

San Francisco

Measuring river geometry for automatic discharge estimation using geographic object-based image analysis (GEOBIA)

Rivers are complex, dynamic, and open systems whose forms reflect processes operating at multiple spatial and temporal scales. One important process parameter responsible for river form is discharge, Q :

$$Q = W * D * V [m^3/s]$$

where W is width of the river, D is depth, and V is velocity. (Leopold et al. 1964). Discharge is generally measured at gauging stations operated by the US Geological Survey (USGS) and other federal, state, or local agencies. Remote sensing may offer an alternative measurement to ungauged reaches improving understanding of surface water processes that could be useful for many applications. The only parameter that can be estimated using visible and near infrared sensors (NIR) is width; it is therefore necessary to establish quantitative relationships between the other two components and observable channel forms, such as longitudinal and cross-sectional profiles or image characteristics. For example, Bjerklie et al. (2003, 2005) empirically developed equations to relate channel slope S , width W , and velocity V .

$$Q = 0.1W^{1.67} V^{1.67} \text{ where } V = 2.3W^{0.8}S^{0.6}$$

This research employed a Geographic Object Based Image Analysis (GEOBIA) approach utilizing WorldView-2 imagery. Four WorldView-2 (WV-2) images with parts of the Feather River, Klamath River, San Joaquin River, and Yuba River were automatically segmented using ERDAS Objective. McFeeters (1996) Normalized Difference Water Index (NDWI) was applied to the first three rivers.

$$NDWI = \frac{G - NIR2}{G + NIR2}$$

The Yuba required an alternate method of image preparation due to atmospheric obstruction, water-surface turbulence, and other variables that reduced the contrast of the NDWI images. A textural filter was applied to the coastal band (least affected by the noise) followed by a conditional median. From the segments, a centerline was extracted and smoothed with edge irregularities and islands dissolved. After this, orthogonal lines were created from which channel width could be calculated (figure 1).

The Feather River (figure 2) exhibits the least overall error, while the Yuba and Klamath Rivers, show the largest discrepancies. The Yuba is an aggradated channel, with large amounts of gravel resulting from hydraulic mining, and the higher friction of multiple channels and a high sediment

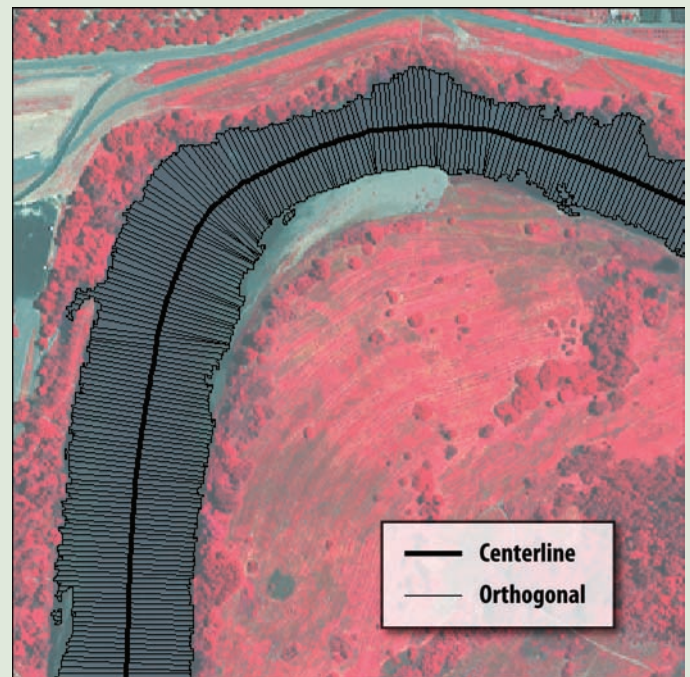


Figure 1. Classified river surface with centerline and orthogonals. Preliminary results show a large degree of error for estimating discharge (Table 1), yet point towards areas where further analysis will elucidate strategies for further model calibration.

Table 1: Reach discharge estimation and other variation parameters.

