GIS NEWS AND INFORMATION

February 1996 (No. 8)

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

Selected Contents: GIS Lyme disease lecture Feb. 29; Anselin short course on advanced spatial analysis now showing in Atlanta; Conferences with GIS public health themes; Hepatitis surveillance data sought; Suggested text materials on GIS and public health; Special attachments

I. Public Health GIS Training Opportunities

A. CDC/ATSDR

NCHS Cartography and GIS Guest Lecture Series

1. Greg Glass and Jay Morgan lecture, **"An Epidemiological and Geographical Approach to the Study of Lyme Disease"**, 2:00-3:00, February 29, 1996 [rescheduled and commemorative of NCHS's 8th annual celebration of **National Geography Awareness Week**. *Please make envision arrangements now for your location*]

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 their use of GIS to study Lyme disease and its environmental covariates. 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. Their work has appeared in *GeoInfo Systems* and *AJPH* and is of much interest to GIS users.

2. The advanced GIS short course **"Spatial Data Analysis Using GIS"**, presented this past September at NCHS by Luc Anselin,PhD, will be ready for February viewing at Chamblee (C) and Corporate Square (CS). All interested Atlanta staff should contact coordinators **Shelba Whaley** (C: 488-7675) and **Peter Kilmarx** (CS: 639-8371) for scheduling information.

B. NON CDC/ATSDR

3. Forwarded from **Jay Smith**, NCEH: **THE SECOND INTERNATIONAL SYMPOSIUM ON SPATIAL ACCURACY ASSESSMENT IN NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES**, May 21-23, 1996, Colorado State University, Fort Collins, Colorado. Topics include accuracy related aspects of spatial statistics, GIS, remote sensing, and multi disciplinary approaches. Several endorsing organizations include the American Statistical Association: Section on Statistics and the Environment, National Center for Geographic Information and Analysis, International Biometric Society, and U.S. EPA [Editor: I've attached the listing of paper topics and authors sent by Jay, in **IV. ATTACHMENTS**]

4. Editor- Note two related national conferences of GIS and public health interest: (A) **1996 Annual Meeting of the Association of American Geographers**, Charlotte, NC, April 9-13. Registration forms may be obtained from the AAG at 1710 16th Street NW, Washington, DC, 20009-3198 or phone 202-234-1450/FAX 202-234-2744. From **Marilyn Ruiz**: The following

papers will be presented at two sessions entitled "GIS and Analytical Mapping for Health Research", on April 12, 1996. Chairs- Marilyn Ruiz, Florida State U. and James Wilson, East Carolina U. Discussants- Russell Kirby, U. of Wis. Medical School and Charles Croner, CDC. Presenters- Geoffrey Jacquez, BioMedware, What can we learn about relationships between health and the environment using GIS?; David Padgett, Austin Peay State U., Isarithmic mapping of childhood lead-soil exposure hot-spots; Lucy Savitz, Cecil G. Sheps Cntr. for Health Services Res., Measuring distance to care using GIS across the rural-urban continuum; Wil Gesler, U. of NC., Approaches for assessing health care accessibility within a GIS environment; Carol Hanchette, NC State Cntr. for Health and Environment, The disease ecology of childhood lead poisoning in N. Carolina: predicted and actual patterns of risk; Peggy Whittie, U of NC., The integration of multilevel modeling techniques and GIS to examine access to care; Jim Wilson, East Carolina U., Regionalizing Communicable Diseases in N. Carolina. Contact: Marilyn O. Ruiz, Assistant Professor, Dept. of Geography, Florida State University, Tallahassee, FL., 32306-2050, 904-644-8374, FAX 904-644-7360, mruiz@coss.fsu.edu.

(B) **American Statistical Association's Twelfth Conference on Radiation And Health**, Vail, CO, June 23-27. Contact ASA at 703-684-1221, ext. 148 (D. Moss).

5. Received from **Jonathan Sperling**, Census Bureau (announcement by Harlan Onsrud): Proceedings of the Conference on Law and Information Policy for Spatial Databases; The full text of this 1995 proceedings is available on-line through http://www.spatial.maine.edu (look under the heading "Specialized Interests" or go directly t o http://www.spatial.maine.edu/tempe/tempe94.html)); The proceedings contains 33 papers prepared by law professors, attorneys dealing with GIS issues, and members of the academic, government, and private sectors confronting GIS legal and information policy issues. The papers are arranged under the following headings: Access to Government's Spatial Information, Intellectual Property Rights in Spatial Databases, Protecting Privacy in Using Geographic Information Systems, and Liability for Spatial Data. The proceedings also contains an introduction chapter and a chapter on the research agenda derived from the conference working groups. Bound copies of the proceedings may be obtained by sending a check or money order made payable to the University of Maine for $35 to: NCGIA, 5711 Boardman Hall, Rm 348, University of Maine, Orono, ME 04469-5711. Harlan J. Onsrud, Chair, Department of Spatial Information Science and Engineering, Scientist, National Center for Geographic Information and Analysis, Phone (207) 581-2175, FAX (207) 581-2206, E-mail: onsrud@ spatial.maine.edu.

II. News from GIS USERS

(Please communicate directly with colleagues on any issues)

A. General News

1. From **Jim Cheek**, Indian Health Service: we obtained a software tutorial on GIS called GISTutor 2. It is simple to use, very complete, and cheap (educator/student price $120). You can order the program from GIS World, Inc., 155 E Boardwalk Dr., Ste 250, Ft. Collins, CO 80525, ph: 970-223-4848. We learned about it in a GIS course at the University of Iowa last summer. I highly recommend it as a good starting point for beginners, and a good refresher/intro to advanced topics for people with more experience. <JCHEEK@IHS.SSW.DHHS.GOV>

2. Subject: GIS Applications and the World Wide Web. (Picked up from <nets@hoshi.cic.sfu.ca> and forwarded by **Mike Qualls**): 'Several people have asked about the relationship between the "simple tool" project and various Geographic Information System (GIS) technologies. Of course, one of the key points of the demo is that

complex technology and specialized software aren't always required to provide a useable service. The focus is on ways we can build frameworks for interpersonal and interagency communication. Nonetheless there's certainly a growing intersection between the communications infrastructure of the Internet and the Web and the data compilation, analysis and display resources of GIS. A number of researchers around the world are working with WWW "front ends" on GIS "engines" as a way to make the relatively arcane GIS technology accessible to non-specialists. An interesting resource list on this, assembled by Kenneth Duda of the Michigan State University Department of Geography, is at: **http://www.ssc.msu.edu/~geo/./wwwgis.html**; It includes links to a series of papers by the folks at ESRI on WWW/ArcInfo-GIS fusion.'

3. Subject: Directory of GIS coursework (Picked up from <gis-l@urisa.org> and forwarded by **Mike Mungiole**, NCHS): As many of you are aware, I conducted a survey of colleges and universities last year regarding GIS education. The initial findings of the survey were reported at the GIS/LIS meeting in Nashville. I have compiled a "1996 Directory of Academic GIS Education" which will be published by Candle/Hunt Publishing Co. I will post ordering information for the directory next week (I am waiting for Candle/Hunt to give me the 800 number for orders. The directory lists information for over 800 academic departments worldwide. Although pricing information will be included with the E-mail post next week, I have arranged with Candle/Hunt to offer a substantial discount ($20.00) to all departments who responded to the survey, and to students. Please E-mail me if you would like information regarding the directory sent to you. Jay Morgan, Department of Geography and Environmental Planning, Towson State University, Baltimore, Maryland 21204-7097, (410) 830-2964,(410) 830-3888 (FAX), e7g4mor@ toe.towson.edu.

