

## **UC Santa Barbara**

### **SPACE (Spatial Perspectives on Analysis for Curriculum Enhancement)**

#### **Title**

Spatial Perspectives on Analysis for Curriculum Enhancement (SPACE)—Final Report

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**FINAL REPORT TO NSF**  
Covering October 2004–March 2009

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June 2009

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## **Final Report to NSF**

June 2009

### **Activities**

Spatial Perspectives on Analysis for Curriculum Enhancement (SPACE) was funded under the national dissemination track of the National Science Foundation's Course, Curriculum, and Laboratory Improvement (CCLI) program. The objective of SPACE was to initiate systemic change in undergraduate education for the social sciences by focusing on the value of spatial thinking and associated technologies—geographic information systems (GIS) and tools for spatial analysis. The significance of spatial technologies has increased over the past three decades, reflecting developments in theory and innovations in software applications that have permitted the integration of data and scientific perspectives across disciplines as well as a broad recognition that geographical representation of information provides an important means to understanding and resolving societal and scientific problems. Providing undergraduates with exposure to GIS, analytical cartography, remote sensing, and spatial econometric concepts and tools were highlighted in SPACE workshops as a basis for motivating students and enhancing their opportunities for advanced studies and employment. In this program, knowledge in spatial analysis was linked to CCLI objectives for dissemination of curricula and assessment practices.

The core funding from NSF was for three years (October 2003 through September 2006), however an additional year of workshops (summer 2007) and a no-cost extension and supplement (October 2008 through March 2009) allowed for extended support for participants in the workshops. SPACE was organized as a consortium led by the University of California, Santa Barbara (Project PI, Donald Janelle; co-PIs, Richard Appelbaum and Michael Goodchild) through its Center for Spatially Integrated Social Science. Under contract to UCSB, other participants in the consortium included The Ohio State University (PI, Mei-Po Kwan), and the University Consortium for Geographic Information Science (UCGIS PI, Arthur Getis and successive presidents of UCGIS).

The primary activities for achieving SPACE goals were eleven week-long residential workshops to provide undergraduate instructors with basic skills in GIS and spatial analysis, and to introduce them to the latest techniques, software, and learning resources. A website ([www.csiss.org/SPACE](http://www.csiss.org/SPACE)) was developed to aid workshop organization and to help consolidate resources of value to instructors in a broad range of disciplines. Extensive follow-up activities were designed to leverage these workshops to achieve high rates of participation among traditionally under-represented groups and to bridge the gap between research and teaching in the social sciences. Follow-up activities included (1) awards for curriculum development projects and supplemental training for social science instructors, and (2) support for conference initiatives. These follow-up programs were operative through March 2009.

### **Summary of Primary Activities**

Activities from October 2003 through March 2009 were directed toward (1) planning, organizing, and implementing up to three workshops per year (2004 to 2007); (2) program administration and logistics; (3) developing and maintaining a project website to serve workshop organizers and participants; (4) providing follow-up support to participants in SPACE workshops; (5) national dissemination; and (6) evaluating and assessing program results.

Overlap among these six general types of activities is essential, but for organizational purposes they are segmented under these headings.

## 1. PLANNING, ORGANIZING, AND IMPLEMENTING WORKSHOPS:

- Workshop coordinators, instructors, and assistants were appointed in October 2003 to plan for summer 2004 workshops at three sites: Ohio State University (OSU), the University of California Santa Barbara (UCSB), and San Diego State University (SDSU, on behalf of the University Consortium for Geographic Information Science, UCGIS).
- In December 2003 the teams for the three workshops met for three days with technical staff and education consultants in Santa Barbara, with a primary goal of structuring the intellectual content and related agenda for each workshop. General guidelines were formulated for the solicitation of applicants, selection of participants, and communication of admission criteria. Preliminary entry and exit surveys were formulated and follow-up activities for workshop participants were designed to help solidify and amplify the mastery of spatial analysis concepts and technologies, pedagogy for the classroom, and assessment of student learning.
- Two important principles were defined for workshop implementation and follow-through: (1) workshops should facilitate participants becoming agents of dissemination of spatial methodologies and spatial thinking in STEM disciplines, and (2) workshop instructors should exemplify and demonstrate the pedagogic practices expected of workshop participants in working with their own students, especially in focusing on project-based learning, classroom communication, hands-on experience, peer interaction, and active assessment of learning.
- The summer 2004 workshops included a 12-day workshop at UCSB and 5-day workshops at OSU and SDSU, with the intention of evaluating different formats for subsequent years in the program.
- Additional annual planning meetings were held in Santa Barbara in December 2004 and December 2005, providing opportunities to assess prior workshop results and to make adjustments in the program for subsequent years. These meetings provided opportunities to share ideas from the different workshop experiences and to acquaint new UCGIS teams from San Francisco State University (SFSU, 2005 workshop) and the University of Oklahoma (OU, 2006 workshop) with the objectives of SPACE. A participant from each workshop was invited to provide client perspective on workshop practices. It was decided at the December 2004 meeting that a 6-day residential workshop format would become the template for all subsequent workshops at OSU, UCSB, and OU. The planning meetings provided excellent opportunities to assess workshop practices as well as to fine-tune application and adjudication procedures, information resources for prospective participants, and the workshop entry and exit surveys.
- For 2007 (a no-cost extension year), UCGIS reallocated its funding to help co-sponsor the workshops at UCSB and OSU. In order to reserve funds needed to administer these workshops, a planning meeting was not held in December 2006. Email and telephone communication proved adequate for coordinating activities.

## 2. PROGRAM ADMINISTRATION AND LOGISTICS:

- The principal investigator, with cooperation from workshop coordinators (Stuart Sweeney at UCSB, Mei-Po Kwan at OSU, John Weeks at SDSU, Richard LeGates at SFSU, and Tarek Rashed at OU) and the Educational Development Coordinator (Fiona Goodchild), completed annual reports for submission to NSF in fall for 2004, 2005, 2007, and 2008.
- A request for a **supplementary** funding was submitted to NSF in October 2007 to provide 2007 workshop participants with resources to assist their implementation of new curriculum and instructional innovations, acquire enhanced training in the use of geographical technologies, and support conference dissemination efforts. NSF granted the supplement in September 2008, allowing for continuation of curriculum development awards and ACCESS conference programs through March 2009.
- The principal investigator completed the Final Report to NSF in late June 2009.

## 3. WEBSITE DEVELOPMENT:

- A prototype website was reviewed at the planning meeting in December 2003. At that time, the primary purpose of the site was to serve workshop administration, including online application procedures, data analysis and protection, and information dissemination.
- Based on recommendations made at the planning meeting, the website ([www.csiss.org/SPACE](http://www.csiss.org/SPACE)) was en-



hanced with resources (syllabi, exercises, data links, assessment instruments, and discipline-relevant resources) for workshop participants as well as for site visitors interested in implementing spatial analysis perspectives to undergraduate education. An on-going effort was made to identify new resources and tools for national dissemination to the broad interdisciplinary set of social scientists interested in spatial thinking and spatial analysis. Workshop participants were invited to contribute resources to the site.

- Site usage increased steadily over the course of the project through 2007 (the last summer for workshops) but has continued at a modest level of use through early 2009, as documented in the “Findings” section.
- The UCSB Center for Spatial Studies will continue to monitor and add resources to the SPACE website. As the Center’s follow-up initiatives at [www.teachspatial.org](http://www.teachspatial.org) expand, it may be appropriate, in the future, to consolidate resources from the two sites.

#### **4. FOLLOW-UP SUPPORT FOR WORKSHOP PARTICIPANTS:**

SPACE sponsored two programs to help solidify participant workshop learning and to extend the reach of SPACE objectives beyond the workshop environment.

- The **Instructional Development Awards** recognized participant accomplishments in introducing new courses and instructional modules at their home institutions. Recipients could use these awards to organize dissemination efforts (short courses and campus forums), or to participate in meetings of discipline associations or in training programs to enhance their own spatial analytic competencies.
  - The award program was announced in November 2004 and, since then, 42 participants have received support in recognition of their accomplishments.
  - A section of the SPACE website describes these accomplishments and provides a resource base used during the workshops to illustrate how prior participants promoted spatial thinking in undergraduate education.
- The **SPACE ACCESS program (Academic Conference Courses to Enhance Social Science)** supported workshop participants in their efforts to organize conference-based sessions, panels, and short workshops for academic and professional societies. ACCESS awards helped participants in these efforts, resulting in the extension of SPACE objectives to the following organizations:
  - Association of Social and Behavioral Scientists (2005)
  - Association of Collegiate Schools of Planning (2005)
  - National Technology and Social Science Conference (2005)
  - UCGIS Winter Meeting (2005) and Summer Assembly (2006)
  - Society for American Archaeology (2006)
  - National HBCU Faculty Development Symposium (2006)
  - Association of American Geographers (2006)
  - American Sociological Association (2007)
  - American Political Science Association (2007)
  - Minorities in Agriculture, Natural Resources, and Related Sciences (2007)
  - American Society for Environmental History (2008)
  - New Orleans Neighborhood Analysis Project’s Community GIS Technology Workshop (2008)
  - Agricultural and Natural Resource Conservation and Management Conference (2008)
  - Harvard University’s AfricaMap Workshop (2009)
  - National Society of Black Engineers (2009)
- Program descriptions, presentations, and related pedagogical resources from these ACCESS activities are posted at <http://www.csiss.org/SPACE/workshops/sessions.php>, and are described in the section on findings.

## 5. NATIONAL DISSEMINATION:

National dissemination focused on wide distribution of applicant solicitation for workshop participation, making use of the SPACE website, fliers, advertising in newsletters and email listings of social science associations, direct contact with institutions of higher learning that serve minority populations, and presentations by SPACE workshop coordinators and instructors.

- Workshop advertising included the design, production, and distribution of fliers, and the preparation of a brochure describing the SPACE program and its resources, emphasizing the value of introducing spatial analysis in undergraduate teaching.
- The principal investigator, co-principal investigators, and workshop instructors gave presentations about the SPACE program to several organizations, including the Social Science History Association (2005), the Crime Mapping Research Conference (2005), the University Consortium for Geographic Information Science (2005 and 2006), and the Association of American Geographers (2005 and 2006). These supplemented the presentations by workshop participants at conference workshops and sessions that they organized through the SPACE ACCESS program.
- Since the inception of the program, designated **minorities** have represented 20 percent of SPACE workshop participants. Significant efforts were made to encourage applicants from minority-serving institutions. Five of the ACCESS-supported conference workshops were for organizations that serve Historically Black Colleges and Universities (HBCUs) and minority populations.
- The SFSU workshop in 2005 featured the development of a video interview of workshop instructors and participants. The video was shown in several conference presentations and is accessible via the SPACE website.
- **Publications** resulting at least in part from the SPACE experience, include the following:
  - D. G. Janelle, S. R. Hespanha, F. Goodchild, and M. F. Goodchild, Workshops and National Dissemination of Geographic Analysis in the Social Sciences: The CSISS Experience in the U.S.A., *Journal of Geography in Higher Education*, (2009) in press.
  - S. R. Hespanha, F. Goodchild, and D. G. Janelle, Spatial Thinking and Technologies in the Undergraduate Social Science Classroom, *Journal of Geography in Higher Education*, (2009) in press.
  - D. G. Janelle and M. F. Goodchild, Concepts, Principles, Tools, and Challenges in Spatially Integrated Social Science, in T. Nyerges, R. McMaster, and H. Couclelis, eds. *Handbook of GIS and Society Research* (Sage Publications, 2009) in press.
  - D. G. Janelle and M. F. Goodchild, Location across Disciplines: Reflections on the CSISS Experience, in H. J. Scholten, R. van de Velde, and N. van Manen, eds. *Geo-ICT and the Role of Location within Science* (Dordrecht, The Netherlands: Springer, 2009) in press.
  - D. G. Janelle, Expanding the Social Sciences with Mapping and GIS, in D. S. Sinton and J. J. Lund, eds. *Understanding Place: GIS and Mapping across the Curriculum* (Redlands, CA: ESRI Press, 2007) 77–82.
- The principal investigator prepared a poster about the SPACE program for presentation at the **CCLI 2008 PI Conference**, Washington DC, 13–14 August 2008.
- Although not supported by SPACE funding, we were motivated by the experiences of the SPACE program to organize, with the help of Dr. Diana Sinton (prior SPACE participant), a **Symposium on a Curriculum for Spatial Thinking** (University of Redlands, June 3–5, 2008). This involved about a dozen social/environmental science professors from around the country (including participants in prior SPACE workshops). An outcome of this workshop has been the circulation of a white paper on the importance of spatial reasoning and the need for formal instruction in spatial thinking at the undergraduate level. In addition, a new wiki-style website was launched in March 2009, featuring teaching resources about spatial concepts (see <http://teachspatial.org>).

## 6. PROGRAM EVALUATION AND ASSESSMENT:

A follow-up survey was designed for participants in the 2004 workshop and was used for participants in successive workshops through 2007. These surveys were administered online approximately 10 to 12 months after the workshops to assess how participants have used workshop experiences to enhance teaching for their institutions and organizations and to advance their own understanding of spatial technologies. In addition to

providing a basis for improving successive workshops, the surveys help to identify both the general and specific outcomes associated with SPACE, as documented in the “Findings” section of this report.

## Workshops

The last two of eleven workshops were offered during summer 2007, one at UCSB and the other at Ohio State University. Although these and prior workshops were described in detail in previous annual reports to NSF, it is useful to include the agenda for the 2007 workshops as context for information presented in the “Findings” section of this final report.

### **Spatial Analysis in the Social Science Curriculum: Enhancing Undergraduate Learning**

*July 15–20, 2007: Santa Barbara, CA*

This workshop focuses on spatial methods and perspectives suited for applications in the under-graduate social science curriculum, such as exploratory spatial data analysis and cartographic visualization. Participants will illustrate these methods and design instructional modules and exercises for use in teaching undergraduates. The workshop will also explore strategies for curriculum development and assessment of student learning. Requirements to benefit from this workshop include prior experience with computer file and data management for quantitative analysis and/or basic GIS applications in the social sciences.

**Instructors:** Stuart Sweeney (coordinator), Fiona Goodchild, Michael Goodchild, Don Janelle, and Waldo Tobler (all of UC Santa Barbara)

**Co-sponsor with CSISS and host institution:** Department of Geography, University of California, Santa Barbara, and the Institute for Social, Behavioral, and Economic Research.

### **Overview of Workshop Goals**

The UCSB workshop introduces social science instructors to the potential added value provided by spatial perspectives. The workshop engages participants with opportunities to learn spatial theory, methods of spatial analysis, and pedagogic strategies for integrating spatial perspectives into lectures, labs, and demonstrations in undergraduate instruction. The training in spatial analytic tools is not presented as an end in itself, but instead as a means to facilitate undergraduate learning within the context of existing social science theory.

The UCSB workshop focuses on: (1) Implementing core spatial concepts through exploratory spatial data analysis and cartographic visualization; (2) Integrating social science theory and spatial analysis; and (3) Visualizing social science data. These basic themes are intended to transcend disciplinary boundaries. Small-group discussions and teamwork will be used throughout the workshop to facilitate the integration of lectures and lab work with pedagogical development.

## Workshop Agenda

Sunday, July 15: Introduction, Motivation, and Project Planning		
9:15	<b>Welcome and Introductions</b>	Don Janelle
10:15	<b>Integrating Spatial Perspectives into Undergraduate Social Science Education</b>	Stuart Sweeney
11:30	<b>Project Planning and Student Assessment</b>	Fiona Goodchild Stacy Rebich-Hespanha Stuart Sweeney
12:15	<i>Lunch with Instructors</i>	
1:30	<b>The Challenge of Spatial Social Science</b> • GIS methods in social science research and education • Thinking spatially in the social sciences • <b>Discussion</b>	Mike Goodchild
3:30	<b>Introducing GIS and Peer Interaction Exercises:</b> Introduction to ArcGIS	Kirk Goldsberry Jeff Howarth
5:30	<b>Workshop Dinner with Instructors</b> (Carrillo Dining Hall)	
6:30	<b>Reception and Poster Session</b> (West Campus Commons)	
Monday, July 16: Spatial Social Science and GIScience		
9:15	<b>Geographic Information Systems/Science: Basic Concepts of GIS</b> • Nature of spatial processes and their representation in GIS	Mike Goodchild
10:45	<b>Learning and Assessing Spatial Thinking</b>	Fiona Goodchild Stacy Rebich-Hespanha
After Lunch	<b>Computer Lab</b> ( <i>laptop software checks, data checks, lab logistics</i> )	
1:15	<b>Structured Lab:</b> ArcGIS I: Data Structures / Data Sources / Mapmaking	Kirk Goldsberry Jeff Howarth
4:00	<b>Parallel Electives</b> <b>Open Computer Lab</b> Staffed by:	Kirk Goldsberry, Jeff Howarth
8 pm	<b>Choropleth Maps with ArcGIS</b> <b>Open Discussion</b> — <i>location to be determined</i>	
Tuesday, July 17: Spatial Analytic Methods in Social Science Instruction		
9:15	<b>Spatial Analytic Methods (exploratory / descriptive / inferential)</b> • Point data: SS methods / applications • Area data: SS methods / applications • Interaction data: SS methods / applications	Stuart Sweeney
10:45	<b>Spatial Analytic Methods (exploratory / descriptive / inferential)</b> • Spatial analytic methods in social science research and education • Added-value from spatial analytic methods • Spatial autocorrelation and relation to social science theories • Classroom demos versus student assignments / labs • <b>Discussion</b>	Stuart Sweeney
12:00	<i>Lunch with Instructors</i>	
1:15	<b>Structured Lab:</b> GeoDa: Exploratory Spatial Data Analysis • Reading ESRI Shape files and variable construction • EDA and ESDA utility and interpretation • Inferential pattern analysis / spatial autocorrelation	Stuart Sweeney Kathryn Grace David Folch
4:00	<b>Parallel Electives</b> <b>Open Computer Lab</b> Staffed by: <b>R Language and STARS</b> (space-time analysis of regional systems)	Kirk Goldsberry, Jeff Howarth Stuart Sweeney

