

## **Geospatial Consortium: Collaborative Geospatial Activities at U of M**

Spring 2009

### **Summary**

Geospatial science concerns the use of technology to understand the spatiotemporal nature of people, places, and processes. Students, staff, and faculty at U of M engage in spatial analysis and modeling of social and natural processes, visualization and data mining of complex information, and examination of the relationships between society and spatial technologies.

This report describes three facets of geospatial teaching, research, and service on campus:

- 1) Development of an informal Geospatial Consortium to share information about geospatial activities on campus.
- 2) Enumeration of geospatial activities on campus and elsewhere. This assessment involved conducting a nationwide study of geospatial activities; reviewing existing U of M courses, research, and centers; consulting with faculty members from many units; and getting advice from a student advisory panel.
- 3) Assessment of future geospatial activities on campus.

The picture is clear—there are myriad individual geospatial efforts but consolidation of our collective strengths offers tremendous opportunities for fortifying existing activities and developing a variety of new ones.

### ***Report Highlights***

Geospatial activities at U of M and beyond

Potential activities on campus

- Standing seminar/brown bag series
- Signature seminar series
- Borchert Lecture/GIS day
- GIS laboratories
- Staff and faculty hires
- Geospatial Center of Excellence

Review of geospatial centers and programs at other institutions

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## 1 Overview

Geospatial science concerns the use of technology to understand the spatiotemporal nature of people, places, and processes. These technologies respond and contribute to a fundamental shift in the way people come to understand the world around them. These technologies—including Internet mapping, in-vehicle navigation systems, video games, Geographic Information Systems (GIS), and the Global Positioning System (GPS)—not only offer new forms of representation, they are becoming the primary way finding and analysis tools of the 21st century. The appeal of vehicle navigation systems and the popularity of Virtual Earth Browsers such as Google Earth (which has been downloaded over 250 million times) are but two indicators of a shift in the way people encounter the world.

The Geospatial Consortium is one of many initiatives on campus seeking to advance geospatial research, teaching, and service (inset). The Geospatial Consortium complements other efforts by focusing on nuts-and-bolts issues that affect students, staff, and faculty. Recent issues include Central Office of Information Technology's (OIT) move to a broader state-wide license for the ArcGIS software package, Enterprise GIS's development of a campus-wide infrastructure GIS, Libraries' ongoing investment in geospatial expertise, and the Minnesota Population Center's (MPC) creation of service positions in GIS. The Geospatial Consortium emerged to meet the need for better communication and collaboration among faculty, students, and staff in planning and implementing these and other geospatial activities.

### Campus Geospatial Initiatives

College of Design's 5D Initiative  
Enterprise GIS  
Institute on the Environment Geospatial Collaborative  
Interdisciplinary Undergraduate Minor in GIS  
Libraries Mapping and GIS Initiatives  
Masters Geographic Information Science (MGIS)  
Minnesota Futures Symposium on Geoinformatics  
Minnesota Population Center Spatial Analysis Core  
Office of Information Technology Activities  
Space and Place Collaborative  
*and many others...*

Geospatial Consortium attendees come from various collegiate units and departments on campus. We began meeting 18 months ago to coordinate GIS software issues, but it quickly became apparent that there are plenty of campus-wide GIS issues that could benefit from greater coordination among units, and so we ended up broadening the group's mandate to tackle a broader range of issues. The overarching goal is to increase the presence, awareness, and use of GIS and geospatial activities on campus. Group members share information on current activities and brainstorm on how to work together towards coordinated program development, service delivery, and strategic infrastructure planning. These activities support the University's goal of becoming a top-three research institution by supporting exceptional students, staff, and faculty. Participation in the Consortium is informal and open to anyone.

The goals of the Geospatial Consortium for the coming years include:

- Continue to get the word out in the form of an annual report to which anyone can contribute (you are holding the first edition). To get the ball rolling, we canvassed a range of people and centers around campus to offer a snapshot of geospatial activity today and glean ideas for tomorrow. The College of Liberal Arts (CLA) funded an RA in part to assess GIS on campus and elsewhere. We invite anyone who is interested to contribute material, especially if we missed you the first time around.
- Meet every semester to share information and discuss concrete steps to improve GIS on campus. This year, for example, OIT and Libraries have focused on getting GIS software into more labs and departments. We describe other activities below that are ongoing, and others that could be pursued in the future.
- Make and maintain informal ties among different people on campus. This has been accomplished in part through maintaining the *geospatial.umn.edu* website and contributing to GIS Day, but there are other avenues.

As is apparent to anyone who does GIS on campus, there are myriad individual efforts, but consolidation of our collective strengths offers tremendous opportunities to fortify existing geospatial activities and extend to a variety of new ones.

## 2 Assessment Process

We employed several complementary strategies to assess geospatial activities on campus and establish a roadmap for future activities. This work takes place against the larger backdrop of the broader U of M geospatial community and the work of many people and loci of activity.

We focused on several forms of assessment and planning:

- *National review.* We spoke to colleagues at U of M (Appendix A) and elsewhere about geospatial programs and reviewed the research literature (Appendix B). We also canvassed the nation for standout examples of geospatial activities at peer institutions, either in the form of full-fledged centers or smaller programs (Appendix C).
- *Curriculum review.* We reviewed geospatial course and degree offerings on campus (Appendix A).
- *Intercollegiate consultation.* We consulted with staff and faculty on campus about their geospatial activities. As part of an ongoing effort in the Department of Geography, we expanded a list that encompasses almost ninety researchers in twenty-nine departments or units across nine colleges or institutes (Appendix A). We also worked closely with staff in OIT, Libraries, and Enterprise GIS to better enumerate staff who work on GIS issues.
- *Student advisory panel.* We spoke with the board and members of the GIS Student Organization (GISSO), comprised of graduate students and undergraduates interested in GIS and cognate fields.