B. Technical News

4. From **Linda Pickle**, NCHS: StatSci has just shipped their S+ Spatial Statistics module to its beta testers. They hope for a 2 month turnaround, after which they will release it as an add-on to S+. I am a beta tester and will report on available features/functions after I have a chance to try it out, but I was very impressed by their demo at ASA.

5. Subject Zip+4 Codes (picked up by **Peter Kilmarx**, NCPS, from <epidemio-l@cc.umontreal.ca>):'I use a program called AccuMail. It takes a set of addresses (for the entire U.S. on CD-ROM) and appends the 11-digit Zip+4 postal code to it. Your next step is to get a database of Zip+4 postal codes and their corresponding latitude and longitude coordinates. Mapinfo sells this but other vendors may be cheaper. Try looking in the magazine "Geo Info Systems" for other data sources. AccuMail is from Group 1 Software (1-800-368-5806). If I (A Skelton)can be of further assistance call me at 314-533-3037. I am an epidemiologist/health services researcher with extensive experience in GIS.

III. Special Items of related Interest

A. Hepatitis data sought (received from Professor **Gerry Rushton**, U. of Iowa, regarding student Rob Jame's following request for hepatitis surveillance data): 'My thesis is trying to define "high risk areas" for AIDS and hepatitis infection acquired from injection drug use or through risky sexual behaviors. I am interested in areas where these risks are endemic--areas that are often called "inner-city", "ghetto" or "underclass" areas. Simply put, the thesis hopes to see if one or more definitions of these areas which have been advanced in the sociology, urban planning, economics literatures are relevant to public health. Interestingly, I have not been able to find a definition of "inner city" in the public health literature, despite its popular use.

I had initially planned to define these "high-risk areas" using AIDS case registration data coded to census tracts--there are several of these datasets available. However, the long interval between HIV infection and diagnosis with AIDS (and subsequent registration of the case) argues against using current location of an AIDS patient as a valid surrogate for the residential location at the time of the infection.

I am now turning my attention to datasets of drug-related criminal justice information (one important dataset exists in Cleveland), and there are some datasets on file with ICPSR which I am reviewing. I am also searching for public health agencies who have geocoded (or at least have addresses for) cases of hepatitis. Hepatitis infection has a much shorter latency, so residence of these cases may be a better surrogate for residence at time of risk. The drug-related hepatitis cases may provide a good measure of these endemic drug-use areas which I seek. However, my search for hepatitis data has been somewhat less than fruitful, and I am writing to see if you were aware of any agencies or individuals who might be keeping hepatitis surveillance data. I hope to conduct the analysis at the census-tract level. Thank you in advance for any suggestions that you might have. [Editor: please send me any suggestions you have and I will make these available to G. Rushton and our readers].

B. Editor- In response to a recent request for text materials that focus on GIS and Public Health, the following references have been compiled from our readership (please continue to send your suggestions in order to build the listing):

From both **Chet Moore**, NCID, and **Ellen Cromley**, U. of CT: There is a new book--de Lepper et al., **"The Added Value of Geographical Information Systems in Public and Environmental Health"**, Kluwer Academic Publishers, 1995, ISBN 0-7923-1887-0, and available through GIS World at $139.50; From both **Marilyn Ruiz**, Florida State U. and **Don Albert**, UNC: Ricketts, Savitz, Gesler and Osborne (eds.), 1994. **"Geographic Methods for Health Services Research: A Focus on the Rural-Urban Continuum"**, available from University Press of America, Inc., 4720 Boston Way, Lanham, Maryland 20706, 800-462-6420; From **Lee De Cola**, USGS-Don't know about books, but Census produces a miniGIS program called **LandView** that has environmental data on it; From **Kang Daehee**, NIOSH: **"GIS for Health and the Environment"**, Proceedings of an International Workshop held in Colombo, Sri Lanka 5-10 September 1994, Edited by Don de Savingny and Pandu Wijeyarante, International Development Research Centre, Ottawa, ON; From **Gerry Rushton**, U. Of Iowa: CD-ROM product, **"Improving Public Health Through Geographical Information Systems: An Instructional Guide to Major Concepts and Their Implementation."** Distributed by Department of Geography, GIS & Health (FIPSE) Project, 316 J.H., The University of Iowa, Iowa City, Iowa 52242; From **Sonia Arbona**, U. Of Texas: Gregory E. Glass, Joan L. Aron, J. Hugh Ellis, Steven S. Yoon. 1993. **Applications of GIS Technology to Disease Control**. Johns Hopkins University, Baltimore, Maryland; [Editor: Please continue to send references at any time]

IV. ATTACHMENTS

A. Keeping up with current developments in DHHS SURVEY INTEGRATION, PERFORMANCE PARTNERSHIP GRANTS and MINORITY HEALTH STATISTICS

Excerpts: Public Health Service, NATIONAL COMMITTEE ON VITAL AND HEALTH STATISTICS, June 14-16, 1995, Washington, D.C., - Meeting Minutes -

DHHS SURVEY INTEGRATION PLAN

Mr. Arnett said that although much work had been done on this project, much remains to be

done. This latest of several attempts at survey consolidation was given impetus by the reinventing government (REGO) effort and pressure to reduce budgets. The current process began with a mandate to develop a consolidation plan in six weeks. The steering committee, headed by Dr. Judith Feder and Nan Hunter, has members from throughout the Department. It is also working on plans for a Data Council and an enhanced data entity (both discussed below).

Mr. Arnett and Mr. Hunter started their project by reviewing all of the Department's 300 surveys and data systems, including many targeted analytic projects, about 100 of which are being coordinated through an effort to integrate and streamline public health surveillance activities and grant reporting systems. Their work focused on roughly two dozen major DHHS surveys. The categories of data source are households, employers, institutions, and providers; a fifth category is called "capacity and infrastructure." The bulk of the work thus far has been done on household surveys.

Mr. Hunter briefly described the major surveys, indicating where they are unique, where there is overlap, and their current status. The household surveys are the National Health Interview Survey (NHIS), the National Medical Expenditure Survey (NMES), the Medicare Current Beneficiary Survey (MCBS), the National Health and Nutrition Examination Survey (NHANES), the National Survey on Family Growth (NSFG), and the National Household Survey on Drug Abuse (NHSDA). The major institutional surveys are the National Nursing Home Survey, the Medicare Current Beneficiary Survey (MCBS), and the NMES Nursing Home Survey (NHS). The employer surveys are the new National Employer Health Insurance Survey (NEHIS) and the NMES Health Insurance Plan Survey (HIPS). Provider surveys are the National Health Care Survey (NHCS) and the NMES Medical Provider Survey (MPS). Other sources include the Area Resource File, which the Department may relate to NHIS data to generate information on communities, and workforce analysis by HRSA. Mr. Hunter noted that Dr. Lasker has reported to the Committee on another group, a series of surveys of the public health infrastructure.

Mr. Arnett observed that while these surveys have in ways served the Department well, there are a number of problems with them. The multiple, decentralized survey efforts overlap. They also generate inadequate data in some areas (e.g., that necessary for behavioral analysis), and pay insufficient attention to state and private needs and resources. Asked by Dr. Ashley about non-survey sources of information on the population's health status, Mr. Arnett said his group's mandate and authority were to look at large-scale Departmental surveys. Mr. Hunter added that there are plans to pursue a CDC effort to coordinate and integrate disease surveillance and facilitate state ability to develop integrated information systems. Asked by Dr. Zill about the State and Local Immunization Coverage and Health Survey, he said that they were unable to find ways to meet the precision requirements of SLICHS through other integrated surveys, but that additional efforts would be made to address the overall State data issue...