5:00	<ul style="list-style-type: none"> <li>• Spatial econometric theory; Spatial error and spatial lag models</li> <li>• Specification tests and model interpretation</li> <li>• GeoDa application: Hedonic real estate model</li> </ul> <b>Workshop Debriefing</b>	Kathryn Grace David Folch
<i>Wednesday, July 18: Cartography / Visualization in Social Science Instruction</i>		
9:15 11:00 Afternoon	<b>Cartographic Visualization in Social Science Instruction</b> <b>Structured Lab: ArcGIS II: Topics in Cartographic Communication</b> <ul style="list-style-type: none"> <li>• Classification</li> </ul> <b>Free Time in Santa Barbara</b> (options depending on interest; consult with Stacy Rebich-Hespanha) <b>Open Computer Lab</b> <b>Consultation with Faculty</b> 8 pm <b>Open Discussion</b> —Location to be determined	Kirk Goldsberry Kirk Goldsberry Jeff Howarth  Limited Staff Support To be arranged
<i>Thursday, July 19: Spatial Interaction, Pedagogy, and Project Development</i>		
9:15 11:00 12:15 1:30 2:30 3:30	<b>Issues in Teaching and Learning</b> Chair: Fiona Goodchild Panel: Stuart Sweeney, and three workshop participants <b>Movement and Flows</b> <ul style="list-style-type: none"> <li>• Flow representation and mapping</li> <li>• Discussion</li> </ul> <i>Lunch with Instructors</i> <b>Introducing Spatial Perspectives in Undergraduate Teaching: Institutional Opportunities and Constraints</b> <b>Parallel Electives</b> <b>Open Computer Lab</b> <b>Flow Mapper Implementation</b> 3:30 <b>Consultations with Instructors</b>	Waldo Tobler  Discussion with Mike Goodchild Kathryn Grace, David Folch, Kirk Goldsberry, Jeff Howarth Waldo Tobler F. Goodchild, M. Goodchild, S. Sweeney, W. Tobler
<i>Friday, July 20: Project Presentations / Closing Session</i>		
9:15 1:15 3:30 4:30 6:00	<b>Participant Presentations and Peer Feedback</b> <ul style="list-style-type: none"> <li>• 8-minute presentation, 4-minute discussion(maximum of 10 PowerPoint slides)</li> <li>• Peer review for each participant</li> </ul> <b>Participant Presentations and Peer Feedback</b> <ul style="list-style-type: none"> <li>• 8-minute presentation, 4-minute discussion</li> <li>• Peer review for each participant</li> </ul> <b>Participant Presentations and Peer Feedback</b> <ul style="list-style-type: none"> <li>• 8-minute presentation, 4-minute discussion</li> <li>• Peer review for each participant</li> </ul> <b>Closing Comments</b> 6:00 <b>BBQ Dinner and Workshop Certificates</b> (Location to be arranged)	Don Janelle, Stuart Sweeney, Fiona Goodchild
<i>Saturday, July 21: Participants Depart Santa Barbara</i>		

## GIS and Spatial Modeling for the Undergraduate Social Science Curriculum

June 18–23, 2007, Columbus, OH

This workshop focuses on spatial thinking, spatial analytic methods and their applications suited for undergraduate social science courses. These methods include cartographic visualization, space-time modeling of individual behavior, spatial interaction models, spatial point pattern analysis and spatial optimization methods. The workshop will also cover curriculum development, pedagogy, and student learning assessment. Workshop participants will consider how to integrate these methods into instructional modules, exercises, and learning assessment approaches. Requirements to benefit from this workshop include prior experience with computer file and data management in applications of quantitative analysis and/or GIS in the social sciences.

**Instructors:** Mei-Po Kwan (coordinator), Ola Ahlqvist, Desheng Liu, Alan Murray, Morton O’Kelly, Kathryn Plank, and Ningchuan Xiao (all of The Ohio State University), and Sara McLafferty (University of Illinois at Urbana-Champaign).

**Co-sponsors with CSISS and host institution:** Department of Geography, The Ohio State University; the University Consortium for Geographic Information Science.

### Workshop Agenda

Monday, June 18		
8:30	Coffee and Bagels	
9:00	<b>Optional Lab Sessions: ArcGIS and GeoDa</b>	
2:00	<b>Welcome</b> (Derby Hall 1080)	D. Janelle, Mei-Po Kwan
3:00	<b>Pedagogy issues: Planning your Students’ Learning</b>	Kathryn Plank
6:00	<b>Reception and Dinner</b> (Buckeye Cafe)	
Tuesday, June 19		
9:00	<b>Lecture Spatial Analysis Using Census Data</b>	Ningchuan Xiao
1:00	<b>Introduction and Space-Time Analysis Census Data</b>	Mei-Po Kwan
4:00	<b>Guest Lecture: Spatial Perspectives on Health and Social Issues</b>	Sara McLafferty
5:00	<b>Extra Lab Sessions</b>	
6:00	Break Dinner on your own	
Wednesday, June 20		
9:00	<b>Introduction to GIS and Cartographic Visualization</b>	Ola Ahlqvist
11:00		
1:00	<b>Lecture Spatial Optimization Modeling</b>	Alan Murray
4:00	<b>Panel Session on Pedagogy Issues (interdisciplinary panel)</b>	Linda Lobao, Philip Brown
5:00	<b>Group Discussion on Pedagogy Issues</b>	
6:00	Break Dinner hosted by Department of Geography, The Ohio State University	
Thursday, June 21		
9:00	<b>Lecture Spatial Interaction Modeling: Space–Price Equilibrium</b>	Morton O’Kelly
1:00	<b>Lecture Exploratory Spatial Data Analysis</b>	Desheng Liu
4:00	<b>Pedagogy issues: Evaluation of Your Students’ Learning</b>	Kathryn Plank
6:00	Dinner on your own	
Friday, June 22		
9:00	<b>Pedagogy Discussion and Group Project</b>	
10:30	<b>Concurrent Lab Sessions on all topics</b>	
	<ul style="list-style-type: none"> <li>• Cartographic Visualization</li> <li>• Space-Time Analysis</li> <li>• Spatial Analysis Using Census Data</li> </ul>	Ahlqvist Kwan Xiao

1:00	<ul style="list-style-type: none"> <li>• Spatial Optimization Modelling</li> <li>• Spatial Interaction Modeling</li> <li>• Exploratory Spatial Data Analysis</li> </ul>	Murray O'Kelly Liu
4:00	<b>Concurrent Lab Sessions continues</b>	
5:00	<b>Group Project:</b> <i>Instructors hold office hours</i> <i>Break Dinner on your own</i>	
<b>Saturday, June 23</b>		
8:30– 12:00	Group Presentations	
12:00– 1:00	<i>Box Lunch</i>	

## SPACE Workshops Sponsored by the University Consortium for Geographic Information Science

### Spatial Analysis and GIS for Undergraduate Course Enhancement in the Social Sciences

*August 2–6, 2004, San Diego, CA*

**Topics covered:** This workshop offers instructors of undergraduate courses in the social sciences an opportunity to gain expertise in the application of GIS and spatial pattern analysis. Primary concentration will be on problems and issues of interest especially to sociologists, criminologists, and demographers. Participants will work collaboratively with workshop leaders and other participants in the design of course materials for use in undergraduate teaching and in learning assessment. Familiarity with GIS and spatial analysis is desirable.

**Instructors:** Arthur Getis and John R. Weeks (coordinators), Jared Aldstadt, and Piotr Jankowski (all of San Diego State University); Fiona Goodchild and Michael Goodchild (both of UC Santa Barbara).

**Co-sponsor with CSISS:** The University Consortium for Geographic Information Science.

**Host institution:** Department of Geography, San Diego State University.

### Workshop Agenda

<b>Monday, August 2</b>		
8:30	Staff & Participant Introductions: What brings you to this workshop? The structure of this workshop	Arthur Getis John Weeks Donald Janelle
9:45	<i>Vision and objectives of SPACE</i>	
<b>10:15</b>	<b>Coffee Break</b>	
10:30	<i>The meaning of spatial thinking</i>	Michael Goodchild
11:15	<i>A brief review of Spatial Analysis/Geographic Information Science</i> <i>Environment concepts</i>	Michael Goodchild Arthur Getis
<b>12:15</b>	<b>Lunch</b>	
1:30	<i>Characteristics of an ideal project</i>	Fiona Goodchild
2:30	<i>Spatial analysis software packages</i>	Jared Aldstadt
3:00	Software demo: GEODA	Michael Goodchild
3:30	Exercise in exploratory spatial data analysis using GEODA	Jared Aldstadt
5:30	Reception at Scripps Cottage on campus	
<b>Tuesday, August 3</b>		
8:30	<i>Issues and answers</i> (Michael Goodchild)	
9:30	<i>Spatial analysis application in demography</i>	Weeks
<b>10:15</b>	<b>Coffee break</b>	
10:30	<i>Construction of curricula</i>	Fiona Goodchild

<b>12:00</b>	<b>Lunch</b>	
1:15	Tour of Center for Earth Systems Analysis and Research	Arthur Getis
1:45	<i>Outlining a curriculum module; Resource issues in curriculum development</i>	Fiona Goodchild
3:45	Exercise in spatial analysis using GEODA	Jared Aldstadt
<b>Wednesday, August 4</b>		
9:00	<i>Aspects of spatial analysis for curriculum development</i>	Arthur Getis
<b>10:15</b>	<b>Coffee Break</b>	
10:30	<i>Curriculum development and enhancement</i>	Stacy Rebich-Hespanha
<b>12:00</b>	<b>Lunch</b>	
1:15	Curriculum development issues: breakout groups	Staff
3:30	The development of evaluation instruments; student assessments	Stacy Rebich-Hespanha, Staff
<b>5:00</b>	<b>Bus tour of San Diego</b> (Balboa Park, Gaslamp District; no host dinner at The Fish Market Restaurant)	
<b>Thursday, August 5</b>		
8:30	<i>Participatory problem solving and decision making with GIS; followed by tutorial</i>	Piotr Jankowski
<b>12:30</b>	<b>Lunch</b>	
1:30	Curriculum development	
<b>6:00</b>	<b>Picnic at Getis' house</b> (bring bathing suits)	
<b>Friday, August 6</b>		
8:30	Participants present their curriculum development plans; discussion; some participants conduct sample classes; summing up; exit survey	

## Introducing GIS for Undergraduate Social Science Courses

August 1–6, 2005, San Francisco, CA

### Schedule

Monday through Friday will be intense structured teaching days with a tight lecture/lab schedule. Workshop days start at 9:00 a.m. and end at 5:00 p.m.

Wednesday afternoon, participants are invited to a historical walking tour of San Francisco. Participants may choose to forego the walking tour and remain at SFSU to work with workshop staff on how to tailor data to specific geographic areas and how to merge their own data with data from other sources.

On Saturday, Richard LeGates and Xiao Hang Liu will describe NSF's evaluation materials available from NSF's On-line Evaluation Resource Library (OEREL) and the SPACE website and lead a discussion of how to assess impacts of introducing spatial analysis into the social science courses.

### Participant Data Needs

The workshop schedule includes optional time for you to work with and analyze your own data. Participants wanting to tailor workshop content to their own interests should compile their own data sets (assuming appropriate permissions are in place and that there is no risk of disclosure of individual data). If you do not have suitable data, sample data sets from all lab sessions and sample data from the software are available. Additionally, there is a wealth of data available to applicants via the Internet (at various credible and verifiable sites). You may wish to explore compiled list of data sources from the Institute for Geographic Information Science at SFSU.

## Workshop Agenda

**Sunday, July 31**

Travel day All participants should be in San Francisco Sunday evening



Monday, August 1:		
9:00	Welcome <ul style="list-style-type: none"> <li>• Overview of SPACE and SFSU workshop</li> <li>• Personnel, and logistics</li> </ul>	
9:30	Overview of spatially integrated social science	Donald Janelle
<b>10:15</b>	<b>Break</b>	
10:30	Pedagogy in undergraduate GIS teaching	Stacy Rebich-Hespanha
10:30	Breakout groups <ul style="list-style-type: none"> <li>• Discuss how participants plan to incorporate GIS into their courses</li> </ul>	
11:45	Breakout group reports	Stacy Rebich-Hespanha
<b>12:00</b>	<b>Lunch</b>	
1:30	Spatial data and its modeling in GIS <ul style="list-style-type: none"> <li>Spatial data <ul style="list-style-type: none"> <li>• Overview of vector and raster GIS models</li> <li>• Common file formats</li> <li>• Map Projections</li> </ul> </li> </ul>	Xiao Hang Liu
<b>3:00</b>	<b>Break</b>	
3:15	ArcMap Operation basics	Richard LeGates,
3:30	Lab on basic GIS operations	Richard LeGates,
<b>5:00</b>	<b>Break</b>	
<b>5:30</b>	<b>Reception</b>	
Tuesday, August 2		
9:00	Introduction to vector GIS <ul style="list-style-type: none"> <li>• The vector GIS model: points, lines, and polygons</li> <li>• Querying</li> <li>• Classifying features</li> </ul>	Richard LeGates,
10:00	Lab on Vector GIS operations. Querying. Classifying features.	
<b>11:00</b>	<b>Break</b>	
11:15	Computerized cartography. Map symbolgy.	Richard LeGates,
<b>12:00</b>	<b>Lunch</b>	
1:30	Computerized cartography. Map symbolgy.	Richard LeGates,
<b>3:15</b>	<b>Break</b>	
1:30	Working with attribute tables <ul style="list-style-type: none"> <li>• Structure of attribute table</li> <li>• Joining and relating data in Excel or SPSS to ArcMap Attribute tables</li> </ul>	Nickel
4:00	Lab on working with attribute tables	Nickel
Wednesday, August 3		
9:00	Introduction to raster GIS	Xiao Hang Liu
<b>10:30</b>	<b>Break</b>	
10:45	Lab exercise on raster-based spatial analysis	
<b>12:00</b>	<b>Lunch</b>	
1:30	Optional open lab. Participants work on their own, individually, or in groups (with technical support).	
2:30	Walking tour of San Francisco (optional)	
Thursday, August 4		
9:00	Vector-based spatial analysis—Overlay, clip, dissolve, buffer, and related operations etc.	Nickel
<b>10:30</b>	<b>Break</b>	
10:45	Lab exercise on vector based spatial data analysis	
<b>12:00</b>	<b>Lunch followed by keynote speaker</b>	
1:00	Keith Clarke (UCSB): "Spatially enhanced social science"	
<b>2:00</b>	<b>Break</b>	

2:15	Group discussion of how participants might incorporate spatial analysis into their teaching	Clarke
3:00	<b>Break</b>	
3:15	Spatial data acquisition	Xiao Hang Liu
4:15	Lab exercise on geocoding	
<b>Friday, August 5</b>		
9:00	Working with census data	Pamuk
10:00	<b>Break</b>	
10:15	Lab exercise on downloading census data and preparing a data set tailored to your area and interests	
Pamuk		
12:00	<b>Lunch</b>	
1:30	Evaluating spatial learning outcomes	Stacy Rebich-Hespanha
3:15	<b>Break</b>	
3:15	Open lab with technical support	
<b>Saturday, August 6</b>		
9:00	Closing workshop procedures	
9:15	Demo of GIS resources	
10:30	<b>Break</b>	
10:45	Participants discussion on curriculum design	
12:00	<b>Lunch</b>	
1:00	Reports/discussion of curriculum design discussions	
2:00	Workshop closes	

## Remote Sensing and GIS Technologies for Undergraduate Curricula in the Social Sciences

July 23–28, 2006, Norman, OK

This workshop will explore the uses of geographic information technologies for undergraduate curricula in the social sciences and offer guidance on the uses of these technologies to enhance spatial understanding for undergraduate social science students. Participants will acquire understanding of the utility of remotely sensed data - how they provide nontraditional, and otherwise unobtainable, measures of social phenomena, and how these measures are used with a wide range of population-related data in GIS for the visualization, analysis, and understanding of social dynamics at micro, macro, and global levels. Lectures, demonstrations, tutorials, and group investigations will foster open discussions to stimulate spatial thinking and problem-solving skills, and to translate these into resources for teaching at the undergraduate level. Applicants should already have basic GIS knowledge since GIS will provide the integrated platform for introducing remote sensing and spatial statistics.

**Instructors:** Tarek Rashed (coordinator), May Yuan, Jon Pedersen (all of The University of Oklahoma), Victor Mesev (Florida State University), and Rebecca Powell (UC Santa Barbara)

**Co-sponsor with CSISS:** The University Consortium for Geographic Information Science [www.ucgis.org](http://www.ucgis.org)

**Host institution:** Department of Geography and the Center for Spatial Analysis, The University of Oklahoma

### Workshop Agenda

<b>Sunday, July 23: Introduction and Motivation</b>		
8:30	Workshop Registration	Melissa Brown
9:00	Orientation and Ice Breaker	Group
9:30	Welcome and overview of remote sensing multidisciplinary education and research initiatives at OU	Lee Williams, VP of Research OU
10:00	The Objectives of SPACE and Resources from the Center for Spatially Integrated Social Science	Don Janelle
10:30	<b>Break</b>	

10:45	Private Universe, Video	
11:15	Science Teaching and the Learner: The Learning Cycle	Jon Pederson
<b>12:00</b>	<b>Lunch</b>	
1:00	Remote sensing and social sciences: A gallery of applications	Tarek Rashed, Katy Rich, Victor Mesev, May Yuan, Lab Consultants
2:15	Computer lab orientation: Login information, overview of software	Chris Cook
<b>2:30</b>	<b>Break</b>	
2:45	Computer exercise: Linking remotely sensed measures and population data to analyze socioeconomic implications of machine space in Los Angeles, CA	Tarek Rashed, Katy Rich, Victor Mesev, May Yuan, Lab Consultants
<b>4:00</b>	<b>Break</b>	
4:15	Group Discussion: Pedagogy discussion (reflections on the Machine Space exercise)	Jon Pedersen, May Yuan, Tarek Rashed, Victor Mesev
<b>5:30</b>	<b>Catered reception &amp; Poster Session</b> (Goal setting for the workshop)	Group

### Monday, July 24: Remote Sensing Classification for Social Science

9:00	Computer exercise: Introduction to image processing software and RS data warehouses	Tarek Rashed, Mang Lung Cheuk, Victor Mesev, Lab Consultants
<b>10:30</b>	<b>Break</b>	
10:45	Introduction to Remote Sensing	Victor Mesev
	<ul style="list-style-type: none"> <li>• Basic RS principles</li> <li>• Types of RS imagery, Data availability</li> </ul>	
	Background Reading (password protected): Mesev Introduction, Introduction to ERDAS IMAGINE	
11:30	Group Reflections	
12:45	Computer exercise: Incorporation of social data in image classification	Victor Mesev, Mang Lung Cheuk, Tarek Rashed, Lab Consultants
<b>2:00</b>	<b>Break</b>	
2:15	RS classification for social science applications	Victor Mesev
	<ul style="list-style-type: none"> <li>• Hard and soft classification</li> <li>• Incorporation of social/economic data in urban image classification</li> </ul>	
<b>3:00</b>	<b>Break</b>	
3:15	Open computer lab and consultation with Faculty	Victor Mesev, Tarek Rashed, May Yuan
<b>4:30</b>	<b>Break</b>	

