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IN THIS ISSUE

FEATURES

Conference in Boulder. 1
NCGIA Software 1
Conference in Pisa. 2
Conference in Greece. 2

INITIATIVES

Research Initiative 4. 2
(Use & Value of Geographic Information)
Research Initiative 5. 3
(Very Large Spatial Databases)
Research Initiative 6. 3
(Spatial Decision Support Systems)
Research Initiative 7 4
(Visualization of the Quality of Spatial Information)
Research Initiative 8 5
(Formalizing Cartographic Knowledge)
Research Initiative 9. 5
(Institutions Sharing Spatial Information)
Research Initiative 10. 5
(Spatio-Temporal Reasoning & GIS)
Research Initiative 12. 6
(GIS & Remote Sensing)
Research Initiative 13. 6
(User Interfaces for GIS)
Research Initiative 14. 7
(Spatial Analysis & GIS)
Research Initiative 15 7
(Roles for GIS in U.S. Global Change Research)
Educational Initiatives 8
Site News 9
NCGIA Publications 12

Conference in Boulder

On September 15-19, 1991, NCGIA, with the help of government and private co-sponsors, presented its First International Conference/Workshop on Integrating Geographic Information Systems and Environmental Modeling, in Boulder, Colorado. The goal was to determine how GIS and spatial data could better contribute to environmental modeling in the natural and physical sciences. Government co-sponsors included the Environmental Protection Agency, the Department of the Interior/Geological Survey, /Fish and Wildlife Service, /Minerals Management Service; the Departments of Energy, Agriculture, and Commerce, also the National Institutes for Global Environmental Change, and NASA. Private sponsors included IBM and ESRI. The organizing committee included Michael Goodchild (NCGIA-Santa Barbara), Lou Steyaert (USGS), Michael Crane (USGS), Carolyn Hunsaker (Oak Ridge National Laboratory), Mason Hewitt (EPA), Denis White (EPA), Dave Rejeski (EPA), Brad Parks (EPA), and Dave Hastings (NOAA). The staff conference coordinators were Judith Parker and Sandi Glendinning (NCGIA-Santa Barbara).

This conference represented the first formal opportunity to join the purposes of geographic information systems and current environmental research. More than 650 people attended to hear speakers, panelists, and seminar leaders on a wide range of subjects, for example: "Ecosystems Modeling," "GIS for Modelers," "Spatial/Geostatistics," "Atmospheric Modeling," "Hydrological Modeling," "Land-Surface Subsurface Process Modeling," and "The Role of Modeling in Policy." An edited volume based on the conference will be published by Oxford University Press later in 1992. NCGIA is planning the Second International Conference/Workshop on Integrating Geographic Information Systems and Environmental Modeling at Breckenridge, Colorado, for September 26-30, 1993. There will be more information on this event in future UPDATEs, or contact the NCGIA Conference Secretariat at 805/893-8224 or FAX: 805/893-8617. Email: ncgia@ncgia.ucsb.edu.

NCGIA Distributes Advanced Software

NCGIA-Santa Barbara will be the exclusive distributor to academics of GEOLINEUS: Lineage tracking, data management and graphical interface for GIS. GEOLINEUS is now available to academic (University and College associated researchers and educators) users of ARC/INFO on the SUN4 and SPARCstation workstations.

GEOLINEUS is a productivity tool that simplifies GIS application development and eases spatial database management. GEOLINEUS is based on David Lanter's research into the application of Computer Aided Software Engineering (CASE) techniques and expert systems to spatial data quality and uses a knowledge-based data structure. Making full use of Graphical User Interface (GUI) technology, the software also lets users view their GIS macros visually as flow charts. Users can interact directly with the flow charts to modify their macros. At the same time, the software's quality assurance system automates data quality reporting as specified in the draft Spatial Data Transfer Standard.

Cost of an academic institution license is $120. For information contact the NCGIA-Santa Barbara office.

In Spring 1992, NCGIA-Santa Barbara will distribute SPACESTAT. Developed by Luc Anselin, SPACESTAT includes a range of descriptive spatial statistics, measurements of spatial autocorrelation and tools to implement spatial analysis in regression models. SPACESTAT facilitates teaching spatial statistics with GIS and focuses on techniques not included in commercial statistical and econometric software. In addition, it is

suitable for the analysis of medium size problems on cross sectional data. Available to researchers for two years, SPACESTAT has been used with spatial data analysis courses taught at both the undergraduate and graduate levels within the Department of Geography of the University of California, Santa Barbara. The new release includes a revised menu structure and data interfaces to a number of commercial GIS, including ARC/INFO and IDRISI, with support for GisPlus, OSU MAP, SPANS, and GRASS to follow.

SPACESTAT requires an IBM-PC compatible with a 80386 or 80486 CPU, math coprocessor, and four megabytes of RAM. A tutorial/workbook on the use of SPACESTAT for spatial data analysis will be available by Fall 1992.

For information on availability and price of the software and technical reports, contact NCGIA-Santa Barbara at the address listed on the back cover.

Conference in Pisa

An international conference, "From Space to Territory: Theories and Methods of Spatio-Temporal Reasoning" will be held in Pisa, Italy, September 21-23, 1992. NCGIA is a co-sponsor of this event, along with the Commission of European Communities, the University of Pisa, the Italian National Research Council (CNUCE & IEI), Regione Toscana, Consorziom Pisa Ricerche, IRPET, AICA, and CISPEL. Max Egenhofer and Andrew Frank (NCGIA-Maine) are helping to organize this international conference. Registration is open.

The conference will concentrate on the following themes: 1) Modeling of Spatial and Geographic Knowledge; 2) Formal Methods for Representing and Reasoning with Spatial Concepts; 3) Formal and Natural Languages for Describing Geographic Space; 4) Modeling of Spatial and Temporal Reasoning; 5) Experiments and Models from Environmental Psychology; 6) Human-Computer Interaction with Spatial and Temporal Data; 7) Interaction between Geographic Theories and GIS Methodologies; and 8) Cultural Aspects of the Spatial and Temporal Cognition of Places. The official languages of the Conference are English and Italian. The program co-chairs are: Andrew U. Frank, Technische Universitat, Vienna; Carlo Da Pozzo, Universita' di Pisa; Mario Pinna, Universita' di Pisa; Irene Campari, CNUCE-Cnr, Pisa. For registration information, contact Mrs. Sabina Buffoni, via Case Dipinde 17, 56127 Pisa Italy. FAX: 39-50-578298.

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Conference in Greece

A NATO Advanced Research Workshop (ARW) on "Modeling the Use and Diffusion of Geographic Information Technologies" is being held in Sounion, Greece, April 8-11, 1992. NATO is primary sponsor, with contributory funding from UK Regional Research Laboratories (UK Economic and Social Research Council); and the Urban and Regional Spatial Analysis Network for Education and Training (Greece URSANET Project with COMETT Program of ECC). Conference registration has been filled.