	Predicted Q	Max. measured Q ¹	Min measured Q ¹	Max. optimum W ²	Min. Optimum W ²
Feather	97.58	176.00	105.15	168.00	142.00
Klamath	146.57	55.78	55.78	45.00	39.00
San Joaquin	291.65	230.27	208.13	117.00	115.00
Yuba	474.49	287.13	286.00	67.00	64.00

¹ Maximum possible Q value in study reach at time of image acquisition, derived from in situ data.

² Maximum/Minimum Width values that would result in accurate discharge measurement, for the range of possible measured Q and slope values.

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DIRECTOR'S MESSAGE 2012

Cloud GIS Opportunities and Challenges

Esri's new support for cloud computing provides an excellent opportunity for accessing ArcGIS Server without having to purchase and maintain web server hardware,

and it gives students access to tools needed to learn the new paradigm of web GIS. Esri lists several benefits of the Cloud for GIS, including a lower total cost, minimal initial investment, reliability, and the ability to easily scale up or down in size, power, or instances as needed. For a university GIS class, we can potentially create temporary "instances" so that each student would have their own individual server with ArcGIS Server pre-installed. Another advantage for universities is that it gets around campus IT security rules that limit the use of programming on web servers. There's also an argument for using the Cloud for data serving for desktop GIS, but I am yet to be convinced that this works reliably enough for class environments where you want to be able to work even when the network goes down.

The Cloud clearly works well for a business model, where rental pricing has a lower total cost than infrastructure investment. However, the bureaucracy of a state university system like ours presents challenges: each purchase has to be approved, which isn't easy to accomplish for what is essentially like a telephone bill. On our campus, we found it useful to develop an alliance with the Computer Science department to together overcome the barriers put up by the Purchasing department. So far, so good; we'll see if it stays a Cloud Nine, or we just fall through...

**Jerry Davis, Director, CSU GIS Specialty Center
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I teach at CSUSM are introductory, upper-division, general education courses that attract a wide-range of undergraduate students from across the university; my classroom is an environment where students begin to realize their stakes in privilege (racial, economic, gendered, and sexual) and social justice. Most times, this doesn't happen easily! Given this context, my goal in learning about GIS was modest: to find ways to help students imagine themselves, and society, differently.

GIS exceeded my expectations for innovative classroom pedagogy. With the support of instructional developers on our campus, and their combined expertise in online teaching and GIS, I created an assignment called "Community Geography of Race / Ethnic Relations in San Diego County" using resources available on www.arcgis.com. I found this free online GIS platform the easiest to use for a first-time foray in integrating GIS in the classroom, as well as the most accessible for students on our commuter campus. We devoted one class session (about 1.5 hours) to familiarizing students with the technology and the assignment, which gave them the opportunity to begin the assignment and complete it at home. The goal of the assignment was to extend student analysis of theoretical readings on race/ ethnic relations through the geospatial visualization of community data in San Diego County, such as demographic and neighborhood diversity. I modeled for students how to ask basic research questions by posing the following question as a guide to the assignment, "How is your own racial identity (or identities) informed by the geospatial expression of 'diversity' in our region?" The students overlay the "USA Diversity Index" onto a base map of San Diego (available on the website), which shows the "diversity" of local neighborhoods by census tract. The students not only visualize the region's "diversity", but critically reflect on their misperceptions of racially and economically diverse communities and neighborhoods, as they were required to map areas they visit frequently for work, leisure, school, etc. (The essays were separately uploaded onto our campus online learning system). In addition, the students address the limitations of the data sets as well. In three anonymous classroom polls on the exercise (n=43): 85% stated they viewed social research in a new way; 89% viewed race/ ethnic relations differently; and 86% recommended I continue to integrate the technology into the course. 

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Using Web-Based GIS Tools to Evaluate Spatial Aspects of Crime

The inspiration for incorporating GIS into a criminological theory course developed after attending a two-day workshop about using geographical tools in teaching. By incorporating geography and crime mapping, several learning outcomes previously established in the class were enhanced. Namely the class aims to help students 1) describe the causes of crime from a sociological/structural perspective, and 2) connect theoretical crime concepts to spatial concepts in local neighborhoods. Utilizing the GIS website www.crimemapping.com, a classroom exercise was created to incorporate these learning outcomes with the desire to encourage students to think spatially about crime. In addition, the exercise introduced students to a straightforward and accessible geographical tool. The GIS website can be used to map local law enforcement and crime data, as well as provide students with basic analysis tools.

