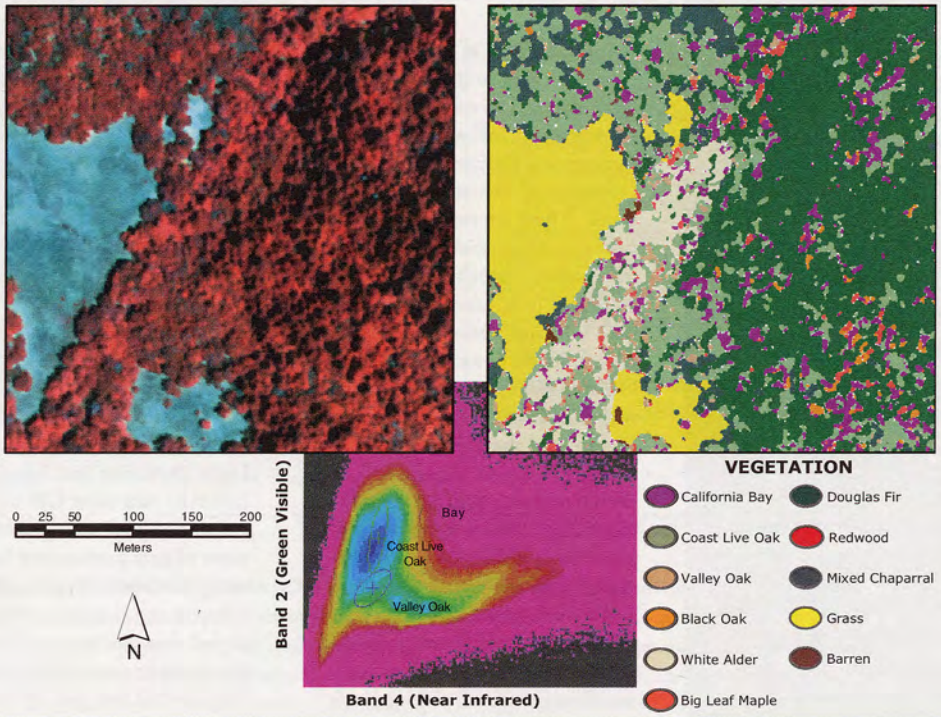
CSU Geospatial Review
GEOGRAPHIC INFORMATION SCIENCE IN THE CALIFORNIA STATE UNIVERSITY SYSTEM VOL. 1, NO. 1 · FALL 2002



GIS and remote-sensing technologies are helping pinpoint critical factors contributing to the spread of Sudden Oak Death. At upper left is a false-color composite of ADAR 5500 airborne multi-spectral imagery. The upper right image shows the spatial distribution of host species by linking imagery with field data on plant community structure. The central lower figure shows relatively clear separation in the spectral signatures of three common tree species, coast live oak, California bay, and valley oak.

GIS Aids Fight Against Sudden Oak Death

Today many factors contribute to environmental change. One insidious factor is the introduction and spread of nonnative plants and animals.

In California, most of us are aware that our hillsides and streams are covered with exotic weeds or patrolled by feral pigs. But there are more dangerous invaders—those that wipe out keystone species in a community.

One such invader is a fungal-like organism called *Phytophthora ramorum,* an emerging and virulent pathogen that causes a lethal canker disease of several oak and tan oak species. Known as Sudden Oak Death, this disease has reached epidemic levels in the coast ranges of California. Sudden Oak Death is spreading rapidly, much as the Chestnut Blight did in eastern North America in the early 20th century, and could completely change the face of our treasured California landscapes.

Although great progress has been made in understanding the basic biology of the pathogen, very little is known about how it is spreading so quickly and which areas are at greatest risk of infection.

A recently funded, multidisciplinary research grant from the National Science Foundation is allowing geographers and biologists at Sonoma State University and the University of California, Davis, to collaboratively study the critical factors in the environment and host species that contribute to the spread of *P. ramorum.*

The researchers are using GIS and remote-sensing technologies in combination with fieldwork and DNA lab analysis to characterize spatial patterns of disease factors. These patterns will include the genetic background of host species, plant community structure, and environmental controls.