Ian Masser (University of Sheffield) and Harlan Onsrud (NCGIA-Maine) are directing the workshop and NCGIA-Maine is providing logistical support for the event. The objective of the ARW is to provide a high-level exchange on methods for analyzing and modeling the diffusion and use of geographic information handling innovations, and to establish directions for future research. Attending will be approximately thirty participants from thirteen countries, including researchers from the diffusion of innovations, management information systems (MIS), organizational theory, and GIS research communities.

A book containing the results of the workshop sessions as well as selected papers will be published in the NATO Advanced Study Institutes Series.

INITIATIVES

Use and Value of Geographic Information I-4

The specialist meeting for this initiative was held in May 1989 and was followed by a series of presentations on the research at GIS/LIS in November 1989. Since that date, personnel working on I-4 have been active primarily in pursuing the research. The overall objective of the work plan has been to develop fundamental integrated frameworks and tools for evaluating the use and value of geographic information. The general form of the research in developing these frameworks has been to conduct, in an iterative manner, investigations into the actual use of geographic information in selected situations. The primary vehicles have been in-depth case studies, limited surveys, and broadly based surveys of both users and non-users of geographic information systems.

A nationwide case study research project to test a series of technology transfer theories in GIS operational environments is underway. The project is a joint effort of NCGIA I- 4 and the URISA Education and Technology Transfer Special Interest Group. To date, several individuals have taken up the call and have agreed to carry out the work and submit their study results in journal article format before the end of the summer. If results warrant, we intend to produce a book or major report on the research results.

Two sessions have been organized by NCGIA Initiative 4 /URISA Education and Technology Transfer S.I.G. for URISA '92 in Washington, DC.: (1) What Can We Learn From GIS Case Study Research; and (2) Knowledge Gained and Future Work: Research in the Use and Diffusion of Geographic Information Technologies.

The primary wrap-up session for I-4 will take place at the NATO Advanced Research Workshop on "Modeling the Use and Diffusion of Geographic Information Technologies" in Sounion, Greece, April 1992.

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Very Large Spatial Databases I-5

Terence Smith (NCGIA-Santa Barbara) is investigating a new generation of spatial database languages that are intended to provide the basis for DBMS/modelling systems, particularly in earth-system science applications. The family of languages is termed "Complex Spatial Object Languages" (CSOL), and the work is proceeding under additional NSF funding in a collaborative effort involving computer and earth scientists at UCSB, University of Washington and University of Wisconsin. A preliminary version of the language was presented at a European workshop on DBMS for spatial applications, and a revised version of the language will be presented at the First International Symposium on Spatial Data Handling in South Carolina in August, 1992. The current research involves not only the language development, but also a full requirements analysis with respect to a specific application (hydrology of the Amazon Basin), and issues relating to the computational support for such a language.

Andrew Frank (NCGIA-Maine) is investigating new spatial query languages. In a paper he presented at a European workshop on Database Management Systems for Geographical Applications on the exploratory access needs of geoscientists, he proposed an iconic language using "data cubes" (for data-sets) and "maps" (for the graphical presentation of data sets) so that "data cubes" can be explored by dragging them over "maps." This separation is in concert with the results of the design of spatial SQL where separate languages were used to formulate the queries and display instructions. Frank is also continuing research in spatial access methods and has published a paper that identifies the special requirements geographical data pose in a GIS for spatial access methods.

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Spatial Decision Support Systems I-6

Two Initiative 6 (SDSS) sessions will be held at the 1992 Association of American Geographers meetings in San Diego:

1) Spatial Decision Support Systems 1: Design and Organizational Issues (Sunday, April 19, 8 - 9:40 a.m.)
2) Spatial Decision Support Systems 2: Routing and Location Selection (Sunday, April 19, 9:55 a.m. - 11:35 a.m.)

A workshop on SDSS also has been arranged for these meetings by Gerard Rushton (San Diego State University) and Paul Densham (NCGIA-Buffalo), covering the principles and applications of SDSS.

The Environmental Protection Agency is funding a three-year project at Buffalo for "Development of a Geographically-Based Ecological Modeling Framework for Exposure-Effects Analysis of Contaminants in the Lower Great Lakes." This project will develop an SDSS which integrates a suite of exposure-effects models with a GIS. There are six co-principal investigators: four from the Great Lakes Program and College of Engineering: J. V. DePinto (Project Director), J. Atkinson, R. R. Rumer, and S. Taylor, and two from NCGIA-SUNY, Hugh Calkins and Paul Densham receiving 20% of the grant. Total funding of $1,643,005 covers the period July 1991 to June 1994.

I-6 has also received funding from several other sources: from the National Science Foundation: "Improving Human-Computer Interaction in Locational Decision-Making"; $99,810, to the Co-Principal Investigators Paul Densham (50%) and M. P. Armstrong, University of Iowa, (50%) for the period June 1991- December 1992. (This grant will also benefit I-13.) From the University Transportation Research Center (Region II, CUNY Institute of Transportation Systems): GIS Technology for Integrated Management of Transportation Systems"; $49,994 to Principal Investigator Satish Mohan, Department of Civil Engineering and Co-Principal Investigator Hugh Calkins (NCGIA-Buffalo).

Research at Buffalo (Paul Densham and Yuemin Ding) has led to the development of a parallel version of Dijkstra's shortest path algorithm. Running on a Transputer array in a PC, this software is being linked to Caliper Corporation's TransCAD GIS. Several parallel location-allocation algorithms also are being developed which will be linked to TransCad. Working at the University of Iowa, Marc Armstrong is developing parallel methods of generating cartographic displays for the solutions to location-allocation models. Over the course of 1992, the analysis and display software will be merged and evaluated against serial processing software.

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Visualization of the Quality of Spatial Data I-7

This initiative focuses on methods and techniques for visually communicating the quality of geographic data to users in meaningful ways. Under this initiative, visualization techniques are being investigated as methods for making complex quality information more comprehensible.

The Specialist Meeting for the initiative, held June 8-12, 1991 in Castine, Maine, revolved around four themes: data quality components, representational issues, data models and structures for supporting quality information and its visual representation, and evaluation of visualization techniques. The specialist meeting generated the following research themes:

-development of conceptual frameworks for matching quality components with visualization tools;
-investigation of user needs and user expectations about data quality;
-the role of visualization of data quality in decision-making and dispute resolution;
-the use and effectiveness of visualization techniques for education and tutorials on spatial data quality;
-database support for quality information and its visual expression;
-development or modification of specific visualization techniques for expressing spatial data quality;
-evaluation of visualization techniques by human subjects in their work environments;
-development of tools to help users create their own quality displays.