### Tuesday, July 25: Syllabus Design for Social Science Courses Integrating RS and GIS Technologies

9:00	Small Group Discussions I: Pedagogic considerations in incorporating remote sensing and GIS in undergraduate curricula	Jon Pederson, Dustin Howard, May Yuan, Tarek Rashed, Victor Mesev, Becky Powell
<b>10:15</b>	<b>Break</b>	
10:30	Small Group Discussions II: Technical considerations in incorporating remote sensing and GIS in undergraduate curricula	May Yuan, Dustin Howard, Jon Pederson, Tarek Rashed, Victor Mesev, Becky Powell
	<ul style="list-style-type: none"> <li>• Develop group syllabi, by interest area, including technical challenges based on the exercise and lectures presented July 23–24</li> </ul>	
11:45	Synthesis of group discussion & reflections	Jon Pederson, May Yuan
<b>12:15</b>	<b>Lunch</b>	
1:30	Field Trip and dinner in Oklahoma City	

### Wednesday, July 26: Regional and Nighttime RS data for social applications

9:00	Computer exercise: Regional land-cover change	Becky Powell, Matt Collier, Tarek Rashed, Lab Consultants
<b>10:30</b>	<b>Break</b>	
10:45	Integrating RS and social science for land-cover change studies	
	<ul style="list-style-type: none"> <li>• Linking human decisions to landscape outcomes</li> <li>• Scales of analysis</li> </ul>	

11:30	Background Reading (password protected): A CIESIN Thematic Guide to Social Science Applications of Remote Sensing	Becky Powell
1:45	Group Reflections	
12:45	<b>Lunch</b>	
2:00	Computer exercise: Nighttime imagery	Becky Powell, Matt Collier, Tarek Rashed, Lab Consultants
2:15	<b>Break</b>	
3:15	Nighttime imagery for social sciences	Becky Powell
3:30	<ul style="list-style-type: none"> <li>• Estimating population</li> <li>• Modeling the spatial distribution of economic activities</li> <li>• Measuring human impact on the environment</li> </ul>	
3:45	Background Reading (password protected): Nighttime Lights Data OU SPACE Workshop Night-time Imagery as a Tool for Global Mapping of Socioeconomic Parameters and Greenhouse Gas Emissions Mapping City Lights with Nighttime Data from the DMSP Operational Linescan System 1997a Satellite inventory of human settlements using nocturnal radiation emissions: a contribution for the global toolchest Night-time Lights of the world: 1994–1995 Trends in night-time city lights an vegetation indices associated with urbanization within the conterminous USA Urbanization in Sub-Saharan Africa and implication for malaria control Ecological light pollution Biomass burning and related trace gas emissions from tropical dry deciduous forests of India: A study using DMSP-OLS data and ground-based measurements A scale-adjusted measure of "Urban sprawl" using nighttime satellite imagery An Empirical Environmental Sustainability Index Derived Solely from Nighttime Satellite Imagery and Ecosystem Service Valuation Global estimates of market and non-market values derived from nighttime satellite imagery, land cover, and ecosystem service valuation Throwing light on straddling stocks <i>Illex argentinus</i> : assessing fishing intensity with satellite imagery	
3:15	Group Reflections	
3:30	<b>Break</b>	
3:45	Open computer lab and consultation with Faculty	Becky Powell, Tarek Rashed, May Yuan
<i>Thursday, July 27: GIS as integration platform for RS and social data</i>		
9:00	Computer exercise: Socioeconomic and population dynamics in response to large-scale natural hazardous events	May Yuan, James Bothwell, Becky Powell, Tarek Rashed, Lab Consultants
10:30	<b>Break</b>	
10:45	GIS Analysis and Modeling with RS and Social Data	
11:45	<ul style="list-style-type: none"> <li>• Integration of RS and social data in GIS</li> <li>• GIS tools for spatial analysis</li> <li>• GIS procedures for spatial modeling</li> <li>• Incorporating spatial thinking, analysis, and modeling into social science curricula</li> </ul>	May Yuan
12:00	Group Reflections	
1:00	<b>Lunch</b>	
2:15	Research case studies and general discussion	Becky Powell, Tarek Rashed, May Yuan
2:30	Group Reflections	
2:45	<b>Break</b>	
	Open computer lab and consultation with faculty	Becky Powell, Tarek Rashed, May Yuan
<i>Friday, July 28: Project presentation and wrapping up</i>		
9:00	Session I: Participant Presentations and Peer Feedback	Group
10:30	<b>Break</b>	
10:45	Session II: Participant Presentations and Peer Feedback	Group
12:00	<b>Lunch</b>	
1:00	Comments on pedagogic elements in the projects	Jon Pederson

1:30	Comments on technical elements in the projects	May Yuan
2:00	<b>Break</b>	
2:15	Keynote lecture and commentary "What Does Google Earth Mean for the Social Sciences?" Background Reading (password protected): What does Google Earth Mean for the Social Sciences?	Mike Goodchild
3:30	<b>Break</b>	
3:45	Closing and workshop certificates	Tarek Rashed

### Follow-up Activities for Workshop Participants

The call for applications for SPACE Awards and ACCESS conference proposals are provided below. Consistent with standards of good science, the adjudication panel (made up of the project's PI, Co-PIs, and workshop instructors) was assigned the task of achieving a balanced distribution of awards across disciplines and across topical research domains.

These programs were formally introduced in November 2004, drawing initially from participants in the 2004 workshops. Workshop participants in subsequent years were added to the invitation list for application announcements, distributed in November of 2005, 2006, 2007, and 2008.

#### CALL FOR APPLICATIONS FOR SPACE INSTRUCTIONAL DEVELOPMENT AWARDS

SPACE invites applications from faculty at four-year colleges and universities for instructional development awards to fund (up to \$1500 of verified expenses) program activities for spatial thinking in undergraduate social science education. Examples of eligible award uses include:

- Presentation of a conference paper about teaching spatial thinking at the undergraduate level in the social sciences.
- Participation in a workshop or training program on uses of spatial analysis/GIS software (e.g., a GIS vendor workshop, ICPSR workshop, or GeoDa workshop with Luc Anselin).
- Participation in a professional workshop dedicated to instruction and student learning of spatial analysis concepts and technology.

To apply, you must have attended a SPACE workshop. **Please submit:**

- Evidence of achievement in meeting instructional goals to implement spatial approaches in your undergraduate course(s) or programs. Examples might include a new syllabus, curriculum development or assessment resources, a superb example of a student course project, and efforts to enhance the diversity of students who benefit from spatial perspectives. Please specify how your instructional development initiatives have benefited the advancement of spatial perspectives in undergraduate education.
- A statement of how the SPACE workshop inspired and/or supported your achievement.
- Commitment to prepare a short case study or example of your achievement for posting on the SPACE website.
- A description of how you would use the expense allocation of up to \$1500 to enhance your instruction of spatial approaches or to help in the dissemination of spatial methodologies to students and colleagues.

### Call for Proposals for ACCESS Academic Conference Courses to Enhance Spatial Science

The ACCESS program is described on the SPACE website as follows:

SPACE sponsors special sessions, short courses, and short workshops on spatial methodologies and curricula development at annual conferences of academic associations. When appropriate, these sessions and short workshops will feature instructors and participants from prior SPACE workshop and symposia programs, and involve educators from the host of disciplines represented at the conference. These may feature demonstrations of how spatial analysis brings added value to instructional programs; others might focus on hands-on instruction in specific spatial methodologies (e.g., spatial visualization of geo-referenced data), or will address issues regarding student needs, expectations, and assessment of learning. These

conference-related events are intended to broaden exposure to the availability of SPACE programs—an opportunity to advertise workshops and to direct instructors to hardcopy and online resources that might assist their classroom offerings and professional development. In addition, the conference setting exposes SPACE personnel to the interests, culture, and needs of scholars from diverse disciplinary backgrounds, enabling more informed and responsive programs for the annual workshop program.

For previously funded ACCESS sessions, see <http://www.csiss.org/SPACE/workshops/sessions.php>

### **INSTRUCTIONS ON APPLYING FOR SPONSORSHIP OF CONFERENCE PROGRAMS**

If you are interested in seeking modest financial support from SPACE, you will need to profile the conference/organization and explain why it provides an appropriate venue for SPACE outreach, and also demonstrate that the workshop plan is consistent with the objectives of SPACE. In a 2-page proposal, please describe the following:

- The Organization (description, objectives, membership)
- The Conference (where, when, purpose/general themes, number of participants, disciplinary mix)
- The Proposed Workshop:
  - Title, duration (half-day/full-day?)
  - Instructors (brief profile)
  - Objectives (see: <http://www.csiss.org/SPACE/about/mission.php>)
  - Agenda
  - Advertising strategy to attract participants
  - Anticipated attendance and disciplinary background of participants
  - Estimated Budget

Organizers who are supported by SPACE agree to the following:

- provide SPACE with a brief report on the outcomes of the workshop: list of attendees and their disciplines, contact information, and details on any workshop-related follow-up activities;
- include a representative from SPACE in the organization and presentation of the workshop;
- post an announcement about the workshop on the SPACE site, borrowing heavily from the proposal;
- post appropriate workshop PowerPoint presentations (pdf format) and workshop-related instructional resources; and
- provide documentation for assessing participant evaluations (from a short post-workshop survey).

The SPACE financial commitment to conference workshop organizers/instructors is to cover travel, conference registration, lodging (only 2 nights) and per diem; SPACE will support the workshop instruction period rather than the full conference participation of workshop leaders. If you are bringing in a special guest presenter for the workshop, a modest honorarium may be considered. SPACE reserves the right to modify this formulation based on the cost considerations of meeting venues and on the availability of funds.

### **Follow-up Surveys**

Follow-up surveys of workshop participants were administered over a secure website in spring 2005, 2006, 2007, and 2008, approximately 10 to 12 months following the annual workshops. Results are documented in the “Findings” section of this report.



NSF Proposal 0231263: NSF 02-043 CCLI National Dissemination

**Final Report to NSF**

June 2009

**Findings**

**1. INTRODUCTION**

In the past decade, significant interest has emerged beyond the traditionally spatial disciplines, such as geography or geology, to engage the analytical and theoretical understandings that can arise from adopting spatial perspectives and methodologies. In the social sciences, special issues of leading national and international journals (Table 1) have featured the role of maps in visualizing geographically referenced social data, geographic information systems (GIS) for exposing spatial relationships among variables and geographical patterns, and spatial econometrics for exploratory data analysis and model building. These special journal issues bracket the period associated with the founding of the NSF-supported Center for Spatially Integrated Social Science (CSISS) in 1999 and the last of its SPACE workshops in summer 2007. These journals document how the increasing availability of geo-referenced data, improvements in spatial software, and internet-enhanced accessibility to resources and training opportunities are contributing factors to this growing interest. They also confirm the important roles played by research funding agencies (especially the National Science Foundation), academic organizations, and businesses worldwide.

CSISS has as its mission the development and support of infrastructure to embed spatial analysis in the social and behavioral sciences. One of its most important strategies for fostering principles of spatially integrated social science has been a program of residential training workshops. Over the summers 2000–2008, more than

<b>Table 1. Journals (1999–2007) Featuring Applications of Spatial Analysis in the Social Sciences</b>
<i>Journal of Quantitative Criminology</i> 1999, 15 (4)
<i>Social Science History</i> 2000, 24 (3)
<i>Geographical &amp; Environmental Modelling</i> 2001, 5 (1)
<i>Agricultural Economics</i> 2002, 27 (3)
<i>Political Analysis</i> 2002, 10 (3)
<i>Political Geography</i> 2002, 21 (2)
<i>Rural Sociology</i> 2002, 67 (4)
<i>International Regional Science Review</i> 2003, 26 (3)
<i>Journal of Economic Geography</i> 2004, 4 (1)
<i>Proceedings of the National Academy of Sciences</i> 2005, 102 (43)
<i>American Journal of Preventive Medicine</i> 2006, 30 (2)
<i>Geographical Analysis</i> 2006, 38 (1)
<i>Environmental and Ecological Statistics</i> 2007, 14 (1 & 2, 3)
<i>Population Research Policy Review</i> 2007, 26
<i>Journal of Econometrics</i> 2007, 140 (1)

800 scholars have received CSISS training in such technologies as GIS, cartographic visualization of social science data, remote sensing, spatial econometrics, spatial demography, and spatial data modeling. Early workshops focused on a young cohort of researchers (e.g., Ph.D. candidates and un-tenured professors), based on the rationale that dissemination would proceed through the demonstrations and the effects of improved scientific understanding for dissertations, publications, and grant proposals by active scholars. It was anticipated, also, that this approach would foster the inclusion of spatial methodologies in instructional practices at graduate and undergraduate levels.

**STRUCTURING A PROGRAM FOR UNDERGRADUATE INSTRUCTORS IN THE SOCIAL SCIENCES**

One of the CSISS training initiatives, featuring one 12-day, seven 6-day, and three 5-day-long residential workshops, was directed explicitly to serving the needs of undergraduate instructors in the social sciences—Spatial Perspectives on Analysis for Curriculum Enhancement. SPACE offered its

first set of workshops in summer 2004. By summer 2007, 218 university instructors and Ph.D. candidates had been introduced to applications of spatial tools to help enhance the integration of spatial thinking for undergraduates across the social sciences. SPACE promoted the value of spatial thinking and associated technologies as a basis for integrating knowledge among disciplines and motivating students through project-based learning on applications relevant to understanding society.

SPACE workshop participants lived together in university dormitory settings and took part in intensive daily training and discourse. Although there was a focus on selecting early-career scholars, participants spanned academic generations, and workshop activities encouraged collaborative networks among participants by stressing the commonality of the spatial perspective to problem identification and to research and teaching approaches. The disciplinary mix of SPACE participants spanned a range of knowledge domains and interest in workshop participation exceeded capacity by a significant margin (Table 2).

This report describes and analyzes SPACE workshop experiences in engaging social science instructors in discourse on enhancing the spatial analytic skills of undergraduate students and in serving as a platform for the sustained dissemination of spatial thinking in the social sciences.

The findings presented in this report are based on two analyses:

1. A review of SPACE participant selection and assessment of their entry, exit, and follow-up survey responses; and
2. A review of how workshop participants used SPACE's follow-up programs to deepen their understanding of spatial methodologies for spatial thinking and to facilitate national dissemination at campus, regional, and national levels.

These analyses are described and interpreted below under the following headings:

2. Applicants and Participants
3. Professional Development in SPACE
4. SPACE Resources for Teaching and Learning (SPACE website)
5. Follow-up Support for Workshop Participants: Educational Development Awards
6. Follow-up Support for Workshop Participants: Academic Conference Courses to Enhance Spatial Science (ACCESS)
7. Impact of SPACE from the Analysis of Participant Surveys
8. Conclusions

Appendices (survey forms, participants, and participant comments)

## **2. APPLICANTS AND PARTICIPANTS**

In advertising the program, the general criteria for selecting participants included having experience with computers and a favorable disposition to rigorous analysis, enthusiasm and commitment to teaching undergraduate students, as well as assembling a group with representation from across social science disciplines.

Having a large number of applicants to choose from enabled a good fit between the expectations of the workshop leaders and the experience and abilities of participants. Thus, although faculty members were preferred for this program, a few Ph.D. candidates (showing a strong commitment to teaching undergraduate students) also participated. Participants agreed to include spatial perspectives and analysis in their undergraduate courses and to complete follow-up surveys on their uses of the workshop experience to enhance undergraduate courses and curriculum. In general, program applicants were comfortable with quantitative methodologies in the social sciences, although not necessarily from a spatial perspective.

The discipline breakdown for the aggregate of all 218 participants over all workshops reflects prevailing patterns of academic activity in spatial analysis within the social sciences and related specializations. The final distribution of participants across disciplines is also related to the program's deliberate attempts to achieve a broad representation of the social sciences, focusing on participants with high estimated potential for new dissemination.

Owing to their potential for achieving greater immediate dissemination, existing university faculty members with Ph.D.s were favored (72% of final participants) over applicants still in student status. Women (52%) were admitted at a slightly higher rate than men (48%). All eleven workshops had both male and female instructors.



<b>Table 2. SPACE Workshop Participants and Applicants 2004–2007</b>				
<b>Disciplines</b>	<b>Applicants</b>	<b>Participants</b>	<b>Acceptance Rate</b>	<b>Percent of Total Participants</b>
Anthropology	19	12	.63	5.5
Archaeology	14	11	.79	5.0
Art & Design	1	1	1.00	0.5
Communications	1	1	1.00	0.5
Computer Science	20	0	.00	0.0
Criminology	9	7	.78	3.2
Demography	8	6	.75	2.8
Economics	24	17	.71	7.8
Education	2	2	1.00	0.9
Environmental Studies	30	14	.47	6.4
GIS	75	27	.36	12.4
Geography	48	33	.69	15.1
History	7	4	.57	1.8
Political Science	24	17	.71	7.8
Psychology	20	0	.00	0.0
Public Health	11	9	.82	4.1
Public Policy & Management	3	1	.33	0.5
Regional Science	6	4	.67	1.8
Religious Studies	1	1	1.00	0.5
Sociology	46	33	.72	15.1
Statistics	3	2	.67	0.9
Tourism Planning	2	2	1.00	0.9
Urban/Region Planning	25	10	.40	4.6
Urban Studies	13	4	.31	1.8
Other	2	0	0.00	0.0
<b>Total:</b>	<b>378</b>	<b>218</b>	<b>.58</b>	
<b>Gender/Minorities:</b>				
Female	166	113	.68	51.8
Male	212	105	.50	48.2
Designated Minorities	59	43	.73	19.7
<b>Completion:</b>		<b>% completed</b>		
- workshop	216	99.1		
- entry survey	217	99.5		
- exit survey	202	92.7		
- follow-up survey	136	62.4		

The applicant pool for SPACE workshops was sufficiently large to allow **diversity** based on discipline, gender, and type of academic institution (e.g., liberal arts and technical colleges, and comprehensive research universities). Thus, as documented in Table 2, nearly 20 percent of workshop invitees were instructors from institutions that NSF designates as minority-serving (Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions, and Tribal Colleges). Diversity is regarded by NSF as a key factor in achieving national dissemination, providing opportunities to advance student learning with technologies that reflect growth in economic opportunities for minorities.

Success in reaching designated minority individuals exceeded our expectations—the result of focused initiatives, including extra financial stipends to encourage participation by qualified candidates. This resulted in 43 participants from Hispanic American, Native American, and African American communities (drawn from 59 applicants). The acceptance rate for minority applicants was 73 percent, compared with an acceptance rate of 53 percent for all 378 applicants.

