

GIS NEWS AND INFORMATION

October 1995 (No. 6)

Dedicated to CDC/ATSDR scientific excellence and advancement in disease control and prevention using GIS

Selected Contents: CDC/ATSDR GIS lectures (pp.1-2); Superfund conference (p.2); Kriging references (p.4); NCHS data systems win praise (pp.4-5); ATSDR GIS position available (beginning p. 5)

I. Public Health GIS Conference and Training Opportunities

A. CDC/ATSDR NCHS Cartography and GIS Guest Lecture Series

1. ***Drane lectures**, 2:00-3:30, October 16, 1995

J. Wanzer Drane, PE, PhD, Professor of Biostatistics, University of South Carolina, School of Public Health, will lecture on (1) “**Cluster**”, the public domain software and manual used for space-time epidemiological investigations (a demonstration is included), (2) “**The Shadow of the Hazard**”, with shadow being symbolic of exposure to a transmitted hazard in the form of a wind plume, a watershed downstream from a toxic waste site, circles of nuclear radiation, right angle distances from electrical conductors, and a host of other similar scenarios. Shadows can be piecewise or continuous attenuated according to geometry and other considerations, and (3) “**Empirical Distributions and Odds Ratios**”, where the most common used dose response function is the logistic. The empirical distribution is revisited. The DAC statistic is created which enables an investigator to localize “hot spots” of adverse health outcomes provided the longitude and latitude of the cases and the population or a random sample therefrom are available. (Dr. Drane will also demonstrate a hand-held GPS or Global Positioning System receiver for establishing precise latitude and longitude measurements on the earth’s surface).

2. ***Glass and Morgan lecture**, 2:00-3:00,

November 16, 1995 [in celebration of NCHS’s 8th annual commemoration of **National Geography Awareness Week**]: Gregory E. Glass, PhD, Epidemiologist, Department of Molecular Microbiology and Immunology, The Johns Hopkins University School of Hygiene and Public Health and John M. Morgan III, PhD, Geographer, Department of Geography and Environmental Planning, Towson State University, will lecture on “**An Epidemiological and Geographical Approach to the Study of Lyme Disease**”. Lyme disease is the most frequent vector-borne disease in the United States. Using GIS software (IDRISI), LANDSAT Thematic Mapper satellite images of land use/land cover and forest distribution, USDA soils databases, USGS geology databases, and other environmental databases, and a tick bite case-control database based on residential address (or location of tick bite, if known), a risk model is generated combining the GIS with logistic regression analysis. The study demonstrates that combining a GIS with epidemiologic methods can produce a useful tool to rapidly identify risk factors of zoonotic disease over large areas.

3. ***MacEachren lecture**, 2:00-3:00, November 27, 1995: Alan M. MacEachren, PhD, Geographer, Department of Geography, Pennsylvania State University, will lecture on “**Mapping Health Statistics: Representing Data Reliability**”. Dr. MacEachren has been working with NCHS (related to the design of the NCHS national mortality atlas) to assess methods of adding data reliability to mortality rate maps. This is a particularly challenging problem for many public health mappers especially when maps without reliability representation are considered easier to read than

maps with reliability representation. An approach was taken that evaluated a combination of three reliability schemes matched to three color schemes for data. The schemes selected are suited to choropleth maps of age-adjusted death rates. Evaluation is based on the experimental assessment of human-subject performance on a variety of typical health-analysis tasks.

4. The half-day course "Spatial Data Analysis Using GIS", taught by Dr. Luc Anselin on September 21 at NCHS, was videotaped as a loanable resource for interested CDC/ATSDR staff. I have already received inquiries about viewing the tape. In order to optimize the viewing, I will initially send the tape when received to **Chet Moore** (Ft. Collins), **Jay Kim** (NIOSH), **Shelba Whaley** (Chamblee) and **Peter Kilmarx** (Corporate Square) and ask that they arrange for an open viewing of the tape at their respective locations. Please contact these individuals for viewing. If you are located elsewhere and can serve to facilitate a viewing at your site, please let me know.

***Envision arrangements from NCHS to your site for this scheduled lecture can be made for your viewing.** To do so, simply contact your site Envision Coordinator immediately to reserve a room and an envision connection.