Research on I-7 topics at Santa Barbara has included work by Yee Leung (visiting from the Chinese University of Hong Kong) and Michael Goodchild on the display and analysis of fuzzy-classified scenes. This project is developing a number of display techniques addressing such issues as the estimation of area of a given class from a fuzzy-classified scene. Diane Schweizer, a graduate student at Santa Barbara, is working on a project which investigates the use of color spaces to display uncertainty in the values assigned to areas in a choropleth map. An instrument has been designed and tested on groups of students to understand whether the simultaneous display of uncertainty and value is a case of bivariate mapping, or whether uncertainty is subject to different cognitive rules. In a related project, David Lanter (NCGIA-Santa Barbara) is investigating the use of alternative contour symbologies in bivariate mapping. This research centers on using contour lines to focus attention on statistical interrelationships between indices represented in bivariate maps. Experiments are being run to test the effectiveness of these techniques and compare them to standard bivariate mapping techniques.

At the University of Maine, Sarah Clapham and Kate Beard have been working on a framework for making logical connections between data quality components and visual variables. This work is based on formal specifications of data quality components including positional accuracy, attribute accuracy, and currency and a selected set of visual variables including color, shape, and size. Scales of measurement are used as the link between the behavior of a quality component and behavior of a visual variable.

Kate Beard has also been working on the use of reference grids as a visual display tool for different quality components. A reference grid is a mesh of uniform cells which can be registered and displayed as a backdrop to the data. The size and configuration of the mesh is used to show different quality variables associated with the data. The uniform grid acts as a visual reference. Distortion of the grid is used to show the location and magnitude of changes in the quality of the data. For example, deviations from the uniform pattern will visually indicate locations and magnitudes of errors in the data. Conversely improvements in the uniformity of the grid can indicate improvements in positional accuracy, for example.

Work is also continuing at Maine on the Data Quality NoteBook, a Hypercard stack which provides a visual and animated tutorial on spatial data quality. The Data Quality Notebook uses the metaphor of a small spiral notebook in which users can flip through the pages to find the information they need. It provides definitions of spatial data quality and its components. The purpose of the Notebook is to track specific data collection methods, and to illustrate how collection and processing activities affect spatial data quality. Two case studies in the notebook, on remote sensing and soil mapping, document the steps of data collection and compilation into products which could be incorporated in a GIS. A matrix is used to show how each compilation step affects positional accuracy, attribute accuracy, completeness, and logical consistency.

At SUNY-Buffalo, research focuses on the utility of hypermedia and animation for generating visual tools displaying data quality. A recently completed Masters thesis by Tom Kress used computer animation to simulate a hypermedia tutorial on quality of natural resources data. Barbara Buttenfield is building on this project to implement the tutorial with full hypermedia capabilities.

In another project at Buffalo, doctoral student Christopher Weber has completed a hypermedia project on dendrochronology for five stands of aspen trees. One goal of the project was to study the utility of color change to represent variability in growth rates. The document allows realtime user exploration of site terrain, aspen growth rates, and summary statistics for each study area. The interface metaphor is a map whose symbols, placenames, and basemap features are linked to bring up displays of text, maps and statistical charts when selected with the mouse.

Additional information on I-7 research is available from the NCGIA Technical Report 91-26 , *Scientific Report of the Specialist Meeting*, and the *I-7 Newsletter,* edited by Geoffrey Dutton. An annotated bibliography compiled jointly by Maine and Buffalo will be available in Spring 1993. The bibliography includes literature from disciplines such as statistics, scientific computing, medical imaging, automated manufacturing, dynamic process analysis, and graphic design. The list currently contains over 100 entries.

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Formalizing Cartographic Knowledge I-8

During 1991, the goals of Initiative 8 were redefined, and the Initiative was retitled to better reflect these new goals. A lack of formal cartographic knowledge impedes implementation of fully automated mapping; many cartographic operations have aspects that are intuitive, or involve specialized expertise and are difficult to formalize. I-8 will build on results from I-3 (map generalization and issues of scale and resolution) and I-7 (visualization issues), and also will draw on (and contribute to) I-13 (interface for the prototype) and I-6 (use of graphics for spatial decision support). The initiative will focus on non-thematic maps, which are the most standardized products in terms of data content, quality, and presentation. The goal of the initiative is development of a test-bed for the formalized knowledge, rather than a single expert system to make maps. The initiative is currently in planning stages, although some research activities are in progress.

Researchers at Buffalo led by Barbara Buttenfield (NCGIA-Buffalo) have undertaken a pilot study to inventory portions of European topographic maps. The goal is to demonstrate that a multiscale inventory can be implemented in a relational database, to determine rules and inconsistencies in the design and generalization of map symbols. The determination of robust rules will reduce the cost of map production and improve consistency and quality control of digital map products. Additionally, formalized rules can be implemented as design defaults in GIS and SDSS software, to reliably display data patterns upon which spatial inference and spatial decision-making are based.

An International Cartographic Association (ICA) Working Group on Map Generalization was formed at the Bournemouth ICA meetings in September, with participation of ICA members from France, Germany, U.K., U.S., Switzerland, Poland, and Spain. Susan Waldorf (Intergraph Corporation) will chair the Working Group for its first year of activities.

At Buffalo, Frank Fico completed his Master's thesis research on generalizing DMA's Digital Chart of the World, a comprehensive digital cartographic database for GIS small-scale mapping. The thesis is being published as *NCGIA Technical Report 92-2*. In other Buffalo research, Feibing Zhan, a doctoral student, has been implementing rules for map design in expert system shells to compare the utility of various systems for map design formalization. During Fall 1991, he began a project using CLIPS expert system shell to develop rules for mapping.

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Institutions Sharing Spatial Information I-9

This initiative is being organized by a seven member core planning group representing six universities. The co-leaders are Gerard Rushton (San Diego State University) and Harlan Onsrud (NCGIA-Maine). The I-9 Specialist Meeting on February 26-29, 1992 in San Diego focused on behavioral and organizational issues acting as impediments or incentives to the sharing of geographic information among and within organizations. A paper produced by the core planning group set forth a sample listing of the behavioral and organizational issues to be addressed as well as a discussion of methodological issues. The specialist meeting brought together participants from three major groups. The first group, from five different user segments, provided detailed reports describing their geographic data sharing experiences and relating them to the initiative research framework. The second group came from the organizational theory, management information systems (MIS), behavioral theory, and methodologist academic communities. The third group came from the academic and general GIS communities. Participants were selected primarily through the refereeing of abstracts in an open call for participation. The workshop should result in a book or publication.

The focus of the specialist meeting was sharing for the benefit of decision makers. Technical issues related to the sharing of geographic information among scientists and sharing for educational purposes are being addressed by NCGIA through other current intiatives. Although legal and public policy issues have also been important in affecting the sharing of geographic information, these issues will be addressed primarily under Initiative 16, "Law, Public Policy, and Spatial Databases," now in the planning stage.

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Spatio-Temporal Reasoning and GIS I-10

Initiative 10 is in an active preparation phase. Since its change in focus and name to "Spatio-Temporal Reasoning in GIS," a number of activities have been undertaken. The initiative will concentrate on geographic space and time related to objects in geographic space. It intends:

-to provide computational frameworks, within which geographic phenomena and their temporal changes can be stimulated;
-to formalize human reasoning processes about geographic space;
-to examine (verify/dismiss/refine) computational reasoning frameworks with observations from experiments about human spatial and temporal perception and cognition.

