# The NCGIA Core Curriculum in GIS

# Introduction

The Core Curriculum Project was launched in the late 1980s as the major educational initiative of the NCGIA. As Geographic Information Systems (GIS) was a new area of study for most universities and colleges, the Core Curriculum in GIS was designed to meet the demand for comprehensive teaching materials. The Curriculum was intended to cover the basic theory and concepts underlying GIS as well as the technical and application issues.

During the 1988-89 academic year, the Center at Santa Barbara, with the help of academic and private sector experts from around the world, developed a comprehensive set of course materials for a year-long introductory sequence in GIS. Designed for instruction at the upper division undergraduate level, these materials consist of 75 units, each intended as the basis for a one-hour lecture. Each unit included 6-8 pages (average) of instructor's notes; exam and discussion questions; and references, handouts and overheads. The package of 1,000+ pages also included a set of slides and the text in digital form on diskette. The 75 units were grouped into modules, distributed among three 25-lecture courses.

Curriculum materials were evaluated in over 100 institutions in several countries in 1989-90, and the resulting comments and suggestions were used to revise the materials for broad dissemination. Within six months of implementing this revision, by December 1990, more than 450 sets were distributed to institutions in over 40 countries and, by January 1995, over 1,300 additional copies of the Curriculum had been deployed in 70 countries,  and the materials were available in Portuguese, Chinese, Hungarian, Japanese, Korean, Polish, Russian, and French. In addition to the copies distributed directly by the NCGIA, several hundred more were distributed by designated National Distribution Sites located in Brazil, Canada (for the French translation only), China, Croatia, Czechia, Estonia, Hungary, Japan, Korea, Lithuania, Morocco, Poland, Russia, and Saudi Arabia. The US accounted for just slightly more than half of the copies distributed. Educational institutions also have received half, with the remaining copies going to government and commercial organizations, bookstores and to private individuals.

Given the popularity of the Curriculum, a decision was made in late 1994 to update and revise the material in a format that would take advantage of the emergent capabilities of the Internet. This revision became the Core Curriculum-Geographic Information Science (1997-2000). In addition, in 1969, NCGIA launched the GIS Core Curriculum for Technical Programs in support of two-year colleges. These curricula were not completed to the levels envisioned by their editors, but an extensive number of high-quality study units were made available online by NCGIA and are available in the e-scholarship collections. NCGIA also participated as a co-sponsor with the American Society for Photogrammetry and Remote Sensing (ASPRS), and the Earth Observation Satellite Company (EOSAT) in a NASA-funded initiative to develop the

Remote Sensing Core Curriculum, launched in 1993 under the direction of Timothy Foresman at the University of Maryland, Baltimore County, and maintained currently as an active educational resource by the International Center for Remote Sensing Education.

**References**

NCGIA Annual Reports for years 1-5 (available in the eScholarship series NCGIA Closing Reports on Research Initiatives and Projects) provide documentation on activities to develop, evaluate, produce, and disseminate the GIS Core Curriculum nationally and internationally.

Kemp, K.K. and F.M. Goodchild (1992). Evaluating a major innovation in higher education: the NCGIA Core Curriculum in GIS. *Journal of Geography in Higher Education*, 16(1):21-35.

Kemp, K.K. and M.F. Goodchild (1991). Developing a curriculum in Geographic Information Systems: The National Center for Geographic Information and Analysis Core Curriculum project. *Journal of Geography in Higher Education*, 15(2):121-132.

**Acknowledgements:**

The vision of Michael Goodchild and his NCGIA colleagues, and the organizational talents and editorial stewardship of Karen Kemp, are recognized as fundamental to the success of the core curriculum concept in helping to establish and sustain the intellectual grounding of geographic information systems/science in the academic environment and their applications in private and governmental sectors for the benefit of society. NCGIA and the UCSB Center for Spatial Studies also extend a special thanks to Brian Klinkenberg (University of British Columbia) for maintaining the GIS Core Curriculum on his website since the mid-1990s and for his cooperation in facilitating the presence of this important collection as an e-scholarship resource.