Superfund XVI Annual Conference

5. Reminder: ATSDR is co-hosting the Superfund XVI Annual Conference, Nov. 6-8, sponsored by the Hazardous Materials Control Resources Institute at the Sheraton Washington Hotel in Washington DC. ATSDR's Division of Health Assessment and Consultation will be presenting a paper entitled, "Geographic Information Systems: A Critical Resource in Exposure Assessment," during the Health and Safety session on Nov. 7. The paper is co-authored by **Danika Holm**,

Morris Maslia, Juan Reyes, Bob Williams, and Mustafa Aral, and outlines various GIS methodologies utilized by ATSDR's GIS staff in its exposure assessment activities. Copies of the presentation can be obtained from either Morris Maslia, 639-0673, or Danika Holm, 639-6066.

B. NON CDC/ATSDR

6. From **Chet Moore**: Workshop-Application of Geographic Information Systems to Problems of Vector Ecology, Sunday, October 8, 1995, 8:00 a.m. to 5:00 p.m.; USDA/APHIS/VS, Centers for Epidemiology and Animal Health, 555 S. Howes, Fort Collins, Colorado. An all-day workshop on GIS and vector ecology will be held in conjunction with the SOVE Annual Meeting in Fort Collins. The workshop will use ATLAS GIS to demonstrate a variety of problems and procedures common to a range of vector- and vector-borne disease-related situations. Examples will be drawn from arboviruses, plague, Lyme disease, *Aedes albopictus*, etc. Main workshop topics are: Introduction to GIS, Mapping Fundamentals, Thematic Maps, Selecting and Editing Map Features, Querying Map and Database Tables, Spatial Features, Address Matching, and Map Presentation Guidelines. For additional information on the workshop, contact: Dr. J.E. Freier, USDA/APHIS/VS, FAX:970-490-7999, Tel.: 970-490-7974, e-mail:jfreier@aphis.usda.gov or Dr. C.G. Moore, CDC/NCID/DVBID, FAX: 970-221-6476, Tel.: 970-221-6423, e-mail: cgm2@cidvbi1.em.cdc.gov. [Editor: Chet notes the class may be oversubscribed]

II. News from CDC/ATSDR GIS USERS

(Please communicate directly with colleagues on any issues)

A. General News

1. From **Monty Howie**, ATSDR: The ATSDR

(Atlanta) has an opening for an Environmental Health Scientist or General Engineer with expertise in Geographical Information Systems. The position is a GS-13 non-supervisory position but will have some supervisory functions. The position should be announced simultaneously internal (open to CDC employees) and external (any federal employee). The incumbent is expected to be an "expert" in Arc/Info GIS, an experienced program manager and a GIS promoter, marketeer. The Position Announcement Number is PSA2NW9 5122 and the official announcement information [SEE ADDENDUM BELOW] information may be obtained by contacting CDC, Human Resources Management Office, Personnel Servicing Activity at (404) 488-1758.

2. From **Linda Pickle**, NCHS: I just talked to someone at Georgetown who told me about a GIS bulletin board on Email. I thought you might want to subscribe, at least for a while to see what it is all about. Supposedly it covers the technical aspects of GIS, for example people writing in with comments about existing software packages. To subscribe, compose an Email to: LISTSERVER@URISA.ORG and in the body of the message type: SUBSCRIBE your name and Email address.

3. From Editor: The half-day course taught by Luc Anselin on September 21, at NCHS (see Item I.A.4. above), was well received by some 36 attendees. As Luc instructs, "Once you have your spatial weights matrix (swm), you're in business." Luc shows the real power of GIS through the use of swm in exploratory spatial data analysis, e.g., describing spatial patterns, discovering patterns of association (clusters), suggesting spatial regimes, and identifying pockets of local nonstationarity. The next release of S-Plus should have the capacity to truly perform robust exploratory spatial statistical analysis incorporating swm.

4. From Editor: I attended the second annual Geographic Technology in Government conference in Reston, VA (September). Of related GIS concern, Plenary speaker Bob Marx, Director of the Decennial Census, explained that the mood in Congress was to reduce costs, and possibly eliminate the Long form. The latter might be replaced by a **Continuous Measurement Survey** (sample). It has not been decided if the Long form should be replaced or supplemented. Bob said the Census is working with all communities to update the Census **Master Address File** (PL 103-430, Census Address List Improvement Act). Standards have been proposed for all city style addresses (for a nationwide address system). Work with the US Postal Service continues on the more difficult area of rural style addresses.