The initiative leaders, Reg Golledge (NCGIA-Santa Barbara) and Max Egenhofer (NCGIA-Maine), have arranged to cooperate with a conference on spatio-temporal reasoning, to be held in Pisa, Italy, September 21–23, 1992. The conference, titled "GIS–From Space to Territory: Theories and Methods of Spatio-Temporal Reasoning," is expected to have considerable contribution from geographers interested in territorial development and from urbanists.

The NCGIA will use this concentration of international and U.S. researchers to hold a two-day workshop immediately afterwards at the same location, to which researchers from the conference with interest in spatio-temporal reasoning will be invited. This workshop will function as the pre-specialist meeting, similar to the successful pre-meetings for I-2 and I-13 in Buffalo and Seattle respectively. The goal of this workshop will be to discuss relevant research areas in spatio-temporal reasoning and to set the agenda for the specialist meeting. Results of this workshop will be published as an NCGIA technical report. The specialist meeting will be held in the U.S. six to nine months after the conference in Pisa.

Suchi Gopal (Boston University) is organizing a special session at Association of American Geographers '92 on "Geographical Reasoning: Research Issues," including presentations by Andrew Frank ("Temporal Data and Temporal Reasoning for GIS"), and Max Egenhofer ("Spatial and Temporal Relationships in GIS Query Languages").

Khaled Al-Taha gave a presentation at GIS/LIS '91 on "User Requirements for Temporal Cadastral Databases." Other recent publications include: Khaled Al-Taha and Andrew Frank, "Temporal GIS Keeps Data Current," *1991-92 International GIS Sourcebook,* GIS World, 384–388; Max Egenhofer, "Reasoning about Topological Relations," in O. Gunther and H. J. Schek (editors). Second Symposium on Large Spatial Databases, Zurich, August 1991, *Lecture Notes in Computer Science,* Volume 525, 143-160; Andrew Frank, "Qualitative Spatial Reasoning with Cardinal Directions," Seventh Austrian Conference, Vienna, September 1991, *Lecture Notes in Computer Science* (in press).

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GIS and Remote Sensing I-12

There are a number of ongoing research activities for I-12 at NCGIA-Santa Barbara. One is on "Coupling Ecological Models to GIS and Remote Sensing," by Bill Reiners, visitor to NCGIA through Spring 1992 from the University of Wyoming. A second is a UCSB Ph.D. dissertation by Ken McGwire: *Addressing the Class Specific Characteristics of Land Cover in Classifications Using Integrated Remote Sensing/GIS Analysis through the Development of a Layered Approach.*

Jeff Star is working on a collaborative research program with the Consortium for International Earth Science Information Networks (CIESIN), a government funded consortium. The research focuses on "Making Scientific Information Accessible to the Decision-Making Process." Collaborators include ESRI and Arnowitz Productions, an award winning multi-media developer. Current schedules are based on the presentation of a prototype information system from this research at the United Nations Conference on Environment and Development in June 1992 in Rio de Janiero.

NCGIA-Santa Barbara expects David Landgrebe of Purdue University to be in residence during May of 1992, doing research on "Integration of Models of Remote Sensing with GIS Based Analysis." He will present some seminars on current research on error propagation and flow in RS/GIS models.

Publications covering past work on I-12 have been well received. The *Proceedings* from the ASPRS Spring '91 sessions on I-12 has sold out the first two printings. A special issue of *Photogrammetric Engineering and Remote Sensing* devoted to I-12 appeared in June 1991. (See list of publications on page 13.)

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User Interfaces for GIS I-13

For this initiative, work is being done simultaneously in Maine, in Vienna, and at SUNY-Buffalo. While researchers in Maine have concentrated on spatial reasoning aspects of user interfaces for GIS, researchers in Vienna have emphasized the communication and task modeling aspects. General research topics in Vienna are metaphors for spatial communication; spatial task analysis and multi-modal languages. Ongoing research concentrates on integrating metaphors into the (conceptual) design of interfaces; determining generic metaphors for GIS use; and visual abstraction mechanisms (pan and zoom). Ongoing collaboration between Maine and Vienna includes formalizing experiential spaces and implementing a user interface for the simplicial data model.

The Buffalo site hosted the I-13 Specialist Meeting June 22-26, 1991. There was little discussion of user interfaces at a "surface' level" (for example, icon design). Rather, the discussion concentrated on conceptual issues, and on needs for evaluation and testing. The needs for typologies of GIS tasks on the one hand, and users and use types on the other, was deemed to be of high priority. Other themes included:

-recognition that spatial concepts are critical to the design of user interfaces for GIS;
-the process of user interface design (as practiced in the HCI community) has many striking similarities to the process of "GIS Design," in which a potential adopter's needs and uses are identified and compared to existing or potential software systems;
-the use of trade-offs, between learnability on the one hand and performance for experienced users on the other, is central;
-public access to information is primarily a user interface problem, combined with a legal problem. Public access to computerized information is of almost no use if useable natural user interfaces are not provided along with the data;
-experimental testing is a critical part of the research agenda. Many researchers with little or no training in experimental psychology would benefit from a "cook-

book" approach to testing needs, situations, and methods, similar to the charts on what statistical methods to use in the end pieces of Blalocks's *Social Statistics;*
-a specific concern for agencies and other large organizations is how to write product specifications for the user interfaces of systems, and how to determine whether the contractor or vendor has met those specifications.

The prioritized research agenda, a report on other discussions at the meeting, and the position papers, will be published as an NCGIA Technical Paper early in 1992. The research agenda will appear as a paper in the Proceedings of the American Congress on Surveying and Mapping's meeting in Albuquerque in March. It also is part of an I-13 Special Session at the Association of American Geographers meeting in San Diego.

A BITNET Listserver called UIGIS-L was established for discussion of these and other issues related to "User Interfaces for Geographic Information Systems." By January, 1992, UIGIS-L had about 200 subscribers.

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The Scientific Policy Committee invites suggestions for future NCGIA research activities and initiatives. Research initiatives are normally multi-investigator, interdisciplinary projects lasting 18-24 months. If you have comments on potential research areas, please contact David Mark at SUNY-Buffalo (Buffalo NY 14261) or any NCGIA member.

Spatial Analysis and GIS I-14

A new research initiative on Spatial Analysis and GIS (I-14) was approved at last June's NCGIA Board of Directors Meeting in Buffalo. The initiative is led by Stewart Fotheringham and Peter Rogerson at Buffalo and Luc Anselin at Santa Barbara. It will focus on the triad of interrelations between GIS, spatial data analysis, and spatial modeling (in the social sciences), and address research questions such as: how can spatial data analysis effectively be integrated with GIS? what is required from a GIS to facilitate spatial modeling? and how can spatial data analysis satisfy the requirements of spatial modeling?