The presenters then described the specific consolidation plan, beginning with the household portion. Mr. Hunter said that when the consolidation planning began, four household surveys (NMES, NHIS, NHANES and NHSDA) were at critical stages. A key decision was made to link the surveys together to the extent possible to allow more efficient sampling, more concerted planning, and greater analytic power. The plan is to link across samples (using the same set of individuals and households in different surveys), to link across content (coordinating the questionnaires in various surveys and making them more comparable), and to coordinate the timing of the surveys.

The core interview of the redesigned HIS will be used as the "launching point and the hub" of the Department's population-based household

surveys. The HIS core interview is conducted on 120,000 individuals, with a reduced core planned for 1996. Rotating modules will get more detail on topics such as health status, utilization and behavior. Periodic and annual supplements will add information on such things as immunization and HIV knowledge. The pool of individuals in 40,000 households around the country will be used for follow-up surveys. Medical Expenditure Panel respondents will be selected from the HIS sample, thus giving access to supplementary HIS information on them. The NMES will for the first time become a longitudinal survey. People will be revisited several times during the year, and stay in the panel for an additional year. Each year's HIS will refresh the panel. Mr. Hunter noted that this is the model used for the National Survey on Family Growth. Subsets of the NHIS will also be used for the NHANES, which is being redesigned. The advantage of tying these surveys together, Mr. Hunter said, is the ability to generate a picture with general characteristics on a large number of people, detailed expenditure data on a subset, very detailed health status data on some -- and all with linkages back to the core HIS and the ability to model back to the larger population. The NHSDA might be done in the same framework, although there are issues about confidentiality and trust. The Department will conduct empirical tests to look at the effect on the response rate and data quality.

PERFORMANCE PARTNERSHIP GRANTS (PPGs)

Ms. Jones welcomed Roz Lasker, M.D. and Suzanne Stoiber, both of the Office of the Assistant Secretary for Health. She described performance partnerships as an important and creative enterprise with potential for short- and long-term payoffs. (The PPG literature explains that the Department has combined over 35 narrowly focused grants into five proposed new partnership grants in the areas of mental health, substance abuse, STD/HIV/AIDS, chronic diseases and disabilities prevention, and immunizations. The Preventive Health and Health Services block grant will also be modified to become a PPG.)

Ms. Stoiber reported that the Administration sent its performance partnership legislation to Congress on June 1. Its primary function, given the Republican control of Congress, is as a statement of a desired framework -- beginning with but not limited to public health -- for a new relationship between the federal government and states in respect to grants. The change begins with "getting out of the business of doing categorical grants," which have achieved a great deal but have now "come to the end of their useful life" because they predispose federal agencies to being too prescriptive. Ms. Stoiber noted that even before the electorate sent the message of wanting the federal government "out of their faces," health professionals at the state and local levels were sending the message that they could do a better job of setting health priorities and wanted more flexibility to do so.

EXCERPTS: NATIONAL COMMITTEE ON VITAL AND HEALTH STATISTICS, SUBCOMMITTEE ON HEALTH STATISTICS FOR MINORITY AND OTHER SPECIAL POPULATIONS, September 28, 1995, Washington, DC- Meeting Minutes

RACIAL DISPARITIES WITHIN THE MEDICAID PATIENT POPULATION

Dr. Lillie-Blanton observed that efforts to restructure Medicaid make the current topic even more urgent, because these efforts may further undermine access to care and decentralize the collection and analysis of information on racial disparities. She also pointed out that current racial disparities in Medicaid must be viewed in an historical context, with a recognition that they were much worse 20 years ago.

In terms of coverage, the racial and ethnic composition of the Medicaid enrollee population is close to that of the population it was intended to serve. Low-income whites are more likely to have private coverage, and blacks are more likely

to have public coverage. Hispanics are the most likely to be uninsured. There are important regional variations in Medicaid coverage, with African Americans in the Northeast and Midwest far more likely to have coverage than those in the South. Overall, the racial disparities in service access are far worse for the uninsured than they are for anyone covered by Medicaid. In other words, Medicaid has done a good job in reducing racial disparities for low-income populations.

In terms of service use, there is evidence of racial differences. Here Dr. Lillie-Blanton referred to two measures: 1989 HIS data and 1993 data. The earlier data show that uninsured people have fewer visits than both those with private insurance and those with Medicaid. Among the uninsured, blacks had 81 percent as many visits as whites. Among those with private insurance, blacks had 77 percent as many visits as whites. Black Medicaid enrollees had roughly half as many visits as whites, and Hispanics had slightly better than that. These disparities persist in the 1993 data: For Medicaid enrollees, blacks have about 60 percent as many visits on average as whites, and Hispanics 68 percent as many visits as whites.

The speaker drew these conclusions: Medicaid has greatly reduced the disparities in insurance coverage; racial differences are greater among upper income populations than among lower-income ones. Hispanics continue to face the greatest barriers in taking advantage of Medicaid. Racial and ethnic differences exist within and across regions. The differences also exist in the use of services, despite relative parity in coverage. Dr. Lillie-Blanton observed that the implication is that while insurance is "an important beginning," other factors are also important, such as disparities in the availability of services in different neighborhoods and the possibility of discriminatory policies and practices. She noted that the expected move to block grant funding and managed care will increase the difficulty of getting data to document and analyze these problems. Moreover, cost-cutting measures usually target research and evaluation.

Dr. Lillie-Blanton predicted that state-level data within the population-based surveys would be problematic because state-level estimates can only be done for eight or ten states, and because of confidentiality issues in releasing the data. A block grant system will make it very difficult to track state-level differences. In response to a question from Dr. Wan, she said she did not have breakdowns on urban-rural distinctions, but NMES may make them possible. The next speaker was Marion Gornick, M.S., of the Health Care Financing Administration.

RACIAL DISPARITIES WITHIN MEDICARE PATIENT POPULATION

Ms. Gornick said that when Medicare began in 1967, there were large differences between white and black beneficiaries in the rate of hospital admissions. By the late 1980s, blacks were being admitted at a higher rate than whites. Health services researchers in the 1970s and 1980s found evidence of diminishing disparities and ultimately concluded, by the late 1980s, that equity had been achieved.

However, researchers taking a closer look since then have found racial disparities in a number of specific procedures, with significantly lower utilization rates for blacks. This has prompted HCFA to look at Medicare data in terms of DRGs, medical DRGs and surgical DRGs for 19 procedures used frequently by the elderly. They found racial disparities in virtually all of them, with the largest differences for several coronary procedures, total knee replacement, and total hip replacement. For example, for cardiac catheterization, the black/white ratio was .68; for coronary artery bypass, it was .39.

The black/white ratios for more traditional procedures (e.g., prostatectomy, mastectomy, hysterectomy) still show racial disparities, but are closer to 1 than for the more "high-tech, newer procedures." Black Medicare

beneficiaries were found to have higher utilization for four procedures, all of which are used in the event of bad outcomes or to treat advanced chronic conditions that have not been treated effectively.

Ms. Gornick said that as a result of feedback from a group of sociologists to whom she presented these findings, she has investigated the impact of socioeconomic status (SES) on the racial disparities. Geocoding was used to ascribe SES factors to the beneficiaries, because of the absence of SES data in Medicare files. The results of this study, which she said was very useful for understanding the separate effects of race and income on specific types of services, will be released soon. She added that Medicare data do not permit any comparisons other than black/white.