## 3 Geospatial Activities at U of M and Beyond

U of M has long been home to research and learning in geospatial science. Over ninety faculty engage in geospatial science or cognate fields via research, teaching, or outreach (Appendix A). This work builds on the fact that in the 1960s, U of M helped create one of the first Geographic Information Systems, the Land Management Information System, and today is the home of MapServer, the leading open source web-mapping application. In terms of education, the Masters of GIS was one of the first professional masters degrees in GIS and is currently recognized as one of the best programs in the nation.<sup>1</sup> The U of M offers over seventy courses in GIS or related topics that contribute to two undergraduate, three masters, and three doctoral programs (Appendix A). Similarly, there is a long history of examining the relationships between spatial technologies and society, including study of its ethical, legal, political, and public dimensions. The University has many internationally known GIS research centers, including the Center of Urban and Regional Affairs, the National Historical GIS, and the Natural Resources Geographic Information System Laboratory (see the full list in Appendix A).

Beyond U of M, geospatial research is rapidly emerging as a key intellectual focus throughout academia. Of particular importance is research under the broader monikers of geospatial science and geoinformatics, which examines spatial technologies to understand people, places, and processes on the earth. Recent articles in *Nature* and the *Proceedings of the National Academy of Sciences*<sup>2</sup> are among the growing number that describe how GIS is being discovered by a wide array of disciplines as both an integrative approach and research topic in and of itself. The rise of GIS in particular as an academic field is evident in how leading institutions such as Harvard University, University of Pennsylvania, and Brown University have created new centers and programs in GIS (we detail these and others below). Finally, key research agencies—National Science Foundation, National Aeronautics and Space Administration, and National Institutes of Health—have targeted GIS and cognate fields for dramatically increased funding.

GIS, for example, fits squarely into the realm of visual analytics, a recently identified interdisciplinary field combining psychological research in reasoning and cognition with interactive visual interfaces and environments, and is the focus of ongoing significant funding from national intelligence and security agencies.

Beyond academia, geospatial technologies underpin emerging educational and workforce needs. The National Research Council (NRC) identifies GIS as a key approach for K-12 education.<sup>3</sup> Over the last 20 years there has been a remarkable growth in the development and use of geospatial technologies along with other developments in instructional technology. The NRC report *Learning to Think Spatially* emphasizes that GIS is “an integrator and a facilitator for problem solving across the curriculum. With advances in computing technologies and the increasing availability of geospatial data, spatial thinking will play a significant role in the information-based economy of the twenty-first century.” Similarly, the Office of the President of the United States and the Department of Labor have identified geospatial technologies, alongside nanotechnology and biotechnology, as one of the three most important high-growth industries in the 21<sup>st</sup> century.<sup>4</sup>

#### 4 Ongoing Geospatial Consortium Activities

Both our interviews with faculty and examination of GIS programs around the country raised key challenges that could be met with relatively modest effort. We give examples of activities and possible “home” organizations, although other organizations could offer these services.

- Data/archiving/server support via Libraries, CLA, and other units. One persistent theme that we hear time and time again is the inefficiency in managing research data, sharing it with others, and archiving data from research projects. One faculty member noted that many times he has seen graduate students build databases, then graduate and leave the data behind with no one to document or preserve them. A lot of good data has been lost. He also saw value in digitizing the collection of the Borchert Map Library so that their maps can be used with modern technological devices. Map Librarian Kristi Jensen has initiated this work, but there is a limit to how much can be done with existing resources and personnel. Another faculty member noted that he once required parcel data for a research project. He paid for a license out of his own research budget. Once word got around that he held these data, people came to him at the cost of considerable personal time and effort. This and other similar situations led him to believe that data subscriptions should be managed centrally and interested parties should have access to a university-wide repository. He would like to see a data librarian for a geospatial library.
- Better coordinated GIS software via OIT. One theme that ran through several interview responses was the inefficiency in purchasing and maintaining geospatial software. While Central OIT manages some of the more common packages, many faculty indicated they end up getting expensive single-use licenses for software that either already exists via a campus-wide license (e.g., Idrisi) or that would be less expensive for current users if paid for via a common contribution pool (e.g., ERDAS). The university should also consider extending coordination practices to cover commonly used hardware (e.g., GPS units).
- Training via MPC or other units. Another persistent theme was the gap in training between do-it-yourself efforts and semester-long courses. A number of faculty members indicated the need for one, three, and five-day workshops for both themselves and their students. Several interviewees noted that most people in their respective areas of research (which range from social sciences to public health to natural sciences) need GIS skills and analysis but they “don’t know it yet.” The potential for geospatial research in these areas and others is great but is largely untapped, here and elsewhere. Steps to encourage researchers to use GIS include provision of short training courses, which may in turn lead people to take semester courses that already exist.