Jointly sponsored by the International Geographical Union (IGU) Commission on Mathematical Models, a Specialist Meeting will be held in San Diego, on April 15-18, 1992, immediately preceding the annual conference of the Association of American Geographers. Planning for this meeting is in an advanced stage. A final list of about forty participants, including representatives from academia, and the private and the public sectors, is being established. Each participant will provide a paper. A selection of these papers will be published as an edited volume. The results of the specialist meeting will be summarized by Fotheringham and Rogerson at a panel session in the American Association of Geographers Conference.

Research related to the initiative is well under way at both the Buffalo and Santa Barbara sites. At Buffalo, geographers Stewart Fotheringham, Peter Rogerson, Paul Densham, Mike Batty, and graduate student Yuemin Ding focus on the integration of spatial analysis and spatial modelling with GIS. Fotheringham (with Yuemin Ding) developed a number of spatial analysis modules that run in Arc/Info, such as a module to compute measures of spatial association, to appear in *Computers, the Environment and Urban Systems*, and a market analysis package. In addition, research is being carried out on general conceptual issues related to the integration of spatial analysis and GIS (Fotheringham and Rogerson), on updating a general spatial interaction modeling package (SIMODEL), on integrating urban modeling and GIS (Batty), and on the Modifiable Areal Unit problem (Fotheringham and Densham).

At Santa Barbara, a group consisting of Luc Anselin, Mike Goodchild, and graduate students Uwe Deichmann and Rusty Dodson is exploring the integration of exploratory spatial data analysis within a GIS. Initial outlines of the conceptual and methodological issues will appear in *The International Journal of Geographical Information Systems* (Goodchild, Haining, and Wise) and *The Annals of Regional Science* (Anselin and Getis). Goodchild, Anselin, and Deichmann also continue their work on developing new methods for areal interpolation in a GIS. Also at Santa Barbara, sociologist Richard Appelbaum is exploring the use of GIS to analyze global patterns of international trade and their impact on industrial location decisions. UCSB economist Jon Sonstelie is carrying out research using spatial analysis to investigate local government spending on education.

NCGIA personnel from both Buffalo and Santa Barbara sites presented the findings from these initial research efforts at a range of forums in late 1991, including the Atlanta GIS/LIS Conference, the annual North American and European Meetings of the Regional Science Association International (respectively in New Orleans and Lisbon), and the Ottawa Conference on Spatial Statistics, organized by Statistics Canada.

For more information, contact:
Stewart Fotheringham or Peter Rogerson
NCGIA
SUNY-Buffalo
Buffalo, NY 14261
716/636-2545

Roles for GIS in US Global Change Research I-15

A steering committee is being drawn together for this initiative. Jack Estes and Jeff Star (NCGIA-Santa Barbara), along with other researchers, have prepared a proposal for the SCOPE General Assembly in Seville, January 1992, titled, "Advanced Data Acquisition and Analysis Technologies for Testing Sustainable Development Hypotheses," in preparation for I-15. Estes and Star are working

with Jean-Paul Malingreau of the Joint Research Centre, Institute for Remote Sensing Applications, of the Commission of the European Communities, to update the SCOPE proposal based on inputs that Malingreau received at the SCOPE Congress in Seville, in January 1992.

Working with Jeff Star and R. Misoutten of UNESCO, Estes is also compiling a brief on "Technologies for Resource Managers" for the 1992 UNESCO Conference in Brazil on Environment and Development.

For further information, please contact:
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EDUCATIONAL INITIATIVES

CORE CURRICULUM PROJECT

The last six months have seen the completion of a set of materials for use in instructional GIS laboratories and continued distribution of the Core Curriculum. The Center has also assisted in the development of several specific GIS education projects and international interest in the educational activities of the Center continued to grow.

Volume 4 - Resources for the Laboratory: The Volume 4 set of technical reports, completed late in the summer of 1991, will assist educators in creating effective laboratory components for their GIS courses. Two reports contain the laboratory exercises originally created for the 1989 draft version of the Core Curriculum, substantially edited and enhanced with the addition of several new exercises. A third report, *The NCGIA Guide to Laboratory Materials*, contains information on other sources of lab exercises and suitable data sets as well as some "idea kernels" which can be developed into exercises based on local conditions. The fourth report, *GIS Teaching Facilities: Six Case Studies on the Acquisition and Management of Laboratories*, provides valuable insight for anyone desiring to establish a laboratory facility for use in GIS courses. A brochure, *Teaching GIS: Resources for the Laboratory,* which describes this set of four reports is available from NCGIA offices. An additional report on videos on GIS and Computer Cartography is being prepared and will be available shortly.

An agreement with the Computers for Teaching Initiative: Centre for Geography (CTICG) at the University of Leicester, U.K., provides for an update of *The NCGIA Guide to Laboratory Materials* in the Spring of 1993. Anyone who has exercises or datasets appropriate for GIS instruction which they would be willing to contribute for the update is encouraged to review the 1991 Guide and submit items using the form supplied at the end of that document or by email:
ncgialab@ncgia.ucsb.edu,
or ncgialab@voodoo.bitnet.

Distribution of the Core Curriculum:
The Curriculum continues to sell well both in the U.S. and internationally, warranting a third printing. As of March 15, 1992, the Center had distributed over 850 copies of the final version to 50 countries and it is clear that many additional copies of the Curriculum are also in circulation. The U.S. still accounts for 51% of the purchasers and Departments of Geography for 36%.

Outreach activities:
Center personnel have been active in promoting the development of effective GIS courses by participating in workshops, seminars and meetings, and by providing limited consultation to institutions seeking to initiate GIS courses and programs. Considerable international attention is now focused on the educational activities of the Center. An initiative to establish an education special interest group in the European GIS organization may lead to the development of a European supplement to the Curriculum. Similar activities are beginning in other regions. Such internationalization of the Curriculum should prove to be of interest to anyone concerned with international aspects of GIS. Versions of the Curriculum are being prepared in Japanese, Chinese, Korean, Spanish and Czech by universities or individuals in the appropriate countries. Russian and Arabic versions are being negotiated.

A proposal for a series of workshops for GIS educators is being circulated. These workshops will provide participants with the opportunity to learn the core concepts of GIS while at the same time developing ideas and materials based on regional conditions. Using the Core Curriculum lectures, each participant will be responsible for presenting a few of the lectures to the class. Following each lecture, the group will discuss the material and suggest revisions and local examples. NCGIA is seeking sponsors for these workshops.

SECONDARY SCHOOL PROJECT

The secondary school project is a natural extension to the Core Curriculum and other educational activities of the Center which previously have been geared to GIS education at the university level. This project will help secondary school teachers promote general GIS awareness and, it is hoped, encourage some of their students to pursue GIS careers. Efforts will also be made to motivate teacher use of GIS in various courses as a support to attainment of course objectives.

The secondary school project has focused on collecting information and materials relating to the use of GIS in the secondary setting. Communication has been initiated with interested secondary school teachers, university faculty around the world, and various GIS vendors. A proposal for a year-long instructional materials development project for secondary schools has been submitted. Part of this project includes a week-long summer workshop for local high school teachers. During the workshop, they will learn about GIS and its applications, review instructional materials developed by the NCGIA and others, and begin to develop GIS lesson plans for use in their own classes. During the following school year, the teachers will implement and evaluate these lesson plans. Finally, the Center will produce two reports. One will be an instructional materials handbook including the materials we have developed and the complete lesson plans. The other will be a summary of the project activities. This summary will provide a model for the development of similar cooperation between teachers and academics in other regions.