Data are being integrated in a GIS-based model that will be used to identify factors that are influencing the spread of Sudden Oak Death across Sonoma County. The model will also provide spatial and temporal predictions of habitat loss resulting from the disease.

The GIS models may also be used in the development of regulations and management strategies to help halt this pathogen that threatens to drastically alter woodlands and forests in California and elsewhere in the country.

MORE INFORMATION:

Ross Meentemeyer, Ph.D., Department of Geography, Sonoma State University, ross.meentemeyer@sonoma.edu.

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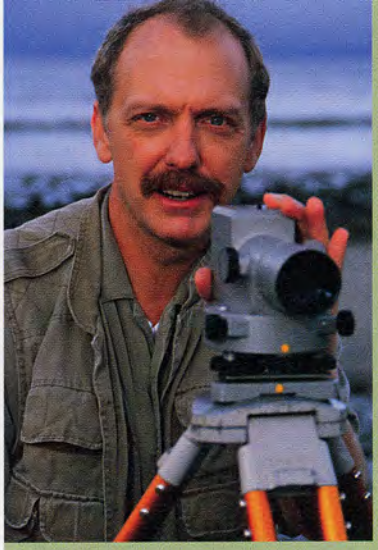


FROM THE DIRECTOR

I hope you like this first issue of CSU Geospatial Review, a newsletter for geographic information scientists in the California State University system.

This is an exciting time, with more and more CSU faculty, staff and students using GIS, remote sensing, global positioning systems and related technologies all the time. Particularly exciting has been the addition of remote sensing practitioners, and our new license to use ERDAS IMAGINE software for remote sensing analysis of earth imagery from satellite and other platforms.

This opens up a new arena for studying ongoing environmental change on our planet, and takes advantage of the increasing availability of detailed satellite and airborne imagery.

At the same time, more and more CSU disciplines and departments are getting into GIS. The list includes anthropology, biology, business, computer science, criminal justice, economics, engineering, environmental studies, forestry, geography, geology, history, journalism, landscape architecture, library science, marketing, natural resource planning, oceanography, physics, political science, public health, recreation and parks, sociology, social science, statistics, urban planning, and wildlife.

For many years, one of the most important goals of the CSU GIS Specialty Center has been to provide a means of sharing ideas. At board meetings and workshops over the years, we've learned to appreciate the value of intercampus discussions. We're often trying to solve the same problem, whether it be staffing a lab, setting up Internet map access, or integrating GPS technology into a research program.

We hope that this newsletter is the next step. This is where you can let others know about your projects and ideas, or perhaps discover future research collaborators on other campuses.

In this issue, we learn about what GIS practitioners at our state universities are doing to halt the spread of Sudden Oak Death, promote precision agriculture, redraw California's congressional and legislative districts, and protect utility infrastructure from damage due to earthquakes.

In coming issues, we hope to hear from your campus! With the wealth of disciplines contributing to the discussion, there's tremendous potential for cross-fertilization, and a great, spatially aware future for the CSU.

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

Cal Poly, SLO, Expands GIS Programs

The College of Agriculture at California Polytechnic State University, San Luis Obispo (Cal Poly), uses GIS technology in several areas of teaching and research.

Since 1998, Cal Poly students have been able to minor in GIS in Agriculture. The minor, offered through the BioResource and Agricultural Engineering (BRAE) Department, consists of 29 quarter units. There are two tracks: precision agriculture and environmental information, which includes emphases in advanced surveying with GIS applications, ecology, or environmental impact analysis.

Additionally, Cal Poly, along with California State University, Fresno, and the University of California, Davis, developed a Web-based precision agriculture curriculum for use by university students as well as those already working in the industry.

Precision agriculture, sometimes called site-specific farming, uses technologies such as GIS, global positioning systems, yield monitoring, variable rate technology, and remote sensing to collect data and manage small areas within a field. The goal is to boost crop yield and make better use of applied materials.

The three universities developed the Web-based curriculum with sophomore-level students in mind, but the material may be useful to anyone with an interest in this emerging field.