Finally, she observed that the researchers in the 1970s and 1980s were misled by relying on global measures from surveys. A large data base is needed to look at these issues. Dr. Williams observed that this constitutes an argument for improving the Medicare data base to permit the study of these issues. Ms. Gornick agreed, and said that HCFA Administrator Bruce Vladek also agrees. The ideal is something that permits linkage of Medicare data with data on race and ethnicity and SES.

Next, Dr. Williams introduced Carol Somkin, Ph.D., of the Kaiser Permanente Medical Care Program.

RACIAL DISPARITIES WITHIN KAISER PATIENT POPULATION

Dr. Somkin said she would focus on data limitations and their impact on assessing racial disparities. The Northern California Kaiser Permanente Medical Care Program has a diverse enrolled population that, with the recent enrollment of Medicaid patients, will become even more representative of the overall population of Northern California. She noted that the movement into managed care increases the importance of looking at possible disparities in the utilization and quality of health services. If uniform provision of care can be established, then other non-financial barriers can be identified. For this, she echoed other speakers in stressing the importance of comprehensive data on such factors as social class and language as well as race and ethnicity.

Dr. Somkin then described three Kaiser studies of the effects of sociodemographic factors on health service utilization and outcomes. For each one, she stressed the analytical difficulties imposed by the fact that the health plan does not routinely collect system-wide sociodemographic information on the general membership.

The first example she cited is a study of adherence to diabetes prevention and management guidelines, testing the hypothesis that blacks have lower levels of care. The authors found that neither the complication rates nor the prevention practices varied by race/ethnicity, nor did referrals to specialists and special programs. However, the unavailability of individual level data on race/ethnicity limited the study in several ways: The authors did not know the true racial/ethnic distribution of diabetic patients, so they relied on indirect measures. They were also unable to directly measure socioeconomic status and to oversample Hispanics.

A second study looked at the accuracy of self-reported data on six cancer detection procedures, and found substantial lack of agreement between self-report and medical audit for all but one, but no significant differences between Hispanics and non-Hispanics. These findings, too, are limited by the lack of membership-wide sociodemographic data.

The third study was of patient and physician determinants of mammography screening, to determine whether it was utilized equally by women in different sociodemographic categories. The researchers (including Dr. Somkin) used block group data as a proxy for individual level data and as a source of information about the neighborhood social context of people's lives. They found that the

effect of having one or more primary care physicians on mammography use was very strong. They also found that neighborhood sociodemographic variables had an effect even on women with two or more physicians, suggesting that understanding the social context is an important factor in increasing screening and other forms of utilization.

In conclusion, Dr. Somkin reiterated the need for individual level data, including social class and language, in order to understand the effect of racial disparities. Dr. Williams then welcomed Anthony Hawkins of the Center for Minority Veterans, Department of Veterans Affairs (VA).

RACIAL DISPARITIES WITHIN VA PATIENT POPULATION

Mr. Hawkins began by describing the VA system, which provides priority health care for veterans with service-connected conditions. As the economy has worsened, eligibility criteria have become more stringent. The VA is moving toward more managed care and primary care, and getting away from long-term hospitalization.

A recent report looked at the disparity in the use of cardiac invasive procedures for veterans who suffered myocardial infarcts, and it found that black veterans were less likely to receive invasive procedures. African Americans use VA services particularly for substance abuse and mental health problems. Asians and Native Americans suffer the highest rate of post-traumatic stress disorder.

The VA is trying to get better race-based research information in order to look at differences in care for different racial and ethnic groups. The Center for Minority Veterans was created by an act of Congress in 1994 to make sure that the VA's policy and procedures do not adversely affect minority veterans and to initiate or advocate research. The research department has identified funds for race-based research, and an Advisory Committee on Minority Veterans has been established.

Mr. Hawkins said that the Center for Minority Veterans is challenging the VA to reexamine its traditional attitude that "a veteran is a veteran is a veteran," partly as a result of pressure from women veterans. The VA is beginning to recognize the differences in the way veterans of color approach the system, and the possible differences in the availability of services. He noted the influence of such factors as facility location and the patient's access to transportation.

The Center is trying to get a picture of its clients and the services they use, with attention to race/ethnicity. A 1992 survey, for example, found that veterans of color, primarily African Americans, use VA facilities at a higher rate than was originally thought; but they primarily use psychiatric and substance abuse services. The Center has also investigated the barriers to getting data and found that people are reluctant to ask questions about race.

Dr. Williams thanked Mr. Hawkins, and then reviewed the morning's findings: that blacks and Hispanics with Medicaid have fewer visits than whites; that blacks on Medicare have lower levels of utilizations for a number of procedures; and that black veterans have lower utilization rates than whites. In each case, however, the studies reviewed patient records after the fact. The Subcommittee now wants to identify the patterns of disparities and the data needed to understand them. He asked two invited responders to comment.

RESPONSE: CASSANDRA BUTTS, J.D.

Ms. Butts is with the NAACP Legal Defense Educational Fund. The Fund, which has been separate from the NAACP for 50 years, litigates on issues of racial discrimination. A focal concern in the health context is the absence of inclusive racial and ethnic data collection. Civil rights laws are a key tool of the organization's work. Relevant in this context are Title VI and the Civil Rights Act of 1964, which require that agencies within the Federal Government promulgate regulations to determine whether or

not the entities receiving federal funds are discriminating on the basis of race and ethnicity. This implies data collection on the basis of race and ethnicity. The Legal Defense Educational Fund has been pushing the Department to include this information on Medicaid forms, believing that the absence of comprehensive utilization data on race and ethnicity has contributed to a lack of enforcement of Title VI. The Fund does not regard HCFA's addition of Social Security race and ethnicity data to its files to be an adequate alternative to collecting the information on its forms.

Ms. Butts observed that the shift to managed care will intensify the need for data collection. States are not required to include utilization data by race or ethnicity on either the front or the back end, which makes it impossible to investigate possible discrimination in managed care programs. She stressed that her organization would continue to push HHS to include the data, and would also push providers and managed care organizations to include race and ethnicity data.

RESPONSE: JON GABEL

Mr. Gabel is with the Group Health Association. He described 1994 research by the National Research Corporation that compared health plans, using a large sample of 132,000. He called attention to this survey as a quick source of a great deal of information on quality of care and other factors. The data base includes information on the health status and demographics of the sample. Mr. Gabel noted that about one-fourth of HMO enrollees are members of racial minorities, compared to 12 percent in fee-for-service plans. Research could be done on this data base looking at the health status and health care satisfaction of people in different racial and ethnic groups.

Commenting on the previous presentations, he observed that they "cry out for multivariate analysis" in which health status is one of many variables. In response to his suggestion, Ms. Gornick said that the Hospital Discharge Survey does not have denominator data, and it lacks unique identifiers. Dr. Parsons added that its Hispanic data are very poor because they are reported by providers.

Dr. Williams then asked the group to discuss what data are needed to understand the nature and magnitude of the racial disparities, why they are taking place, and the interventions that would make a difference. He noted that there are several possible explanations for the disparities, including discrimination, patient preferences and lack of trust in the health care system, and socioeconomic status-related factors. Without data, however, it is impossible to identify the actual reasons. He asked the group to consider what kinds of information NCVHS should recommend that the federal government collect to describe and understand these issues.

GENERAL DISCUSSION: DATA NEEDS AND BARRIERS

Ms. Gornick asked Ms. Butts on what forms her organization wanted to see race and ethnicity data. She noted that Medicare's best race data are in an enrollment base, and the agency favors self-description over ascribed race and ethnicity. She urged Mr. Gabel to get this information into more enrollment data bases. Ms. Butts said she was referring to Medicaid UB92 forms, and added that enrollment data would also be helpful.