B. Technical News

5. From **Jay Kim**, NIOSH: As a GIS user, I find it useful to include Alaska and Hawaii with mainland U.S. in a full-page display. I understand that some programs cannot display the two states with adjusted size, e.g. reduce the size of AK, increase HI, and display them with the other coterminous 48 states. I would appreciate hearing from GIS user group members on this matter in terms of the software they use. Perhaps we can discuss other related items such as map import/export capabilities, number of title lines allowable, capability to put New York city (multiple counties) in an inset, etc.? Knowledge about member mapping programs and their functionality would be very helpful. Thank you.

6. From **Matt Clarke**, Viral Diseases: I receive the GIS News and Information letter. I work in Viral Diseases, and we think we may have an interesting application for kriging. We have surveillance data that could lend itself to geostatistical analysis. I was wondering about

available software for kriging--Does it exist? Is it expensive? Would training be necessary? Any insight or direction that you could provide would be greatly appreciated.

Editor: Matt and I have subsequently teamed up on this topic. We thought it would be useful to CDC/ATSDR GIS Users to prepare a list of references on kriging. To get you started, our list includes:

Kriging References

- Carrat F. and AJ Valleron (1992). Epidemiologic mapping using the "Kriging" method: application to an influenza-like illness in France, *American Jn of Epidemiology*, vol. 135, No. 11, Jan. 1, 1293-1300.
- Cressie N. (1986) Kriging nonstationary data, *Jn of the American Statistical Association*, 81(395):625-34.
- Cressie, N. (1988). Spatial prediction and ordinary kriging, *Mathematical Geology*, 20, 405-421.
- Cressie, N. (1989). The many faces of spatial prediction, In M. Armstrong (Ed.), *Geostatistics*, Vol. 1, 163-176, Dordrecht: Kluwer Academic.
- Oliver MA, Muir KR, Webster R, et al. (1992). A geostatistical approach to the analysis of pattern in rare diseases. *Jn Pub Health Med*, 14(3):280-89.
- Oliver, M. and R. Webster (1990). Kriging: A method of interpolation for geographical information systems, *Intern'l Jn of Geographical Information Systems*, 4, 313-332.
- Flowerdew, R, Green, and E. Kehris (1991). Using areal interpolation methods in geographic information systems, *Papers in Regional Science*, 70, 303-313.
- Goodchild, M, Anselin, L, and U.Deichmann (1993). A framework for the spatial interpolation of socioeconomic data, *Environment and Planning A*, 25, 383-397.
- Venables, W. And B. Ripley (1994). *Modern applied statistics with S-Plus*, New York: Springer-Verlag, 383-292.

- Moxley, A. and P. Allanson (1994). Areal interpolation of spatially extensive variables: a comparison of alternative techniques, *Intern'l Jn of Geographical Information Systems*, 8, 479-487.
- Flowerdew, R. and M. Green (1993). Developments in areal interpolation methods and GIS. In Fisher and Nijkamp (Eds.), *Geographic Information Systems, spatial modeling and policy evaluation*, Berlin: Springer-Verlag.
- Selected discussions in Cressie, N. (1991). *Statistics for spatial data*, New York: Wiley and Haining R. (1990). *Spatial data analysis in the social and environmental sciences*, Cambridge: Cambridge University Press.
- Flahault A, Garnerin P, Chauvin P, et al. (1995). Sentinelle traces of an epidemic of acute gastroenteritis in France. *Lancet* vol. 346:162-63.
- Wartenberg D, Uchrin C, Coogan P. (1991). Estimating exposure using kriging: A simulation study. *Environ Health Perspective*, 94:75-82.

Matt also notes: Of further interest for the newsletter, it seems that the theory of kriging is very well established in the literature; however, software is lacking, as far as I can tell. I contacted SAS. They are in the very early stages of developing PROC KRIGING and PROC VARIOGRAM for the SAS/STAT product. The software rep that I spoke to (Bev Wilson) suggested writing a letter to her attention to give to the stat development group to encourage faster development of these new procs. If SAS knows there is a demand from users they try hard to meet needs. Editor: Try calling Luc Anselin as well at (304) 293-8546.