- Research support via MPC or other organizations. There appears to be a niche for geospatial “tech support” that could provide help and advice on small jobs on the order of five to fifty hours. Many researchers indicated that they are very interested in using geospatial approaches in their work but are not equipped to perform even simple tasks. One professor noted, for example, that he often receives calls with basic GIS questions, often at the last minute, and he would like to refer these people to a central location instead of tutoring other faculty and students in GIS. Another researcher gave several examples of projects where he had a geoprocessing task to accomplish, but given the amount of time necessary to figure it out, ended up leaving that research out of the final product. Although he teaches GIS and uses it, there are many areas where he is less comfortable in the software, and would like to have a tech support center for questions beyond his expertise.
- GIS support for community organizations and state and local government via CURA and other units. CURA has developed a core staff with time and resources to provide such help, especially catering to the needs of smaller organizations without their own resources. Likewise, research support can be given to faculty working on Minnesota issues. CURA staff connect to various regional, state, and national policy organizations. It is the Twin Cities link for the Urban Institute’s National Neighborhood Indicator Partnership.
- Digital and analog cartography via the Cartography Lab. Dr. Mark Lindberg heads the lab, and provides visualization and cartography expertise to a range of users, including private sector firms and public sector organizations.

Compared to other institutions, the U of M faces both advantages and disadvantages compared to other institutions when developing geospatial programs. When we compare our existing and future geospatial activities to those at other institutions (Appendix C), it is necessary to understand the advantages afforded by location (e.g. South Dakota State University’s GIS Center of Excellence takes advantage of being near a federal research center for remote sensing) and by resources (e.g., Harvard’s Center for Geographic Analysis is part of a very wealthy university). We have many of our own resources and venues for cooperation beyond the university, but their sustainability is often fragile. It is crucial to continue to support existing strengths, while developing means and mechanisms to create new opportunities. An example of this kind of activity is the exploration of the creative uses of geospatial research in the humanities and social sciences, for example, as seen in the Phase II award of the Minnesota Futures’ program to Ali Momeni’s project, *Mobile Media for Everyday People: Bridging the Digital-Physical Divide*. Intriguing opportunities exist for this and other humanities projects by linking studies to GIS and visualization.

## 5 Potential Activities

Geospatial research is increasingly essential to many fields, and the University of Minnesota is poised to build on the existing strengths. Below, we examine several activities ranging from a standing seminar series through to the establishment of a Geospatial Center of Excellence.

### 5.1 Standing Seminar/Brown Bag Series

Several of U of M faculty with whom we consulted expressed fond memories for a brown bag series on GIS topics, last offered in 2000. The series was typically hosted three times a year on a rotating basis among units on the St. Paul campus, the East Bank, and the West Bank. Now is a good time to revisit this tradition given the general level of interest in GIS on campus.

*Possible activity:* Schedule the seminar series starting in Fall 2009 with a modest budget from supporting departments to bring in guest speakers. It would also be important to highlight U of M research and infrastructure activities by inviting on-campus faculty, staff, and students.

## 5.2 Signature Seminar Series

A funded semester seminar series of six to nine seminars from geospatial researchers across disciplines would help facilitate interactions. Another potential format is a three-day workshop. In either case, one likely goal would be to produce an edited volume or special journal issue. The signature seminar series would also be a good venue to integrate non-quantitative aspects of space and place into what is largely a quantitative field.

*Possible activity:* Following on the MN Futures symposium held in January 2009, develop a seminar series for 2010.

## 5.3 Borchert Lecture/GIS day

The 2007 GIS Day and inaugural Borchert Lecture was given by Jack Dangermond, president of the largest GIS software and service provider company, Environmental Systems Research Institute (ESRI). Dangermond studied landscape architecture here before going onto Harvard and then founding ESRI. While Jack Dangermond left his mark and received an honorary degree for his contributions, we must build on this event. We had the great fortune to have the esteemed scholar Michael Goodchild, from University of California Santa Barbara, present the 2009 Borchert lecture, which helped put this event on a solid foundation.

*Possible activity:* The MGIS program is working towards creating an anchor event for the University and CLA, and should request annual funding as part of its budget.

## 5.4 GIS Laboratory

There are several research centers on campus but no single Geospatial Analysis Laboratory. CLA is considering such a lab that would build on the existing strengths in the Minnesota Population Center with the newly-established Spatial Analysis Core and the Department of Geography Cartography Laboratory. It or a similar lab would offer access to data, support for work with GI technologies, and a regular set of training courses for university members and for continuing education programs. This facility would help to catalyze existing, yet disparate, interdisciplinary activities and provide the much-needed expertise in geospatial research that is increasingly being sought after by many around campus. One professional GIS expert (P&A line) would be necessary for this laboratory to help with software development, analysis, and programming.

## 5.5 Staff and Faculty Hires

Key to geospatial programs are faculty and staff. A cluster of hires in conjunction with a synergistic geospatial laboratory would support myriad new and cutting-edge research projects that would connect many areas of the college and university. Staff hires would also be critical, both within existing organizations such as Libraries and OIT, as well as new ones. Successful geospatial centers and programs at other institutions (Appendix C) have five to ten full-time staff and faculty positions.

## 5.6 Geospatial Center of Excellence

To conclude discussion of possible activities, we turn to the largest, establishing a Geospatial Center of Excellence. We reviewed programs nationwide to identify potential templates for establishing a center on campus. Compared to many peer institutions, U of M offers extremely rich resources in terms of libraries, map collections, and research and teaching labs. However, universities with organizations dedicated to geospatial research and education have more training courses, more technical assistance capabilities, and greater communication among

researchers in different disciplines. Full details on GIS centers and programs across the nation are given in Appendix C.