Students are given a detailed instruction sheet with several tasks and questions to answer. Students go to the website, input their home address as the starting point, then identify the most frequent crimes that have occurred within two miles of their home within the last 30 days. This simple task lets them become familiar with manipulating the basic controls of the website, such as selecting area of interest, setting temporal elements and changing data displayed on the map. Students then look at the map and identify any trends in the way the data are distributed on the map. While the data may not yield clear spatial trends, the exercise is designed to get students to think about the how basic geographic elements affect the places where crime occurs. Even basic observations about crime being centered near parking lots or local convenience stores accomplishes this goal.

Building upon these findings, students are encouraged to use the tools provided by the website to find other trends. Students can use the website to create a "trend report" for their location and answer several questions. The report gives them information such as a pie chart of offenses in their area, as well as a distribution of crime across the days of the week. Students are instructed to pick another address they are curious about and run a similar analysis with slightly different variables (time span and area of analysis).

In order to tie the assignment back to larger themes of criminological theory, students are asked to interpret their earlier observations with respect to specific theories. Students are encouraged to think about structural theories such as social disorganization and the way that environmental conditions

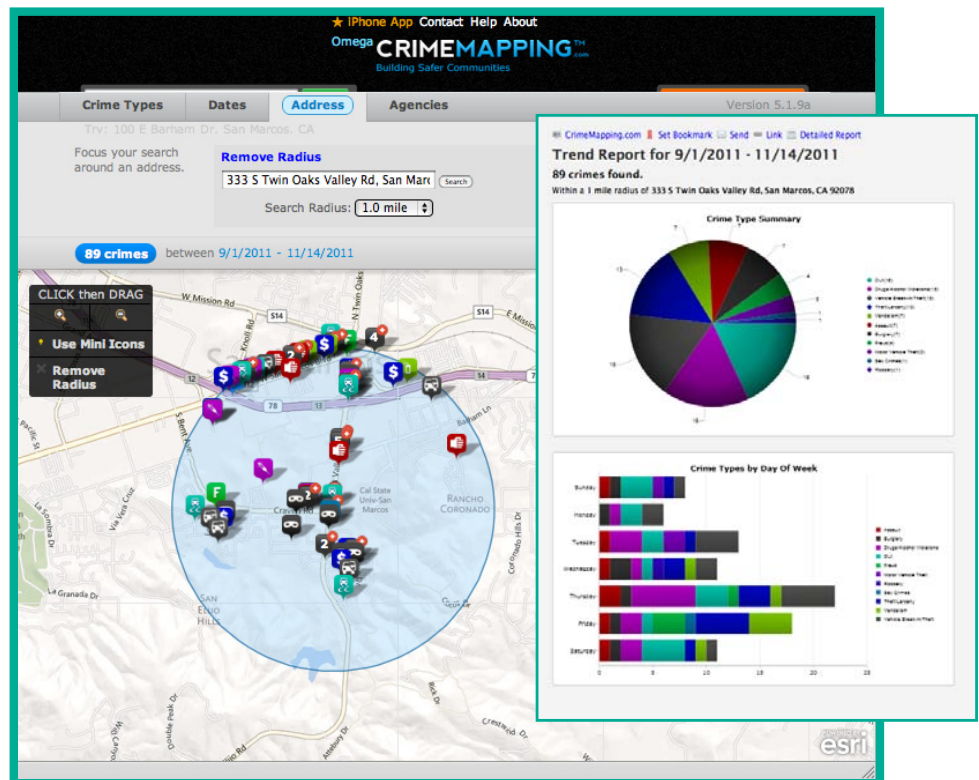


Figure 1: www.crimemapping.com

affect the causes of crime. By relating this analysis of theory to the analysis of a geographical context that is familiar to them, it creates a wonderful learning opportunity at the intersection of theory, spatial analysis and applied criminology.

Lastly, to reinforce the connection between crime theory and the more personal spatial patterns of crime in their own neighborhoods, students are encouraged to create a crime alert. This tool of the website will send an e-mail to inform students when a crime has occurred within a designated geographical area. They are asked to consider how this practical tool interacts with concepts covered in class such as situational crime prevention. This uncomplicated and succinct activity can accomplish dynamic learning outcomes within a short time.