### 3. PROFESSIONAL DEVELOPMENT IN SPACE

#### STRUCTURING WORKSHOPS AND PROGRAM OBJECTIVES

SPACE's specific **goal** was to assist faculty in becoming innovative teachers in the use of spatial analysis, enabling them to provide opportunities for their students to work directly with geo-referenced databases and the latest software. Correspondingly, each workshop featured outstanding computer and instructional facilities as well as support from workshop leaders recognized for their ability to communicate across disciplinary boundaries. Hands-on experience and customized support for each workshop participant were of critical importance to achieving workshop outcomes that participants could then transfer to their home institutions.

The **general objectives** of the workshops were to:

- demonstrate the value of knowledge integration through a common focus on spatial perspectives for enhanced understanding of problems traditional to the social sciences—a goal consistent with recent high-profile statements on the importance of the spatial perspective (Colwell, 2004; Butz & Torrey, 2006);
- promote the integration of technology in undergraduate education by exposing workshop participants to software tools that are both fiscally affordable for their institutions and cognitively accessible for their students;
- establish and encourage support networks based on strong peer-to-peer interaction throughout the workshop period and in follow-up activities; and
- lay the foundation for broad national dissemination of spatial thinking in the social sciences.

#### WORKSHOP PEDAGOGY

A primary concern of workshop organizers was to facilitate the transfer of the workshop experience to undergraduate teaching. This transfer influenced all aspects of workshop planning and was guided by the following questions:

- How can materials and concepts presented in workshops be reconciled with what participants can teach in their undergraduate courses?
- How can workshops be structured to illustrate the benefits of alternative teaching formats that participants might use to enhance the learning of their undergraduate students?
- How can workshops encourage and equip participants to adopt learning assessment practices with their students?
- How can workshops engage participants in useful strategies for finding and manipulating relevant data for use in their undergraduate teaching?

The pedagogy for different sections of the workshops was varied to help demonstrate the value of different types of instruction; for example, combinations of small-group discussions, individual laboratory assignments, and lectures can address a variety of learning goals and student learning styles (McCray, DeHaan, & Schuck, 2003).

Because workshop participants came from different disciplinary backgrounds and had varied levels of prior exposure to spatial thinking, exercises were designed to meet the needs of both novice and experienced users of GIS and spatial statistics. Participants were paired for some exercises so that one had more experience than the other. This not only provided teaching opportunities for more experienced participants, but also required that workshop exercises be designed to provide enough challenge and simultaneously offer a reasonable starting point for less experienced participants.

## CURRICULUM DEVELOPMENT, LEARNING ASSESSMENT, AND THE WORKSHOP AGENDA

The actual structuring of the workshop agenda considered the characteristics of the participant group—their disciplines, prior knowledge and experiences, and stated personal objectives for participating, as determined by their responses in application and entry surveys. Using one of the workshops at the University of California, Santa Barbara (UCSB) as an example, the workshop's structure was sufficiently flexible to permit participant requests for topical discussions or instruction and for one-on-one consultation.

A stylized graphic agenda (Figure 1) provides a summary of the workshop syllabus for the 2007 workshop at UCSB. From left to right, the five columns (time arrows) reflect the general sequence of activities over the six days. They represent: (1) general logistics for academic and social events, (2) linking spatial theory and analysis with social science perspectives, (3) alignment of theory and analysis skills with pedagogic needs and assessment of student learning, (4) structured labs for the development of technical skills, and (5) preparation of individual projects for presentation on the final day of the workshop. See the full agenda at <http://www.csiss.org/SPACE/workshops/2007/UCSB/agenda.php>.

The workshop schedule provided early opportunities for participants to share previous experiences and expertise, especially in terms of curriculum development and assessment (see Figure 1, column 3, pedagogy and assessment). An early introduction to relevant cognitive theories about spatial learning (McCray, DeHaan, & Schuck, 2003; National Research Council, 2006) was motivated by the expectation that these would guide the design of participant presentations for the final day of the workshop (column 5). Research on the influence of prior knowledge was discussed and strategies for collecting data on the entry-level knowledge of students were suggested (Bransford, Brown, & Cocking, 1999). In practice, only a few workshop participants had experience in assessing the prior knowledge of their students.

Participants also shared experiences on course evaluations and learning assessments, frequently noting the benefits of short in-class exercises, individual projects, and group work on projects in local communities. These discussions supplemented ideas on in-class surveys for learning assessments for tracking the progression of student learning on such topics as data interpretation, synthesis, problem analysis, and modeling. Other discussions focused on matching course objectives and instruction with the final performance assessment of student achievement (Angelo & Cross, 1993), and on ideas of how to guide students in developing portfolios of their work to satisfy course requirements as well as for use in future careers.

## PROFESSIONAL DEVELOPMENT ISSUES IN SPACE

To prompt discussion about SPACE professional development priorities for **program evaluation and student assessment**, Fiona Goodchild (SPACE Coordinator of Professional Development) provided guidance to instructors in the various workshops, raising questions and identifying goals that link SPACE program initiatives with NSF's CLLI objectives for learning in STEM disciplines. Annual planning meetings in December 2003, 2004, and 2005 were of exceptional value in sorting out priorities for program development, establishing criteria for selecting participants, determining the differentiation of workshops, initiating the organization of workshop materials, and planning final workshop agenda. They also provided an opportunity for workshop instructors to reach common understanding about the importance of program evaluation and the promotion of good practices of student assessment. In these meetings, Goodchild was assisted by Kathryn Plank (Associate Director, Faculty & TA Development, Ohio State University), Jon Pederson (Dean, College of Education, University of Oklahoma), Stacy Rebich-Hespanha (graduate student interested in student learning, UCSB).

Donald Cartwright (Coordinator, Faculty Mentor Program in the Teaching Support Centre, University of Western Ontario), Eric J. Fournier (Chair, Department of Geography and Co-Principal Investigator for an NSF-funded project on Academic Excellence through GIS project (AEGIS), Samford University), Richard Johnson and Stanley Nicholson (former directors, Office of Instructional Consultation, UCSB) participated as external consultants regarding professional development, pedagogy, and learning assessment for SPACE. Together, this team demonstrated exceptional leadership in directing the SPACE program toward an insightful incorporation of successful professional development practices that were valued highly by workshop participants.

Goodchild, Plank, Rebich-Hespanha, and Pederson were on hand for all the workshops at their institutions, providing lectures on pedagogy and learning assessment, guiding group discussion, and assisting workshop participants with issues of project and curriculum development and instrument design. In addition, Goodchild and Rebich-Hespanha provided professional development support for the workshops at San Diego State University (2004) and San Francisco State University (2005).

# SPACE workshop 2007 - UCSB

participants ♦ instructors

prior knowledge ♦ experience ♦ expertise

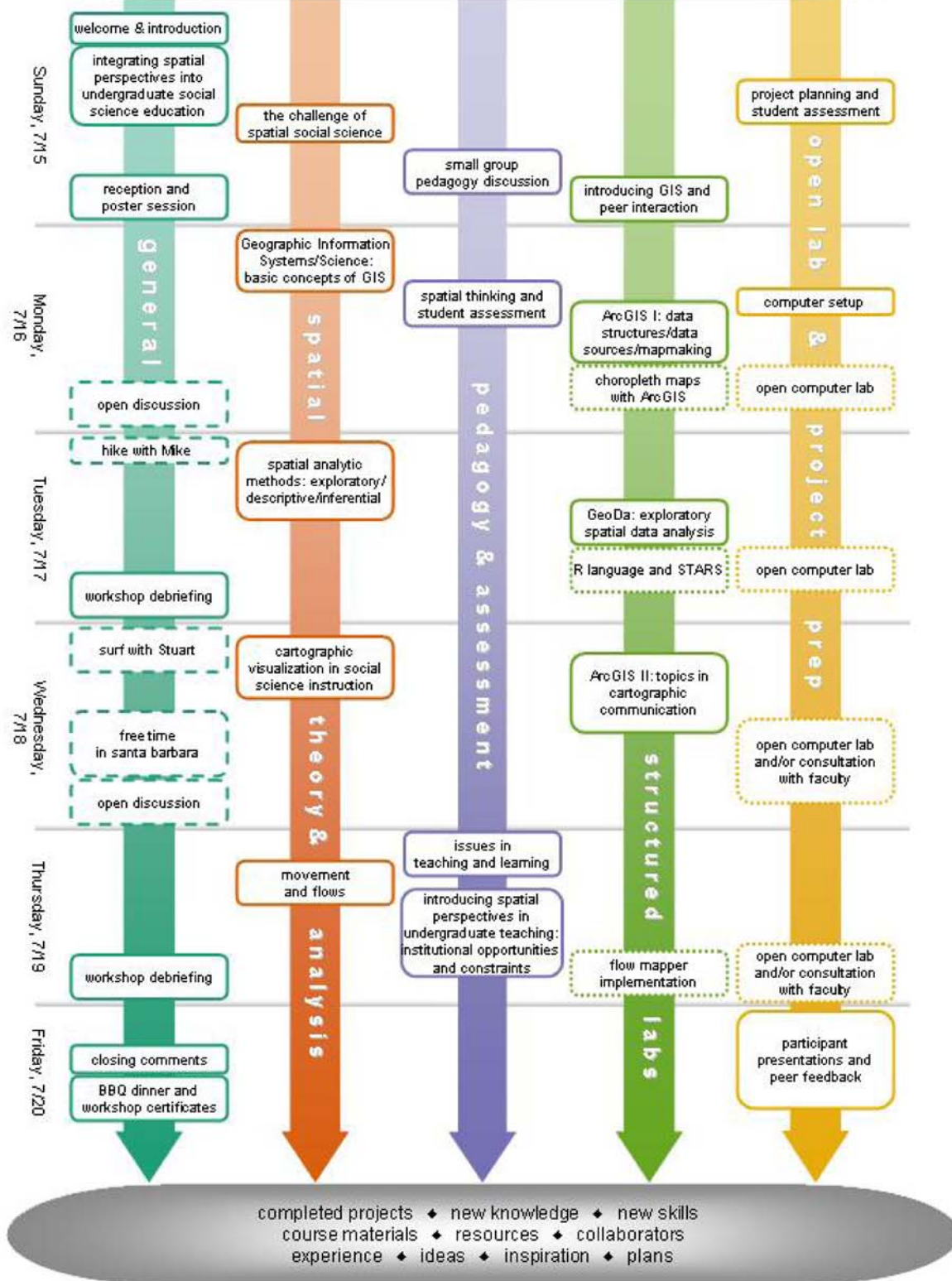


Figure 1. Summary of the workshop syllabus for the 2007 workshop

Two questions were of special significance for the development of SPACE workshops and for the transfer of workshop experiences to promote undergraduate learning opportunities:

### **1. To what extent will SPACE programs influence the incorporation of spatial perspectives and analysis into undergraduate courses?**

#### **Program Evaluation**

- How do participants benefit from participation in SPACE workshops and follow-up activities?
- This question was considered for three suggested dimensions of **professional development objectives**, listed below.

#### PERSONAL:

- Improve fundamental understanding of spatial methods and principles.
- Improve ability to understand and use related software.

#### PROFESSIONAL:

- Engage faculty in development of curriculum, including lab exercises, demonstrations, and lectures.
- Engage faculty in collaboration with network of researchers who teach social science courses from a spatial perspective.
- Disseminate teaching resources on SPACE web site or at academic meetings (providing guidelines and criteria for identifying best practices).

#### INSTITUTIONAL:

- Enhance undergraduate curriculum with new concepts, principles, and techniques of spatial analysis.
- Implement new undergraduate courses that build on spatial thinking and perspectives, such as GIS and spatial pattern analysis.
- Conduct student evaluation of new initiatives.

These professional development objectives for SPACE provided a basis for designing questions that appeared on the workshop application form, as well as in the entry, exit, and follow-up surveys of workshop participants. This approach helped to document the prior knowledge of participants entering workshops and provided benchmarks for measuring and documenting relevant results and program success. Surveys included both open-ended questions and scaled rankings of specific items. They were supplemented in most workshops with instructor-directed discussions about technical issues in spatial analysis and with peer-group discussions about pedagogical and assessment practices.

### **2. How can SPACE help faculty to develop methods for assessing and grading student learning and performance in enhanced or new courses?**

#### **Student Assessment**

- SPACE did not have the resources to conduct student assessment at remote sites. However, to make the claim that a spatial perspective is important to student achievement in social science disciplines, all SPACE workshops presented and discussed methods for faculty to use in documenting the impact of pedagogical initiatives on student learning.
- Workshop discussion focused on the types of questions and rubric designs that are matched to instructional and learning objectives and that demonstrate student learning and understanding of spatial concepts and analytical approaches.
- At UCSB the Office of Instructional Consultation offers help on certain topics (e.g., how to guide instruction, enhance learning, or assign grades), and provides examples of assessment used in various courses. Since many workshop participants work within the constraints of their local departments or institutions, they were encouraged to seek guidance from campus resource centers and local peers who are currently engaged with the design and use of assessment instruments.

### REFERENCES CITED IN SECTION 3:

- Angelo, T. A., & K. P. Cross (1993) *Classroom Assessment Techniques: A Handbook for College Teachers*. San Francisco, CA: Jossey-Bass.
- Bransford, J. D., A. L. Brown, & R. R. Cocking, Eds (1999) *How People Learn: Brain, Mind, Experience, and School*. Washington, DC: National Academy Press.
- Butz, W., & B. B. Torrey (2006) Some frontiers in social science, *Science*, 312(5782): 1898–1900.
- Colwell, R. (2004) The new landscape of science: a geographic portal, *Annals of the Association of American Geographers*, 94(4): 703–708.
- McCray, R. A., R. L. DeHaan, & J. A. Schuck, Eds (2003) *Improving Undergraduate Instruction in Science, Technology, Engineering, and Mathematics: Report of a Workshop*, National Research Council Steering Committee on Criteria and Benchmarks for Increased Learning from Undergraduate STEM Instruction. Washington, DC: The National Academies Press.
- National Research Council (2006) *Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum*. Washington, DC: The National Academies Press.

## 4. RESOURCES FOR TEACHING AND LEARNING (SPACE WEBSITE)

### LEARNING AND TEACHING RESOURCES

Workshop participants had access to an extensive set of resources available on the CSISS and SPACE websites to assist their preparations for the workshop and to make use of in their own teaching. Through the CSISS Learning Resources portal at [http://www.csiss.org/learning\\_resources](http://www.csiss.org/learning_resources), they had access to the following:

- The CSISS **GIS Cookbook**—simple tutorials on basic GIS operations aimed at social scientists with minimum knowledge of geography and GIS and its underlying principles.
- CSISS **edited video clips**—presentations by instructors from prior workshops on *Map Making and Visualization of Spatial Data in the Social Sciences*, *Spatial Pattern Analysis in a GIS Environment*, and *Geographically Weighted Regression* (Fotheringham, Brunsdon, & Charlton, 2002).
- The **CSISS Classics**—a collection of vignettes that feature summary discussion about contributions to spatial thinking by social scientists. The *Classics* give primary emphasis to research before 1980, with an attempt to capture and acknowledge the repository of spatial thinking from such disciplines as anthropology, economics, geography, history, political science, sociology, and urban studies over the past few centuries. This collection, visited by approximately 30,000 visitors per month, documents some of the intellectual inheritance of spatial thinking by social scientists and is a useful resource for students.

The spatial tools page (<http://www.csiss.org/clearinghouse/>) enabled the downloading of spatial statistics software, including:

- **GeoDa™** for exploratory spatial data analysis—one of the primary software tools used in SPACE workshops. Aside from its value as a serious research tool, it provides an excellent resource for engaging undergraduate social science students in rigorous data analysis and visualization exercises (Rey & Anselin, 2006).
- **FlowMapper**, developed by Waldo Tobler for mapping flows from interaction matrices, was another easy-to-use tool appropriate for exercises to use in undergraduate teaching.

In addition, the SPACE site offered an assembly of resources organized by discipline (including syllabi and exercises) and information on learning assessment and curriculum development. Guides for selecting GIS software and for using virtual globes (e.g., Google Earth) were oriented to applications in teaching. A special collection of instructional innovations from prior workshop participants illustrated the benefits of the SPACE program and provided pedagogic guidance for other social scientists seeking to adopt spatial perspectives in teaching (<http://www.csiss.org/SPACE/materials/participants/>).

The SPACE website was the principal vehicle for managing SPACE programs across different universities, distributing workshop materials to participants, and sharing teaching and learning resources. Resources organized by discipline have proven especially popular for visitors to the site (including workshop participants). In the no-cost extension period (October 2007–March 2009), the discipline section was enhanced, consolidating resources

from various places on the site (learning, teaching, and assessment materials; links, special collections (e.g., CSISS classics), workshop participant contributions, and conference sessions, etc.) around discipline names that are common search terms. It is anticipated that this will facilitate both academic and public accessibility to resources upon conclusion of the SPACE program.

Traffic logs for the site were analyzed using *WebTrends Log Analyzer*.

<b>Table 3. Use of Website (<a href="http://www.csiss.org/SPACE">www.csiss.org/SPACE</a>) 1 January 2004–31 March 2009</b>					
<b>Reporting Period:</b>	<b>1/1/04– 7/31/04</b>	<b>8/1/04– 8/15/05</b>	<b>10/1/06– 9/30/07</b>	<b>10/1/07– 9/15/08</b>	<b>9/2/08– 3/31/09</b>
Days in reporting period	213	380	365	351	211
Total hits	179,491	584,598	661,947	458,916	283,329
<b>Average hits per day</b>	<b>843</b>	<b>1,538</b>	<b>1,814</b>	<b>1,307</b>	<b>1,342</b>
Total visitors	11,730	54,760	114,993	77,892	43,477
<b>Average visitors per day</b>	<b>55</b>	<b>144</b>	<b>315</b>	<b>223</b>	<b>206</b>
Number of unique visitors	3,010	12,788	23,463	21,384	14,797
<b>Percent repeat visitors</b>	<b>27</b>	<b>23</b>	<b>26</b>	<b>31</b>	<b>18</b>
<b>Average visitor length (minutes)</b>	<b>12.2</b>	<b>21.4</b>	<b>13.5</b>	<b>21.2</b>	<b>26.3</b>
<b>The Most Requested Areas on the Site ( number in period / average number per day)</b>					
Home page	2,059 / 10	6,354 / 17	7,676 / 21	6,164 / 18	6,184 / 29
Workshop home page	2,857 / 13	4,169 / 11	5,033 / 14	4,404 / 12	3,188 / 15
Discipline Resources	992 / 5	3,463 / 9	9,768 / 27	6,332 / 18	5,462 / 26
Learning resources	538 / 3	1,276 / 3	1,788 / 5	1,404 / 4	1,263 / 6
Teaching materials	582 / 3	1,269 / 3	1,777 / 5	1,307 / 4	1,282 / 6
Participant contributions			1,468 / 4	1,086 / 3	987 / 5
About the program			1,653 / 5	1,291 / 4	1,170 / 6
Choosing a GIS		1,139	2,095	993	
Forum	769	2,414			
My page	579				
UCSB workshop	889	1,591	1,717		
OSU workshop	772	1,289	1,702		
SDSU workshop	743				
SFSU workshop		1,160			
Oklahoma workshop			1,010		
Workshop application	502	1,100	1,123		

It was anticipated that use of the website would decline following the final SPACE workshops in 2007. This has been the case, however, the decline has not been substantial. Because the reporting periods vary in duration, raw number of hits and visitors are standardized to per-day measures. An increase in the average time that visitors spend on the site is a possible indicator that current users value the site; however a drop in the proportion of repeat users may be a sign that the absence of annual workshops has decreased its immediate attraction. Based on the exit surveys of workshop participants, an assessment of the site's value was presented in prior annual reports. Regrettably, the annual follow-up surveys did not track the persistence of its value for these participants.