Many academic institutions around the country have identified the need to support multidisciplinary geospatial research activities occurring across campus. We identified two tiers of peer institutions. Tier One consists of those that have established a large-scale center or group dedicated to support geospatial research and education in relevant fields and departments. Tier Two institutions are similar to the University of Minnesota in size, history, and expertise in GIS, but do not have coordinated efforts to the extent the Tier One institutions do. These examples can serve as case studies for the University of Minnesota when considering options and ideas for spatial research coordination and support.

Importantly, a Geospatial Center of Excellence could manage many of the above noted functions of the Geospatial Consortium as well as provide new ones. One faculty interviewee, for example, argued that a center would help secure funding for large projects. Such a center that could facilitate research teams to seek grants from large programs, like NSF's Cyber-Enabled Discovery and Innovation. Other major benefits include more sustained and profound support than a laboratory alone could support.

### ***Tier One***

- Brown University: Spatial Structures in the Social Sciences
- Harvard University: Center For Geographic Analysis
- University of California Berkeley: Geographic Information Science Center
- University of California Santa Barbara: Center for Spatial Studies
- Pennsylvania State University: GIS Council
- South Dakota State University: Geographic Information Science Center of Excellence.

### ***Tier Two***

- University of Iowa
- University of North Carolina
- University of Wisconsin

Full details on both tiers of institution are given in Appendix C. The table below provides a quick look at key indicators.

<b>Institution</b>	<b>Center Name</b>	<b>Year Founded</b>	<b>Funding Mechanisms</b>	<b>Staff FTEs</b>	<b>Activities</b>
Brown University	Spatial Structures in the Social Sciences (S4)	2003	Central administration	8	Colloquium series, training, project consulting and support, research and data dissemination
Harvard University	Center for Geographic Analysis (CGA)	2005	Mixed	8	Workshops and training, help desk support, project consulting, seminars and colloquia, project funding, site licensing
Pennsylvania State University	Geospatial Information Systems Council (GIS Council)	2001	Contributions from 8 academic units	7	Project seed funding, campus GIS information sharing, outreach, data sharing
South Dakota State University	Geographic Information Science Center of Excellence (GIScCE)		State, EROS	5	Collaborative research, professional development, curriculum support
University of California at Berkeley	Geographic Information Science Center (GISC)	1998	Mixed	6	Short courses, research projects, consulting, help desk support, community outreach

University of California at Santa Barbara	Center for Spatial Studies (spatial@UCSB)	2007	Chancellor and Executive Vice Chancellor	10	Seminars, workshops, research, campus collaboration, lab construction and maintenance, consulting, curriculum development, web portal, data support
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## 6 Conclusion

There are tremendous opportunities for U of M geospatial activities. In many respects, we face a chicken-and-egg problem: we should build capacity to support specific and demonstrated needs, but very often these needs only become apparent when capacity exists but fails to be sustained. Related, there exists the potential to support clearly targeted geospatial efforts, but not at the cost of limiting support for existing successful programs or merely by targeting support to help overcome legacy barriers between programs and institutions. The review of programs at other institutions points to the vitality of institutions with histories of collaborative activities and the opportunities for new collaboration with sufficient funding to bring units activities together. Considering the long history of geospatial activities at U of M and the many kinds of current activities, is time to consolidate individual efforts and develop broader, synergistic initiatives.

## **Appendix AU of M Geospatial Resources**

*People.* U of M is home to many students and faculty that teach and do research on different aspects of geospatial science.

For a list of people, see <http://geospatial.umn.edu/people.htm>.

*Degrees and courses.* U of M offers a range of degrees and courses in geospatial technology. This list is compiled from the undergraduate and graduate catalogs. We also asked individual departments to denote GIS degrees.

For a list of courses, see <http://geospatial.umn.edu/curric.htm>.

*Research.* Many U of M units do geospatial research.

For a list of courses, see <http://geospatial.umn.edu/research.htm>.

## Appendix B Literature Reviewed

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## Appendix C Geospatial Programs and Centers at Peer Institutions

As noted above, we identified two tiers of peer institutions. Tier One consists of institutions that have established a large-scale center or group dedicated to support geospatial research and education in relevant fields and departments. Tier Two institutions do not have coordinated efforts to the extent the Tier One institutions have, but they are well known for some GIS activities.

### ***Tier One***

- Brown University: Spatial Structures in the Social Sciences
- Harvard University: Center For Geographic Analysis
- University of California Berkeley: Geographic Information Science Center
- University of California Santa Barbara: Center for Spatial Studies
- Pennsylvania State University: GIS Council
- South Dakota State University: Geographic Information Science Center of Excellence.

### ***Tier Two***

- University of Iowa
- University of North Carolina
- University of Wisconsin

### **Brown University**

Brown's Spatial Structures in the Social Sciences (S4) began in 2002 as scholars in several different social science disciplines recognized the need to develop a stronger spatial analysis capacity at the University. Through their efforts, the Population Studies and Training Center and Department of Sociology recruited Dr. Naresh Kumar to coordinate Geographic Information Systems software and hardware, offer training for undergraduate and graduate students, and consult with faculty on spatial analysis aspects of their research.

When the University announced its Plan for Academic Enrichment under the leadership of President Ruth Simmons and Provost Robert Zimmer, a more formal steering committee was created to prepare a proposal for long-term development in this area. The group has included scholars who at that time were chairs of several departments (Andrew Foster, Economics; Vernon Henderson, Urban Studies; Vincent Mor, Community Health; Michael White, Sociology; Alan Zuckerman, Political Science) and directors of two major research centers (Mark Pitt, Population Studies and Training Center; Darrell West, Taubman Center for Public Policy and American Institutions). They proposed several new faculty appointments, recruitment of a director, a series of workshops and seminars, creation of a GIS lab, and support for graduate students and postdoctoral fellows in relevant disciplines. This initiative was formally approved in 2003 by Brown's Academic Priorities Committee under the S4 name: Spatial Structures in the Social Sciences.