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load may have skewed results. The Klamath is a fairly entrenched channel, and the SRTM values used in slope calculation resulted in high variability. The San Joaquin River, at the time of image acquisition, had inundated its floodplain so width values calculated may not accurately reflect overbank flow characteristics.

REFERENCES

- Bjerklie, D.M., Dingman, S.L., Vorosmarty, C.J., Bolster, C.H., and Congalton, R.G. 2003. Evaluating the potential for measuring river discharge from space. *Journal of Hydrology* 278: 17-38.
- Bjerklie, D.M., Moller, D., Smith, L.C., and Dingman, S.L. 2005. Estimating discharge in rivers using remotely sensed hydraulic information. *Journal of Hydrology* 309: 191-209
- Leopold, L.B., Wolman, M.G., and Miller, J.P. 1964. *Fluvial Processes in Geomorphology*. New York, NY: Dover.
- McFeeters, S.K. 1996. The use of Normalized Difference Water Index (NDWI) in the delineation of open water features. *International Journal of Remote Sensing* 17: 1425-1432.

Smith, L.C., and Pavelsky, T.M. 2008. Estimation of river discharge, propagation speed, and hydraulic geometry from space: Lena River, Siberia. *Water Resources Research* 44: W03426-W0342

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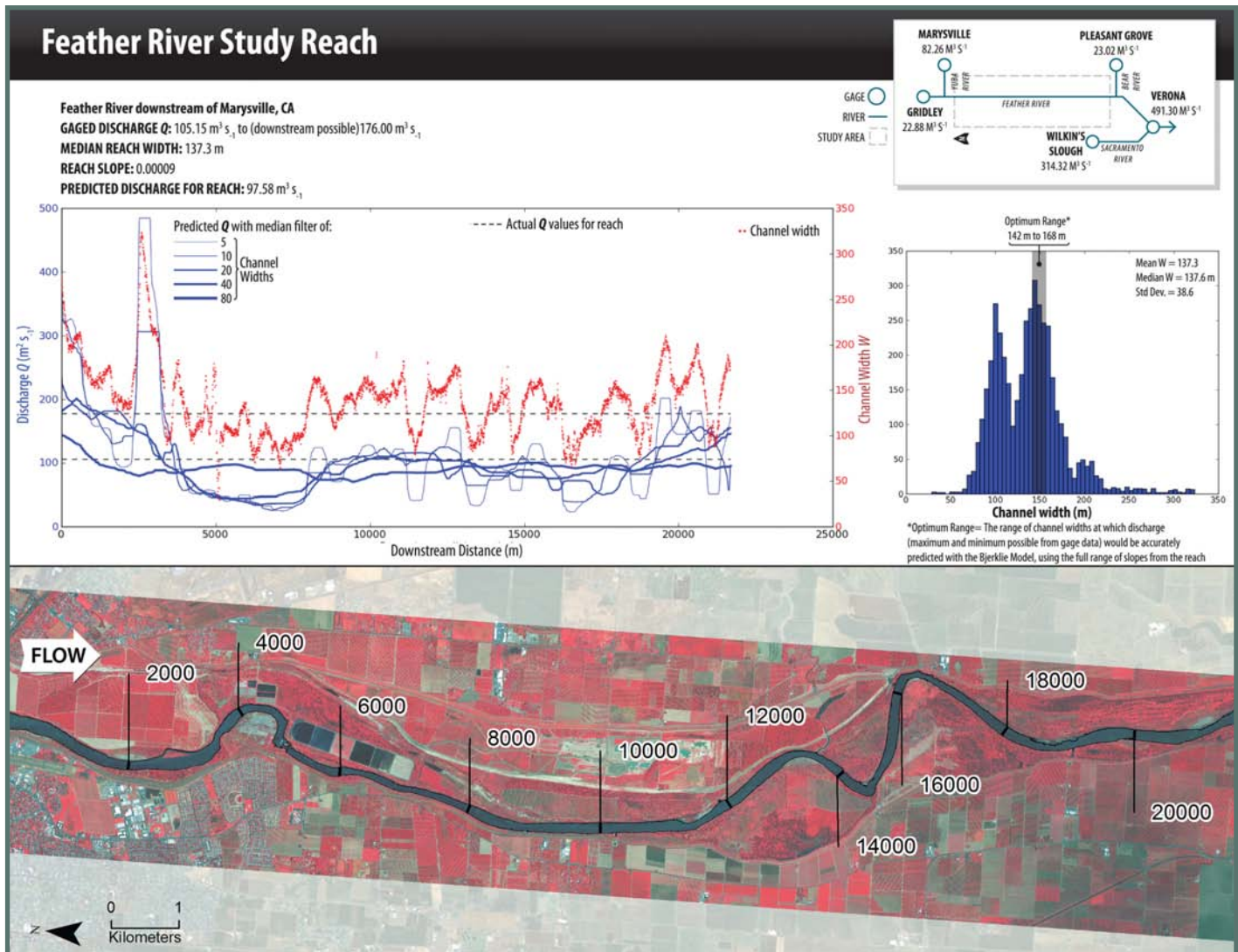