For more information on the secondary school project, contact Steve Palladino, NCGIA-Santa Barbara.
E-mail: spalladi@ncgia.ucsb.edu.

SITE NEWS

BUFFALO

Visiting Researchers:
-Paul Longley, Lecturer in the Department of City and Regional Planning at the University of Wales at Cardiff, was in residence at the NCGIA-Buffalo for the fall semester. Longley is co-authoring with Mike Batty on the manuscript of a book entitled *Urban Morphology.*
-Britton Harris, Professor Emeritus in City and Regional Planning at the University of Pennsylvania, was in residence October 21-November 1 at the Buffalo site. During that time, Harris consulted with UB faculty and led several graduate classes. Harris collaborated with Mike Batty on a paper that Harris later presented at the Regional Science Association meetings in New Orleans. That paper has been published as *NCGIA Technical Report 92-1*: *Locational Models, Geographic Information, and Planning Support Systems.*
-Geoff Dutton is a visiting fellow at the Buffalo site for one month during the Spring Semester 1992. During the visit, he will work with Barbara Buttenfield on problems of visualization related to I- 7. He will be involved in student seminars and the Department of Geography/NCGIA Colloquium Series. Dutton will also spend time working on the *Initiative 7 Newsletter: VQSD-Visualizing the Quality of Spatial Data,* for which he serves as editor.

Distinguished Speakers Series:
During Autumn 1991, NCGIA-Buffalo co-sponsored a distinguished visitors colloquium series with the Department of Geography. Colloquium speakers included:

-Bruce Ralston, Department of Geography, University of Tennessee, "A Transportation Investment Strategy for Bangladesh";
-Britton Harris, Professor Emeritus, City and Regional Planning, University of Pennsylvania, "Planning, Geography, and Economics in Spatial Decision Making";
-Michael Goodchild, NCGIA Director and Department of Geography, University of California at Santa Barbara, "A Factorial Model of Aggregate Spatio-Temporal Behavior: Application to the Diurnal Cycle";
—Clive Ruggles, School of Archaeological Studies and Department of Computing Studies, University of Leicester, "How Do We Know What Data We Have? Approaches to Spatial Meta-Data";
-Paul Longley, Department of City and Regional Planning, University of Wales at Cardiff, "An Analysis of U.K. Local Government Revenue-Raising Using a Street-Level GIS."

New Fractals and Chaos Course:
Faculty in the Geography Department at Buffalo are teaching a new course entitled "Fractals and Chaos in Geography" during Spring Semester 1992. The course, open only to graduate students, is team-taught by several faculty members, including five NCGIA members and one NCGIA visiting scholar. So far, there has been enormous interest in the class. Featured topics will include: Fractal Trees and Allometry, Fractal Terrain, Line Generalization, DLA and Urban Structure, and Chaos and Population Growth.

Personnel:
New Members of the Buffalo Center in clude: Alex Anas, Economics; Sam Cole, Planning and Design, Martin Helander, Industrial Engineering; Dennis Jelinski, Geography; and Satish Mohan, Civil Engineering.

Debbie Buffamanti has been hired as the Microcomputing Support Specialist for the Geographic Information and Analysis Laboratory. She was previously employed by UB's Office of Academic Computing. Dawn Becker was hired as the NCGIA-Buffalo secretary, replacing Sue Baker.

MAINE

Visiting Scholars:
-Wolfgang Kainz, Assistant Professor at the Department of Geography, University of Vienna, joins the NCGIA-Department of Surveying Engineering at the University of Maine as a Visiting Professor for 18 months. Dr. Kainz is teaching a course on geometry and computer graphics.
-William Mackaness has been appointed a Postdoctoral Research Associate at the University of Maine for two years. Mackaness is working on visualization of data quality and automated generalization and spatial proximity trees.
-Joe Paiva, an engineer from the Image Processing Division, National Institute for Space Research (INPE), Brazil, is a Visiting Research Associate with NCGIA-Maine for one year.

Research Grants:
Max Egenhofer and Andrew Frank have been awarded a three-year research contract (1992–1994) from Intergraph Corporation to continue work on reasoning about spatial relations.

Personnel:
Andrew Frank has accepted the chairmanship for Geoinformation at the Technical University of Vienna. He also continues as Research Professor in the Department of Surveying Engineering and as Cooperating Professor in the Department of Computer Science, both at the University of Maine.

Graduate students at the University of Maine are working on a number of GIS-related topics including: "Measurement-Based LIS," "User Requirements for Integration of Remote Sensing Data in GIS," "Temporal Reasoning in a Cadastral System," and "Selection of Point-Represented Map Objects to Preserve Pattern and Visual Character." Taher Buyong completed the Doctorate in the Department of Surveying Engineering in January 1992. His thesis is entitled *Measurement-Based Multi-purpose Cadastral Systems.*

SANTA BARBARA

Visiting Scholars:
During Summer 1991, Professor Yee Leung from the Chinese University of Hong Kong - Shatin visited the Santa Barbara site to do research with Professors Tobler, Anselin, Smith, and Goodchild on the Accuracy of Spatial Databases (I-1), Visualization of the Quality of Spatial Information (I-7), and Integration of GIS and Remote Sensing (I-12). In August 1991, Manfred Ehlers (now located at Vechta University) and Nick Faust (Georgia Institute of Technology) joined with I-12 researchers for a month to draft several papers and proposals. Faust completed a paper on error propagation, and Ehlers drew up a proposal to the U.S. government on "Numerical Approaches to Rectification."

January - June 1992, Professor William Reiners, Chairman of the University of Wyoming-Laramie Department of Botany, is working with Michael Goodchild and Frank Davis on spatial modeling of the ecological consequences of global climate change (I-12 and I-15). Also visiting for one year of research on a GIS data-

base to track deforestation and carbon gas emissions in the Amazonian ecosystem is Julio D'Alge of Brazil's National Institute for Space Research (INPE). In Spring 1992, Daniela Palma and Roberto Benedetti, representing Italy's ENEA and Telespazio respectively, will be at NCGIA to study the integration of spatial analysis and GIS (I-14).

Conferences and Meetings:
On February 1-2, 1992, NCGIA co-sponsored with the Department of Anthropology and the Social Science Computing Facility a Conference on the Anthropology of Human Behavior through Geographic Information and Analysis. About 80 registrants heard 25 papers on subjects such as, "GIS and the Structure of Anthropological and Archaeological Data," and "A Formal Justification of the Application of GIS to the Cultural Ecological Analysis of Land Use Intensification and Deforestation in the Amazon." A Proceedings will be published.