**Note to users:** In comparison with the original paper copy of the curriculum, the digital version is currently missing a number of graphics and supplementary materials. Although these resources are not critical to the value of the Core Curriculum in GIS, an effort will be made to restore them to this eScholarship collection at a later date. The next four pages present a scan of an informative NCGIA promotional flier about the Core Curriculum in GIS that was distributed in the early 1990s.

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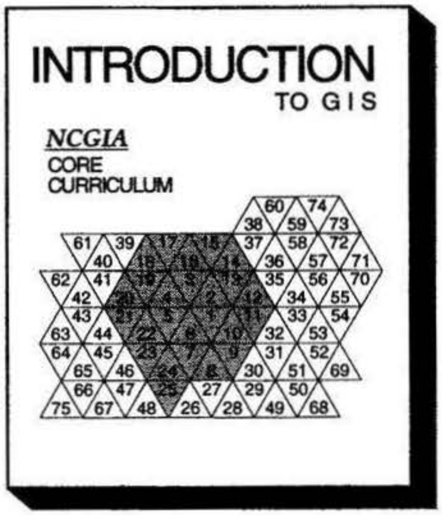
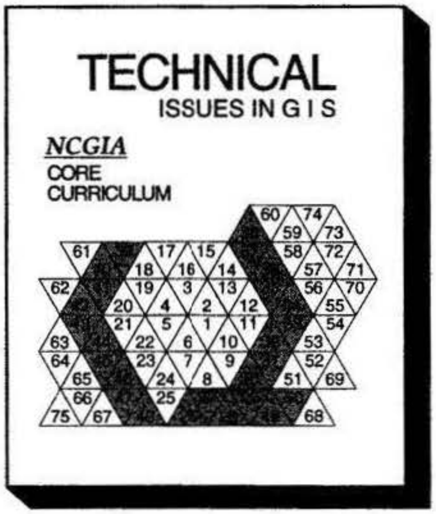
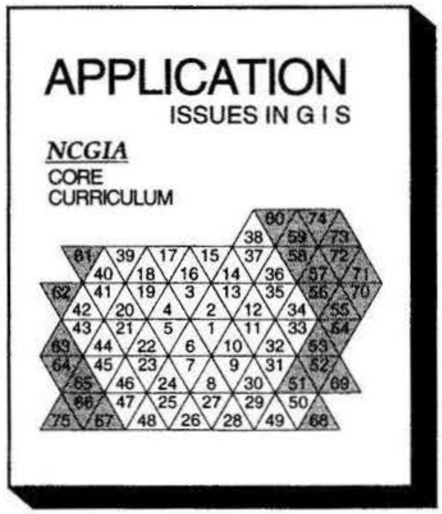
National Center for
Geographic Information
and Analysis




# CORE CURRICULUM IN GIS

Edited by Michael F. Goodchild and Karen K. Kemp,
*NCGIA*, University of California at Santa Barbara

Recognizing the severe shortage of trained GIS personnel, the NCGIA has developed a comprehensive set of teaching materials to assist institutions initiate quality GIS courses. The NCGIA Core Curriculum has been designed to provide a wide overview of the important issues in the development, use and management of GIS.

Following a year of development involving input from over 30 North American and British GIS experts, an intensive testing and evaluation program was conducted by 110 institutions around the world during 1989-90. Feedback from this program provided material for extensive revisions in 1990.

The Core Curriculum consists of three volumes of teaching materials for a year long sequence of courses covering the general topics of Introduction to GIS, Technical Issues and Application Issues. The volumes contain lecture notes with masters for overheads and handouts. A slide set of color transparencies to support the lectures and disks with electronic versions of the notes are also included.

Now a milestone in GIS education, the NCGIA Core Curriculum has been distributed world-wide and is available in several languages.

## Introduction to GIS

## Technical Issues in GIS

## Application Issues in GIS

# LECTURE TOPICS

## INTRODUCTION TO GIS

**A. Introduction**
1. What is GIS?
2. Maps and map analysis
3. Introduction to computers

**B. A first view of GIS**
4. Raster GIS
5. Raster GIS capabilities

**C. Data acquisition**
6. Sampling the world
7. Data input
8. Socio-economic data
9. Environmental data

**D. Spatial databases**
10. Models of reality
11. Spatial objects and database models
12. Relationships among spatial objects