III. Other Items of related Interest

NCHS DATA SYSTEMS RECEIVE HIGH PRAISE AT NATIONAL ACADEMY OF SCIENCES: At a special meeting of the Institute of Medicine and the Mapping Science Committee

(National Academy of Sciences/National Research Council), NCHS data reporting systems received high praise from Dr. Kathleen Lohr, Director, Division of Health Care Services, Institute of Medicine. The private sector is driving significant changes in proprietary acquisitions, mergers, etc. in the form of managed care and HMOs. These new forms of health care provision will ultimately replace Medicare and are likely to record data according to their own proprietary needs. And they can be expected to vary from state to state. Given the loss of Medicare insurance forms, NCHS data systems will play an increasing lead role in collecting standardized health information on the US population. The future analytic utility of NCHS data would grow even further with the addition of geocoded information. Reported by **Chuck Croner**, ORM, NCHS/CDC invited representative.

NEWSLETTER NOMINATED FOR AWARD:

[Editor] I am pleased to inform you that our **GIS NEWS AND INFORMATION** newsletter (less than 1-year old) was nominated for “an award for excellence in health communications” at the Second Annual CDC/ATSDR Communicators Roundtable Award Ceremony, Atlanta. The newsletter is recognized as providing a timely electronic forum on GIS and mapping issues for more than 300 on-line CDC/ATSDR professional public health staff.

SEE BELOW ATTACHED ADDENDUM-GIS POSITION PD FOR GIS EXPERTISE

ADDENDUM

**Environmental Scientist-Position Description
(Geographical Information Systems Expert)**

INTRODUCTION

The Agency for Toxic Substances and Disease

Registry (ATSDR) has health-related responsibilities pertaining to hazardous waste sites and emergency chemical releases. The ATSDR responsibilities are specified in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended in the Superfund Amendments and Reauthorization Act of 1986 (SARA) and in Amendments to the Resource Conservation and Recovery Act of 1984 (RCRA).

Subject incumbent serves as environmental scientist in the Division of Health Assessment and Consultation (DHAC) responsible for managing the planning, implementation and evaluation of Geographical Information System (GIS) integration ATSDR wide. Serves as a technical expert/authority in the field of environmental science/geographical information systems, and as such participates in the development of integrated environmental analysis and management technologies; identifies required techniques and data. Incumbent develops technologies for integrating and analyzing hazardous waste sites data using the geographical information system (GIS) and uses these automated integrated techniques to support decisionmaking, reporting status and ATSDR GIS policy.

MAJOR DUTIES

Exercises primary responsibility for the overall direction, coordination and implementation of GIS integration ATSDR wide. Develops and maintains necessary automated integration technologies to interface GIS systems with other Agency computer systems. Develops automation needed to analyze main frame data for targeting and trends.

Provides leadership in the development, implementation and administration of ATSDR GIS policies, goals and objectives. Provides expertise needed to automate the data needed to produce

hazardous waste sites status and trend reports. Directs integration of hazardous wastes sites data and monitoring data to prioritize problems and target sources causing greatest risk.

Evaluates technical data and information provided by contractors, scientific consultants, state and local health departments, ATSDR scientific staff and the public, in preparing GIS spatial analyses of hazardous waste sites and potentially affected human populations. Reviews and evaluates alternative and, often times, conflicting analytical methods and computer models of an advanced nature for effectiveness and efficiency for spatial analyses of hazardous waste sites; prepares technical guidelines for use by ATSDR scientific staff.

Participates with various national committees and taskforces to develop national standards for geospatial data, metadata, and the National Spatial Data Infrastructure. As agency spokesperson for GIS, works with expert scientist to establish integration and acceptance as it relates to databases.

Prepares and conducts workshops/seminars and technical material for publication and to disseminate information on recent advancements/new technologies in public health. Maintains scientific liaison with engineers and scientists in the Environmental Protection Agency (EPA), Centers for Disease Control (CDC), other Federal and State Agencies, academia, and industry to remain cognizant of the latest developments relating to GIS.

Provides expert technical assistance in developing end user applications to exchange spatial and tabular data with EPA, NASA, ORNL, WHO, USGS, CDC, and state cooperative agreement staff. Evaluates and anticipates advancements in GIS to develop strategies as it relates to ATSDR's

mission and objectives.

Provides consultation to HHS headquarters, regional, and field personnel, other Federal, State, and local health environmental agencies on special problems associated with geographical information systems, (e.g., spatial analysis, environmental engineering and health), and to develop and implement GIS systems within state health departments. Provides technical oversight and coordination to assure compatible systems that facilitate information exchanges and technological advancements.

