

Digital Mapping and Geographic Information Systems in Undergraduate Geology Curricula

Workshop

PARTICIPANTS

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INTRODUCTION

The Keck workshop on digital mapping and Geographic Information Systems (GIS) in undergraduate geology curricula was held at Trinity University from March 13–16 1997. There were three major goals for the workshop. The first was to familiarize the participants, through discussion and hands-on exercises, with the state-of-the-art in software and hardware appropriate for the scope of GIS activities in undergraduate teaching and research. The second goal was to exchange ideas and experiences in teaching mapping and GIS in classes and employing these techniques in research activities appropriate for undergraduates. The final goal was to explore ways in which the Keck Consortium departments might develop group efforts and proposals to enhance our abilities to teach and use GIS at our institutions and in our local communities.

WORKSHOP SYNOPSIS

Participants arrived in San Antonio on the afternoon of Thursday, March 13 (except for Cathy Manduca who was delayed by some mysterious substance known as snow). With everyone present, we began the program on Thursday evening with a presentation by Glenn Kroeger (Trinity) on the fundamental concepts of cartography, including geoids, ellipsoids, datums, projections and grid systems. The concept that the latitude and longitude of a point on the Earth's surface are not absolute, but depend on the choice of datum, is critical to integrating conventional hard copy map data with georeferenced digital data and GPS data. The demonstration concluded with the mosaicing of two digital 7.5 minute DEM quads and the registration of this raster data to vector data including county and state lines stored in geographic coordinates. This went on until rather late in the evening, but needed to be covered before Friday's session.

On Friday morning, representatives from Trimble demonstrated a complete range of GPS equipment for the group. We were able to examine hand-held GPS systems, with and without post-processing capabilities, backpack based systems with the ability to carry out real-time differential corrections using beacon transmissions, and engineering grades systems with proprietary FM technology that allow real-time sub-centimeter work.

Friday afternoon was our first chance to discuss and use GIS software. After a refresher lesson on raster and vector GIS systems, we went to the computer lab. Working in pairs, everybody got a chance to solve some GIS problems using both vector and raster GIS techniques using ArcView3.0a software by ESRI with the Spatial Analyst (raster) extensions. The vector based problems included simple mapping problems with world population data. A combination of vector and raster data was used in problems including the mapping of residential property tracts in a FEMA flood zone, gridding and contouring pH data from a farm to plan a minimum cost treatment program, and locating a small business based on locations of other similar businesses, population density, and income and spending patterns based on census data.

On Saturday morning, several participants gave presentations on their personal experiences in teaching GIS and embarking on research projects using GIS. Mary Savina (Carleton) presented methods and results from her GIS class. Her student projects were an obviously successful approach to teaching GIS. Bill Fox (Williams) presented the results of his efforts to study the vegetation of the Hopkins Memorial Forest (adjacent to the Williams Campus) using aerial photography and digital elevation data. Bill presented some original ideas for using ground-truth data on the size, species and location of trees in grid cells to estimate the spectral response seen in aerial photographs. Andy DeWet (Franklin and Marshall) presented his work on the environmental characterization of the Baker Campus, a tract of land owned by Franklin and Marshall. Part of the site includes sports fields but 65 acres is now woods, meadows and wetlands. This part of the site was a brickworks (between 1920 and 1980). Clay was extracted from parts of the site before 1947 and between 1957 and 1964 two landfills were active. Andy's work combines environmental exploration geophysics with GIS integration of data sets. The required visit to the Alamo, and lunch on San Antonio's river walk followed the morning session.

Saturday afternoon found us back in the lab investigating more advanced raster GIS software methodologies. Exercises included siting facilities using slope and aspect from DEMs, computing cost surfaces and finding least-cost paths, and applying cost surface techniques to DEMs to carry out hydrologic modeling including delineation of watershed sub-basins and the generation of stream order maps. We also took the opportunity to play with other software packages. Mary Savina demonstrated Idrisi for Windows using data from Carleton. Glenn Kroeger demonstrated image processing with ER-Mapper, and the Macintosh enthusiasts got a chance to play with the latest version of Map*Factory. After a long Saturday, we finished up with a late night fajita-fest.

Our Sunday morning wrap-up session included a discussion of the software, hardware, and support needs of different schools and departments. We investigated ways that we might operate as a consortium to fill some of these needs. Ideas included efforts to site-license software across the consortium or to approach software vendors for consortium wide donations. Some of these efforts are becoming less critical as the cost of both hardware and software declines. A common decision, faced by many of the group, is whether it is necessary to invest in ArcInfo software from ESRI, or whether ArcView along with other utilities have eliminated the need for the more expensive package. It was clear to the group that some consortium schools have well established courses and research programs, and that other consortium schools might not want to be involved in group efforts at this time. We also discussed a wide variety of models for developing funding sources for more GIS based projects and for developing outreach programs involving local community projects and secondary teachers in our local school districts.

**WORKSHOP ON
ESTUARINE AND COASTAL SCIENCE**

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