**E. Vector view of GIS**
13. Vector GIS
14. Vector GIS capabilities

**F. Using the GIS**
15. Spatial analysis
16. Output
17. Graphic output design issues
18. Modes of user/GIS interaction
19. Generating complex products
20. GIS for archives

**G. Past, present and future**
21. Raster/vector debate
22. Object/layer debate
23. History of GIS
24. GIS marketplace
25. Trends in GIS

## TECHNICAL ISSUES IN GIS

**H. Coordinate systems & geocoding**
26. Common coordinate systems
27. Map projections
28. Affine & curvilinear transformations
29. Discrete georeferencing

**I. Vector data structures & algorithms**
30. Storage of complex spatial objects
31. Storage of lines: chain code
32. Simple algorithms I-line intersection
33. Simple algorithms II-polygons
34. Polygon overlay operation

**J. Raster data structure & algorithms**
35. Raster storage
36. Hierarchical data structures
37. Quadtree algorithms and spatial indexes

**K. Data structures & algorithms for surfaces, volumes and time**
38. Digital elevation models
39. TIN data model
40. Spatial interpolation I
41. Spatial interpolation II
42. Temporal and 3D databases

**L. Databases for GIS**
43. Database concepts I
44. Database concepts II

**M. Error modeling and data uncertainty**
45. Accuracy of spatial databases
46. Managing error
47. Fractals
48. Line generalization

**N. Visualization**
49. Visualization of spatial data
50. Color theory

## APPLICATION ISSUES IN GIS

**O. GIS application areas**
51. GIS application areas
52. Resource management applications
53. Urban planning and management
54. Cadastral records and LIS
55. Facilities management
56. Demographic and network applications

**P. Decision-making in a GIS context**
57. Multiple criteria methods
58. Location-allocation on networks
59. Spatial decision support systems

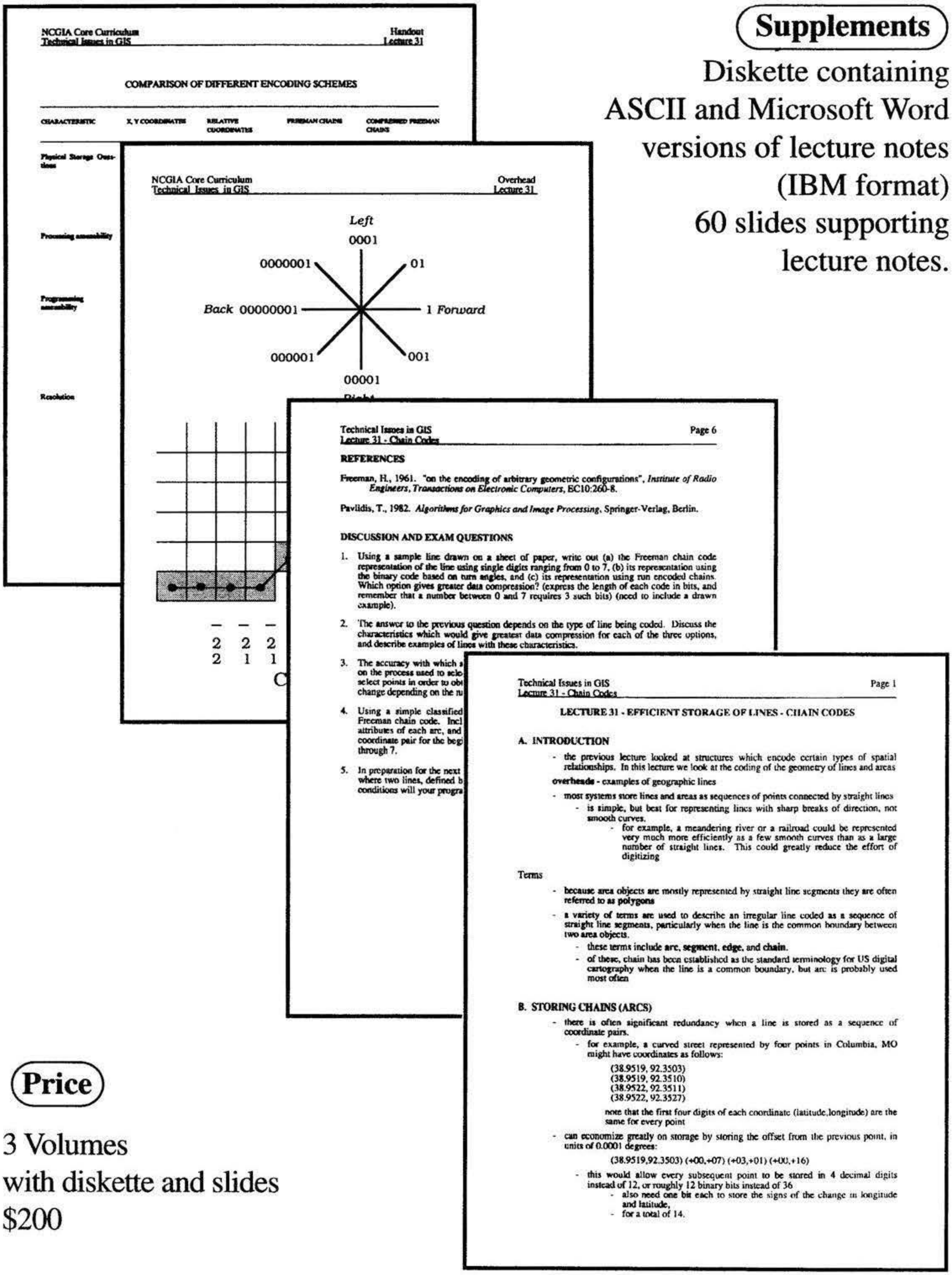
**Q. System planning**
60. System planning overview
61. Functional requirements analysis
62. Systems evaluation
63. Benchmarking
64. Pilot project
65. Costs and benefits