Conducts special investigations or projects of complex environmental health problems requiring in-depth experience and expertise in geographical information systems. Provides analysis for inclusion in public health assessments, health consultations and other scientific reports in support of special projects.

Provides key analysis and assessment of environmental data associated with uncontrolled hazardous waste sites and provides recommendations concerning site specific environmental sampling strategies and characterization of environmental exposure pathways. Evaluates site specific environmental information to determine the potential for migration of hazardous substances through environmental pathways; assesses and identifies populations for exposure investigations, health surveillance, or other health studies.

Performs other duties as assigned.

KNOWLEDGE, SKILLS AND ABILITIES

Knowledge of environmental and health science, in order to develop and apply new approaches, extend and modify editing techniques, and solve complex environmental health problems.

Skill in advanced analysis techniques in GIS with emphasis on environmental application, enabling the incumbent to provide expert advice and consulting services to federal and state scientists and engineers.

Ability to provide technical/scientific and managerial review of complex environmental health issues associated with hazardous waste.

Ability to supervise and manage environmental programmatic activities and resources.

Ability to communicate in writing complex scientific data related to environmental science and geographical information systems.

Ability to effectively communicate orally.

SUPERVISORY CONTROLS

Supervisor, Program Evaluation, Records and Information Services Branch, Division of Health Assessment and Consultation, makes assignments in the form of individual projects and broad overall objectives. Incumbent typically develops assigned projects independently, coordinating with other specialists as needed. Technical decisions made by the incumbent, on GIS integration, are considered as authoritative and are accepted. Completed work is reviewed for adherence to policy and for soundness of professional and technical judgments.

GUIDELINES

Guidelines are stated agency regulations, policies and practices, program policy statements, and professional technical publications. Incumbent exercises judgment in deviating from traditional methods that may be available, adapting and developing new methods as required. Incumbent conceives of new projects or studies to advance the applied technology capabilities. Incumbent is

expected to exercise personal judgment to carry out work in the most effective manner.

COMPLEXITY

Current systems and components are designed and constructed as pilot or demonstration models. Incumbent performs the full range of technical analysis techniques utilizing conventional methods and practices based on sound theory. Since techniques are still in a state of change, occasional unconventional methods are employed requiring new application development. Incumbent is an expert in the science of public health and capable of developing critical spatial analytical techniques using state-of-the-art information systems to relate multimedia environmental pathways with diverse demographic data. Incumbent also maintains a national level GIS database that is interactive with local, state and other federal agency databases.

SCOPE AND EFFECT

GIS is a critical component for meeting the deadlines for the agency minority health and environmental justice initiatives and congressional mandates for public health assessments and health consultations. Incumbent is responsible for interpreting national guidelines and developing agency standards and procedures for GIS integration. As such, incumbent is responsible for managing ongoing nationwide integration in the application of GIS to environmental health evaluations at hazardous waste sites, including public health assessments, health consultations, exposure investigations, health studies and health education activities for hazardous waste sites nationwide. The significance of these applications is critical since it allows for the specific identification of information on the release of hazardous substances and health effects on human populations.

PERSONAL CONTACTS

Personal contacts are with ATSDR scientific and administrative staff, state and local governments, private groups, public health/engineering personnel, officials of CDC headquarters, and key officials and professionals of others federal agencies and state or local government.

PURPOSE OF CONTACTS

To develop national standards and guidelines, provide direction, exchange scientific and technical information, provide policy analysis, and defend the integrity of scientific conclusions drawn for GIS.

PHYSICAL DEMANDS

Work is sedentary except during occasional visits to sites and/or fields. During visits to sites and facilities there may be requirements to carry equipment, not exceeding 35 pounds. Frequent travel may be required using commercial airline flights. There is considerable walking, bending, climbing and stooping while carrying field equipment.

WORK ENVIRONMENT

Work is primarily in an office setting and performed in air conditioned surroundings, except for travel on occasional site/field projects.

Chuck Croner, Editor, **GIS NEWS AND INFORMATION**, Office of Research and Methodology, National Center for Health Statistics, Centers for Disease Control and Prevention

Enjoy the Fall (N. Hemisphere) pumpkins...and stay in GIS touch