#### REFERENCES CITED IN SECTION 4:

- Fotheringham, A. S., C. Brunsdon, & M. Charlton (2002) *Geographically Weighted Regression. The Analysis of Spatially Varying Relationships* (New York: John Wiley).
- Rey S., & L. Anselin, Eds (2006) Special issue on software for spatial analysis in the social sciences, *Geographical Analysis* 38(1).

### 5. FOLLOW-UP SUPPORT FOR WORKSHOP PARTICIPANTS

#### LEVERAGING WORKSHOPS THROUGH ACADEMIC DEVELOPMENT AWARDS

While the workshops were vehicles for dissemination of spatial thinking and methodologies to a number of scholars, their effectiveness was enhanced by follow-through professional development opportunities and active peer support networks established during the workshops. Special initiatives to maintain the momentum for workshop participants and to engage them as active agents of dissemination included a program of academic development awards.

Based on participants' accomplishments with instructional innovations at their home institutions, the awards program made modest funds available for the design of exercises, implementation of new courses, and organization of local workshops and seminars to expand resources and interest in spatial methodologies among faculty from different disciplines. These awards also supported their continued acquisition of skills by attending special training sessions and the building of databases that contribute to exercises based on social and environmental problems in local regions. These accomplishments are summarized in greater detail in Table 4 and on the SPACE website, where they represent resources for use and inspiration to other instructors and website users (see <http://www.csiss.org/SPACE/materials/participants/>).

Recipients represent the disciplines of anthropology, archaeology, communication, criminal justice, demography, economics, geography, health sciences, history, international studies, library science, political science, resources management, sociology, and urban studies/planning. This program has enabled SPACE to provide examples on its website of what workshop participants have accomplished, while simultaneously providing a resource base of ideas, exercises, and syllabi for website visitors and for other workshop participants. Awardees did not necessarily use all of the funds allocated to them; this allowed for a few additional awards during the no-extension period of NSF support.



Table 4. SPACE Instructional Development Awards 2004–2009

Award Recipients	Affiliation	Accomplishments	Use of Award
<b>2004 Awards</b>			
<p><b>Veronica Arias, Heather Richards, &amp; Judith Van der Elst</b> \$2250</p>	<p>Archaeology, University of New Mexico</p>	<p>Developed new undergraduate course on Geospatial Analysis in Archaeology.</p>	<p>Participated in a conference and workshop; organized a campus-wide symposium on spatial analysis for archaeologists, and completed further course development.</p>
<p><b>Kathleen Bell</b> \$1000</p>	<p>Economics, University of Maine</p>	<p>Altered course on Resource Economics to include independent student projects and spatial thinking using GIS and spatial statistics.</p>	<p>Attended conference on Computers in Urban Planning and Urban Management, in London, to gain new ideas for course development.</p>
<p><b>Wendy Bigler</b> \$750</p>	<p>Geography, Southern Illinois University Carbondale</p>	<p>Designed core curriculum class on “Environmental Conservation” that emphasizes critical spatial reasoning. Introduced GeoDA-based exercises for three other courses.</p>	<p>Collaborated with Chris Weiss on a “best practices” article about using GeoDA in undergraduate social science classrooms for presentation at the 2006 annual meeting of the American Association for the Advancement of Science (AAAS).</p>
<p><b>Mark Bjelland</b> \$1000</p>	<p>Geography, Gustavus Adolphus College</p>	<p>Develop a new course syllabus that makes use of GeoDa and ArcView, introduced GeoDa to colleagues for undergraduate teaching, and developed plans for a college-wide workshop on why space matters in statistical analysis.</p>	<p>Attended conference on Computers in Urban Planning and Urban Management, in London, for purposes of further undergraduate course development.</p>
<p><b>Ulla Bunz</b> \$1000</p>	<p>Communication, Rutgers University</p>	<p>Redesigned course syllabus to include “spatial perspectives on social change” and developed student field-research exercises.</p>	<p>Organized a short course on integrating spatial research in communication teaching for the International Communication Association meetings in Dresden (2006).</p>
<p><b>Owen Dwyer</b> \$500</p>	<p>Geography, Indiana University, Indianapolis</p>	<p>Developed course exercise to measure the influence of distance on society, using the gravity model as a basis for students to apply and think critically about spatial modeling.</p>	<p>Participated in spatial analysis workshops at the annual meeting of the Association of American Geographers.</p>
<p><b>Jo Beth Mertens</b> \$1250</p>	<p>Economics, Hobart &amp; William Smith Colleges</p>	<p>Developed a course exercise “Introducing Spatial Analysis Using GeoDa” and gave related presentation at the “Teaching Economics: Instruction and Classroom-based Research” conference.</p>	<p>Attended a course by Luc Anselin on spatial statistics and offered a seminar on spatial analysis in teaching for undergraduate instructors at Hobart &amp; William Smith Colleges.</p>

Award Recipients	Affiliation	Accomplishments	Use of Award
<b>David Padgett</b> \$750	History, Geography, & Political Science, Tennessee State University	Designed modules using student-gathered research data to demonstrate spatial concepts, using Arc GIS, GeoDa, and FlowMapper.	Gave presentation on “GIS-Supported Demonstration Modules in an Undergraduate Urban Geography Course” for the 2005 ESRI Education User Conference.
<b>Susan Pulsipher</b> \$500	Director, Library Services, Methodist College	Developed syllabus for course on <i>Introduction to Spatial Analysis</i> and planned a baseline survey on GIS use prior to incorporating GIS into the curriculum of the college.	Participated in workshops to enhance uses of GIS in studies of criminal justice and community participation, and presented papers on using GIS in teaching to conferences on library and information science.
<b>Sumeeta Srinivasan</b> \$500	Div. of Engineering & Applied Sciences, Harvard University	Introduced course on “Spatial Analysis of Environmental and Social Systems,” attracting students from Applied Mathematics, Economics, Environmental Sciences, the Kennedy School of Government, Earth and Planetary Sciences, and Environmental Engineering. GIS and GeoDa are featured.	Explored organization of a Harvard/ MIT/ BU community workshop on spatial analysis involving leading researchers in the GIS and spatial analysis fields. Presented a paper on teaching spatial analysis to a social science conference.
<b>Christopher Weiss</b> \$750	Sociology, Columbia University	Designed new courses for interdisciplinary Urban Studies undergraduate program at Columbia-Barnard: “Conceptual Issues in Spatial Analysis for the Social Sciences,” and “Methodological Issues in Spatial Analysis for the Social Sciences.” Both courses employ modules for students to use GIS and GeoDa software.	Collaborated with Wendy Bigler on a “best practices” article about using GeoDA in undergraduate social science classrooms for presentation at meetings of the AAAS and the Association for Public Policy Analysis and Management.
<b>Petra Zimmermann</b> \$1250	Geography, Ball State University	Enhanced GIS course for a broad audience of social science and environmental science students.	Organized an on-campus workshop on “An Introduction to Spatial Analysis” for faculty and graduate teaching assistants at Ball State University.
<b>2005–2006 Awards</b>			
<b>Claude Barnes &amp; Laurie Garo</b> \$2,500	Political Science & Criminal Justice, North Carolina A&T State University; Geography & Earth Sciences, University of North Carolina at Charlotte	Created new GIS for Social Science courses at (HBCUs) in North Carolina, including <i>GIS in Criminology for Social Sciences</i> at Johnson C. Smith University and <i>GIS for Social Sciences</i> at North Carolina A & T University.	Organized a workshop and gave presentations on the introduction of GIS courses for social scientists at the Thirteenth National HBCU Faculty Development Symposium in Houston in October 2006.

Award Recipients	Affiliation	Accomplishments	Use of Award
<b>Wenquan (Charles) Zhang</b> \$1,250	Sociology, Brown University / Texas A&M University	Designed and implemented a GIS course at Brown University for sociologists and other social scientists.	Participated in an ESRI Arc-IMS training course.
<b>Christopher Holoman</b> \$1,000	Political Science, Hilbert College	Mentored students in Weapons and War course for modeling the projection of military force across space.	Organized a workshop in Fall 2006 to provide orientation in spatial analysis for Hilbert faculty.
<b>Benjamin Forest</b> \$1,250	Geography, Dartmouth College; currently at McGill University	Developed a GIS course project to help students understand social and economic consequences of space.	Revised course exercises to explore the political consequences of political representation and sovereignty in Quebec.
<b>Adriana Abdenur</b> \$1,250	International Affairs, The New School Cultural & Social Anthropology, Stanford University	Modified a course on Urbanization and Inequality in South Africa, initiated discussion on developing a more explicit spatial focus in studies of international development, published an article in the New School <i>International Affairs Bulletin</i> on the need for spatial perspective in teaching and research, and established a partnership with the New School's Parsons Institute for Information Mapping to create pedagogical materials on inequality in cities of the developing world.	Acquired data for student exercises and engaged students in the development, design, and publication of didactic materials for use in courses on urbanization and segregation of South African and Brazilian cities.
<b>Paulla Ebron &amp; Claudia Engel</b> \$750	Sociology, Cornell University	Introduced GIS-based exercises and spatial perspectives in introductory courses on the anthropology of globalization.	Acquire geo-referenced demographic and economic data on non-US global cities and employed undergraduate research assistants to create a repository of shapefiles for developing teaching resources.
<b>Joe D. Francis</b> \$750	Political Science, University of California, Berkeley	Developed and taught course on Analytic Mapping and Spatial Modeling.	Participated in the 2007 summer workshops on Spatial Regression at the University of Illinois, Urbana-Champaign as a foundation for developing a new course on spatial statistics.
<b>Iris Hui</b> \$1,200	Geography, Indiana State	Developed a 2006–2007 seminar series at UCB on <i>Social Science in Place: GIS, Spatial Concepts and Applied Social Science</i> .	Organized a Panel discussion at the 2007 annual meeting of the American Political Science Association on “GIS, Spatial Statistics, and Political Science” and participated as a panelist

Award Recipients	Affiliation	Accomplishments	Use of Award
<b>Nancy Obermeyer</b> \$750	University, Terre Haute History, Geography, and Political Science, Fort Valley State University	Undertook several initiatives to expand GIS teaching applications across a range of disciplines at Indiana State.	to explore GIS applications in political science at the 2007 annual meeting of the Association of American Geographers.  Organized campus workshops for creating teaching modules and for helping researchers in the use of GIS.
<b>Iheanyi N. Osondu</b> \$500	Office of the Vice President for Academic Affairs, Trinity University (San Antonio)	Developed a new undergraduate certificate course in GIS.	Organized a campus enlightenment event on the uses of GIS in undergraduate teaching and on the value of GIS in serving the local region of Fort Valley State University.
<b>Claudia Scholz</b> \$810	Geology & Geography, Georgia Southern University	Worked with colleagues and students on applications of GIS, mapping, and spatial thinking in teaching and research; and organized a panel of prior participants in SPACE workshops to explore <i>Integrating Spatial Thinking into the Sociology Curriculum</i> at the 2007 annual meeting of the American Sociological Association.	Participated in an ESRI training session on GIS to assist her development of content for sociology courses at Trinity University.
<b>Wei Tu</b> \$810	Geography & Environment, Boston University	Developed Internet GIS resources for teaching and enhancing existing courses in GIS and cartography.	Attended an advanced ArcIMS training session offered by ESRI to assist in expanding the use of Internet GIS in teaching.
<b>Joan Walker</b> \$750	Currently Transportation, University of California, Berkeley	Enhanced courses in GIS and in Economic Geography with greater hands-on GIS applications.	Initiated discussions on establishing a region-wide alliance of GIS instructors in the Boston area for sharing web resources on GIS case studies.
<b>2007 Awards</b>			
<b>J. Kevin Byrne</b> \$750	Visualization and Sustainable Design Program, Minneapolis College of Art and Design	Developed a one-month module on exploratory spatial data analysis for a 2 <sup>nd</sup> -/3 <sup>rd</sup> -year course on Visual Thinking and developed a proposal for a new course on Introduction to Geovisualization that will introduce students to uses of ArcGIS, GeoDa, and various Web resources.	Presented a tutorial on the use of Parallel Coordinate plots in GeoDa for the 2008 World Congress in Computer Science, Computer Engineering, and Applied Computing, titled "Parallel Coordinates at Age 30: Why and How GeoDa Works as a Powerful and Intuitive Method for

Award Recipients	Affiliation	Accomplishments	Use of Award
<b>Rajrani Kalra</b> \$1,000	Geography, University of Central Arkansas / currently at California State University San Bernadino	Developed GeoDa-based exercises to introduce spatial thinking in undergraduate courses and worked on the organization of a campus-wide workshop on Thinking Spatially in the Social Sciences.	Geovisualizing Demographic Data.”  Participated in a workshop on Advanced Analysis with ArcGIS.
<b>Allan Joseph Medwick</b> \$1,200	Office of Institutional Research and Department of Computer Science, Kean University	Developed a workbook on GIS for a 6-hour workshop on Spatial Analysis for Institutional Research and introduced GIS and spatial analysis in an undergraduate course on Technology and Information Systems in Modern Society.	Participated in a workshop on Advanced Analysis with ArcGIS.
<b>Sookhee Oh</b> \$1,200	Sociology, University of Missouri, Kansas City	Introduced spatial analytic approaches in an undergraduate course on Methods of Sociological Research, required for sociology and criminology majors. Initiated the development of a new course on Spatial Thinking in the Social Sciences.	Participated in the Advance Spatial Analysis Workshop on Spatial Pattern Analysis offered by the Center for Spatially Integrated Social Science at the University of California, Santa Barbara in 2008.
<b>Heather Richards-Rissetto &amp; Judith van der Elst</b> \$1,225	Anthropology, University of New Mexico	Developed and taught new courses on GIS applications in anthropology and archaeology, promoted awareness of spatial methods for teaching and research at the University of New Mexico, organized a conference symposium on GIS in archaeology education, and developed a course in visualization in conjunction with UNM’s Art and Technology Lab.	Developed and implemented a summer 2008 class on spatial methodologies of relevance to local minority students and their communities in New Mexico.
<b>Michael Strager</b> \$1,200	Resource Management, West Virginia University	Developed a new course on Applied GIS for the Social Sciences to be taught for the first time in fall 2008.	Trained graduate assistants and acquired data and software for student exercises.
<b>Steve Wuhs</b> \$1,250	Government & International Relations, University of Redlands	Developed and taught a new course on Territorial Politics: Territory, Politics, and Economy, the first example of a lab-based social science course at UR. The labs provide students with exposure to spatial analytic software, such as GeoDa and	Created a speaker series of spatially inclined social scientists to complement the course on Territorial Politics and to illustrate the value of spatial perspectives for teaching more broadly across the university.

Award Recipients	Affiliation	Accomplishments	Use of Award
		ArcMap, and to applications of the GoogleEarth geo-browser.	
<b>2008—2009 Awards</b>			
<b>Diana Grigsby-Toussaint</b> \$1550	Kinesiology & Community Health, University of Illinois at Urbana-Champaign	Developed a two-day Health GIS workshop (2008) to introduce undergraduate students in the College of Applied Health Sciences to the applications of GIS in health.	Developed and offered a GIS and Health workshop (2009) for students in the College of Applied Health Sciences.
<b>Leah Greden Mathews</b> \$750	Economics, University of North Carolina, Asheville	Added spatial components to a second-year multi-disciplinary course in Land Economics, and structured the final course project to focus on spatial dimensions of sustainable regional development.	Incorporated local spatial data sets and spatially oriented activities in two regularly taught classes. Activities, for example, included students' use of spatial methods to analyze local production and consumption patterns.
<b>Linda Loubert</b> \$1000	Institute for Urban Research, Morgan State University	Provided exposure to the value of geospatial science to multi-disciplinary faculty and students.	Participate in an ESRI ArcGIS course and developed an introductory GIS workshop to encourage other faculty members to use GIS tools in their curriculum.
<b>Chris Mayda</b> \$600	Geography & Geology, Eastern Michigan University	Encouraged original research by undergraduate students and facilitated their participation in a national academic conference.	Supported undergraduate students in the development of instructional resources relating to cultural landscapes and sustainable development.
<b>Michelle M. Thompson</b> \$1250	Planning & Urban Studies, University of New Orleans	Helped to develop an urban and regional information system that has assisted community recovery efforts in New Orleans and provided related resources for undergraduate and graduate	Promoted dissemination of project methodology among instructors and researchers in urban studies through conference presentations.

## 6. FOLLOW-UP SUPPORT FOR WORKSHOP PARTICIPANTS

### LEVERAGING WORKSHOPS THROUGH ACCESS

The **Academic Conference Courses for Enhancing Spatial Science** (ACCESS) program supported workshop participants in the organization of conference sessions that align with the SPACE objective of national dissemination of spatial thinking in social science undergraduate education. This report provides brief summaries for each of the conference programs that received ACCESS awards. More complete details, including abstracts, full presentations, and related instructional resources are available at <http://www.csiss.org/SPACE/workshops/sessions.php>. These resources offer examples of curriculum development, student exercises, learning assessment, instructional strategies, uses of spatial data, and research (both student research and faculty).

#### **The National Society of Black Engineers (NSBE)**

#### **A SPACE-sponsored workshop on GIS, GPS, and Remote Sensing Applications in Support of Analyzing Urban Accessibility Issues and Emergency Preparedness and Response**

*Las Vegas, Nevada, March 28, 2009*

**Objectives:** The primary objective of this workshop was to expose NSBE attendees to geospatial technology. The focus upon emergency preparedness and response provided a holistic educational approach that unites technical aspects of engineering with the social issues involved in mitigating the impacts of natural and anthropogenic hazards. Although geospatial technology applications are now a staple within the engineering profession, many HBCU students are not exposed to them in their collegiate curriculums. Relatively few HBCU engineering programs are known to have a significant presence of GIS-based courses.