In February and March of 1992, NCGIA entered into negotiations with representatives of Hitachi America, Ltd., for a resident research program with three researchers spending up to five years at NCGIA. The focus of their study would be the analysis of urban systems using GIS; support systems for doing urban planning; and control systems for urban facilities.

Personnel:
In September of 1991, Chih Chang Lin was hired full time as a computer analyst to support research at the Santa Barbara site. Terry Smith stepped down from Associate Directorship of NCGIA in Summer 1991, but is still very active in research. Luc Anselin is now Santa Barbara's Associate Director.

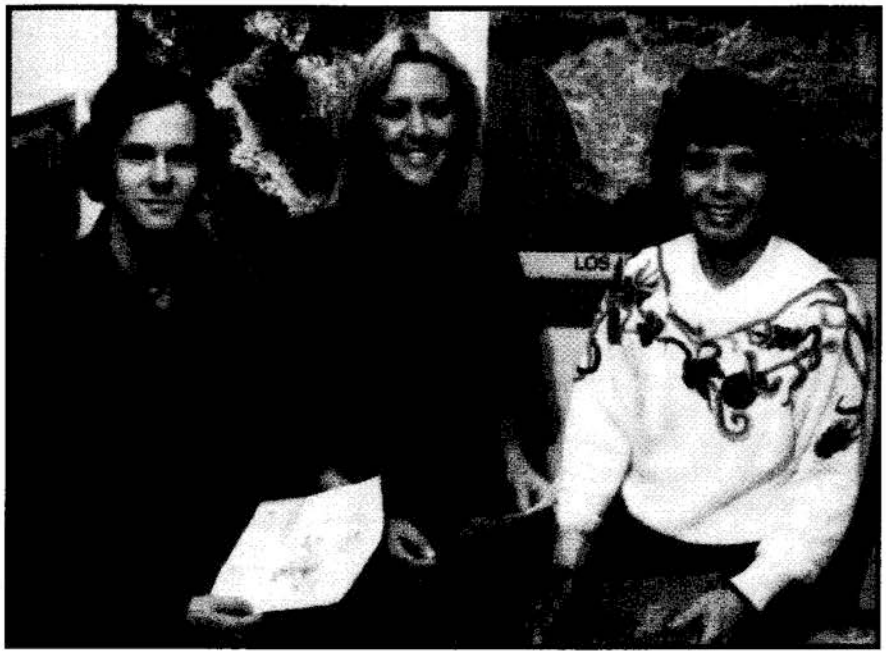
Contracts and Grants, Software:
In Fall 1991, NCGIA Director Michael Goodchild received a grant from the California Department of Forestry to draw together an Accuracy Assessment Task Force. This group, including Janine Stenback (CDF), Colin MacLean (U.S. Forest Service), Phil Langley (Forest Data Corporation), Russ Congalton (University of New Hampshire Department of Natural Resources), and Frank Davis (NCGIA-Santa Barbara) met twice, in October and December of 1991, and will meet two more times in 1992. They will develop a strategy for performing an accuracy assessment, will test this strategy, and then issue a report. This work relates to prior research on Accuracy of Spatial Databases, I-1.

David Lanter, Assistant Professor of Geography at UCSB and NCGIA Research Fellow, has received a Fulbright grant for July 1992 through January 1993 to bring his lineage research to Portugal's Centro Nacional de Informacao Geografica, and to study their use of GIS, geographic information and analysis, and image processing in relationship to spatial decision support (I-6, I-7, I-9, I-12, I-13, I-14).

Luc Anselin and graduate students Sheri Hudak and Rusty Dodson are developing a series of software modules to facilitate the analysis of spatial effects in commercial econometric software. This includes tests for spatial autocorrelation and the maximum likelihood estimation models with spatial autoregressive forms. Modules have been developed for five commercial software packages: Splus, Gauss, Limdep, Shazam, and Rats. Source code, description of methodology, and illustrative examples will be published as an NCGIA Technical Report in Spring 1992. This development effort was funded in part by research grants to Anselin from NSF (SES 87-21857) and the University of California Academic Senate. Software contributions came from Caliper Corporation, ESRI, and StatSci. Hardware was provided under the NCGIA IBM joint study agreement.

INTRODUCING THE SANTA BARBARA STAFF:

Subsequent to UPDATE editions, NCGIA-Santa Barbara gets frequent calls for further information regarding Santa Barbara activities, and particularly national NCGIA activities. Santa Barbara also receives more than 200 visitors a year, both international and domestic. Below is the Santa Barbara staff (left to right): Richard Johnson has worked at NCGIA since Spring of 1989 as the computer resources manager. He is responsible for all network maintenance and trouble-shooting. Richard researches current and future technology in reference to all NCGIA research projects, and is responsible for electronic distribution of NCGIA reports. Sandi Glendinning has worked at the Center since its inception in 1988. She coordinates conferences, workshops, and meetings, and manages site-visitations. She is a general information and resource person. Judith Parker has worked at NCGIA for one year as office administrator and budget manager. She assists with conferences, and is the editor for quarterly, annual and other reports and proposals, including the UPDATE.



BOOKS PUBLISHED BY NCGIA RESEARCHERS:

I-1: *Accuracy of Spatial Databases*, edited by Michael F. Goodchild and Sucharita Gopal. London: Taylor & Francis, 1989. ISBN: 0-85066-847-6.

I-2: *Cognitive and Linguistic Aspects of Geographic Space,* edited by D. M. Mark and A. U. Frank. Dordrecht: Kluwer, 1991. ISBN: 0-7923-1537-5.

I-3: *Map Generalization: Making Rules for Knowledge Representation,* edited by B. P. Buttenfield and R. B. McMaster. London: Longman House, 1991. ISBN: 0-582 08062-2.

I-5: *Design and Implementation of Large Spatial Databases* (First Symposium SSD '89, Santa Barbara, California, July '89, Proceedings), edited by A. Buchmann, O. Gunther, T. R. Smith, and Y. F. Wang. New York: Springer-Verlag, 1989. ISBN: 3-540-52208-5.

I-12: *The Integration of Remote Sensing and Geographic Information Systems,* edited by Jeffrey Star. Bethesda: ASPRS, 1991. ISBN: 0-944426-49-2.

Jeffrey Star and John Estes, *Geographic Information Systems.* Englewood Cliffs: Prentice Hall, 1990. ISBN: 0-13-351123-5.

Geographical Information Systems: Principles and Applications, edited by Michael Goodchild, D. J. Maguire, and D. W. Rhind. London: Longman House, 1991. ISBN: 0-582-05661-6.

Cities of the 21st Century: New Technologies snd Spatial Systems, edited by J. Brotchie, M. Batty, P. Hall, and P. Newton. New York: Halsted Press and London: Longman Chesire, 1991. ISBN: 0-470-21742-1.