**R. System implementation**
66. Database creation
67. Implementation issues
68. Implementation strategies for large organizations

**S. Other issues**
69. GIS standards
70. Legal issues
71. Development of a national GIS policy
72. GIS and global science
73. GIS and spatial cognition
74. Knowledge based techniques
75. The future of GIS

## Supplements

Diskette containing ASCII and Microsoft Word versions of lecture notes (IBM format)
60 slides supporting lecture notes.




## Price

3 Volumes
with diskette and slides
$200

# Related *NCGIA* Publications

**91-12: GIS Laboratory Exercises: Volume 1, edited by Rustin F. Dodson, UCSB**, exercises designed to illustrate and reinforce principles presented in Volume I: Introduction GIS of the NCGIA Core Curriculum; includes two diskettes ___ $25.00

**91-14: GIS Laboratory Exercises: Volume 2 Technical Issues, by Howard Veregin**, exercises designed to illustrate and reinforce principles presented in Volume II: Technical Issues in GIS of the NCGIA CoreCurriculum; includes one diskette ___ $20.00

**91-21: GIS Teaching Facilities: Six Case Studies on the Acquisition and Management of Laboratories, edited by Stephen Palladino and Karen K. Kemp, UCSB**, includes six case studies reviewing the acquisition and management of computer labs established primarily for teaching GIS ___ $27.00

**91-27: VT/GIS: The von Thunen GIS package, by Rustin F. Dodson, UCSB,** provides an interactive tutorial and exercises with which students can explore a spatially-relaxed von Thunen model ___ $15.50

**92-9: GIS Videos: An Annotated Bibliography, by Amy Ruggles, UCSB, and ASPRS,** describes over 120 educational videos on GIS and related subjects, from government agencies, software and hardware vendors, and independent video companies ___ $22.00

**92-13: A Glossary of GIS Terminology, compiled by Dr. G. Padmanabhan and Jeawan Yoon, North Dakota State University, and Mark Leipnik, UCSB,** gives a comprehensive alphabetical listing of technical terms and their common meanings, also an alphabetical list of acronyms related to GIS ___ $14.50

**93-10: The NCGIA Guide to Laboratory Materials - 1993, edited by Rustin F. Dodson, UCSB,** a compendium of information pertaining to GIS laboratory education ___ $32.50

**93-11: African Data Viewer - compiled by Stephen D. Palladino, UCSB,** Thirty IDRISI based sets of climatic factors, population density, elevation and soil degradation. This product of the NCGIA Secondary Education Project is self-contained, requiring no additional software to view the data. Designed to introduce K-12 teacher and students to digital GIS data ___ $4.00

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