This workshop targeted college and university faculty, practicing engineers, and students with little to no experience with geospatial technology. The workshop instructors encouraged student attendees to seek out GIS training opportunities, even if they must venture outside of their engineering colleges. Faculty attendees were presented with guidelines on how to push for the development of GIS-based courses on their campuses and were encouraged to find ways to work with geographers or other social scientists that are GIS-savvy in promoting student experiences in interdisciplinary applications of GIS. Information on career opportunities for students with GIS competency as presented.

NSBE is one of the largest student-managed organizations in the country and the annual convention attracts students, academicians, and technical professionals from the United States and two dozen other nations. The agenda includes professional workshops, a career/college fair, and technical exhibits (see <http://national.nsbe.org/>). With a convention attendance of about 10,000 each year, this was an excellent opportunity to expose geospatial technology to a new, ethnically diverse audience.

#### **Workshop Instructors and Consultant:**

**Pamela Bingham**, Director, Bingham Consulting Services, Silver Spring, Maryland. She is a former director of the Historically Black College and Universities (HBCU) Summer Faculty GIS Workshops. She was the NSBE liaison for this workshop.

**Talia McCray**, Assistant Professor of Community & Regional Planning, University of Texas at Austin. She led off the workshop with a presentation demonstrating innovative methods to address activity patterns of disadvantaged populations. She shared her research on mobility constraints and accessibility challenges for low-income women and youth and emphasized the great potential for GIS applications in transportation planning and engineering work.

**David A. Padgett**, Associate Professor of Geography and Director of the Geographic Information Sciences Laboratory, Tennessee State University. His presentation was on the importance of geospatial technology in emergency planning and response, especially in inner-city areas. He provided information about opportunities for training in GIS, obtaining GIS software, and developing a GIS-based curriculum. He also gave a "crash course" in the basics of GPS. Approximately 20 participants completed a GPS exercise simulating inner-city community-based efforts to locate emergency shelters. Each participant had a chance to work with a hand-held GPS receiver. Point locations of "potential emergency shelters" were logged, pertinent shelter attribute data were recorded on a worksheet, and the points were later mapped using ArcGIS to create a high-resolution image covering Las Vegas, Nevada.

## Africa Map SPACE Workshop

Center for Geographic Analysis (CGA), Harvard University, Cambridge MA March 25, 2009



SPACE helped in the sponsorship of a one-day workshop to introduce and evaluate [AfricaMap](#) (a GeoPortal for Assisting Research and Teaching in the Humanities and Social Sciences). The event was hosted by the Center for Geographic Analysis at Harvard University, founded in 2006 as a technology platform in the Institute for Quantitative Social Science. Participants in the workshop came mostly from academic institutions and non-governmental organizations located in the northeastern portion of the United States.

**Objectives:** This workshop explored new perspectives in geospatial technology and new approaches to Africa humanities and social science research using **AfricaMap** as an interactive, open access technology framework. The technology is intended to provide key spatial and temporal data on Africa and could provide a framework for making spatial data accessible for less developed countries all over the world. AfricaMap offers a virtual space where scholars, practitioners, and students from around the globe and across disciplines can collaborate.

Many countries in Africa have been underserved in geospatial technologies. Spatial data exists, but it is difficult to find. In addition, gathered data is often lost because central archives are lacking. To address these problems, AfricaMap will:

- Map Africa with a high level of resolution online
- Allow users to explore Africa at different resolutions
- Accumulate both contemporary and historical data supplied by researchers and make them permanently accessible online
- Work with other spatial information sources for Africa in an online environment

### Workshop Instructors

**Wendy Guan**, Director of GIS Research Services, CGA, Harvard University

**Ben Lewis**, Senior GIS Specialist, CGA, Harvard University

**Sumeeta Srinivasan**, Preceptor in Geospatial Methods, Department of Government, Harvard University. She is affiliated with the China Project at Harvard and teaches courses on GIS, spatial analysis, and modeling. She was a participant in the 2004 SPACE workshop at Ohio State University.



### Workshop Schedule:

9:00–9:30	Signing in, logistics, getting set up.
9:30–10:00	Presentation by Wendy Guan, Director of GIS Research Services at CGA: Trends in Geographic Information Systems (GIS)
10:00–10:30	Presentation by Paul Cote, Graduate School of Design: Introduction to GIS Technology.
10:30–10:45	Break
10:30–11:15	Presentation by Ben Lewis of CGA: Introduction to the AfricaMap Framework
11:15–12:00	Demonstrations by Ben Lewis: System with reference to research tasks
12:00–1:00	Lunch
1:00–2:00	Hands-on Lab. Attendees will work through a series of exercises designed to cover the system's main functions. Help will be provided (see details on page 6 of the <a href="#">AfricaMap SPACE Workshop Handout.pdf</a> ).
2:00–2:30	Instructor summary of key functions with hands-on demo.
2:30–2:45	Break
2:45–3:30	Group Level Critique. We will divide into 5 groups and critique the AfricaMap system, developing ideas for improvement (see details on page 15 of the <a href="#">AfricaMap SPACE Workshop Handout.pdf</a> ).
3:30–4:00	Workshop Level Recommendations for Improvement. We will reconvene and derive a set of prioritized recommendations for future enhancements (see details on page 15 of the <a href="#">AfricaMap SPACE Workshop Handout.pdf</a> ).

### The NONAP Community GIS Technology Workshop

*University of New Orleans, New Orleans, Louisiana, February 22, 2008*

**Michelle M. Thompson**, SPACE participant in 2004, is the founder and Director of the New Orleans Neighborhood Analysis Project (NONAP), an organization to help with the recovery of New Orleans after Hurricane Katrina. She was a Visiting Scholar in the Department of City & Regional Planning Cornell University at the time of NONAP workshop. She is currently a professor of urban planning at the University of New Orleans.

The "NONAP Community GIS Technology Workshop" provided students and Community Based/Neighborhood Organizations with GIS Mapping through hands-on exercises and demonstrations. NONAP is developing an information portal with geospatial tools, training, and technology that can be adapted for use by communities but also expandable to support academic research and education.

The **objectives of NONAP** are to:

1. Train student teams on how to use web-enabled information technology systems with relational databases.
2. Create a web portal of shared data services that will continue to be populated through a free, public, online environment for use by multiple asynchronous users.
3. Support existing public property community information systems, such as the City of New Orleans "Community on One Page" and Greater New Orleans Community Data Center.
4. Provide technical documentation to train community and university professionals on the use of the Internet mapping service through a custom interface.
5. Share ideas and information with universities and stakeholders to support intra-university, and community-university, resource sharing and research support.

For more Information, see: <http://www.csiss.org/SPACE/workshops/sessions.php#anc10> and <http://www.csiss.org/SPACE/materials/participants/2008/Thompson.php>.

### 2008 Annual Meeting of the American Society for Environmental History Workshop on Using GIS for Environmental History

*Hosted by Idaho State University, Boise State University, and the University of Idaho, Boise, Idaho, March 14, 2008*

**Objectives:** Spatial analysis is an important part of environmental history. This half-day workshop focused on ways to expand the interest in and awareness of GIS as a tool for teachers and scholars. Central goals were to make participants more aware of what GIS offers and how it works and to give them personal experience in analyzing spatial datasets and files so that they are more prepared to incorporate the tools into their own classrooms.

**Kevin R. Marsh**, Department of History, Idaho State University, organized the workshop. Kevin participated in the

SPACE workshop at UCSB in 2005. SPACE co-sponsored the workshop with Bionomics Environmental, Inc. Participants came from a number of countries and from across the United States, representing disciplines such as geography, geology, climate science, environmental studies, and history.

#### **Workshop Instructors:**

**Geoff Cunfer**, a historian at the University of Saskatchewan, uses GIS extensively to analyze changing agricultural use of the Great Plains since the 1800s. He is author of *On the Great Plains: Agriculture and Environment* (College Station, 2005).

**Sally Hermansen** is a geographer at the University of British Columbia. She has used GIS for published research on land use change and shifting attitudes regarding urban wetlands, and frequently teaches classes in GIS and Historical GIS.

**Sarah Hinman** is a geographer in the History Department at Idaho State University. She has used GIS to study disease outbreaks and infant mortality in turn-of-the-century Baltimore and Washington, DC. Dr. Hinman teaches in the GIS-based graduate program in Historical Resources Management at ISU.

**Keith Rice**, a geographer at the University of Wisconsin, Stevens Point, has long-term expertise in teaching students to conduct spatial analysis of historic land use in Wisconsin.

**Keith Weber** is director of the GIS Training and Research Center at Idaho State University.

**Derrick Sharp** and **Matthew Finn** served as lab assistants for the workshop. Both are students in the GIS-based M.A. program in Historical Resources Management at Idaho State University.

### **National Conference on Agriculture and Natural Resource Conservation and Management, Panel Discussion on Teaching of GIS and Remote Sensing**

*Delaware State University, Dover, Delaware, April 17–19, 2008*

The panel was organized by **Shobha Sriharan** (Department of Agriculture & Human Ecology at Virginia State University), SPACE Workshop Participant in 2006 at the University of Oklahoma and in 2007 at the University of California, Santa Barbara.

Panelists included:

**Shobha Sriharan**, Virginia State University

**Linda Hayden**, **Francisco San Juan**, and **Elizabeth Noble**, Elizabeth City State University

**Godfrey Uzochukwu**, North Carolina A & T University

**Gulnihal Ozbay** and **Zhiming Yang**, Delaware State University

Panelists discussed course content and strategies for offering hands-on software experiences for “**1890 Institutions**” and **Historically Black Colleges and Universities** (HBCUs), how to avail the assistance from providers of software (ArcGIS by ESRI and Erdas Imagine by Leica Geosystems) and GPS (Garmin), the design of user-friendly exercises, and drawing on the expertise of GIS educators from nearby institutions and agencies. They also reviewed the current enrollment of students in GIS courses; strategies to publicize courses across campus; and ways to advise students from the sciences, liberal arts, and business.

The panel was followed by a **poster session**, featuring the research of undergraduate students from the institutions represented on the panel. In addition, high school students and teachers from the local Dover area attended the session and focused on issues of building awareness of GIS opportunities for precollege audiences and discussed successes and limitations of teaching introductory-level GIS at schools.

The **National Conference on Agriculture and Natural Resource Conservation and Management** is an initiative of the College of Agriculture and Related Sciences at Delaware State University to bring agriculture and natural resource faculty and students together for exchange of ideas.

### **American Sociological Association—102nd Annual Meeting Integrating Spatial Thinking into the Sociology Curriculum**

*New York City, August 2007*

The Session was organized by **Claudia Scholz**, Research Programs Coordinator at Trinity University in San Antonio. Claudia participated in two SPACE workshops (UCSB in 2006 and Ohio State University in 2007). The presentation titles and authors follow:

- Beyond the Field Trip: On Tourism as a Pedagogical Strategy, **Shaul Kelner** and **George Sanders**, Vanderbilt University

- Spatial Sociopoly: Understanding the Role of Space in Inequality using “Monopoly” Board Game, **Kishi Ducre**, Syracuse University
- Teaching Residential Segregation in Undergraduate Classes Using Spatial Methods, **Laurel Cornell**, Indiana University
- Race and Space: Crime, Joblessness and the American Apartheid, **Karen Hayslett-McCall**, University of Texas at Dallas
- Integrating GIS Across Disciplines in a Liberal Arts College, **Jeana Abromeit**, Alverno College

### **Minorities in Agriculture, Natural Resources, and Related Sciences (MANRRS), 22nd Annual Career Fair and Training Conference**

*Birmingham, Alabama, March 2007*

#### **Workshop on GIS, GPS, and Remote Sensing Applications in Support of Community and Urban Forestry**

**David A. Padgett**, Associate Professor of Geography and Director of the Geographic Information Sciences Laboratory at Tennessee State University, led the half-day workshop with the following content:

- The background and methodology of three urban forestry projects developed by undergraduate students as Power Point presentations;
- Live demonstrations of GIS software;
- An outdoor tree inventory exercise to demonstrate the use of GPS receivers;
- Importing the inventory data into ArcGIS for display on a digital ortho quarter quadrangle;
- Discussion of the results and procedures of the exercise; and
- An overview of opportunities for training in GIS, acquisition of GIS software, and the development of GIS-based curriculum.

### **National HBCU Faculty Development Symposium “Leading and Learning in an Age of Accountability,” Workshop on GIS and Spatial Analysis Methods in Social Sciences Teaching and Research**

*Houston, Texas, October 2006*

Workshop leaders included **David A. Padgett**, Associate Professor of Geography and Director of the Geographic Information Sciences Laboratory at Tennessee State University, **Charles Barnes**, Department of Political Science at North Carolina A&T State University, and **Laurie Garo**, Department of Geography at University of North Carolina at Charlotte, and instructor at Johnson C. Smith University.

#### **Workshop Objectives:**

- Expose HBCU (Historically Black Colleges and Universities) faculty to innovative ways that geographic information systems (GIS), spatial analysis, and related technologies may be used to enhance social sciences teaching and research;
- Provide HBCU faculty with information on how to obtain affordable GIS and spatial analysis software, and how and where to get training;
- Demonstrate how students may directly benefit by adding GIS and spatial analysis applications to their professional skill sets;
- Encourage those in attendance to attend GIS-related workshops, such as the **SPACE** workshops sponsored by the Center for Spatially Integrated Social Science (CSISS) and the **HBCU Faculty GIS Workshops**; and
- Invite attendees to join the **HBCU GIS user’s online discussion group**.

### **University Consortium for Geographic Information Science (UCGIS) Summer Assembly**

*Vancouver, Washington, July 2006*

Instructors and participants in the SFSU SPACE/UCGIS 2005 workshop at San Francisco State University (SFSU) made a plenary presentation describing the workshop. Delegates from 70 UCGIS member institutions, students, and others attended the presentation.

Presentations featured a description of the workshop by **Richard LeGates** (workshop PI and Professor of Urban Studies at SFSU) and **XiaoHang Liu** (workshop Co-PI and Assistant Professor of Geography at SFSU), a video that describes the workshop experience, presentations from three faculty workshop participants, and discussion.

**Jeana Abromeit** (Professor of Sociology at Alverno College) described how she used SPACE workshop material to create the college's first GIS course, establish a GIS lab, and create materials to integrate spatial thinking into Alverno's curriculum.

**Chris Holoman** (Associate professor of Political Science at Hilbert College) described his use of workshop material and a CSISS Instructional Development award to help create Hilbert's first two GIS courses, establish a GIS lab, expose every Hilbert student to basic spatial thinking concepts in a course that he teaches, and organize a one-day faculty development workshop on GIS and spatial thinking for Hilbert faculty.

**Benjamin Forest** (Associate professor of Geography, at McGill University) described an exercise he developed using material from Houston, Texas to teach Dartmouth University students about the politics of gerrymandering and how he will use information from the workshop and support from a SPACE Instructional Development award to develop a new module using ArcGIS' redistricting extension to teach McGill students about redistricting in Quebec city and to simulate spatial consequences of sovereignty for Quebec.

### **Society for American Archaeology (SAA) 71st Annual Meeting Symposium on Integrating Geospatial Perspectives and Education in Archaeology** *San Juan, Puerto Rico, April 2006*

2004 and 2005 SPACE workshop participants, **Veronica Arias**, **Heather Richards**, and **Judith van der Elst** (Department of Anthropology, University of New Mexico), organized this symposium to focus on pedagogical approaches, innovative teaching methodologies, instructional development, and dissemination of teaching strategies suited for teaching geospatial methods and techniques. Presentations included the following:

- Spatial Thinking and Technologies in the Undergraduate Social Science Classroom  
**Stacy Rebich-Hespanha**, **Fiona Goodchild**, and **Don Janelle**, UC Santa Barbara
- Using Cultural Resource Information System Geospatial Data in Scholarly Research and Public Education  
**Karyn DeDufour**, Archeological Records Management Section, N.M. Historic Preservation Division, and **Jeremy Kulisheck**, Detail Project Archeologist, Gila National Forest
- Developing Spatial Thinking in Archaeology through GeoScience  
**Veronica Arias**, **Heather Richards**, and **Judith van der Elst**, University of New Mexico
- The Student Perspective on Geospatial Education  
**David Plaza** and **Mona Angel**, University of New Mexico
- GIS and Spatial Statistical Tools for Archaeological Work,  
**Joe D. Francis** and **Antoni Magri**, Cornell University
- GIS, Faunal Remains, and Public Archaeology in the Gulf of Maine  
**Matthew Bampton**, **Nathan Hamilton**, and **Rosemary Mosher**, University of Southern Maine
- Eco's Eye: Semiotic Approaches to Designing a New Computer Application for Visualization of Spatially Distributed Archaeological Data  
**Kevin Schwarz**, ASC Group, Inc., and **Jerry Mount**, University of Iowa
- Representing Maya Architecture: Techniques for Research and Education  
**Jennifer Ahlfeldt**, University of New Mexico. **Heather Richards**, University of New Mexico, and **Laura Ackley**, University of California, Berkeley
- Mindscapes and Virtual Ecosystems  
**Maurizio Forte**, Istituto per le Tecnologie Applicate ai Beni Culturali, Rome
- Positive side-effects of the implementation of GIS on heritage management in developing countries  
**Rolf Schütt**, Architect—World Heritage Consultant, Santa Cruz, Bolivia
- Nasca archaeology in 3D: Interdisciplinary research and education in Palpa on the south coast of Peru  
**Karsten Lambers**, German Archaeological Institute, KAAK Bonn
- Learning and Teaching: Using a Public Planning Process as a Teaching Tool  
**Sarah Schlanger**, New Mexico Bureau of Land Management
- Session Discussant: **Stacy Rebich-Hespanha**, SPACE, University of California, Santa Barbara

Abstracts for all of the above presentations are available at <http://www.csiss.org/SPACE/materials/participants/docs/SAA%20Session%20abstracts.pdf>.

## Association of Collegiate Schools of Planning Annual Conference, Roundtable and Workshop on Integrating GIS and Spatial Analysis into the Undergraduate Planning Curriculum

Kansas City, Missouri, October 2005

**Richard LeGates**, Professor of Urban Studies at San Francisco State University, and coordinator of the 2005 SPACE workshop at SFSU, organized a set of events related to curriculum development. The objective was to encourage greater use of spatial concepts in planning courses and to introduce resources and tools to make this possible.

The **Roundtable** introduced teaching materials developed by the panelists and reviewed open-source software appropriate for teaching spatial concepts to students of urban planning.

A **Drop-in Workshop**, equipped with laptop computers, permitted meeting attendees to review demonstrations of GIS instructional modules for ArcGIS software and to experiment with open-source software for spatial analysis (GeoDa, FlowMapper, and STARS).