Figure 2: Results for the Feather River Study

Mapping of Serpentine Soils in the Lassen and Plumas National Forests

California is known to have one of the world's richest endemic floras associated with serpentine soils. Many of these species are considered sensitive and rare (Hickman 1993; Skinner and Pavlik 1994). Serpentine soils are derived from ultramafic rocks, or rocks with low levels of silica and high levels of magnesium oxide and iron oxide. Serpentinite is a soft and highly weatherable rock which is prone to mass wasting. In general, soils derived from ultramafic parent materials tend to be red to black in color and exhibit sparse and stunted vegetative growth due to extremely low calcium: magnesium ratios and the presence of heavy metals such as nickel, chromium and cobalt.

Ultramafic bedrock exists below just over one percent of the land area of California. Despite this small land area, species that are endemic to serpentine soils make up approximately 13% of the total endemic species in the state of California. Both from ecological and evolutionary perspectives, these unique habitats provide an ideal framework to study and understand how the spatial structure of these soils relates to biological diversity (Harrison et al 2000). Thus, a map depicting the geographic distribution of serpentine soils is vital to ecological studies.

The main goal of this project is to develop a serpentine soil map for the Storrie Fire region in the Lassen and Plumas National Forests using remote sensing data. Existing geologic maps were used as references to initially identify possible serpentine soil locations. An updated map of serpentine soils in the Storrie Fire Area would help researchers that are currently engaged in studying rare endemics in the region. The map would facilitate in the development of a management plan of serpentine plant populations after a large wildfire. It provides an opportunity to study spatial gradients in the diversity of the serpentine flora.

Landsat Thematic Mapper (TM5) image data (scene acquired on July 29, 2010) was used in the study. A series of spectral indices such as vegetation and mineral indices in combination with unsupervised and supervised classification techniques were employed to produce binary image outputs indicating probability of serpentine areas. Serpentine soil locations tend to have ground surfaces largely comprised of at least partially exposed ground surfaces, and as such mineral indices are potentially relevant indicators of possible serpentine soil sites. Mineral indices would not be appropriate in areas where serpentine may exhibit more dense vegetation, and those areas are what we hope to explore more thoroughly with LiDAR data analysis. The supervised classification procedures were supported by field work conducted during the summer of 2011. A stratified random sampling of 150 points in three different Normalized Difference Vegetation Index (NDVI) thresholds was delineated: 0.0-0.3 (low), 0.3- 0.6 (medium), 0.6-1 (high). The ground truth data collected from these sites were used in the unsupervised and supervised classification procedures. Map algebra operations within GIS were used to produce the final probability map. Figure 1 shows the spatial distribution of the probability classes of serpentine soils along with the area estimates. Based on ground truth data obtained in July

