KNOWLEDGE-BASED GEOGRAPHIC INFORMATION SYSTEMS ON THE MACINTOSH COMPUTER: A COMPONENT OF THE GYPSES PROJECT.

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ABSTRACT

GypsES, a decision-support and expert system for the management of Gypsy Moth addresses five related research problems in a modular, computer-based project. The modules are hazard rating, monitoring, prediction, treatment decision and treatment implementation. One common component is a geographic information system designed to function intelligently. We refer to this component as an intelligent GIS, (IGIS). The IGIS is incorporated in a prototype GypsES package on a Macintosh computer. The paper discusses the issues in the design and development of IGIS with regard to the hardware and software components, the nature of intelligence in the GIS environment and typical functions that IGIS will be called upon to perform by the various modules of GypsES.

An overall conceptual design of the GypsES project has been formalized giving IGIS a fundamental position underlying all other components and requiring communication with them. An expert system shell that the GIS and applications modules is being refined to exploit the window, icons, menus and pointing device capabilities of the Macintosh computer. The public domain GIS software, GRASS, developed by the Army Corps of Engineers, is being evaluated for suitability for basic GIS capabilities on the basis of its open, modular, C-language program structure. A hypertext prototype is now available to evaluate the user interface, determine flows of information in the decision-making process, and examine alternative output formats.

The intelligent functions of a GIS can be separated into three classes: user interface, knowledge base for GIS operations and knowledge base for application specific functions. The user interface guides an inexperienced user through the most efficient use of the system according to the stated needs of the user. A GIS knowledge base is necessary to permit the use of GypsES modules without comprehensive training in GIS technology. The application-specific knowledge base is part of a domain-specific expert system, e.g. Hazard Rating.

The experience of GIS experts and cartographers will be formalized in a knowledge base to assist in 1) map design, 2) terrain feature and cartographic feature extraction, 3) geographic database maintenance and 4) spatial analysis / geographic decision support. The knowledge bases will feature natural language interfaces and a facility for the explanation of reasoning behind decisions, i.e. the logic path is traced through the production rules to permit the user to determine the acceptability of the expert system outcome.