Dr. Lillie-Blanton observed that for Medicare, HCFA is resistant to doing more than linking to SSA data, which is an inferior data source because it only has black, white and other. She suggested that the Committee encourage and promote better ways of collecting race and ethnicity data upon enrollment in Medicare. She also noted that a strong argument for collecting this information is the need to comply with Title VI.

Dr. Schwartz asked about collecting race and ethnicity at the first visit, after enrollment. Dr. Somkin said there is some concern at Kaiser that it is illegal to collect this information. In addition, there is fear that people will be denied care or enrollment because of their race or

ethnicity. Despite these counterforces, Kaiser is investigating ways to collect the data. She noted that the problem with collecting at first visit is that the data are then not available on enrollees who do not make visits.

Dr. Lillie-Blanton distinguished between public and private programs, noting that in the former it is illegal to discriminate and data collection should not be deterred. In contrast, the information could have an adverse affect with private insurers who want to avoid people considered at higher risk.

Mr. Hawkins said the VA has no place on its forms for a race identifier at enrollment, but this is taken in the first visit. A question is not asked about race, however; "someone makes a judgment by eye-balling them." He observed that this can lead to internal disparities in individual records, and added that there is some thought that OMB does not permit asking about race and ethnicity. (This misconception was addressed later in the discussion.)

Dr. Lillie-Blanton observed that subtle forms of discrimination occur in sites other than the provider base, which argues for the need to "understand the broad context of someone's life." She continued that the likely conversion of Medicaid to block grants argues for the use of surveys to get at the desired information. In addition, state data collection should be encouraged. She noted that what is now known about racial/ethnic disparities and service use by Hispanics is obtained from NMES and the HIS.

Mr. Gabel urged efforts to document the effects on vulnerable populations of the changes now being imposed by Congress. Dr. Williams expressed strong agreement, and worried that a reliance on the national data system does not permit attention to small vulnerable subpopulations such as Asian and Pacific Islander subgroups. He suggested that the Subcommittee help develop strategies to see that these populations are not missed.

In response to a question, Mr. Gabel elaborated on an earlier comment on the trend of the HMO industry not to have information on multispecialty groups. He explained that this results from HMOs contracting out some areas of care without mechanisms for key kinds of data collection. Dr. Lillie-Blanton commented on the resistance of plans to adding data collection requirements onto their service delivery requirements. She urged that the states approach these relationships as purchasers rather than as regulators, and build language into their contracts with providers that requires the provision of certain information. For this purpose, some standard language might be developed and shared with the states.

UPDATE ON OMB DIRECTIVE 15 REVIEW

Dr. Williams welcomed Katherine Wallman, from the Office of Management and Budget. Ms. Wallman outlined OMB's three-pronged process for reviewing Directive 15 (August Federal Register notice): prong one, which began with a set of public hearings in July, 1994 and was followed by a public comment period that generated about 900 letters; prong two, study by an interagency committee comprising the principal collectors and users of race and ethnicity data from 30 agencies; and prong three, the current phase, involving research and testing of the alternatives suggested to OMB.

The initial report on the Current Population Survey supplement, conducted in May, 1995, is due out in late October, and public use tapes will be available by the end of the year. In addition, the Census Bureau plans two major tests in 1996 in preparation for the year 2000 Census.

PLANS FOR 1996 NATIONAL CONTENT TEST AND 1996 RACE AND ETHNICITY TARGETED TEST

Dr. Williams introduced Roderick Harrison, Ph.D. and Nampeo McKenney, from the Census Bureau. Ms. McKenney said the Bureau had been involved in research and testing for about two years, with three broad activities. The first is

cognitive research, focus groups and classroom experiments and analysis of 1990 Census data. The results of this research and analysis guided the development of the question proposal for the testing program.

In 1996, the National Content Survey will test all population and housing questions, including alternative versions of the race and ethnicity questions, followed by a reinterview. The Race and Ethnic Targeted Test (RETT) will be conducted in June, 1996 with a diverse group of populations, including multiracial persons and urban and rural samples. They expect about half of the 90,000 households to respond, and a sample of the respondents will be reinterviewed. The 1990 census questions on race and ethnicity, with a few modifications, will be used as the control panel.

Ms. McKenney then circulated the questions to be tested. The National Content Survey will focus on multiracial classification and terminology issues as well as the sequencing of the questions on race and Hispanic origin. The goal of the latter is to reduce the non-response rate to the Hispanic origin question, as well as the number of Hispanics who report as "Other" race.

Dr. Harrison commented that the non-response rate was about 10 percent, so the vast majority of people already respond. The National Content Survey, scheduled for March 1996, will administer a questionnaire that addresses alternative terminology, alternative sequencing, multiracial status and the assessment of ancestry.

Turning to the RETT, he said that this test will focus on proposed questions involving multiracial classification and one that combines race and Hispanic origin and ancestry. It will target American Indians and Alaska Natives, Hispanics, multi-racial persons, Asian and Pacific Islanders, white ethnics, and Blacks.

An audience member asked about the distinction between nation state origin and ethnic heritage, noting the changes in identity resulting from the breakup of the Soviet Union. Ms. McKenney said that the 1990 Census covered about 140 ethnic groups that would have been considered part of the USSR. She added that people everywhere tend to identify themselves by their ethnic heritage rather than the nation state in which they live.

MAY 1995 CPS SUPPLEMENT PRELIMINARY FINDINGS

Dr. Williams introduced Clyde Tucker, Ph.D. from the Bureau of Labor Statistics. The Current Population Survey contains about 60,000 households per month, divided into four panels for testing different question wording and formats for race and ethnicity. The test examined the effects of a multiracial category and using Hispanic as a race (versus a separate Hispanic ethnicity question). It also looked at alternative terminology preferences for African Americans, and asked people who identified themselves as multiracial their reasons for doing so. The CPS is conducted largely over the telephone, with a face-to-face visit in months one and five.

The researchers also conducted cognitive research during the May CPS to help interpret the results. They monitored telephone interviewing centers, had observers for face-to-face interviews, taped 300 telephone interviews, and debriefed interviewers. In response to a question, Dr. Tucker said that the BLS did not keep information on the race of the interviewer, but interviewers are often the same race as interviewees. The group discussed the impact of the interviewer's race and ethnicity on responses, a factor that the Bureau was not able to study. The BLS is not allowed to have access to information about interviewer characteristics. Furthermore, funding for the CPS does not permit randomly assigning cases to interviewers and having control groups in order to study such factors. Dr. Williams commented that research findings suggest that the perceived race of the interviewer does have an effect on race-sensitive questions, even in telephone interviews.

Initial results of the May CPS study will be made available in a press release in late

October and more detailed findings will be issued in early November. A public use data set will be available by the end of the year. Dr. Williams commented that the foregoing reports reflect a very ambitious and informed research agenda that will put the measurement of racial and ethnic status on firmer ground. He commended the federal agencies and researchers involved in the project.

Ms. Wallman was asked to comment on the OMB policy regarding race and ethnicity questions. She said there is no federal, and to her knowledge no state, law prohibiting such questions. Under the Paperwork Reduction Act, OMB is responsible for reviewing and clearing all reporting requirements that go out to the public, but this applies to all questions on all subjects. OMB's role is to reduce burden on the public and to encourage consistent practices among federal agencies. It does not prohibit the collection of data on race and ethnicity. Ms. Wallman stressed that OMB also does not prohibit the collection of more detailed information than is provided for in Directive 15, as long as there is good reason for collecting the detail.

