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**The Use of Geographical Information Systems and Remote Sensing
Technologies in Analyzing Land and Natural Resource
Tenure Issues: Possibilities and Prospects**

Proposed Institutional and Research Priorities

On March 29, 1995, the research planning workshop on the use of spatial technologies and their integration with land and natural resource tenure was held on the University of Wisconsin-Madison campus. Over 130 faculty and graduate students from 18 different departments or centers attended, and there has been an enthusiastic response to the content and results of the workshop.

The following memo outlines both institutional activities and proposed research topics (both "basic" and "applied") that were discussed at the end of the workshop, or that were submitted on "resource sheets" completed by many of the workshop participants. Suggested next steps under each category include:

- * **Institutional** - (1) Planning meetings; (2) Graduate seminar; (3) Meta-data Database; and (4) Linkages outside UW;
- * **"Basic"** - (1) Systems research; (2) Information access; and (3) Transaction costs; and
- * **"Applied"** - (1) Modelling tenure systems within a GIS; (2) "Hot Spots"; and (3) Land information in developing countries.

Please note that these topics are a **FIRST DRAFT** of the discussions from the workshop, and both the content and interested persons are subject to change. Should those mentioned in the text feel that they are not appropriate, or not available, for the cited research activity, please contact Jim Gage and the appropriate change will be made.

Finally, in considering next steps, the questions that now confront those interested in the integration of these concepts are the following: Which issues below are worth pursuing? Which seem to be the most logical first activity to pursue? Select individuals will be personally solicited for their opinions, but please pass this memorandum to faculty and graduate students who may want to work on these issues. Consider also whether a large research grant can be written to incorporate all of these issues.

Institutional Concerns

The major institutional concern appeared to be that of communication between the different departments and groups at the University of Wisconsin - Madison. There appeared to be some skepticism as to whether the ideas and concepts discussed at this workshop could be turned into cross-disciplinary research and other activities. The suggestions below are an attempt to "institutionalize" the merging of tenure issues and spatial technologies and build further capacity at UW to continue to develop this integration.

I. Institutionalize regular planning meetings, including one-half day research planning meetings each semester, to review progress made on suggestions from this workshop.

This meeting would serve to follow-up on on-going issues related to institutional concerns, "basic" research and "applied" research. It is conceivable that a format similar to the March 29 workshop could be followed, with presentations and questions, and a facilitated discussion at the end. One very practical use of these 1/2 day workshops could be, as a research community, to discuss and review possible research proposals to outside funding agencies. The sponsorship of the workshop could rotate each semester to a different department or center on campus.

The organization of these seminar meetings should be through a standing multi-disciplinary committee of faculty and graduate students. The formation of this committee should be discussed by the sponsors of the workshop.

The semester events should also be linked to ongoing committee meetings. Monthly meetings (i.e., the SIAC meeting or LTC staff meetings) should include a 5-10 minute synopsis of research results to inform (and get feedback from) departments and centers.

II. A seminar that explores ways to integrate Spatial Technologies and Land and Natural Resource Tenure issues.

A semester seminar, open to all faculty and graduate students, could be offered once a year either by LTC or IES, or jointly by the two. Holding the seminar during the spring semester would avoid conflicts with the fall LTER (Long Term Ecological Research) seminar. The seminar could be team taught (one professor from LTC or an affiliated department, and the other from a SIAC related department) featuring student led discussions. Approximately half of the course's readings/lectures could be land and natural resource tenure focused and half GIS/Remote Sensing/GPS focused. The course could be 1 or 2 credits - for 1 credit, students would be expected to lead a discussion, and for 2 credits, students would be expected to write a 10 page research paper on integrating socio-economic data and GIS/Remote Sensing/GPS.

III. Create and maintain a UW "meta-data database."

The database would contain information regarding Technology resources and Land and Natural Resource Tenure issues, and would feature UW resources. The database would include information regarding possible funding sources for projects relating to, using, or researching, spatial technologies and land/natural resource tenure issues, data on old projects, and a framework for how spatial technologies have been/can be integrated into land/natural resource tenure research.

Questions related to instituting such a meta-data database are:

1. Who would set it up?
2. Who would be the database manager?
3. Where would it reside?
4. Where would the funding come from?

It was suggested that an executive committee for this type of database could include, for example, D. David Moyer, David Stanfield, Tom Lillesand, and Richard Barrows. A possible scenario for day-to-day management of the data base would be assigning an RA from LTC and an RA from IES or ERSC on a 1/4 or 1/2 time basis.

IV. Linkages outside of the University

It was noted that UW-Madison is virtually unparalleled in expertise and resources in both Spatial Technologies and Land and Natural Resource Tenure issues. From this position of excellence, UW should strategically begin to examine external alliances who could be partners in the development of this new initiative. Establishing both a list of UW associated researchers that could act as contact persons to other key researchers and organizations is a necessary first step. Examples of key contacts and point people are:

The EROS Data Center - through Eric Wood
The East-West Center - through Nancy Podger
Wisconsin State Assembly - through Brenda Haskins
The Wisconsin DNR

"Basic" Research

Throughout the workshop, there was an indication that the merging of tenure issues and spatial technologies was at an initial stage, and there was a need to ask basic questions on how the technologies could measure socio-economic data. Issues of scale, appropriateness (versus existing methodologies) and cost were among the issues most discussed. Note that a number of these "basic" research areas may be appropriate for dissertation or thesis topics.

I. Incorporating tenure concerns into a GIS

The incorporation of complex land and natural resource tenure concerns and data (described at the workshop as often being "fuzzy") may not be easy - the "bundle of rights" in a tenure system may

change from season-to-season, and traditional tenure systems sometimes maintain a flexibility that may be difficult to organize spatially. Questions of the number of data layers within a tenure GIS and what factors and variables they represent will be important as these system issues are examined.

