NCGIA CURRICULUM IN REMOTE SENSING

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The NCGIA Remote Sensing Core Curriculum (RSCC) is a logical follow-on to the original NCGIA Core Curriculum in GIS. An urgent need exists for developing educational materials stressing the integration of remote sensing, GPS, and geographic information systems. This project seeks to develop educational materials to advance scientific understanding of the field of remote sensing. A set of eleven core courses were suggested to represent the fundamental topics of remote sensing. Out of the eleven core courses, 4 were chosen by the steering committee as being high priority. These are:

1 Aerial Photography and Introduction to Photogrammetry
2 Overview of Remote Sensing of the Environment
3 Introductory Digital Image Processing
4 Remote Sensing Applications

The steering committee members are: Timothy W. Foresman, University of Maryland Baltimore County (Principal Investigator); Tina Cary, EOSAT; Ron Eastman, Clark University; John E. Estes, University of California, Santa Barbara; Nick Faust, Georgia Technical Research Institute; John Jensen, University of South Carolina; Karen K. Kemp, National Center for Geographic Information and Analysis; Kenneth C. McGwire, Desert Research Institute; and Anthony Shupin, EOSAT.

The American Society for Photogrammetry and Remote Sensing has accepted the proposal to house and manage the Remote Sensing Core Curriculum as part of ASPRS's long-term educational commitment.

The RSCC homepage is located at http://www.umbc.edu/rscc

THE NEW ON-LINE CORE CURRICULUM IN GEOGRAPHIC INFORMATION SCIENCE

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Given the continuing demand for copies of the original 1990 NCGIA Core Curriculum in GIS, NCGIA has decided that a major revision is warranted. While it was initially felt that widespread diffusion of the original set of lecture materials would eventually make the Curriculum redundant, the continued rapid development of the technology and the awakening of the concept of geographic information science continues to make such materials of value. This time, the Curriculum will be developed and distributed over the Internet. Using the World Wide Web (WWW) as the main distribution channel has many advantages, including ease of revision, ability to adjust content and structure as the project evolves, reduction of physical distribution demands and the provision of a direct means for referencing related resources on-line. We will continue some of the most successful aspects of the original project; in particular, encouraging full participation of the international GIS education community. However, the new Core Curriculum project is based on a completely new outline which takes into consideration the changes and advances during the past 6 years. Contents will evolve gradually as units are added to the web site, new topics suggested and hyperlinks between related subjects established. In order to ensure the quality of the contents, all submissions and suggested links to other web based materials are subject to peer review and approval by an international Editorial Committee. This paper reviews some of the issues faced during the recent development of these materials.

DESIGN PHILOSOPHY

In keeping with the spirit and success of the original Core Curriculum (CC) and to meet the same specific need in the GIS education materials market, the new Core Curriculum (GISCC) will concentrate solely on providing fundamental course content assistance for educators - formally as lecture materials, but adaptable for whatever instructional mode each course instructor wishes to use. Thus, as before, we are not interested in compiling a comprehensive textbook, but rather, lecture note outlines similar in structure and content to those used originally. As a "core" curriculum, it is not intended to impose any specific

structure or educational objectives. Instructors will be encouraged to pick and choose amongst the materials on offer in order to develop courses suited specifically for their own students.

Organizing the core concepts of GIS into a number of small, self-contained units based on a one-hour lecture format provides both an organizing framework and flexibility for instructors using the materials in their individual course preparation. By placing the materials on-line, the potential exists for subsidiary project teams to develop supporting structures (e.g. hypertext) which organize the lecture notes and other on-line materials into interactive tutorial systems. A number of such projects are already under discussion with partners from around the world. However, our priority for 1996 is to create the fundamental set of materials and to get it on-line and accessible for discussion and comment.

ORGANIZATION OF THE CORE CONCEPTS

The proposed framework of the curriculum is based on a simple principle that the characteristic distinguishing GIS and geographic information technologies in general from all other fields is a focus on geographic concepts. These are defined as the primitive elements, features, and relationships used to analyze, model, reason and make decisions in a geographic context. They range from concepts about the form of the Earth and the measurement of position on its surface, to concepts of direction, adjacency, and connectivity, to the more advanced concepts that underlie our understanding of the processes that operate on the Earth's surface. Geographic knowledge is constructed from geographic concepts, and these concepts form the basis for people's conceptual understanding of the world around them. Geographic concepts range from the simplest primitives of geographic cognition learned in early childhood to the far more advanced structures used in the modeling of environmental and social processes.

The curriculum is organized as a tree, with geographic concepts at the bottom or root node. Above this are four major branches: the branch that deals with the concepts themselves, enumerates them, and describes their role in human cognition; the branch that discusses the implementation and handling of geographic concepts in digital computers; the branch that examines the management of these technologies, their implications for society, and the social context in which they are being used; and finally, a branch which critically examines how GIS is used in various applications. The four main branches are titled "Fundamental Geographic Concepts for GIS"; "Implementing Geographic Concepts in GIS"; "Geographic Information Technology in Society"; and "Application Areas and Case Studies".