Dr. Williams thanked the presenters and asked them to keep the Subcommittee informed of their projects. He then welcomed Dr. Greg Pappas and Dr. Clemencia Vargas of the National Center for Health Statistics.

REPORT TO THE ASSISTANT SECRETARY FOR HEALTH ON SOCIOECONOMIC STATUS AND THE HEALTH OF AMERICANS

Dr. Pappas said the report on the health and socioeconomic status (SES) of Americans (to be called the Lee Report) would complement the Heckler Report, which contributed to understanding of the health status of minority populations in the U.S. by relating the SES dimension to health. He added that both Dr. Lee and his wife have been leaders in studying and calling attention to this area of concern.

The report's cross-cutting themes include the multi-dimensionality of social class and the fact that social class is a gradient. Age, gender and race/ethnicity are also treated as cross-cutting issues. It will begin with an executive summary or chart book that will be also be published independently, probably in advance of the report, with highlights and figures and bullets to summarize the report. Chapters two through seven will address the following: changing disparities in mortality and morbidity; race, ethnicity and SES; the relationships between class, place and individual SES; the relationships between social structure and individual behavior; access and utilization issues; and international comparisons. The final chapter will discuss policy implications. It will lay out a framework for understanding the importance of data and social science for policy making, and show areas in which an understanding of the relationship between SES and health might help in social policy formulation.

UPDATE ON SSA AND HCFA

Beginning with some background, Mr. Moore said that until a few years ago, Medicare records only contained the categories of Black, White, Other and Unknown. All the data came from the Social Security Administration. The law suit against the Secretary, which called for race/ethnicity on every claim, prompted an effort to improve Medicare data. HCFA feels that claims are the wrong place, and enrollment data sets the right place, for race and ethnicity data. By matching HCFA and SSA records, HCFA has improved its enrollment data. In addition, in October it will start sending out a survey to 2.5 million people who have Hispanic surnames and/or were in the Other or Unknown categories. The goal is to update the Medicare records that were derived from the old form. This will be done using the proxy identifier, provided it is found to be valid.

The mailing will continue for six weeks, and a 50 percent response is expected. In addition to birthplace, HCFA used the Census Bureau's

Hispanic surname algorithms to determine who is and is not Hispanic. The questionnaire responses are regarded as a chance to validate the algorithms. A report is planned for the spring, and Mr. Moore promised to report to the Subcommittee at that time. He reminded the group that 35.5 million of the 38 million beneficiaries are already identified, and this project is designed to improve the data. He added that beginning in January, the plan is to annotate claims with the new classifications. Past claims will not be revised.

Dr. Carter-Pokras reported that the Departmental Minority Health Data Inventory should be ready in early October, in print and on the Internet. She described several evaluation efforts underway on OMB Directive 15: cognitive research on how people perceive their race and ethnicity classification; pilot tests of race and ethnicity questions for the National Household Survey on Drug Abuse; a study contrasting the self-identification and birth certificate data for 750 multiracial and Hispanic women who recently had babies with the classification; and a CDC study of how funeral directors collect race and ethnicity data.

B. SPATIAL ACCURACY SYMPOSIUM PAPER TITLES

SYMPOSIUM ON SPATIAL STATISTICAL ACCURACY IN NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES (List of accepted papers with tentative spatial titles)

SPATIAL STATISTICS, Keynote Speaker: Noel A.C. Cressie, Statistical Modeling of Environmental Data in Space and Time.

AMERICAN STATISTICAL ASSOCIATION SESSION ON THEORETICAL ASPECTS OF CONDITIONAL SIMULATION (Carol A. Gotway, Moderator); An Overview of Stochastic Spatial Simulation, R. Mohan Srivastiva, Choosing and Using Simulation Algorithms, Donald E. Myers; A Case Study in Geostatistical Modeling for Petroleum Reservoir Description, Jeffrey M. Yarus, Jeffrey A. May, and Timothy C. Coburn; The Components of Geostatistical Simulation, Carol A. Gotway and Brian M. Rutherford.

AMERICAN STATISTICAL ASSOCIATION SESSION ON APPLICATIONS OF CONDITIONAL SIMULATION (Carol A. Gotway, Moderator): A General Approach to Sample Selection for Site Characterization, Brian M. Rutherford; Consideration of Spatial Variability in the Modeling and Management of Non-Point Source Pollution to Groundwater, Wayne Woldt, Mohamed Dahab, Istvan Bogardi, and Farida Goderya; Incorporating Soil Variability into a Spatially Distributed Model of Percolate Accounting, Andrew S. Rogowski.

AMERICAN STATISTICAL ASSOCIATION SESSION ON MODELS FOR MULTISCALE PROCESSES AND DATA (Katherine Campbell, Moderator): Development of a General Framework for Modeling Multi-Scale Variability in Hydrologic Processes, Praveen Kumar; Flow-Based Scale-Up of Heterogeneous Porous Media Using Homogenization and Wavelet Representation, Joe Koebbe; Nonhomogeneous Hidden Markov Models Allowing Stochastic Down-Scaling of Synoptic Atmospheric Patterns to Local Hydrologic Phenomena, Peter Guttorp and James P. Hughes; Explicit Consideration of Multiple Landscape Scales while Selecting Spatial Resolutions, John B. Collins and Curtis E. Woodcock.

AMERICAN STATISTICAL ASSOCIATION SESSION ON ACCOMMODATING MULTIPLE SPATIAL SCALES IN LANDSCAPE ASSESSMENT (Katherine Campbell, Moderator): Calibration-Based Methods for Correcting Area Estimates Derived from Coarse Resolution Land-Cover Data, Aaron Moody and Curtis E. Woodcock; Geostatistical Analysis of Multi-Spatial Resolution Imaging Spectrometer Data for Characterizing Forest

Ecosystems, Paul Treitz and Phillip Howarth; Response of a Watershed Model to Varying Spatial Landscape Characteristics, Dennis Swaney, Wen-Ling Kuo, David Weinstein, Charles Mohler, Stephen D. DeGloria, Tammo Steenhuis, and Charles McCulloch.

KRIGING TECHNIQUES - THEORY (Dale L. Zimmerman, Moderator): Using Trend-Surface Methodology and Locally Weighted Regression to Compare Spatial Surfaces, Dale L. Zimmerman, Zhi-Jun Liu, and George R. Hallberg; The Effect of Heterogeneous Spatial Covariance on Prediction Uncertainty, J. Andrew Royle and Douglas W. Nychka; A Gamma-function Model for D-variate Spectra and Cross-spectra for Large Scale Frequency Domain Simulation of Stationary Random Functions in Rn, Leon E. Borgman and John W. Kern; Further Explorations of Relationships between Semi-variogram and Spatial Autoregressive Models, Daniel A. Griffith and Larry J. Layne.

KRIGING TECHNIQUES - APPLICATIONS (Gerard Heuvelink, Moderator): Computing the Area Affected by Phosphorous Runoff in an Everglades Wetland: A Comparison of Ordinary Kriging, Bayesian Kriging, and Thin-Plate Spline, Song S. Qian; Mapping Synecological Coordinates: Spatial Analysis of Environmental Factors in a Forested Landscape, Margaret R. Holdaway and Gary J. Brand; On the Robustness of Data Assimilation Methods in Air Pollution Models, X.F. Zhang and A.W. Heemink; An Application of Spatial Statistics to Access Data Usability for Risk-Based Environmental Restoration Decisions, Elizabeth J. Kelly and Katherine Campbell.