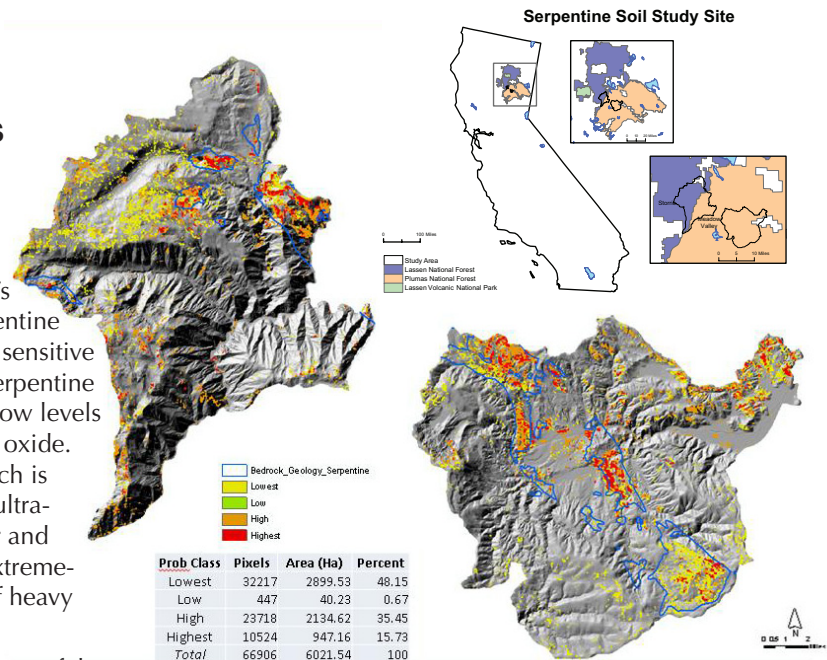


Figure 1. Map output of Serpentine soil classification in comparison to existing ultramafic bedrock geology (shown in blue).

2011, the soil prediction map was found to be approximately 69% accurate in predicting serpentine soil locations.

The preliminary map produced will be further refined using terrain data extracted from LiDAR remote sensing. Analyzing the variations in terrain texture with digital terrain models derived from LiDAR data may yield a textural pattern unique to serpentine soils that sets it apart from other, spectrally indistinguishable soil types. Additionally, field data collection using hyperspectral instruments such as the ASD FieldSpec (planned for 2012 summer) should provide more information about the spectral properties of the serpentine soils under different conditions of vegetation cover.

ACKNOWLEDGEMENT

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REFERENCES CITED:

- Harrison, S., Viers, J.H., Quinn, J.F. 2000. *Climatic and Spatial Patterns of Diversity in the Serpentine plants of California. Diversity and Distributions* 6: 153-161.
- Hickman, J.C. 1993. *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley, CA.
- Skinner, M.W., and Pavlik, B.M. 1994. *California Native Plant Society's inventory of rare and endangered plants of California. CNPS Special Publication 1*. CNPS, Sacramento, CA.

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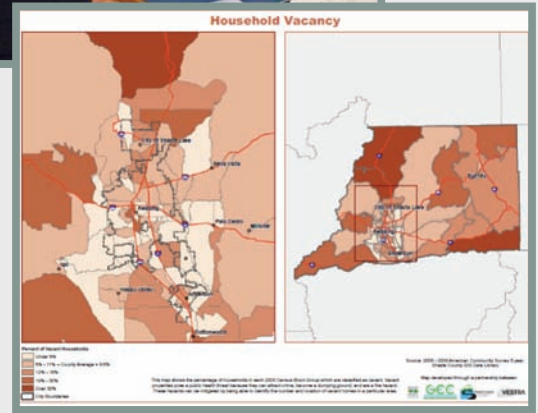
NSF/Advanced Technology in Education funds Geospatial Education Collaborative with Shasta College and CSU, Chico

The Department of Geography and Planning at California State University (CSU), Chico is participating with California Community College (CCC), Shasta College on the Geospatial Education Collaborative (GEC) project under NSF's Advanced Technology in Education program (ATE/NSF #1003865) workforce training of students in high-technology fields. It includes partnerships between community colleges, universities and employers. The Geospatial Education Collaborative is aimed at broadening the scope of geospatial education to meet these goals.

To expose students to geospatial technologies in their first years in college, the project has developed general education courses, under the common title "Digital Planet." These courses will be taught for the first time in 2012 at both Shasta College and CSU Chico. These articulated courses are now part of Chico's general education pathway "Science, Technology and Society" and Shasta's GIS Certificate. The courses provide an overview of how geospatial technologies are used. Students will reflect on issues such as privacy, representation, geopolitics, surveillance and equity to assess the benefits, ethics and risks of these technologies. This course will satisfy requirements in general education at Chico. The project secured approval of this course as part of the CCC/CSU general education pattern for students transferring from Shasta College to any CSU campus. In the next year, Shasta aims to develop a transfer degree in Geography in support of the directive under SB1440, and to gain GE approval under the University of California GE pattern.