In spring 2004, S4 announced the appointment of John Logan, a sociologist and formerly Director of the [Lewis Mumford Center](#) for Comparative Urban and Regional Research, University at Albany, as its first Director. The growing S4 staff has been provided newly renovated space in Maxcy Hall in the center of the Brown campus. S4 has also been designated as the Spatial Analysis Core for the [Population Studies and Training Center](#), and this institutional connection has proved valuable for both programs.

S4 now counts 35 faculty affiliates from departments across the campus, not only in social sciences. S4 employs a director, associate director, four post-doctoral research associates, two full time programmers/lab managers, and several graduate students.

In addition, Brown's facilities include The Environmental and Remote Technologies Laboratory (EARTH Lab), which provides support to Brown University's research and academic activities as they relate to Geographic Information Systems (GIS) and Remote Sensing (RS). This support includes not only a collection of data, software, and hardware, but also training and assistance in the use of GIS and RS. Training in GIS can be undertaken through one-on-one sessions, workshops/seminars designed to meet specific requirements, on-line courses, a semester-long course and/or custom tutorials. Training in RS is through the courses Global Environmental Remote Sensing; Advanced Remote Sensing; and Remote Sensing of Earth and Planetary Surfaces. EARTH Lab staff are available to work with faculty, staff, and students, regardless of discipline, in the utilization and application of these technologies.

Brown's ESRI site license is coordinated through the EARTH Lab.

Project Examples: S4 collaborators created a series of maps and an interactive web mapping service as a part of a community improvement project for the city of Providence, Rhode Island. Geospatial technology was employed as a part of a large effort to excavate the Petra Great Temple in Jordan. S4's MapUSA site delivers data on census tracts throughout the entire United States.

Spatial Structures in the Social Sciences

Website: <http://www.s4.brown.edu/>

Director: John Logan, [john\\_logan@brown.edu](mailto:john_logan@brown.edu), 401-863-2267

## Harvard University

Harvard's Center for Geographic Analysis at Harvard University was founded in 2005; its first Director is Dr. Peter K. Bol of the Department of East Asian Languages and Civilizations. As a technology platform in the [Institute for Quantitative Social Science](#), the Center focuses on research and education in the field of spatial analysis and geographic information. The Center works across the university to strengthen geographic information systems infrastructure, interoperability, collaboration and services.

Building on the foundation already created by the Harvard Geospatial Library and the Harvard Map Collection, the Center for Geographic Analysis supports a wide range of scholarly research projects that apply spatial analysis, administers Harvard-wide GIS infrastructure, including GIS software site licenses, collects and disseminates spatial datasets from scattered sources. The Center has eight permanent professional staff who can guide and support complex projects across Harvard, in addition to five research affiliates. A Faculty Steering Committee of 18 includes representatives from a variety of departments, including Public Health, History of Art and Architecture, East Asian Languages, Medical School, Economics, Engineering and Applied Sciences, Statistics, Graduate School of Design, Organismic and Evolutionary Biology, Sociology, Earth and Planetary Sciences, Kennedy School of Government, and Anthropology. The CGA is also served by an 11-member Technical Advisory Committee.

The CGA fosters collaboration through the ABCD-GIS Working Group, which focuses on how Geographical Information Systems are used in the Harvard community and promotes the sharing of information and expertise to help solve mutual problems. The group, co-chaired by representatives from the Map Library, Planning Office, Graduate School of Design, and School of Public Health, meets monthly. Other collaborations include a semimonthly GIS Colloquium Series organized by the Department of Earth and Planetary Sciences, a campus-wide effort to document the history of GIS at Harvard, and events hosted by The Leadership for a Networked World Program and the Government Innovators Network.

Site licenses for ArcGIS, FME, and Erdas Imagine are paid for and managed by a coop of contributing departments for the benefit of the entire university. ArcGIS software is available for download through the CGA website.

Harvard has twelve GIS labs spread out around campus with at least 229 seats. Four labs contain plotters and six contain scanners. Software includes ArcGIS 9.2 and 9.1, ArcGIS Business Analyst, ArcView 3.2, ERDAS Imagine, Goda095i, FME, Arc2Earth Pro, Global Mapper, MultiSpecW32, GeoDa, MapInfo, Geolytics, and Google Earth Pro. Quantitative data is housed at the Harvard-MIT Data Center and Harvard Geospatial Library, and many labs contain specialized data sets. The CGA owns several GPS devices, including Trimble GeoXT, GeoExplorer 3, Garmin GPSMAP60Cxm Garmin eTrex Legend Hcx, and ATP Photofinder GPS. Finally, the Geographic Information Sharing Tool was developed to facilitate browsing, creating, sharing, and downloading geographic information using the freeware version of Google Earth as the client software. GIST was funded by a Harvard Provost Office Innovation Grant for use in Harvard courses.

**Project Examples:** The China Historical GIS established a database of historical administrative units for different periods in Chinese History, and provides a base GIS platform for researchers to use for spatial analysis, temporal statistical modeling, and representation of selected historical units as digital maps. The HEALTHMap website automatically picks up and charts fresh case reports and other data from sources such as the World Health Organization, Google News, and the disease alert Web site ProMed-Mail. Information can be sorted by disease and country links to the original report or article.