The public may access the curriculum at **www.precision.org.**

As part of this project, the three universities hosted visits by community college instructors, farmers, ranchers and service providers, all eager to learn more about precision agriculture. The instructors are using their new expertise to develop their own courses in precision agriculture. Those from the industry now have a better understanding of how to use GIS to increase crop yield and reduce pollution – thus increasing profitability in an environmentally friendly manner.

Today, the emphasis has shifted toward making laboratory exercises available via the Web to educators and those in the industry. The Web curriculum was funded by grants from the U.S. Department of Agriculture and the California State University Agricultural Research Initiative.

Cal Poly is also researching procedures to evaluate the accuracy of Light Detection and Ranging (LIDAR) data using GIS technology.

Among goals are the development of data profiles and 3-D views using Terramodel land-modeling software and the measurement of digital elevation models from aerial photographs using IMAGINE OrthoBASE Pro, part of ERDAS photogrammetry software.

MORE INFORMATION:
Rollin Strohman, Ph.D., professor emeritus, Cal Poly BRAE, rstrohma@calpoly.edu.

Cal Poly student views LIDAR data.

The CSU GIS Specialty Center

The CSU GIS Specialty Center was established in 1992 to promote the use of geographic information systems (GIS) and other geographic techniques for spatial analysis within the CSU system. Member campuses participate in a software site license with Environmental Systems Research Institute (ESRI) for GIS software and ERDAS for remote sensing and image processing software. Benefits include training and technical workshops, membership in the University Consortium for Geographic Information Science, and complimentary registrations for the ESRI User and Education User conferences. 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 visit the GIS Specialty Center online at **http://www.calstate.edu/gis,** or contact Debra Dwyer the site license administrator, at **gis@sfsu.edu.**

GIS Helps Redraw Legislative Districts

The redrawing of legislative and political districts is always an important task that follows the release of U.S. Census data each decade.

In California, GIS specialists at California State University, Northridge, (CSUN), played a key role in the recent redrawing of Congressional boundaries and state Assembly and Board of Equalization districts based on 2000 Census data.

Using ArcGIS 8.1, the CSUN specialists, under the direction of Geography Professor Eugene Turner, created large maps of Assembly districts that were displayed during public hearings held during the summer of 2000.

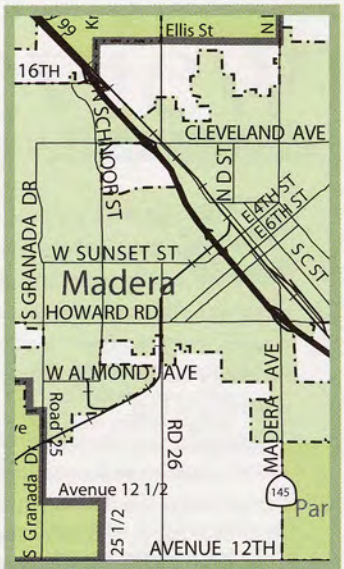
After the hearings, Turner's team created atlases for the redrawn Assembly districts, and later for the new Board of Equalization districts. The atlases, which are black and white and 11 inches by 17 inches, are so precise that a candidate for political office can accurately determine the district of residence for any particular home.

One of the bigger challenges faced by Turner's team was how to address the somewhat conflicting goals of revealing the overall shape of the district while also revealing features such as roads, streams or city boundaries that a district boundary might follow.

The team solved the problem by creating up to 10 maps—some large in scale, others small—for each of the various Assembly and Board of Equalization districts. For complicated boundaries that followed city streets, the team created maps at a scale as large as 1:35,000. Where the boundaries followed county lines, the scale was as small as 1:7.5 million.

The California State Assembly Speaker's Office is distributing copies of the atlases developed by Turner's team. They also are available on CD-ROM and online at the California Assembly web site, **http://assembly.ca.gov.** To find them, click Committee on Elections, Reapportionment, and Constitutional Amendments.

MORE INFORMATION: *Eugene Turner, Ph.D., Department of Geography, CSU, Northridge, eturner@csun.edu.*



Detail from map of Assembly District 29.