In support of the goal of increased collaboration between the universities and community colleges, a team of three faculty participated in Chico's E-Academy over the summer of 2011. This included Principal Investigator Dan Scollon from Shasta College, and LaDonna Knigge (Co-PI from CSU Chico), and her colleague, Dean Fairbanks. The E-Academy brought together thirteen teams from CSU Chico to explore the use of technology in the classroom. The teams used this opportunity to develop a model for instruction of Digital Planet which blends on-line and in-class practices and includes hands-on exercises to help students think critically about the pervasive existence of geospatial technologies in their lives.

Aside from its focus on general education, the Geospatial Education Collaborative is supporting student interns to work with community organizations and agencies in Chico and in Redding (see photo). Interns have worked at the City of Chico and at the Northern California Regional Land Trust in Chico. They have also worked at the City of Redding, Shasta County, Whiskeytown National Recreation Area, and at CCC Shasta College Office of Institutional Research. The grant is also supporting a community-centered GIS project in which students working at Vestra Resources, a Redding-based GIS consulting firm, implement community health indicators in



Top: Geospatial Education Collaborative is supporting student interns to work with community organizations and agencies in Chico and in Redding

Bottom: Preliminary map for the Redding Area Community Well-Being Atlas

collaboration with Shasta County Public Health (see preliminary map). The resulting Community Well-Being Atlas, targeted for completion in Spring 2012, will be hosted on the Shasta College Regional GIS Server. This regional server, to be hosted at Shasta starting in Spring 2012, may also support student-centered projects at CSU Chico.

In an effort to expose younger students to the fun of place-based technologies, the grant is supporting outreach to secondary students and teachers in the Redding area. Shasta College Geography instructor Melinda Kashuba has developed geospatial curriculum and led activities that center on geo-based and Internet-based mapping sites. Outreach activities also include career fairs and environmental events in the community such as Science Saturday at Turtle Bay Exploration Park

With the completion of the two-year ATE grant in August of 2012, the GEC team is focusing on delivery of the new 'Digital Planet' courses, completion of student-centered GIS projects, and evaluation of impacts. Looking toward the future, the team will continue to cultivate the spirit of collaboration among students, geography departments, and the wider community.

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Collaborative Mapplets for Service Learning Opportunities at CSU Chico

The Geography and Planning Department at CSU Chico has collaborated with campus sustainability entities this fall semester in creating online locator maps built with Adobe Flex and ESRI's ArcGIS Server. The department's Instructional Support Technician, Cathie Benjamin, was awarded funding through the Center for Excellence in Learning and Teaching and from the College of BSS to develop the necessary GIS server resources, to supervise three student assistants in creating pilot "mapplets," and to develop a course module for spring 2012. With support from Adobe, mobile web mapping applications will be developed for next fall.

The first step in the process was to obtain and configure the hardware and software necessary to get ArcGIS Server up and running. The CSU-wide site license from ESRI includes ArcGIS Server version 10 and access to technical support. The next hurdle was learning about web mapping from online seminars and tutorials, forums, and exploring samples available at ArcGIS Online (www.arcgis.com). Some choices for web APIs (Application Programming Interfaces—used to "mash up" GIS datasets and web browsers) were JavaScript, Flex, and Silverlight/WPF. For its relatively short learning curve, customization options, extensibility, and ease of use, the ArcGIS Viewer for Flex was chosen as a starting point. Utilizing Flash in the background, this flexviewer can also be used with editing, charts, clustering, and time-aware data. Furthermore, the ArcGIS API for Flex can be utilized in conjunction with FlashBuilder software to develop maps/apps for mobile devices such as iPhone, iPad, Android, and Blackberry.

As a pilot effort, three student assistants were taught to configure the ArcGIS Viewer for Flex template (similar to a wizard). They were asked to develop flexviewer "mapplets" in support of sustainability efforts on campus: two outdoor research sites and a conference. The students learned quickly, and developed an entrepreneurial camaraderie that spread to include geography club members and fellow students. In response, an impromptu

workshop on flexviewers was hosted in the department's GIS lab for anyone to attend, even faculty members. More workshops will be scheduled for next spring.