Center for Geographic Analysis

Website: <http://gis.harvard.edu/>

Director: Peter K. Bol, [pkbol@fas.harvard.edu](mailto:pkbol@fas.harvard.edu), 617-495-4305

### **University of California – Berkeley**

The Geographic Information Science Center (GISC) at the University of California at Berkeley was established in 1998 to serve Berkeley faculty, students, and staff by coordinating the acquisition, instruction, deployment, and development of geographic information technologies on the campus. An independent campus unit administratively located under Vice Provost Jan Devries, the Center is not directly managed by any particular unit or department on campus and thus has a campus-wide mandate. The fundamental mission of the center is to raise the level of GIS expertise on the entire campus and to stimulate cross disciplinary education, research, and cooperation using these technologies. In turn, the Center seeks to raise the visibility of existing activity, to encourage linkages and to stimulate new research and education at Berkeley in the rapidly developing field of geographic information science. It accomplishes this mission by serving research, education, and administration with computer infrastructure support; shared hardware resources; distribution of site licensed software; specialized instructional classes and seminars; data development, repository and access; consulting services; programming support; community building; and outreach.

In addition, the GISC offers consulting services to campus constituents, including but not limited to, advice on equipment configuration and instrumentation, project design, connectivity to the campus license servers, and database design. GISC also is interested in participating in grant proposal development and to act as a hub for collaborative research on topics in geographic information science.

The Director of GISC is John Radke. It has six full time staff, three instructors, five PhD students, one affiliate and two visitors.

Besides supporting departmental and organizational research projects, the Center operates a Help Desk which assists with questions from the campus community and offers tutoring from students and staff. It coordinates the ESRI site license which provides software to students and faculty.

Project Examples: Calmap is an open source web-mapping application developed for the CERES group at the Resources Agency of the State of California. It was developed as a support application for the State's Prop40 and Prop50 grant program for water conservation and development where project applicants document their projects via a web application. The Center also developed an interactive map of Herman Melville's activities on the island of Nuku Hiva. It also created a web mapping application for InfoOakland, a tool for community organizations to gather and to analyze information in furthering their goals toward social justice.

Geographic Information Science Center

Website: <http://www.gisc.berkeley.edu/>

Director: John Radke, [ratt@gisc.berkeley.edu](mailto:ratt@gisc.berkeley.edu), 510-643-3561

### **University of California – Santa Barbara**

The UCSB Center for Spatial Studies ([spatial@ucsb](mailto:spatial@ucsb)), established in 2007, is a university-wide resource and research center at the University of California, Santa Barbara. Its mission is to facilitate the integration of spatial thinking into processes for learning and discovery in the natural, social, and behavioral sciences, to promote excellence in engineering and applied sciences, and to enhance creativity in the arts and humanities.

[spatial@ucsb](mailto:spatial@ucsb) is dedicated to promoting spatially related events, research, and teaching for the entire campus, for all disciplines that share interest in the importance of spatial thinking in science and in artistic endeavors, the development of spatial analytic tools, and the importance of place in society.

[spatial@ucsb](mailto:spatial@ucsb) offers new capacity for growth through its strong existing programs and facilities. It expands their scope and effectiveness by creating new opportunities for collaboration. In addition to building on the strengths of the present, it looks to the future by growing the young science of spatial thinking into a major field of research and teaching. Its goals are to:

- Integrate spatial thinking into the corpus of reasoning across the domains of knowledge for research and teaching.
- Frame curricula to equip UCSB graduates with the concepts, methods, and applications of spatial thinking.
- Provide a Web portal to curriculum and learning resources and a Web forum for exchange of ideas and training opportunities for faculty, researchers, and students.
- Promote research on new tools and applications of spatial thinking.
- Sponsor advanced research seminars, specialist meetings, workshops, and other events that serve the UCSB academic community and its leadership role nationally and internationally.

The Center is guided by an Executive Committee of 12 faculty members from Departments such as Geography, Sociology, Education, Ecology, Natural Resources, Marine Sciences, Psychology, Religious Studies, and Computer Science. Its director is Geography Professor Michael Goodchild, who has also served as the Director of the National Center for Geographic Information and Analysis and UCSB Center for Spatially Integrated Social Sciences. The Center is also home to six dedicated research associates, one visiting scholar, and four staff people, including a coordinator, web developer, and two spatial consultants.

In terms of collaboration, [spatial@ucsb](mailto:spatial@ucsb) is affiliated with two centers on campus concerned with spatial analysis: the National Center for Geographic Information and Analysis and five

subgroups, including the National Consortium on Remote Sensing in Transportation, the Strategic Enhancement of NGA's Geographic Information Science Infrastructure, Vehicle Intelligence & Transportation Laboratory, Project Battula, Project Varenius, and Project Gigalopolis. It is also affiliated with the Center for Spatially Integrated Social Science, including its GIS Population Center and the Spatial Perspectives on Analysis for Curriculum Enhancement project.

The Center organizes regular brown bag presentations, a graduate student forum, and specialist meetings. It offers consulting services to for course design, short courses in spatial tools and research, and a GIS course with a multi-disciplinary theme for graduate students. It also offers extensive resources in teaching materials and tools through its website. It also partners with campus entities to strengthen proposals on spatial projects and organizes data and imagery on the physical and human environment and on planning for the local area and UCSB campus. The Center is developing a new GIS lab using Geography Department space.

Spatial@UCSB is funded by the university's Chancellor and Executive Vice Chancellor.