What is Geographic Information Science (GISci)?

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

GEOGRAPHIC INFORMATION SYSTEMS (GIS)
Comprehensive databases tied to location, with an integrated set of tools for querying, analyzing, and displaying information. Classes of GIS tools include those that support: **1)** logical map overlay, integrating multi-layer data sources in an analysis; **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. GIS technology is rapidly gaining popularity as a means of dealing with all sorts of information stored on maps.

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. With new satellite platforms going up every year, with increasing richness in spatial and spectral detail, this technology is becoming an essential tool for geographic information scientists.

CARTOGRAPHY
The art and science of making maps. An important methodological arena for geographic information scientists is communicating the results of studies. Cartographical theories and methods focus on information content, symbolization and design to get the correct message across.

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

CSU Celebrates GIS Day

CSU campuses across California will celebrate GIS Day 2002 on **Wednesday, Nov. 20,** with open houses and technology demonstrations aimed at educating the public about the real-world applications of geographic information systems.

GIS Day is part of the National Geographic Society's annual Geography Awareness Week, to be held Nov. 17–32.

The theme for GIS Day this year is **"America's Backyard: Exploring Your Public Lands."**

FOR INFORMATION regarding events at specific campuses, please click the GIS Day link at **http://csugis.sfsu.edu.**

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Jerry Davis

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GIS Helps Monitor Quakes

Southern California is a major site of seismic activity. More than 10,000 earthquakes rattle the region in a given year. Although most are too small to be noticed, every so often a temblor wreaks havoc on a city's infrastructure, disrupting and even endangering lives.

Naturally, earthquakes are of particular concern for utilities such as Southern California Edison, which distributes power to more than 10 million consumers every day.

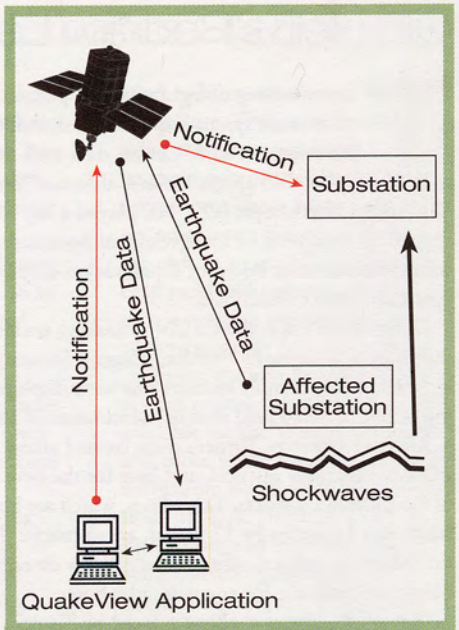
In an effort to protect its infrastructure, the utility teamed up with researchers from California State Polytechnic University, Pomona, to develop a real-time, satellite-based network to monitor quakes and transmit warnings of imminent seismic events.

The resulting GIS-based software package, called QuakeView, is at the core of Southern California Edison's emergency preparedness system. The software provides real-time detection of earthquakes and affected areas.

Currently, QuakeView consists of two primary components. The earthquake simulation component is a Java-based application that acquires real-time quake data and processes it into dynamic spatial data. This spatial data is then fed continuously to an ArcView client application responsible for the visual display of real-time wave fronts that an earthquake creates.

The second component (the application environment) contains two servers—one for data processing and one for event tracking in real time. It also contains an ArcView client application that displays the satellite receiver status and the real-time wave fronts that an earthquake creates.

QuakeView has received extensive coverage in the media, with stories appearing in the *Los Angeles Times, Inland Valley Daily Bulletin,* and *San Gabriel Valley Tribune.*



Southern California Edison's satellite-based earthquake monitoring system includes satellites, earthquake sensors, QuakeView, and substations.

MORE INFORMATION: *Xudong Jia, Ph.D., Department of Civil Engineering, Cal Poly, Pomona, xjia@csupomona.edu.*

CSU Geospatial Review
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132

SFSU San Francisco State University