To help disseminate knowledge of these techniques, a 3-week course module is planned for the department's Advanced GIS class in March 2012. The GIS students will learn about ArcGIS Online and other mapping resources, about ArcGIS Server version 10 and its web mapping services, and about the customizable template called the ArcGIS Viewer for Flex. Class discussions will focus on the different development environment that is needed when designing an interactive online map, as opposed to a printed map. Each student will then be paired with a community group to develop individual custom mapplets.

Ms. Benjamin plans to continue the development of online mapping resources for the department by learning to create custom widgets and interfaces and by programming for mobile devices. She was successful in obtaining an educational license from Adobe so that FlashBuilder can be offered in the CSU Chico GIS computer lab. Paired with the tablet computers purchased for the department's faculty and staff last spring, this new web mapping environment will help to update class content and keep courses relevant to emerging technologies.

RESOURCES:

The three pilot mapplets can be viewed at these URL's:

- Butte Creek Ecological Preserve:
<http://geochico.csuchico.edu/bcep>
- This Way to Sustainability Conference VII:
<http://geochico.csuchico.edu/susCon>
- Big Chico Creek Ecological Reserve:
<http://geochico.csuchico.edu/bccer>

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Figure 1: Screenshots from the three pilot mapplets: Blue Creek Ecological Preserve, topo view; This Way to Sustainability Conference VII, street view, Big Chico Ecological Preserve, satellite view.

San Marcos

Teaching Race/Ethnic Relations with GIS

An experimental teaching project with GIS shows improved student engagement in a Race / Ethnic Relations hybrid course in the Department of Sociology at California State University San Marcos (CSUSM). Located in northern San Diego County, the project originated through a two-day inaugural GIS Resources and Instructional Development Workshop (GRID) in Fall 2010, a joint partnership between CSUSM and Palomar Community College funded by the National Science Foundation's Advanced Technological Education Program. Aimed at local teachers and other public service professionals with minimal experience in GIS methods, the two-day workshop offered a primer on GIS resources and included adaptable curriculum samples for educators in various academic fields and institutions. Faculty from both sponsoring campuses, local public and charter high schools, as well as representatives of public agencies, formed a spirited collaboration based not only in being novices to GIS, but in realizing the potential of educational technologies to transform the classroom and public service.

I held some reservations initially about how GIS could help me personally to expand curriculum in my areas of expertise as an interdisciplinary scholar trained in Critical Race and Ethnic

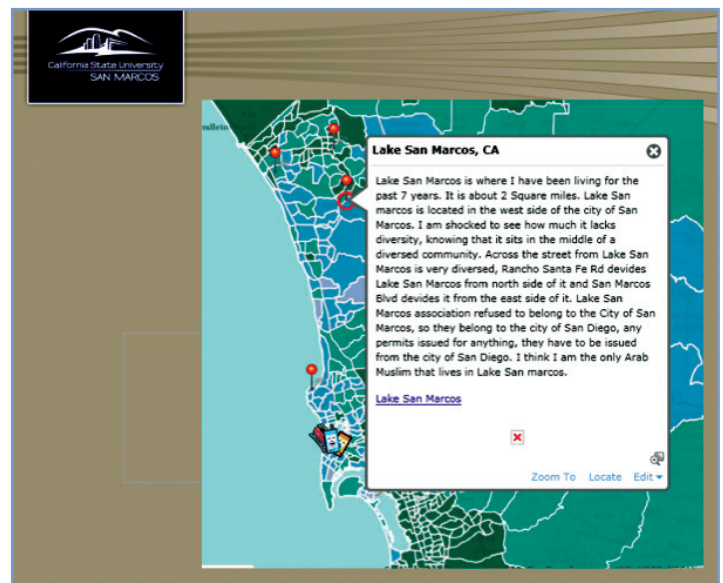


Figure 1: Example of student project.

Studies. My teaching and research are based in theoretical concepts and epistemological positions that challenge the existing system of power relations in society, which would otherwise claim that colorblindness ideology and institutional equity have been achieved in the 21st Century. The classes

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