Project Examples: Spatial@UCSB does not conduct research on its own, rather it provides tools and resources to researchers and educators across campus to achieve their goals.

Center For Spatial Studies

Website: <http://www.spatial.ucsb.edu/>

Director: Michael Goodchild, [good@geog.ucsb.edu](mailto:good@geog.ucsb.edu), 805-893-8049

## **Pennsylvania State University**

The Penn State Geospatial Information Systems (GIS) Council was formed in 2001 to facilitate GIS-related activities, support preparation of large-scale proposals related to GIS, increase awareness of the use of GIS, identify the places at Penn State where geospatial expertise exists, and define other GIS-related issues University wide.

In Spring 2001 Dr. Eva J. Pell, Vice President for Research at Penn State, created the GIS Council composed of representatives from various campuses, research units and colleges. The GIS Council was asked to report on five specific charges:

1. *facilitate GIS-related activities*
2. *facilitate preparation of large-scale proposals*
3. *increase awareness of the use of GIS*
4. *identify the places where expertise exists*
5. *define other GIS-related issues University wide*

In November 2002, Tina Enderlein was appointed as the first Geospatial Information Systems (GIS) Officer for Penn State. The position was created resulting from a key recommendation in a GIS Council report commissioned by Eva J. Pell. The position has been made possible by financial commitments from eight academic units across the University. The contributing academic units include:

- College of Agricultural Sciences
- College of Earth and Mineral Sciences
- College of Engineering
- Applied Research Laboratory
- The Pennsylvania State University Capitol College, Harrisburg
- Hershey Medical College
- Penn State's Institutes of the Environment
- Social Science Research Institute
- Office of the Vice President for Research

The GIS Council is co-chaired by Dr. Wayne Myers, Professor of Forest Biometrics and Director, Office for Remote Sensing and Spatial Information Resources, University Park, and Brady Stroh, Director, Center for GIS, Penn State Harrisburg.

The GISC provides seed funding for projects to promote GIS and to develop new areas of interest and collaboration in GIS across campus. It maintains a calendar of events, coordinates site licenses and ESRI Virtual Campus courses, and centralizes information on research and resources on its website.

Project Examples: Like UC-Santa Barbara, Penn State's GIS Council does not conduct its own research and instead provides assistance and coordination for those who are active in GIS around campus.

GIS Council

Website: <http://www.gis.psu.edu/>

GIS Officer: Tina Enderlein, tme10@psu.edu, 814-865-1221

### **South Dakota State University**

The Geographic Information Science Center of Excellence (GIScCE) is a joint collaboration between South Dakota State University (SDSU) and the United States Geological Survey's National Center for Earth Resources Observation and Sciences (EROS). The purpose of the GIScCE is to enable South Dakota State University faculty and students, and EROS scientists to carry out collaborative research, seek professional development, and implement educational programs in the applications of geographic information science.

The idea for the GIScCE was formed and implemented by administrative leaders at SDSU, EROS, and the South Dakota State Board of Regents. EROS, a longtime collaborator with researchers at SDSU, is the largest civilian repository of remotely sensed data sets and a renowned center of applied earth systems science. In recognizing these strengths, a primary emphasis of the GIScCE will be the use of remotely sensed data sets to study the land surface and its modification over time.

Through the combined resources of many disciplines, the GIScCE seeks to investigate important questions regarding the dynamic earth system. Initial goals of the center include: establishing a solid foundation of teamed Senior Scientists who will compete for research funding, recruit and train additional staff, and expand the center's activities; strengthening educational programs at SDSU by creating opportunities for students to engage in GISc-related research topics while participating in the new Geospatial Science and Engineering PhD program; and expanding training and consulting services to local, national and international clients.

The GIScCE employs the capabilities of geographic information science, namely remote sensing, geographic information systems, digital mapping, and geostatistics, to document and understand the changing earth. To fully achieve this, an interdisciplinary center of study is required, one which utilizes engineering principles to efficiently and accurately process earth observation data, geographic principles to create meaningful thematic depictions of land cover and land use change, and applications which focus on the resultant effects of change on the geosphere, biosphere and hydrosphere. To date, 13 researchers from SDSU and EROS have been recruited to constitute the GIScCE staff of Senior Scientists. A staff of five administrative, IT, and research staff run the day to day operations. The Center also includes 28 graduate students, five postdoctoral fellows, one visiting scientist.

Project Examples: The GIScCE is currently working on several NASA-funded projects, including

- A Global Burned Area Earth Science Data Record from MODIS
- Earth Science Data Records of Global Forest Cover Change
- Enhanced Land Cover and Land Cover Change Products from MODIS
- Integrating MODIS crop characterization capabilities with AWiFS and agricultural survey data

- Web-enabled Landsat data (WELD) - a consistent seamless near real time MODIS-Landsat data fusion for the terrestrial user community

GIS Center of Excellence

Website: <http://globalmonitoring.sdstate.edu/>

Co-Director: Matthew Hanson, [matthew.hanson@sdstate.edu](mailto:matthew.hanson@sdstate.edu), 605-688-6848

## University of Iowa

The University of Iowa does not have a central GIS organization like some of the other universities in this report. They do, however, have an organization called the Center for Global and Regional Environmental Change (CGRER) which coordinates and funds spatial research across campus and beyond.