RECENT NCGIA TECHNICAL PAPERS:

91-1: Fractal Geometry and Spatial Phenomena, by Mark MacLennan, A. Stewart Fotheringham & Mike Batty, SUNY-Buffalo; Paul Longley, U. Wales $10.50
91-2: A Conceptual Framework for Integrated Metadata Management in Very Large Spatial Databases, by Nehal Trivedi & Terence R. Smith, UCSB $9.50
91-3: A Cartographic Animation of Average Yearly Surface Temperatures for the 48 Contiguous United States: 1897-1986, by Christopher Weber, SUNY-Buffalo $9.00
91-4: Temporal Relations in Geographic Information Systems: A Workshop at U. Maine, Orono, October 12-13, 1990, by Renato Barrera, Andrew Frank & Khaled Al-Taha, U. Maine $9.50
91-5: The Integration of Spatial Analysis and GIS: The Development of the STATCAS Module for ARC/INFO, by Y. Ding & A. Steward Fotheringham, SUNY-Buffalo $6.50
91-6: User-Centered Graphical User Interface Design for GIS, D. Lanter & R. Essinger, UCSB $6.00
91-7: A Framework for the Definition of Topological Relationships and an Algebraic Approach to Spatial Reasoning within this Framework, by Max J. Egenhofer, U. Maine, John R. Herring, Intergraph; Terence Smith & Keith Park, UCSB ..$6.50
91-8: Spatial Data Representation and Basic Operations for a Triangular Hierarchical Data Structure, by Michael Goodchild, Yang Shiren, & Geoffrey Dutton, UCSB $6.00
91-9: Spatial Decision Support Systems: Bibliography, by M. Gould & P. Densham, SUNY-Buffalo $4.50
91-10: Designing and Implementing Strategies for Solving Large Location-Allocation Problems with Heuristic Methods, by Paul Densham SUNY-Buffalo, & Gerard Rushton, SDSU $6.50
91-11: Connecting ARC/INFO and SNACTor: Project Report, by Stuart C. Shapiro, Hans Chalupsky, & Hsueh-cheng Chou, SUNY-Buffalo $4.00
91-12: GIS Lab Exercises: Volume 1, edited by Rustin F. Dodson, UCSB $25.00
91-13: The Performance of Tests for Spatial Dependence in a Linear Regression, L. Anselin & S. Rey, UCSB $7.50
91-14: GIS Laboratory Exercises: Volume 2 Technical Issues, edited by Howard Veregin $20.00
91-15: An Annotated Bibliography on Human Computer Interaction for GIS, compiled by students in Course SVE 698, U. Maine $15.00
91-16: Initiative-12: Integration of Remote Sensing and GIS: Report of the Specialist Meeting $35.50
91-17: Multiple Topological Representations, by Bud P. Bruegger & Werner Kuhn, U. Maine. $6.00
91-18: Visual Interfaces to Geometry, by Werner Kuhn and Max J. Egenhofer, U. Maine. $8.00
91-19: The Use of a Geographic Information System for Second-Order Analysis of Spatial Point Patterns, by Mark J. MacLennan, SUNY-Buffalo ..... $6.00.
91-20: The NCGIA Guide to Laboratory Materials - 1991, edited by Rustin Dodson, Karen Kemp, & Stephen Palladino, UCSB. $24.00
91-21: GIS Teaching Facilities: Six Case Studies on the Acquisition and Management of Laboratories, edited by Stephen D. Palladino & Karen K. Kemp, UCSB $27.00
91-22: Bibliography on Animation of Spatial Data: A Guide to Literature, Video and Movie Media, by Barbara Buttenfield, Christopher Weber, Mark MacLennan, & John Elliott, SUNY-Buffalo $6.00
91-23: The Use of Vegetation Maps and Geographic Information Systems for Assessing Conifer Land in California, by Michael F. Goodchild, Frank W. Davis, M. Painho, & D. M. Stoms, UCSB $13.50
91-24: German GIS/LIS Standards, by Werner Kuhn, U. Maine $8.50
91-26: Initiative 7 Specialist Meeting: Visualization of Spatial Data Quality, by Kate M. Beard, U. Maine, Barbara P. Buttenfield, SUNY-Buffalo, & Sarah Clapham, U. Maine..... $39.50
91-27: VT/GIS The von Thunen GIS Package, by Rustin F. Dodson, UCSB $15.50
92-1: Locational Models, Geographic Information, and Planning Support Systems, by Britton Harris, U. Penn, & Michael Batty, SUNY-Buffalo $8.00

OTHER NCGIA PUBLICATIONS:

NCGIA Core Curriculum in GIS, eds., Michael F. Goodchild & Karen K. Kemp, UCSB $200.00
For overseas delivery, include $60 extra for International Airmail handling: $260.00
Cognitive and Linguistic Aspects of Space, compiled by David M. Mark, SUNY-Buffalo. $4.50
Spatial Analysis Using GIS: Seminar Workbook (Second Edition), by Michael F. Goodchild, UCSB $15.50
Object-Oriented Database Technology for GIS: Seminar Workbook, by Andrew Frank & Max Egenhofer, U. Maine $21.00
Annual Report Year 1 (December 1, 1988 - November 30, 1989). $7.50
Annual Report Year 2 (December 1, 1989 - November 30, 1990). $8.50
Annual Report Year 3 (December 1, 1990 - November 30, 1991). $9.00

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FTP ACCESS TO PUBLICATIONS

NCGIA at UCSB has a public FTP area in which we make available some (but not all) of the Technical Reports we publish. Those which are available will be found on NCGIA.UCSB.EDU [128.111.254.105] in the directory "pub/tech-reports". We try to make them available in both textual and postscript formats within the "text" and "postscript" directories respectively. (The "postscript" format is suitable for sending directly to any printer supporting the Adobe Postscript language.) The entire Publications List is available in both formats in these same directories as "pub-list.txt" and "pub-list.ps" respectively. The papers available are named according to their publication number, so retrieving a copy of the current Publications List would be a good starting point. Each paper is named according to the following scheme:

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number.body = The actual body of the paper.
- or -
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(Where the name is actually a directory, the entire contents of the paper is contained in the directory as separate files, suitable for the FTP "mget" command.)

More papers will be added to this FTP area as NCGIA receives the computer readable source for the papers. We are capable of handling source for most word processors under Unix, DOS, and MacOS. If your Technical Report is listed in the Publications List but isn't available for public FTP, it is because NCGIA hasn't yet received it in a computer readable form. Please feel free to contact NCGIA at UCSB for further information.

Some papers relevant to various Initiatives will also be found in the directory "pub/Initiatives" organized by the Initiative number. These are usually in textual form, but if postscript is the only form available, the name will end in ".ps". For those people who have access to the WAIS (Wide Area Information Service), NCGIA also maintains a server for the "NCGIA-Technical-Papers" database. This allows searching for papers online via keywords. (Those available in this fashion are only the papers in the "tech-reports/text" directory.)

(All of the above-mentioned is an added free service and in no way obligates NCGIA to make available any other papers in the publication list.) For more information about FTP, consult your local Systems Manager. For more information about WAIS, you can FTP "pub/wais/wais-discussion/wais-overview.text" from "quake.think.com" [192.31.181.1])

NCGIA UPDATE
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