Panelists and demonstrators for this program included **Ayse Pamuk**, Associate Professor of Urban Studies at SFSU; **Brian Paar**, Workbook project manager for ESRI Virtual Campus; and **Stuart Sweeney**, Assistant Professor, Department of Geography, University of California Santa Barbara and Coordinator for the 2004–2007 UCSB SPACE summer workshops.

## National Technology and Social Science Conference, Workshop on GIS, GPS, and Spatial Analysis Tools in Support of Service Learning

Las Vegas, NV, April 2005

2004 SPACE workshop participant, **David Padgett**, organized a hands-on workshop demonstrating the integration of locational information from field surveys using GIS and GPS. Participants represented the disciplines of anthropology, economics, education, ethnic studies, geography, history, psychology, political science, sociology, and women's studies. The agenda follows:

### Introductions

#### Introduction to Global Positioning Systems and Basic Principles of Cartography

**Discussion** Service Learning Experiences in Social Science Courses

*Break*

**Divide into groups** Each group prepared its GPS units for a mock neighborhood audit. Some groups used low-cost GPS units, one group worked with a more expensive unit.

**Mock neighborhood audit** Groups collected GPS positions, recorded attribute information, and took photographs of "sites of potential neighborhood problems and/or physical barriers to public transit accessibility."

*Break*

**Instructor Demonstration** How to import data and photos into a Geographic Information System.

**Instructor Demonstration** How to layout maps for most effective use in spatial analysis.

**Attendees shared ideas** for implementing GIS, GPS, and spatial analysis tools to enhance their own curriculums.

**Wrap-up**, evaluation, and adjournment

## Association of Social and Behavioral Scientists, Panel on GIS and Spatial Analysis Tools to Enhance Social Science Course Content and Research

Nashville, TN, March 11, 2005

2004 SPACE workshop participants, **David Padgett** and **Nikitah Imani**, organized a Panel Session for the 70th Anniversary Annual Meeting of ASBS. ASBS membership is drawn primarily from academics representing Historically Black Colleges and Universities (HBCUs), spanning a broad range of disciplines in the social and behavioral sciences. The session included three presentations and follow-up discussions:

- Geographic Information Systems (GIS) in Support of Service Learning Course Content in an Undergraduate Urban Geography Course—**David A. Padgett**, Tennessee State University
- Notes on Building a Critical Sociological Pedagogy for Spatial Analysis: Adventures in Oxymorons—**Nikitah Imani**, James Madison University
- Applications of GIS and Spatial Analysis Tools in the Development of Demonstration Modules for an Urban Geography Course—**David A. Padgett**, Tennessee State University

The University Consortium for Geographic Information Science (UCGIS) was a collaborating partner in the SPACE program and was responsible for offering one of the program's three annual workshops. A feature of the UCGIS workshop was that participants might be invited to give presentations and to participate in mini-workshop sessions in conjunction with the UCGIS Assemblies and Meetings. Some of the results of the 2004 SPACE workshop at San Diego State University were showcased at the UCGIS Winter Meeting.

- Introduction, **John R. Weeks**, San Diego State University, Chair (Coordinator of SPACE workshop at SDSU)
- The Role of UCGIS as a Cooperating Agency for GIScience Education, **Arthur Getis**, San Diego State University
- Bringing Space to the Core: Developing Undergraduate Curriculum in Spatial Reasoning, **Wendy Bigler**, Arizona State University
- Introducing Space in a Non-Computational Context, **Timothy M. Bray**, University of Texas at Dallas
- Integrating GIS and Urban Geography in the Classroom (& Beyond), **David R. Rain**, George Washington University
- Adaptation and Implementation of an Undergraduate Spatial Analysis Curriculum for Social Science Majors, **Christopher C. Weiss**, Columbia University

## **7. IMPACT OF SPACE FROM THE ANALYSIS OF PARTICIPANT SURVEYS**

### **WORKSHOP OUTCOMES AND EVALUATION**

As shown in Figure 1, the graphic syllabus for the UCSB workshop, the desired outcomes for participants included the acquisition of new knowledge and skills, completion of projects, access to course materials and resources, collaboration with peers and workshop instructors, inspiration, and plans for future applications. Many of these positive outcomes are reflected in project presentations on the final day of the workshop.

### **FINAL PROJECTS**

Final projects included the design of exercises to engage students in spatial thinking and in applications of GIS or *GeoDa*, the development of new course syllabi, and ideas for project-based student learning through exposure to issues in local communities. Titles of some of the presentations by participants in UCSB workshops are listed in Table 5.

<b>Table 5. Titles of Participant Presentations at UCSB SPACE Workshops</b>
<b>2005–2007</b>
<p><b>Integrating Spatial Perspectives in Lectures and Labs</b></p> <ul style="list-style-type: none"> <li>• Redistricting Labs in Political Science</li> <li>• Exploring the Social Geography of Civil Rights Tourism</li> <li>• Quantitative Methods in Archaeology: Students’ Final Project</li> <li>• Infusing Basic Spatial Thinking through Exercises and a Final Student Project</li> <li>• Spatial Thinking in Public Affairs: Example Module</li> <li>• Interpreting Landscape</li> </ul>
<p><b>Introducing Spatial Perspectives in Curriculum and Course Design</b></p> <ul style="list-style-type: none"> <li>• A Curriculum Sequence for Landscape Analysis and Planning</li> <li>• Incorporating Spatial Analysis Options in Economic Geography and Quantitative Methods Courses</li> <li>• Integrating Sociological Research with Spatial Concepts in Sociology and Area Courses</li> <li>• Redesign of GIS Course in Anthropology</li> </ul>
<p><b>Using Spatial Methods for Regional and Global Perspectives in Undergraduate Teaching</b></p> <ul style="list-style-type: none"> <li>• Trade among Nations</li> <li>• Foreign Direct Investment: Global Flows and Mapping the Global Commodity Chains</li> <li>• Visualizing Borders and Diasporas</li> <li>• HIV/AIDS Around the World</li> <li>• Exploring New Mexico Landscapes</li> <li>• Location Patterns of R&amp;D in India</li> <li>• Italian Regional Immigrant Integration</li> <li>• Mapping Prehistoric Economy in Central California</li> <li>• Spatial Dimensions and Perceptions of Idaho Irrigation Communities, 1900–1945</li> <li>• Race, Politics, and Redistricting in North Carolina</li> </ul>
<p><b>Spatial Understanding of Social Issues through Project-based Case Studies</b></p> <ul style="list-style-type: none"> <li>• Distributions of Prison Populations over Time in the United States</li> <li>• Spatial Analysis of Juvenile Delinquency Risk Factors</li> <li>• Spatial Patterns and Flows in Congressional Campaign Contributions</li> <li>• Mapping Retail “Predatory” Landscapes</li> <li>• Mapping New Orleans: Spatial Variation in the Impact of Hurricane Katrina</li> <li>• Baltimore Public Schools: Structure, Place, and Outcomes</li> <li>• Visualizing Urban Growth: San Antonio 1960–2000</li> <li>• Disparities in Infant Mortality Rates in Greensboro, NC</li> <li>• Understanding the Geography of Disease in the US</li> <li>• Spatial Units, Urban Environments, and Health Outcomes</li> </ul>

### **ENTRY-EXIT SURVEY COMPARISON**

The workshop exit survey was completed online, usually after participants returned to their home institutions. The design of the exit survey was intended to match the workshop goals that participants cited in their entry surveys. The entry and exit surveys included questions about:

- the perceived barriers to the adoption of spatial analysis in undergraduate teaching;
- participants’ aspirations for gaining technical content knowledge and insights for teaching and assessment;
- participant expectations of engagement with fellow workshop participants; and
- participant expectations of workshop instruction in spatial analysis concepts and pedagogical strategies.

Table 6 provides the matched average values for entry and exit surveys for all of the participants in the three 2006 SPACE workshops. In general, these surveys revealed significant gains in removing the barriers to technical skills, good progress with learning assessment and teaching strategies, expanded knowledge about the tools, theories, and problems of spatial analysis and data visualization, and new strategies for helping students learn. The mixed results for meeting expectations about specific technologies reflect the ambition of participants to master more than can be achieved in six days and the realization that additional work will be required beyond the workshop experience. Although most participants reveled in their mastery of techniques, such as GIS, they also acknowledged that understanding the fundamental concepts of spatial thinking (e.g., scale, neighborhood, spatial dependence, and spatial heterogeneity) is not easily assimilated in a short period and that they will need to invest even more effort to achieve solid theoretical grounding for their work.

By the second year of the SPACE workshops, more attention was given to the theoretical understanding of concepts of spatial thinking and less to the mastery of tools. This shift was expanded in subsequent years, coinciding with the publication of *Learning to Think Spatially* (National Research Council, 2006), and capturing a theme of growing interest in research and teaching, as seen in such recent publications as Gersmehl & Gersmehl (2007), Marsh, *et al.* (2007), Golledge, *et al.* (2008), Janelle and Goodchild (2009), and Lee & Bednarz (2009).

<i>What Did Those Accepted into 2006 SPACE Workshops Perceive as Barriers and Expect as Outcomes for Teaching Spatial Analysis?</i>		<i>How Did SPACE Workshop Participants Rate the 2006 Workshops?</i>	
	<b>Entry<sup>1</sup></b>	<b>Exit<sup>2</sup></b>	
Pedagogical Knowledge <b>Barrier (B)</b>	<b>2.62</b>	<b>3.32</b>	<b>Removed Barriers (RB)</b> –Knowledge
GIS Experience <b>B</b>	<b>2.38</b>	<b>3.67</b>	<b>RB</b> –GIS
Data Access <b>B</b>	<b>2.18</b>	<b>3.46</b>	<b>RB</b> –Data Access
Software Access <b>B</b>	<b>2.05</b>	<b>3.68</b>	<b>RB</b> –Software Use
Technical Support <b>B</b>	<b>2.45</b>	<b>3.42</b>	<b>RB</b> –Spatial Teaching
<b>Workshop Expectation (WS Exp)</b>			<b>Met Expectations (ME)</b>
WS Exp–Spatial Statistics	<b>3.45</b>	<b>3.39</b>	<b>ME</b> –Spatial Statistics
WS Exp–Data Visualization	<b>3.48</b>	<b>3.46</b>	<b>ME</b> –Data Visualization
WS Exp–GIS Software Use	<b>3.15</b>	<b>3.52</b>	<b>ME</b> –GIS
WS Exp–Data for Classes	<b>3.48</b>	<b>3.50</b>	<b>ME</b> –Data for Classes
<b>Discuss (D)</b> Learning Assessment	<b>3.30</b>	<b>3.56</b>	<b>Gained Ideas (GI)</b> about Student Learning
–	–	<b>3.24</b>	<b>GI</b> –Assess Student Learning
D Strategies for Teaching	<b>3.15</b>	<b>3.63</b>	<b>GI</b> –Spatial Methods for Teaching
–	–	<b>3.29</b>	<b>GI</b> –Pedagogical Strategies
D Curricula/Class Activities	<b>3.63</b>	<b>3.76</b>	<b>GI</b> –Develop Curricula
D Student Projects	<b>3.25</b>	<b>3.61</b>	<b>GI</b> –Student Projects
<b>Learn (L)</b> Spatial Analysis Tools	<b>3.40</b>	<b>3.71</b>	<b>Expanded Knowledge (EK)</b> –Spatial Tools
L Data Visualization Theory	<b>3.08</b>	<b>3.33</b>	<b>EK</b> –Theory of Data Visualization
L Answers to Problems in Spatial Analysis	<b>2.67</b>	<b>3.38</b>	<b>EK</b> –Problems in Spatial Analysis
L Pedagogical Strategies	<b>3.48</b>	<b>3.49</b>	<b>EK</b> –Strategies to Help Students
<sup>1</sup> 1= not an obstacle at all / not important; 4= very significant obstacle / very important <sup>2</sup> 1=did not help at all / of no value; 4=helped significantly / exceeded expectations			



## FOLLOW-UP SURVEYS

Results from the follow-up survey of participants from the 2007 workshops at the University of California Santa Barbara (UCSB) and Ohio State University (OSU) are provided in Table 7. Follow-up surveys were administered to participants approximately one year following their participation in a workshop. Completed by 68 percent of workshop participants, the results show generally positive experiences at the workshops and moderate to significant impacts on subsequent teaching and dissemination efforts (discussion with others / presentations to colleagues and at meetings). The OSU workshop received generally higher scores on most survey items than in prior years. Although UCSB's scores fell slightly from previous years, the overall assessment was positive.

<b>Table 7. Summer Workshops 2007 Follow-up Survey—Results</b>		
Measures	UCSB	OSU
<b>WORKSHOP EXPERIENCE<sup>1</sup></b>		
Collaboration with participants	3.8	4.3
Instructor presentations	4.4	4.3
Workshop content	4.2	4.4
Workshop lab exercises	3.6	4.0
Workshop organization	4.1	4.4
Materials and handouts	4.1	4.4
Workshop facilities	4.0	4.5
Local organization	4.2	4.5
Housing facilities	4.4	3.7
Overall experience	4.4	4.3
<b>IMPACTS OF WORKSHOP<sup>2</sup></b>		
New ideas for content in undergraduate courses	3.9	4.3
New labs or exercises for undergraduate courses	3.9	3.9
New courses for student learning about spatial analysis	3.5	3.7
New modules to engage undergrads in spatial analysis	4.2	3.9
Assessment of student ability to use spatial analysis	3.6	3.1
Discussion with teaching colleagues teaching spatial analysis	3.7	4.1
Presentations to colleagues about teaching spatial analysis	2.7	3.3
Plans for presentations about SPACE at professional meetings	2.7	2.3
<sup>1/2</sup> Average values, scaled from 1 to 5. 1= unsuccessful/no impact; 2= somewhat successful/very little impact; 3= moderately successful/some impact; 4= successful/moderate impact; 5= very successful/strong impact. See survey form in Appendix.		

Table 8 shows the average scores on items in the follow-up surveys for all SPACE workshops aggregated by year, from 2004 to 2007. The average values are on a scale from 1 to 5, calculated for 136 respondents (62 percent of all workshop participants) on surveys conducted one year after the 2004, 2005, 2006, and 2007 workshops. In general, SPACE achieved its broad mission of promoting the dissemination of spatial technologies to enhance undergraduate education in the social sciences. Its focus on diversity resulted in representation of participants across gender, ethnicity, and race from all regions of the United States. More than 70 workshop participants, representing more than a dozen disciplines, reported on the role of SPACE in their introduction of new courses on spatial analysis and spatial thinking, and nearly 100 participants credited SPACE workshops as instrumental in their introduction of new course exercises and teaching modules. The workshops, in general, exceeded participant expectations in removing barriers to applications of spatial technologies in teaching, expanding participant knowledge about uses of tools for spatial analysis, and introducing strategies for success-

ful teaching. More than 100 participants reported on actively sharing their workshop experiences with colleagues at their own institutions and at conferences.

1 = No Impact, 2 = Very Little Impact, 3 = Some Impact, 4 = Moderate Impact, 5 = Strong Impact					
	2004	2005	2006	2007	%*
• Gained and implemented <b>new ideas for content in undergraduate courses</b>	4.1	4.1	4.2	4.1	77
• Developed <b>new labs and exercises</b> for undergraduate courses	3.8	3.9	4.0	3.9	73
• Introduced <b>new course(s)</b> that include student learning about spatial analysis	3.2	3.1	3.4	3.6	60
• Developed plans for <b>new course modules</b> that will engage undergrads in spatial analysis theory and/or techniques	3.9	3.8	4.1	4.1	73
• Initiated <b>assessment of student ability/learning</b> in use spatial analysis	3.1	3.3	3.3	3.3	47
• Held <b>discussion(s) with teaching colleagues</b> about new resources for teaching spatial analysis	4.1	3.8	4.1	3.9	60
• Made <b>formal presentation(s) to teaching colleagues</b> about new resources for teaching spatial analysis	3.4	2.4	3.4	3.0	40
• Have <b>plans to make presentations about SPACE</b> at professional meetings	2.8	2.3	3.1	2.5	20
• Have <b>already made presentations about SPACE</b> at professional meetings	2.1	1.5	2.3	2.2	20
<b>Overall Workshop Experience</b>					%**
1= unsuccessful, 2 = a little successful, 3 = moderately successful, 4 = successful, 5 = very successful	4.3	4.2	4.5	4.3	<b>90</b>

\* indicating “moderate” to “strong” impact of SPACE  
 \*\* indicating workshop “successful” to “very successful”

## REFERENCES CITED IN SECTION 7:

- Gersmehl, P. J., and C. A. Gersmehl (2007). Spatial thinking by young children: neurologic evidence for early development and “educability.” *Journal of Geography*, 106(5): 181–191.
- Golledge, R. G., M. Marsh, and S. Battersby (2008). Matching geospatial concepts with geographic educational needs, *Geographical Research*, 46(1): 85–98.
- Janelle, D. G. , and M. F. Goodchild (2009). Concepts, principles, tools, and challenges in spatially integrated social science, in: Nyerges, T., H. Couclelis, & R. McMaster, Eds., *GIS & Society Research*. Thousand Oaks, CA: Sage Publications, in press.
- Lee, J. , and R. Bednarz (2009). Effect of GIS learning on spatial thinking. *Journal of Geography in Higher Education*, in press.
- Marsh, M., R. Golledge, and S. E. Battersby (2007). Geospatial concept understanding and recognition in G6–college students: A preliminary argument for minimal GIS. *Annals of the Association of American Geographers*, 97(4): 696–712.
- National Research Council (2006). *Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum*. Washington, DC: The National Academies Press.

## 8. CONCLUSIONS

**Findings** are derived from the follow-up and entry/exit surveys, discussed in this final report and in prior annual reports, and from voluntary comments within surveys by participants in the SPACE program (see appendix).

SPACE achieved its general mission for promoting the dissemination of spatial technologies to enhance undergraduate education in the social sciences.

- A focus on **diversity** resulted in representation of participants across gender, ethnicity, and race from all regions of the United States.
- More than 70 workshop participants, representing more than a dozen disciplines, reported on the role of SPACE in their introduction of **new courses** on spatial analysis and spatial thinking.

- Nearly a hundred participants cited SPACE workshops as instrumental in their introduction of **new course exercises and teaching modules**.
- The workshops, in general, **exceeded participant expectations** in removing barriers to applications of spatial technologies in teaching, expanding participant knowledge about uses of tools for spatial analysis, and introducing strategies for successful teaching.
- More than 100 participants reported on actively **sharing their workshop experience with colleagues** at their own institutions and with colleagues at conferences.
- The first-generation of **multiplier effects of SPACE workshop participation** are beyond our capability to estimate with great accuracy, but combinations of exposure through campus seminars and workshops organized by participants and through the fourteen special conference sessions sponsored by the SPACE ACCESS program place peer interaction with workshop attendees at about 1,000. In addition, a conservative estimate is that up to 16,000 students may have benefited through new courses and altered approaches to teaching as result of SPACE involvement by their instructors. Assumptions for this estimate are: 190 courses, 25 students per course, impact commences one year following workshop participation, and the impact continues to accumulate from year to year (i.e., 40 courses from the 2004 workshops equal 1,000 students who will have benefitted beginning in 2005, continuing through 2009, for a total of 5,000).