CGRER is the result of a group of scientists with interests in the areas of global change and environmental sciences getting together in the fall of 1988 to discuss the implications of global change. In November of 1989 the group hosted a symposium, Preparing for Climatic Changes: A Midwest Perspective. Subsequently a seminar series was formed and prominent speakers were invited to campus. Housed in the Iowa Advanced Technology Laboratory, CGRER was established by the State Board of Regents in 1990 and receives funding from a public utility trust fund, as mandated by Iowa's Energy Efficiency Act.

CGRER promotes interdisciplinary efforts that focus on the multiple aspects of global environmental change, including the regional effects on natural ecosystems, environments, and resources, and on human health, culture and social systems. Center membership is composed of interested faculty members at any of Iowa's colleges and universities. Currently there are 50+ CGRER members.

The primary goals of CGRER are:

- promote interactions between researchers interested in the effects and interactions of global change
- pursue funding opportunities for multi-disciplinary projects from Federal, State, and private sources
- attract highly qualified students to campus who are interested in earth system science
- acquire state-of-the-art facilities and equipment essential to the conduct of global change research
- assist the State and its industries in their activities related to the effects of environmental change

Two faculty members, Gregory R. Carmichael and Jerry Schnoor, both from the Department of Civil and Environmental Engineering, serve as CGRER co-directors. Faculty from 17 UI departments and five other universities participate in CGRER.

Center for Global and Regional Environmental Change

Website: <http://www.cgrer.uiowa.edu/>

## University of Wisconsin

GIS research and organization occur at several departments and organizations at Wisconsin, including the Land Information and Computer Graphics Facility, Spatial Information and Analysis Consortium, the Arthur H. Robinson Map Library, and State Cartographer's Office.

The University of Wisconsin at Madison's Land Information and Computer Graphics Facility (LICGF) is the GIS center of campus, housed in the College of Agriculture and Life Sciences. Its

mission is to provide research, training, and outreach in the use of land and geographic information systems. The mission focuses on land records modernization, land and natural resource management applications, and the use of information for land-use decision-making. LICGF is the administrative home of the eight-member National Consortium for Rural Geospatial Innovations in America (RGIS).

The facility provides a venue for both inter-disciplinary, multi-agency projects and individual faculty and student research efforts. One of the important missions of LICGF is providing instructional material in the form of workshops, video courses, university curriculum and the publication *Land Information Bulletin*.

SIAC arose from UW-Madison's response to the National Science Foundation call for the establishment of a National Center for Geographic Information and Analysis (NCGIA) in 1988. Since its formation by UW-Madison faculty in 1991, SIAC's primary mission has been to provide coordination of those programs and activities that address the collection, management, analysis, and application of spatially-referenced information about our natural, social, and cultural environments. This has included research, but in recent years as focused on coordinating curriculum, organizing a lecture series each fall, and a student paper competition in the spring. SIAC has one quarter-time employee on staff to run its operations. With the retirement of several GIS faculty and new faculty unable to dedicate time and resources, SIAC's activities and funding are scaled back compared to the past, but will likely be resuscitated in the future.

The Arthur H. Robinson Map Library, a sub-unit of the Department of Geography, contains a six-seat public lab with GIS software and a GIS librarian present to provide assistance. The Map and GIS Librarian, Jaime Stoltenberg, also organizes a short course introducing GIS to the campus community each fall, which has become a part of a campus-wide GIS day.

The State Cartographer's Office's mission is in outreach, and it distributes maps, aerial imagery, and other information to the public through its web portal.

Research and teaching labs are maintained separately by the Geography Department, Forestry Department, Robinson Map Library, and the State Cartographer's Office. The LCIF maintains a UW system wide ESRI license and the Forestry Department maintains ERDAS software, which anyone in the system can buy into. Other software packages are negotiated at the Department level. All students have free access to ESRI Virtual Campus courses through UW's site license.

Spatial Information and Analysis Consortium

Website: <http://www.siac.wisc.edu/>

Director: Steve Ventura, [sventura@wisc.edu](mailto:sventura@wisc.edu), 608-262-6416

### **UNC/Carolina Population Center**

The University of North Carolina at Chapel Hill has several departments and units on campus that provide GIS resources. All campus computer labs are loaded with ArcGIS and Erdas Imagine, and the Map Library includes specialized GIS labs with additional software and training opportunities. The Odum Institute maintains a consulting service, staffed by advanced graduate students, who are on call to answer questions regarding GIS software and related analysis. In addition, several members of the Institute staff have more advanced expertise in GIS analysis. The Odum Institute also offers short courses. Though UNC does not have a centralized organization like the other institutions mentioned here, the Carolina Population Center (CPC), located at UNC, is similar to our Minnesota Population Center. The Center's faculty fellows and graduate students currently work on over 50 funded projects concerning population.

As the first population center to propose a Spatial Analysis Unit in 1994, CPC has been a leader in this regard. The unit's specific objectives are to promote the incorporation of spatial perspectives and assist in project development, provide cost-effective support to CPC projects using spatial data and methods, encourage innovation in the blending of social and spatial tools and perspectives, and provide training as needed.

The Spatial Analysis Unit provides the following services to the CPC community in support of population-based research:

- Consultation for Proposal Development and Ongoing Research
- Spatial Database Development
- Spatial Analysis and Measurements
- Remotely Sensed Image Analysis
- Spatially Explicit Simulation Modeling
- Spatial Statistics
- Cartographic Design and Visualization
- Training

Carolina Population Center

Website: <http://www.cpc.unc.edu/>

Director: Barbara Entwisle, [entwisle@unc.edu](mailto:entwisle@unc.edu), 919-966-1710

## **Appendix D Endnotes**

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