GEOGRAPHIC INFORMATION SYSTEMS (GIS): Keynote Speaker: Michael Goodchild Communicating the Results of Accuracy Assessment: metadata, digital libraries, and assessing fitness for use.

GIS SYSTEMIC ERROR PROPAGATION (Jane Drummond, Moderator): The Development of a Geographic Information System Information Quality Module, Jane Drummond; Communication of Uncertainty in Spatial Data to Policy Makers, Morwenna Spear, Jane Hall, and Richard Wadsworth; Accuracy Assessment of GIS Products for Planning Rural Environments in New Zealand, Gary J. Hunter, Barbara Hock, and Michael F. Goodchild; A User-Friendly Tool for Error Modeling in a GIS Environment, Frank Forier and Frank Canters.

PROBLEMS IN POLYGON DELINEATION (Kim Lowell, Moderator): Discrete Polygons or Continuous Surface: Which is the Appropriate Way to Model the Forest Cartographically, Kim Lowell; Choosing between abrupt and gradual spatial variation, G.B.M. Heuvelink and J.A. Huisman; Stratification in Geostatistical Soil Mapping Based on the Nature of Map Boundaries and the Structure of the Spatial Variation within Mapping Units, G. Boucneau, M. Van Meirvenne, and G. Hofman; Reliability of Area Mapping by Delineation in Aerial Photographs, C.P. Gross and P. Adler; The Effect of Spatial Uncertainty on Disease Cluster Statistics, Goeffrey M. Jacquez.

UNCERTAINTY ASSESSMENT IN TERRAIN AND ELEVATION MODELING (Peter Fisher, Moderator): The Effect of Database Generalization on the Accuracy of the Viewshed, Peter Fisher; Modeling Uncertainty in three Slope Stability Models: A Case Study of the H.J. Andrews Forest in Oregon, USA, Michelle L. Murillo; Terrain, Climate, and the Spatial Extension of Biological Site Data: Accuracy Assessments from a Case Study in the Forests of Ontario, Canada, Dan McKenney, Brendan Mackey, Richard Sims, Yuhong Wang, and Michael Hutchinson; An Assessment of the Horizontal Accuracy of Interim Terrain Data, L.A. Fatale, J.A. Messmore, and J.R. Ackeret.

POSITIONAL OR LOCATIONAL ACCURACY ASSESSMENT (Michael J.c. Weir, Moderator): Acquisition of Spatial Data by Forest Management Agencies: A Review, Michael J.C. Weir; Attribute and Positional Accuracy Assessment of the Murray Darling Basin Project, Australia, R.W. Fitzgerald, K.T. Ritman, and A. Lewis; A New Method for Evaluating Positional Map Accuracy, Michal Lodin and David Skea; Quantifying Spatial Confidence in a Raster-Based GIS, Matthew H. Pelkki.

ACCURACY ISSUES USING GPS: Measuring the Performance of Algorithms for Generating Ground Slope, W.H. Ryder and D. Voyadgis; An Overview of Spatial Data Accuracy Research: The Affect (or Lack of) on Forest Management Decisions, Russell Combs, Jr., Paul V. Bolstad, and James L. Smith; Procedures and Results of GPS Located Accuracy Assessment Plots for Lassen National Forest (USA) Vegetation Map, Kevin Casey; A Method for Measuring the Spatial Accuracy of Coordinates Collected Using the Global Positioning System, Thomas Owens.

REMOTE SENSING (Keynote Address): Russell G. Congalton.

GLOBAL MONITORING TECHNIQUES - I (Cristoph Kleinn, Moderator) Assessment of Forest Cover from Raster Images: On the Possible Impact of Misregistration, Cristoph Kleinn, Berthold Traub, and Matthias Dees; Large Scale Tropical Forest Change Monitoring Using Multiple Resolution Satellite Data: From Hot Spot Detection to Global Deforestation Assessment?, Herve Jeanjean; Linear Mixture Modeling with Autocorrelated Errors, Jaynatha Ediriwickrema, Siamak Khorram, Marcia Gumpertz, and John Brockhaus, Uncertainty Assessment in Soil and TERrain (SOTER) Digital Database Development in Hungary, T.F. Helt, E. Dobos, E. Micheli, M.F. Baumgardner, and C.J. Johannsen.

GLOBAL MONITORING TECHNIQUES - II (Raymond L. Czaplewski, Moderator): Assessing AVHRR-Based Seasonal Land Cover Characteristics Database: A Case Study, Zhiliang Zhu, Donald O. Ohlen, Raymond L. Czaplewski, and Robert E. Burgan; Investigation of Possible Contribution of NDVI to Misclassification in AVHRR Data Analysis, David L. Evans and Raymond L. Czaplewski; The Distributions of and Relationships Among Measures of Association and Agreement for Assessing the Accuracy of Classifications of Remotely-Sensed Images, Gene Fosnight; Optimum Area Sampling Frame Using High Resolution Images with Operational Objective: How to Conciliate Statistical Requirements and Practical Aspects, Helene De Boissezon.

DESIGNS FOR INVENTORY AND MONITORING (Michael Kohl, Moderator): Spatial Accuracy Requirements for Monitoring Peatlands in Switzerland, Michael Kohl, Andreas Grunig, and Han-Jorg Schnellbacher; Forest Spatial Surveys Using the Rao-Hartley-Cochran Sampling Design, Jeffrey S. Pontius; Assessing the Accuracy of a Regional Land Cover Classification, William Clerke, Raymond Czaplewski, Jeff Campbell, and Janet Fahringer; Spatial and Temporal Models in Contextual Classification, Bo Ranneby.

REMOTE SENSING ACCURACY ASSESSMENT (Kass Green, Moderator): Practical Considerations in Designing and Implementing Thematic Accuracy Assessment of Maps Created from Remotely Sensed Data, Kass Green; Generalized Linear Mixed Models for Analyzing Map Error in a Satellite-based Vegetation Map of Utah (USA), Gretchen G. Moisen, D. Richard Cutler, and Thomas C. Edwards, Jr.; Statistical Properties of Five Indices in Assessing the Accuracy of Remotely Sensed Data Using Double Sampling, Mohammed A. Kalkhan, Robin M. Reich, and Raymond L. Czaplewski; Estimation of Crop Acreage from

Satellite Derived Land-cover Data, Frank Canters and Frank Forier.

REMOTE SENSING SAMPLING DESIGNS (Stephen V. Stehman, Moderator): Cost-Effective, Practical Sampling Strategies for Accuracy Assessment of Large-Scale Thematic Maps, Stephen V. Stehman; Cooperative Accuracy Assessment Strategies for Sampling a Natural Landcover Map of Arkansas , R.S. Dzur, M.E. Garner, K.G. Smith, W.F. Limp, D.G. Catanzaro, and R. L. Thompson; Spatial and Probabilistic Classification of Forest Structures Using Landsat Thematic Mapper Data, Jeffrey L. Moffet; Total Error Estimation in a Spatial Database for GIS, Jose Alberto Quintahilha and Marcos Rodriques; Sampling Satellite Images for Area Estimates in a Large Region, F.J. Gallego.

FUZZY SET THEORY IN SPATIAL PROCESSES (Curtis Woodcock, Moderator): On Roles and Goals for Map Accuracy Assessment: A Remote Sensing Perspective, Curtis Woodcock; Fuzzy Measures in Multi-Criteria Evaluation, J. Ronald Eastman and Hong Jiang; Integration of Inventory and Field Data for Automated Fuzzy Accuracy Assessment of Large Scale Remote Sensing-Derived Vegetation Maps in Region 5 National Forests, Jeff Milliken, Kevin Casey, and Kama Kennedy; Uncertainty of Spatial Metric Relations in GIS, Xiaoyong Chen, Takeshi Doihara, and Mitsuru Nasu.