Above each of these branch nodes are further subtrees terminating in individual instructional units or leaf nodes. The atomic unit provides notes on

which an instructor can base a 50 minute class. It consists of about 7 pages of point-form text, with inline sketches and graphics. The notes provide a structure within which the instructor can add anecdote, examples and additional material to flesh out the framework, make it more interesting and add to its pedagogic value.

By using a tree structure, the curriculum avoids linearity, and allows complexity to be added. The number of levels of the tree is not defined; new units can be added above existing ones, to add greater detail, but must be appropriately linked to the parent. If an instructor opted to traverse the entire curriculum, it could be done in any combination of height and breadth - height-first traversal would produce a linear and highly specialized course structure, while breadth-first traversal would place all of the introductory material first.

At best, the community as a whole will likely agree only on the lower levels of the tree. The proposed editorial procedure is designed to allow as much freedom as possible in the upper more detailed levels, so that units can be contributed on specialized topics with minimal need for restructuring. The only requirement is that they fit the template for the individual instructional unit, and fit somewhere above a parent node. If a parent node does not exist, the editorial committee will need to consider whether it should be generated so as to provide an appropriate home for the proposed child.

EDITORIAL PROCEDURE

The editorial procedure of the new Core Curriculum is based on the journal metaphor. The project is overseen by an Editorial Board, consisting of several individuals with broadly based experience in GIS and in GIS education. The Board has broad and general responsibilities. They will oversee all aspects of the project and ensure that the project as a whole meets its scientific and educational objectives. Members of the Board will assist the Senior Editor to ensure internal consistency in language and structure between separate sections of the Core Curriculum.

In addition, several Section Editors have been assigned to individual sections of the initial outline. These members of the Editorial Committee are responsible for compiling the individual units within their sections. The editorial committee consists of approximately 20 individuals known for their expertise in particular domains, and together covering the subject matter of the curriculum. In contrast to the Editorial Board, their responsibilities are narrow and deep. In order to populate the lower nodes of the tree, many of the first round of units have been solicited by the editors, though many offers to write individual units have been received and will continue to be accepted. Each preliminary unit is reviewed by referees selected by the editor, comments returned to the author, and the submission revised until author and editor agree on its acceptability and the unit can be publically posted.

Following this initial review and acceptance, each unit is published on the Web as a draft and comment invited. Comments will be submitted electronically and forwarded to the editor. The editor and author will work together to revise the draft into its final version which will replace the version currently on the net.

A senior editor manages the entire project and oversees coordination between the editorial board and committee. Editorial assistants at UCSB as well as at the University of British Columbia and other locations have provided communication and WWW technical support.

DEVELOPMENT - PHASE ONE (1995-97)

Nov '95	initiate discussion and review of outline and editorial structure
April '96	recruit editorial board and committee
May-on '96	recruit section editors
June-July '96	prepare unit template and construct WWW structure
June-on '96	section editors begin to recruit authors
July-on '96	units written, reviewed, revised
September-on '96	post to public web site
September '96-May '97	on-line review units revised as necessary
Fall '97	publish CD and, possibly, paper version

DEVELOPMENT - PHASE TWO (BEGINNING 1997)

Once the initial set of units has been posted publically in early 1997, a number of subsidiary projects are planned. These projects will take advantage of the many offers of assistance received from GIS educators and others interested in developing WWW technology for education around the world.

Navigation Tools

A number of navigation tools will be required to assist users find units on specific themes or related to others of interest. These tools will include an index based on index words provided by authors, a search tool and a map which lays out graphically how various units are linked to one another.

Partner projects (suggestions)

Partner projects will be conducted by teams either within the NCGIA or at locations external to it. These projects will allow anyone with access to the Core

Curriculum units on the web to modify and augment the materials for various purposes. Approved projects will be refereed or otherwise vested to ensure the quality of their results matches that of the main body of work. Suggestions for additional partner projects are gladly accepted. Possible partner projects currently under consideration are:

Student oriented materials - to begin with a demonstration project to convert a section of the basic teacher-oriented units to student-oriented materials suitable for guided self study (project suggested by University of Salzburg).

Active learning modules which incorporate the theoretical material within learning activities - a variation of this will be tested within our other major Curriculum project currently underway, the Core Curriculum for Technical Programs. (see http://www.ncgia. ucsb.edu/education/curricula/giscc/welcome.html).

Course generators - a forms based interface which would allow an instructor to identify a range of topics to be taught and which would output a list of units to teach.

Other projects - include Web-based tutorials, distance learning modules, model course syllabi and laboratory materials.

TO CONTRIBUTE OR FOR MORE INFORMATION

If you would like to contribute to this project or to learn more about our partner projects, please see the web site at:
http://www.ncgia.ucsb.edu/education/curricula/giscc/welcome.html