The objective of SPACE to initiate systemic change in undergraduate education for the social sciences was ambitious. By no logical standard could a workshop program that served 218 undergraduate instructors possibly achieve systemic change across a range of disciplines in the social and behavioral sciences that claimed more than 102,000 instructors in 2003 (NSF, *Science and Engineering Indicators*, 2008). However, by focusing the workshop program on the value of spatial thinking and associated technologies, the 218 workshop participants tapped into a range of developments in geo-spatial technologies that have placed spatial information processing at the center of major changes in society and science. Over the past decade, broad public and scientific exposure to such recent innovations as geo-browsers (typified by Google Earth and global positioning systems (GPS) have magnified the areas of application of maps and spatial statistics. In addition, advances in geographic information systems (GIS) and exploratory spatial data analysis (ESDA) have made the tools of spatial analysis increasingly accessible for research and teaching. However, while data and tools have advanced, there is a serious lag in the dissemination of sound conceptual understandings of the spatial concepts that must inform best practices in spatial analysis.

Over the course of its existence, the SPACE program has with each successive workshop given increasing attention to the underlying spatial concepts that users of spatial tools must understand. These include the different ways of specifying location, the importance of scale, and the advanced and less intuitively understood concepts of spatial dependence and spatial heterogeneity that underlie scientific inference in the spatial domain. In an era when spatial tools have become more commonplace, the conceptual foundations of spatial literacy become increasingly important. Unfortunately, the expansion in awareness of spatial technologies is not matched by an education system that gives adequate attention to spatial intelligence and spatial reasoning skills.

With their origins in geography, CSISS personnel had to acknowledge early on that the perspectives of geography must complement rather than dominate the theoretical and methodological orientations of other social sciences. Applications of spatial analysis by prominent representatives of specific disciplines were, in general, most persuasive in building support for spatial methodologies in specific research and teaching communities. Co-opting participants in training workshops and specialist research meetings as agents of dissemination were useful approaches, but such strategies must be in the interests of the participants and be seen as valuable by peers in their own disciplines. Peer networks formed through intensive residential workshops can be of significant help to sustaining the momentum required to move from research to instructional uses of spatial methods. Dissemination of spatial analysis beyond its core disciplinary origins requires multiple strategies. In the case of CSISS, distinct but mutually reinforcing programs addressed the needs for (a) exemplary applications relevant to interests of different disciplines, (b) resources and analytic tools, (c) training opportunities, and (d) special efforts to service traditionally underrepresented populations.

The timing of NSF support for SPACE through the Division of Undergraduate Education's CCLI program has been especially significant, corresponding with the popularization of spatial technologies through handheld devices and web delivery. It also corresponds with increasing capabilities to geo-code scientific and other observations, and the ability to integrate spatial data and scientific perspectives across disciplines, leading to

The timing of NSF support for SPACE through the Division of Undergraduate Education's CCLI program has been especially significant, corresponding with the popularization of spatial technologies through handheld devices and web delivery. It also corresponds with increasing capabilities to geo-code scientific and other observations, and the ability to integrate spatial data and scientific perspectives across disciplines, leading to a broad recognition that geographical representation of information provides an important means to understanding and resolving societal and scientific problems. Providing undergraduates with exposure to GIS, analytical cartography, remote sensing, and spatial econometric concepts and tools were highlighted in SPACE workshops as a basis for motivating students and enhancing their opportunities for advanced studies and employment. In this program, knowledge in spatial analysis was linked with CCLI objectives for national dissemination of curricula and assessment resources. Equally important, SPACE has helped to promote a movement to strengthen the abilities of undergraduate instructors and students in the application of spatial thinking in the social sciences.

*Report submitted to the National Science Foundation  
Donald G. Janelle  
June 29, 2009*

## Appendices

- Appendix 1* List of Participants in SPACE Workshops
- Appendix 2* Voluntary comments from space workshop participants, derived from surveys
- Appendix 3* From the NSF Fastlane Report:
  - a. Project Participants
  - b. Organization Partners
  - c. Activities and Findings
  - d. Contributions
- Appendix 4* Survey Forms Used for SPACE Workshops

## Appendix I—Participant Listings for 2004, 2005, 2006, 2007

### SPACE WORKSHOPS:

#### SUMMER 2004

##### Ohio State University

- Veronica Arias Archaeology, University of New Mexico
- Kathleen Bell Economics, University of Maine
- Ulla Bunz Communications and Information Systems, Rutgers University
- Maria Conroy Urban and Regional Planning, The Ohio State University
- Owen Dwyer Human Geography, Indiana University, Indianapolis
- Douglas Feldman Anthropology, SUNY Brockport
- Robert Greenbaum Urban and Regional Economic Development, School of Public Policy & Management, Ohio State University
- Gregory Hooks Sociology, Washington State University
- Nikitah Imani Sociology, James Madison University
- Meadow Linder Sociology, University of Michigan
- Sandy Marquart-Pyatt Sociology,
- Leah Mathews Economics, UNC Asheville
- Heather Richards Archaeology, University of New Mexico
- Arun Srinivasan Economics, Indiana University Southeast
- Sumeeta Srinivasan Environmental Studies & Policy Harvard University
- Sarah Surface-Evans Archaeology, Michigan State University
- Michelle Thompson Geographic Information Science, Cornell University
- Judith Van der Elst Archaeology, University of New Mexico
- Marie-helene Vandersmissen Geographic Information Science, Laval University
- Joan Walker Human Geography, Boston University
- Lu Wang Geographic Information Science, Queen's University,
- Petra Zimmermann Geographic Information Science, Ball State University

##### University of California, Santa Barbara

- Carlos Balsas Urban and Regional Planning, University of Massachusetts
- Tapan Deka Socio-Economics, Gauhati University and UGC Govt. of India
- Karen Donahue Criminology, University of La Verne
- Julie Ford Sociology, SUNY-Brockport
- Madelyn Glickfeld Environmental Studies & Policy, UCLA Institute of the Environment
- Pavlina Latkova Tourism, Parks and Recreation, Michigan State University,
- April Linton Sociology, Princeton University, University of California, San Diego
- Stephen Lipscomb Economics, UC, Santa Barbara
- Jo Beth Mertens Economics, Hobart and William Smith Colleges
- David Padgett Urban Studies, Tennessee State University
- William S. Payne Tourism Management, NC State University
- Wenquan Zhang *Teaching Interest:* Sociology, University at Albany, State University of New York

##### San Diego State University

- Katrin Anacker Urban and Regional Planning, The Ohio State University
- Wendy Bigler Environmental Studies & Policy, Arizona State University
- Mark Bjelland Human Geography, Gustavus Adolphus College
- Timothy Bray Criminology, University of Texas at Dallas
- Randy Gainey Sociology, Old Dominion University
- Sukumar Ganapati Urban and Regional Planning, University of Southern California
- David Guertin Watershed Management, University of Arizona
- Karen Hayslett-McCall Criminology, University of Texas at Dallas
- Amy Hessl Environmental Studies & Policy, West Virginia University,
- David Iaquina Sociology, Nebraska Wesleyan University
- Christine Jocoy Human Geography, California State University, Long Beach
- Jani Little Human Geography, University of Colorado

- Loretta Lynch Economics, University of Maryland
- Wendy Miller Geographic Information Science, Washington College
- Susan Pulsipher Geographic Information Science, Methodist College
- David Rain Geographic Information Science, George Washington University
- Jungyul Sohn Regional Science, University of Memphis
- Christopher Weiss Sociology, Columbia University
- Eric Yamashita Urban and Regional Planning, University of Hawaii

### SUMMER 2005

#### Ohio State University

- Adegoke Ademiluyi Human Geography, Fayetteville State University
- Samuel Adu-Prah Geographic Information Science, Alcorn State University
- Nairne Cameron Geographic Information Science, University of Alberta
- Jinmu Choi Geographic Information Science, University of Georgia
- Christopher Cusack Human Geography, Keene State College
- Bernadette De Leon Public Health, Indiana University
- Yuri Gorokhovich Geographic Information Science, Columbia University
- Lynn Harvey Sociology, Winston-Salem State University
- Rajrani Kalra Urban Studies, Kent State University
- Sunwoong Kim Economics, University of Wisconsin-Milwaukee
- Kevin Leander Human Geography, Vanderbilt University
- Jiyeong Lee Geographic Information Science, University of North Carolina-Charlotte
- Sun Park Geographic Information Science, University of Hawaii-Hilo
- Karin Pfeffer Geographic Information Science, University of Amsterdam
- Clara Popa Communication Studies, Rowan University
- Alexander Prishchepov Geographic Information Science, Oklahoma State University
- Julio Rivera Human Geography, Carthage College
- Shouraseni Sen Roy Geographic Information Science, Arizona State University
- Talar Sahsuvaroglu Human Geography, McMaster University
- Jungyul Sohn Regional Science, University of Memphis
- Stephen Truhon Psychology, Winston-Salem State University
- Paul Von Hippel Sociology, Ohio State University
- Cecile Yancu Public Health, Winston-Salem State University
- Li Yin Urban and Regional Planning, State University of New York-Buffalo

#### University of California, Santa Barbara

- Claude Barnes Political Science, North Carolina A&T State University
- Janice Bell Public Health, University of Washington
- Sheryl Breen Political Science, St. Olaf College
- Sung Chun Sociology, University of Notre Dame
- Marlese Durr Sociology, Wright State University
- Owen Dwyer Human Geography, Indiana University-Indianapolis
- Jennifer Earl Sociology, University of California-Santa Barbara
- Joe D. Francis Sociology, Cornell University
- Kurt Fuellhart Human Geography, Shippensburg University
- Laurie Garo Geographic Information Science, University of North Carolina-Charlotte
- Randolph Horn Political Science, Samford University
- Mary Lou Larson Anthropology, University of Wyoming
- Brian Lee Landscape Architecture, University of Kentucky
- Kevin Marsh History, Idaho State University
- Georgina Moreno Economics, Scripps College
- Steven Perlmutter Political Science, College of William and Mary
- Heather Richards Archaeology, University of New Mexico
- Glenwood Ross Economics, Morehouse College
- Diana Sinton Geographic Information Science, National Institute for Technology & Liberal Education
- Jon Sonstelie Economics, University of California-Santa Barbara

- **Sudhir Thakur** Human Geography, University of North Dakota
- **Judith Van der Elst** Archaeology, University of New Mexico

### San Francisco State University (for UCGIS)

- **Jeana Abromeit**, Sociology, Alverno College
- **Philip Birge-Liberman**, Human Geography, Syracuse University
- **Bettina Bergmann**, Humanities, Mount Holyoke College
- **Giovanna di Chiro**, Environmental Studies & Policy, Mount Holyoke College
- **Vernon Domingo**, Human Geography, Bridgewater State College
- **Paulla Ebron**, Research and Technology, Stanford University
- **Robert Eng**, History, University of Redlands
- **Claudia Engel**, Education, Stanford University
- **Annalise Fonza**, Urban Planning and Politics, Mount Holyoke College
- **Benjamin Forest**, Human Geography, Dartmouth College
- **Theresa Garvin**, Human Geography, University of Alberta
- **Susan Handy**, Environmental Studies & Policy, University of California-Davis
- **Kathryn Henderson**, Sociology, Texas A&M University
- **Christopher Holoman**, Political Science, Hilbert College
- **Gareth John** Human Geography, Gustavus Adolphus College
- **Ka mutombo Kabasele** Demography, Xavier University
- **Mona Ray** Economics, Morehouse College
- **Isaac Robinson** Sociology, North Carolina Central University
- **Sue Steiner** Community Studies/Policy, Arizona State University
- **Alan Trevithick** Anthropology, Westchester Community College
- **Anibal Yanez-Chavez** Human Geography, California State University-San Marcos

### SUMMER 2006

#### Ohio State University

- **Babette Audant** CUNY Kingsborough Community College, Human Geography
- **Laura Blanciforti** WVU/NIOSH/CDC, Economics
- **Lincoln D. Chandler** Florida Memorial University, Criminology
- **Ke Chen** University of Cincinnati, Geography
- **Joe D. Francis** Cornell University, Sociology
- **Peng Gao** Syracuse University, Statistics
- **Jamie Griffiths** University of South Florida, Public Health
- **Iris Hui** University of California, Berkeley, Political Science
- **Andres Jauregui** Columbus State University, Economics
- **Changjoo Kim** Minnesota State University, Geographic Information Science
- **Enrique Lopez** UPR-Cayey Instituto Investigaciones Interdisciplinarias, Statistics
- **Rolin Mainuddin** North Carolina Central University, Political Science
- **Timothy Miller** Denison University, Economics
- **Brian Nicholls** University of Wisconsin-Milwaukee, Archaeology
- **Nancy Obermeyer** Indiana State University, Human Geography
- **Sunhee Sang** Minnesota State University, Geographic Information Science
- **Michael Strager** West Virginia University
- **Michele Villinski** DePauw University, Economics
- **Khodr Zaarour** Shaw University, Political Science

#### University of Oklahoma

- **Adegoke Ademiluyi** Fayetteville State University, Human Geography
- **Veronica Arias** University of New Mexico, Archaeology
- **Joe Bowersox** Willamette University, Political Science
- **William Brown** Texas Southern University, Human Geography
- **Hongmian Gong** Hunter College, Human Geography
- **Daikwon Han** Morehead State University, Institute for Regional Analysis & Public Policy
- **Ge Lin** West Virginia University, Geographic Information Science



- **Chris Mayda** Eastern Michigan University, Human Geography
- **Iheanyichukwu Osondu** Fort Valley State University, Human Geography
- **Jungyul Sohn** University of Memphis, Regional Science
- **Shobha Sriharan** Virginia State University, Environmental Studies & Policy
- **Judith van der Elst** University of New Mexico, Archaeology

#### **University of California, Santa Barbara**

- **Adriana Abdenur** The New School, Sociology and urban studies
- **Kishi Animashaun** Syracuse University, Environmental sociology and African-American studies
- **Marit Berntson** Roanoke College, Sociology
- **Neil Carlson** Calvin College, Political science and research methods
- **Jon Christensen** Stanford University, History
- **Alexandra Cole** California State University, Northridge, Political science
- **Charlotte Cooper** University of California, Santa Cruz, Archaeology
- **Laurel Cornell** Indiana University, Demography, sociology, East Asian culture
- **Albert Esteve-Palos** Universitat Autònoma de Barcelona, Spatial demography
- **Steve Graves** California State University, Northridge, Human geography
- **Daikwon Han** Morehead State University, Spatial demography and epidemiology, regional analysis
- **Yamuranai Kurewa** Bennett College, Social work
- **Jean LaVigne** Gustavus Adolphus College
- **Linda Loubert** Morgan State University, Urban studies and GIS
- **James Loucky** Western Washington University, Anthropology, international migrations and borderlands
- **Susan Maguire** University at Buffalo, Historical archaeology
- **Lisa Oliver** Simon Fraser University, Human geography
- **Jacqueline Olvera** Connecticut College, Urban sociology
- **Claudia Scholz** University of Texas, San Antonio, Environmental sociology and community development
- **Sue Steiner** Arizona State University, Social work and community change
- **Wei Tu** Georgia Southern University, Geographic information science
- **Ming Wen** University of Utah, Medical sociology and social epidemiology
- **Zhirong Zhao** Eastern Michigan University, Political science and public administration

#### **SUMMER 2007**

#### **Ohio State University**

- **Gregory Bohr** California Polytechnic State University, Environmental Studies & Policy; Geography
- **Olga Bychkova** The Ohio State University, Political Science
- **Marlese Durr** Wright State University, Sociology
- **Fazlay Faruque** University of Mississippi Medical Center, Public Health; GI Science
- **John Gossom** The Ohio State University, Human Geography
- **Diana Grigsby-Toussaint** University of Illinois Chicago, Public Health
- **Elizabeth Groff** Temple University, Criminology; Geography
- **Randolph Horn** Samford University, Political Science
- **Antwan Jones** Bowling Green State University, Demography
- **Ranbir Kang** Oklahoma State University, Geographic Information Science
- **Yushim Kim** The Ohio State University, Criminal Justice; Geographic Information Science
- **Katherine King** University of Michigan, Demography
- **Marilyn Krogh** Loyola University Chicago, Sociology; Urban Studies
- **Zhe Li** Clark University, Geographic Information Science
- **L Joe Morgan** UNC Greensboro, Geographic Information Science
- **Kenyatta Phelps** Bowling Green State University, Sociology; Criminology
- **Claudia Scholz** Trinity University (TX), Sociology; International Development
- **Sarah Smith** Delta College (MI), Sociology
- **Jeffery Strickland** Montclair State University, History; Historical Geography
- **Wei Tu** Georgia Southern University, Geographic Information Science
- **Xi Zhang** University of Pittsburgh, Sociology
- **Jennifer Ziemke** University of Wisconsin-Madison, Political Science

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- **Sean Anderson** California State University Channel Islands, Environmental Studies & Policy
- **Wesley Bernardini** University of Redlands, Archaeology
- **Kevin Byrne** Minneapolis College of Art and Design, Visualization and creative management
- **Valentina David** Bethune-Cookman College, Environmental Science
- **Alex De Pinto** University of Redlands, Economics
- **Joshua Dyck** University at Buffalo, SUNY, Political Science
- **Jill Grigsby** Pomona College, Sociology
- **Hiroyuki Iseki** University of Toledo, Urban and Regional Planning
- **Esther John** Northwest Indian College, Education and Curriculum Development
- **Rajrani Kalra** University of Central Arkansas/Kent State University, Human Geography
- **Sharla Lair** Florida State University, Geographic Information Science
- **Lillian Larsen** University of Redlands, Religious Studies, History
- **Allan Joseph Medwick** Kean University, Education Management; Asian and Chinese Studies
- **Sookhee Oh** Brown University, Sociology
- **Kerry Pannell** DePauw University, Economics
- **Jen Petersen** New York University, Sociology; Urban Studies
- **Ana Simão** University of Coimbra, Resources Management and GIS
- **Shobha Sriharan** Virginia State University, Environmental Science
- **Jun Sunseri** University of California, Santa Cruz, Anthropology
- **William Van Lopik** College of Menominee Nation, Geographic Information Science
- **Steve Wuhs** University of Redlands, Political Science
- **Li Yin** University at Buffalo (SUNY), Urban and Regional Planning