MIS-REGISTRATION ERRORS: Plot Collocation Error- Impacts on Area Estimation, Willem W. S. van Hees; From Data Accuracy to Data Quality: Using Spatial Statistics to Predict the Implications of Spatial Error in Point Data, A. Lewis, M.F. Hutchinson, and H.A. Nix Moving into Secondary Map Projections: An Analysis of Potential Inconsistencies in Spatial Data, Mohammad Nor Said and Peter F. Fisher; Filling in Missing Forestry Data: Exploring Autocorrelational Techniques, Alissa N. Antle and Peter Marshall.

SPATIAL INTERPOLATION (G.P. Patil, Moderator): Optimizing Sampling Schemes for Mapping and Dredging Polluted Sediment Layers, L. Hazelhoff; The Influence of Vegetation Cover Density and Topographic Parameters on the Thermal Emission of Beech Forests of Simburini Mountains in Central Italy, Carlo Ricotta, Giancarlo Avena, and Fernando Ferri; Forest Cover Monitoring in India: The Satellite Experience, J. B. Lal; Application of Non-parametric Kernel Regression and Nearest-Neighbor Regression for Generalizing Sample Tree Information, Annika Kangas and Kar T. Korhonen.

UNCERTAINTIES IN FOREST MONITORING AND PROJECTION SYSTEMS (George Z. Gertner, Moderator): A Method for Assessing the Prediction Quality of Mechanistic Forest Growth Models, Biing T. Guan, George Z. Gertner, and Pablo Parysow; Statistical Analysis of Error Propagation in National Level Carbon Budgets, C.J. Cieszewski, D.P. Turner, and D. Phillips; Simulating Size-Age Relationships, Ronald E. McRoberts; Using Seemingly Unrelated Regression to Build an Individual-Tree Stand Simulation Model for Austria, Hubert Hasenauer, Robert A. Monserud, and Timothy Gregoire.

LANDSCAPE PATTERN (Denice Shaw, Moderator): Accuracy Assessment of Landscape Patterns, Deb J. Chaloud, George T. Flatman, and E. Terry Slonecker; Sensitivity of Selected Landscape Pattern Metrics to Land Cover Misclassification and Differences in Land Cover Composition, James D. Wickham, Robert V. O Neill, Kurt H. Riitters, and K. Bruce Jones; Quantifying the Uncertainty in Landscape Pattern Measures, George Hess and Jeff Bay; Spatial (In)consistency of Watershed Delineation among Agencies/Scales in Pennsylvania, Wayne L. Meyers, Barry M. Evans, and Michael C. Anderson.

SPATIAL BIODIVERSITY (Tom Edwards,

Moderator): Genetics, Geographics, and Prairie Dogs: A Model of Spatial Movements across a Complex Landscape, Gillian Bowser; Effect of Uncertainty in Mapped Biodiversity Data on Optimal Conservation Decisions, Michael J. Conroy and Jennifer E. Crocker; Development of a Survey Sampling Methodology for Rare Species, Molly Van Caster, Dave Bowden, and Jennifer Hoeting; Sensitivity Analysis of Species Richness Mapping to Variations in Wildlife-Habitat Relationships, Tom Kohley.

SPATIAL POINT PROCESSES AND CELLULAR AUTOMATA: Methods to Analyze the Spatial Structure of Plant Communities, P.W. Braun, H. Balzter, B. Lachnit, and W. Kohler; Spatial Patterns in Northern Tolerant Hardwoods: Point Processes versus Coverage Process. Are Trees Infinitely Small Points? John A. Kershaw, Jr.; Modeling Population Dynamics with Cellular Automata, H. Balzter, P. Braun, and W. Kohler.

ABSTRACTS ACCEPTED FOR THE POSTER SESSION: GOES Visible and Infrared Channels to Evaluate Cloud Processes in Air Quality Models, Sharon LeDuc, Johathan Pleim, YanChing Zhang, and Jeff Wang; Inconsistency of Line Convolution as a Quality Factor in the Maintenance of Spatial Databases, Michael J.C. Weir; A Comparison of the Spatial Accuracy of Two Land Cover/Use Mapping Methods, Larry Robinson and Thomas Owens; European Forest Institute Data for Internet Browsers: Custom Queries and Visualization, Ivo Kupka; The Effect of Camera Position and Ground Control Point Survey Technique on the Spatial Accuracy of Rectified 35mm Oblique Angle Photography, Kyle R. Bohnenstiehl; Sensibility and Uncertainty Analyses of an Expert System to Determine Stand Treatments, O. Eckmullner and M. Moser; Characterizing Error in a Historic Vegetation Map, Tim Haithcoat and Eric Compas; Lead-Based Paint Survey Data: Spatial Variation, Tze-San Lee; Design of Forestry Resources Management and Dynamic Monitoring Geographic Information System, Zhang Xiaoli; Applying GIS Technology to Forest Management on Public Lands: Problems and Potentials, John Nichols; Locating Trees by Image Processing of Digital Aerial Photos, Kim Dralle; Application of Quality Assurance to Digital Databases for Aquatic Ecosystems, James L. Regens, Christopher Swalm, Donald G. Hodges, James T. Gunter, and Jacqueline Keim; Optimizing a Fuzzy Logic-based Thinning Model with Evolutionary Algorithms, Markus Kahn; Measurement Precision, and Covariance Structures on Uncertainty Propagation using the Delta Method, Jim Penney; The Definition of Satellite Orbit Parameters and Evaluation of Sampling Error for a Proposed Cloud Radar, Ivan Astin; Quality Evaluation Services on Internet, Anders Ostman, Analysis of Spatial Structure of Tree Crowns, Boris Zeide; Accuracy Improvement in Variable Stream Buffer Mapping, Wei-Ning Xiang; Evaluation of Forest Condition Assessment Data, F. Mitterbock and O.Eckmullner; Spatial and Temporal Dependence of Tree Size and Increment in a Natural Forest Ecosystem, Franco Biondi and Donald E. Myers; Modeling Animal Movements within a GIS Framework, G. Janeau, J. Joachim, and F. Spitz; Stratified Two-Stage Sampling (Self-Weighted) for Assessment of Village Forest Resources in Bangladesh, S.S. Islam Application of Randomized Block Permutation Procedures in Analyzing Multi-Species Point Patterns, Kristine L. Metzger, Robin M. Reich, and Charles D. Bonham; Spatial Relationship of Armillaria Root Disease and Site Productivity of Ponderosa Pine on the Black Hills National Forest, Melanie A. Kallas, Robin M. Reich, and William R. Jacobi; Uncertainty of Spatially Averaged Rainfall Estimates from Rain Gages, Jeffrey R. McCollum and Witold F. Krajewski; Extensive Forest Mensuration with Airborne Infrared Laser Altimeter, T. Sweda and Y. Fukushima; Application of Remote Sensing Technology in Assessing Wood Resources in Village Conditions, Jamil A. Chowdhury; The Analysis

of the Landscape Structure and Ecological Space Pattern of the Die Bu Forestry Bureau, Tang Jilin; Ratio Conversion Mechanism and Its Application to the Compilation of Forest Distribution Maps, You Xianxiang, Yang Xiaoming, and Wang Changhan; Defining Urban Settlements: Certainties Regarding Uncertainties, Mahavir and Sahar Al-Amir.

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