Al Vonderohe suggested that it may be appropriate for he and John Bruce to work together on this research.

In conjunction with the above, it was suggested by Bev Phillips that rather than developing tenure layers in a GIS, perhaps it would be better to develop a "Tenure Information System" that would incorporate spatial representations of tenure systems using GIS methodology. Once the relevant factors are mapped for a given area, the results would suggest one or two appropriate "layers" to add to others for a given area. The appropriate categories, such as competing tenure claims, seasonal tenure rights, dominant forms of tenure, etc., would depend on both the realities of the place and also the problem being analyzed.

II. Characteristics of the technology and issues of information access

A number of participants (including Jim Clapp and Eva Jensen) voiced concern over the use and misuse of the information generated by these technologies - would the information be shared and used by local people, or would this information enable powerful individuals to use this to take advantage of local tenure situations. The suggestion was made to team political scientists, historians, sociologists, GIS specialists and others to investigate the ramifications of the use of this technology in the U.S. and overseas. Questions that could be investigated include:

- * What could happen if this information became dominated by one person/institution?
- * How can information be disseminated through the use of this technology? Can it be? Is it possible to decentralize/democratize these technologies' use, and the information types it creates? In short, who will have access to the information and the technology given its costs?
- * What is the "appropriate" use(s) of GIS technology for natural resource, tenure, socio-economic issues?

III. Investigate questions of the present transaction costs and costs incurred by foregoing the use of GIS today

Are there future costs incurred to individuals or society by not using this technology today? One idea is to consider Coase's economic value theory for information and include economists and business sciences to consider these questions.

"Applied" Research

The "applied" research direction implies that there may be activities or projects where the workshop participants see the near future incorporation of spatial technologies. As noted in (I.) below, there are still "basic" questions that will need to be addressed.

I. Use GIS as the base for building models to help understand tenure systems.

Models could incorporate disparate information such as statistically analyzable information for econometric analysis, case studies, information on the ecological processes in the study area, information on community problem solving, community tenure systems, national tenure systems, etc. A statistical package could also be tied to the system to help with statistical analysis of the relevant data. Causality in the system would be tested (i.e. humans as a constraining influence on the ecosystem) and hypotheses would be tested. Particular interest in this was expressed by Steve Ventura and Mike Roth.

Specific projects that could be considered under this framework include the following:

- A. Research in Third World Countries, with existing sources of data, to link socio-economic data with spatial technology. One such country is Brazil. Is it possible to use GIS database and spatial analysis and display capabilities as a platform for modeling human/environmental interactions in parts of Brazil's Legal Amazonia? (Interest by Arch Haller)
- B. Examine areas where deforestation and desertification are taking place (example: West Africa). Use a GIS's database and spatial analysis and display capabilities as a platform to try to spatially relate this phenomena with tenure concerns, and use the technology to help analyze the causal relationships between land cover change and land use/tenure practices.
- C. Examine the spatial distribution of poverty in Latin America. Monitor what has happened in areas where agrarian reforms are being dismantled. Use GIS's database and spatial analysis and display powers as the platform for analyzing information that has already been gathered. Include in the database socio-economic data, ecological data, etc. (Interest by Bill Thiesenhusen)
- D. Track urbanization and peri-urban expansion through the creation of a GIS for an expanding urban area in a current project. Explore the possibility of using the GIS's database and spatial analysis and display capacities to analyze and coordinate land use changes with land planning, land rights, land markets, and land prices. Also, investigate the relationship between food security and changes in land use. Explore if it is possible to identify areas likely to experience rural/urban "sustainable credit schemes." (Interest by John Strasma)
- E. Use GIS's database and spatial analysis and display capabilities to investigate relationships between land titling, agronomic conditions and patterns, soil types, and tenure systems in the Peruvian jungle and other Peruvian areas. (Interest by Susana Lastarria)
- F. Use GIS's database and spatial analysis and display capabilities to organize information and investigate results of research that has taken place in buffer zones of protected areas in Africa, Asia, and Latin America. (Interest by Phil Nyhus)
- G. Use of GIS to evaluate land use degradation in Albania, and possible links to land tenure (Interest by Peter Bloch and Mohamed Mohamed)

II. "Hot spots"

A second area for the integration of spatial technologies into current or future applied work is the use of remotely sensed data to help identify areas where research should be undertaken (i.e. to identify "hot spots"). "Hot spots" that could be identified include areas within a specified region that are undergoing land degradation, forest infringement, peri-urban expansion, etc. Examples of this presented on 3/29 include Eric Wood's display of land degradation in central Senegal and Steve Ventura's identification of urban expansion in Middleton. The consideration of the work done by LICGF in Wisconsin on these issues may be a first step.

One specific idea for application of this was Jeff Kaufmann's suggestion of using remotely sensed data within a GIS to clarify issues of and identify areas where indigenous conservation ethics and practices are present in the pastoralist areas of Madagascar.

III. Land Information in developing countries

GIS could help provide information for land taxing, valuation, and compensation for land expropriation in developing countries. Tied to this is the investigation of the role of GIS in facilitating land titling and registration, conflict resolution, and the prevention of land grabs.

Specific projects where this might be applicable are pending projects that Steve Hendrix is associated with in Venezuela, El Salvador, and Guyana.

Reactions and additions to the ideas presented above are welcome. Please send them to Jim Gage at the Land Tenure Center by April 21 (tel. - x25538; fax. - x22141; email - jdgage@facstaff.wisc.edu). A list of participants will be attached to a final draft of this memo, which will be available at the end of April.