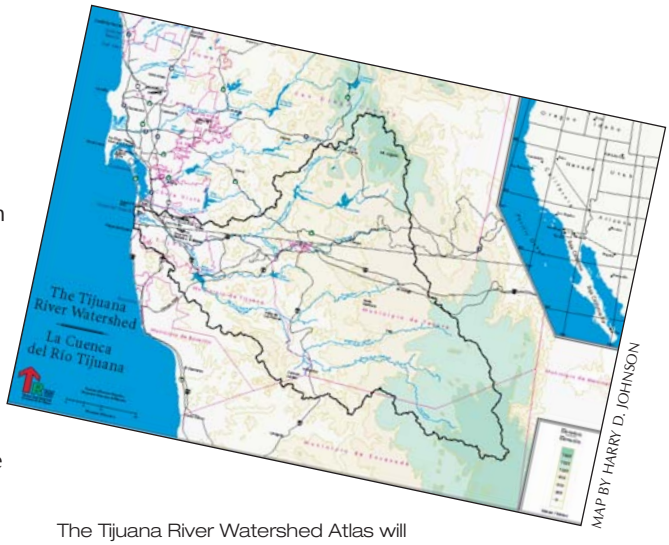
Provides a means for determining earth location and navigation, using a constellation of satellites and the technology for interpreting their signals. Field data collection for GIS and remote sensing projects is increasingly dependent on GPS.

WHILE HAVING ITS ROOTS in geography, many disciplines have contributed to the development and use of Geographic Information Science. In the CSU System, anthropologists, biologists, business marketers, computer scientists, economists, engineers, environmental scientists, foresters, geologists, historians, journalists, landscape architects, natural resource planners, oceanographers, political scientists, sociologists, urban planners, and wildlife scientists also use these technologies in their classes and for their research.

San Diego

Build It and They Will Come

A landmark action occurred in 1994 when San Diego State University (SDSU) and El Colegio de la Frontera Norte in Mexico signed a memorandum of understanding (MOU) to develop a GIS for the Tijuana River Watershed to facilitate binational education, research, and management activities. Population growth and rapid urban expansion have brought numerous environmental and social problems to the watershed. Binational cooperation is necessary to solve these problems. Educational products made possible by the GIS include a large poster, a CD allowing users to explore the watershed, and a border atlas; an atlas of the TRW is under preparation. More than a dozen research projects on such topics as water quality analysis and hydrologic modeling have been made possible by the watershed database. The eventual goal of the TRW program is to develop and implement a binational watershed management plan to promote long-term environmental sustainability in the basin. A framework for the plan is currently under way with a State of California-funded project, "A Binational Vision for the Tijuana River Watershed."



MAP BY HARRY D. JOHNSON

The Tijuana River Watershed Atlas will provide stakeholders a unique view of the binational watershed. The atlas includes sections on the physical and cultural characteristics as well as directed sections on the cities of Tijuana and Tecate and the Tijuana River National Estuarine Research Reserve.

MORE INFORMATION: *Tijuana River Watershed (TRW) program Web site,* ***http://trw.sdsu.edu/****, or contact Richard Wright, Ph.D., Department of Geography, San Diego State University, wright@typhoon.sdsu.edu.*

San Francisco State University

CSUGeospatial Review
CSU GIS Specialty Center
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132