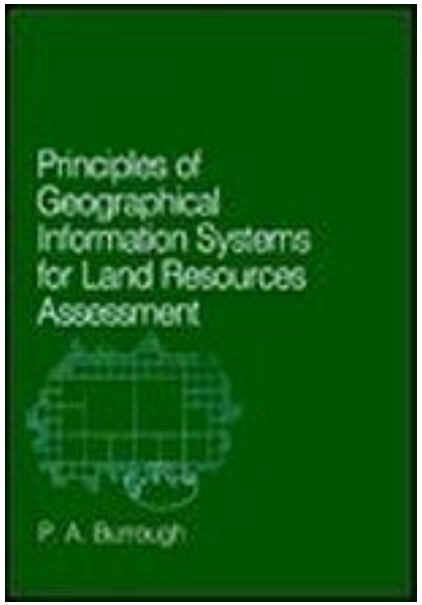
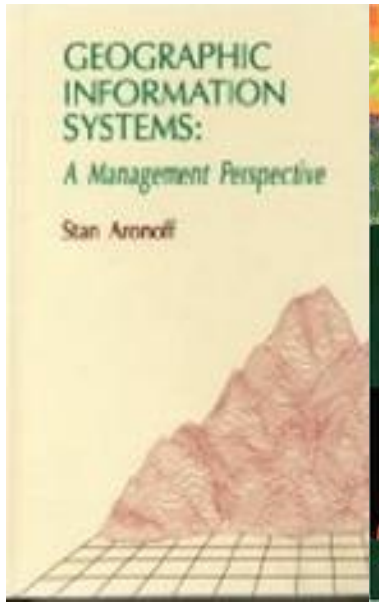
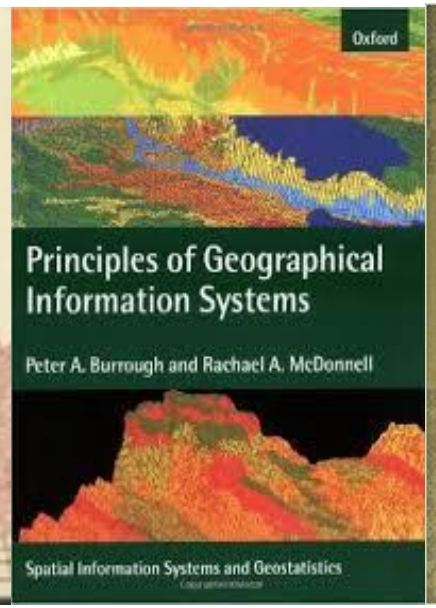
Teoria e Método em Geoprocessamento

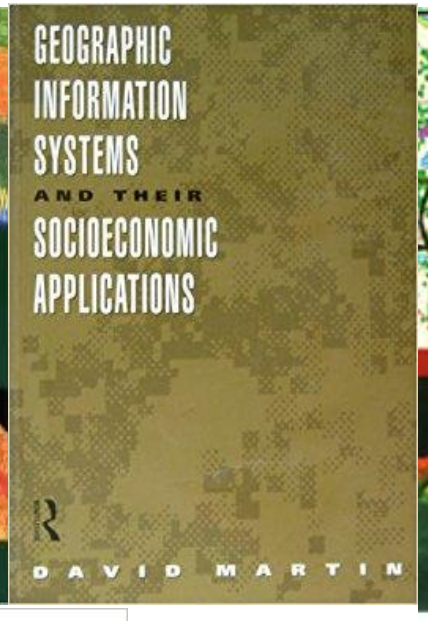
Fernando Shinji Kawakubo

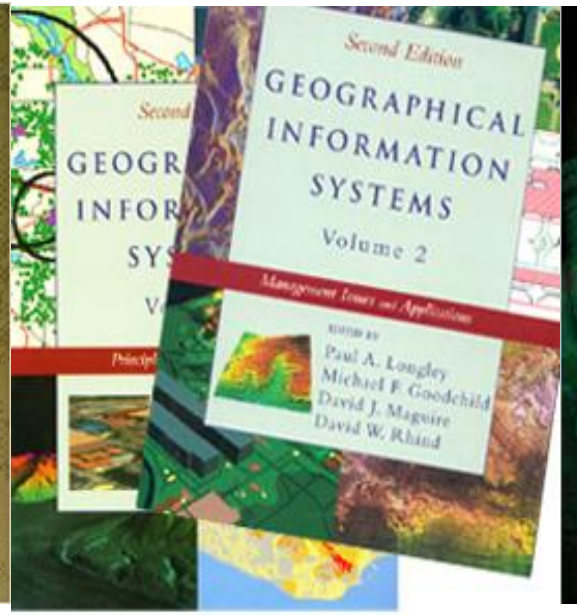
Os Livros Clássicos

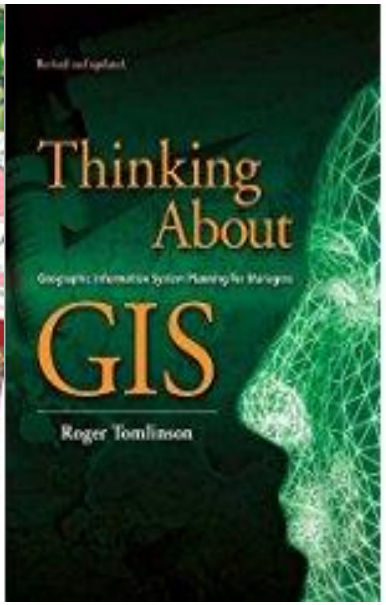


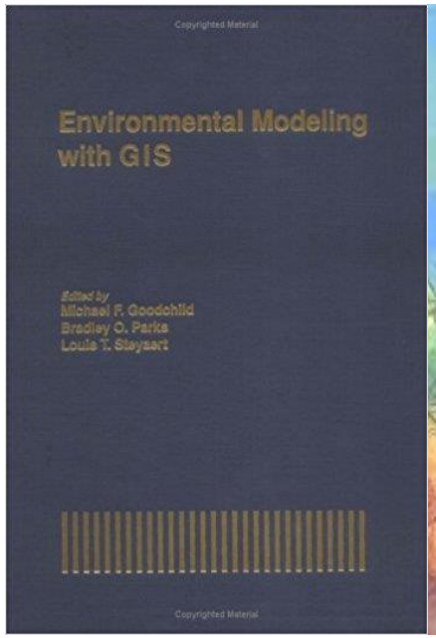


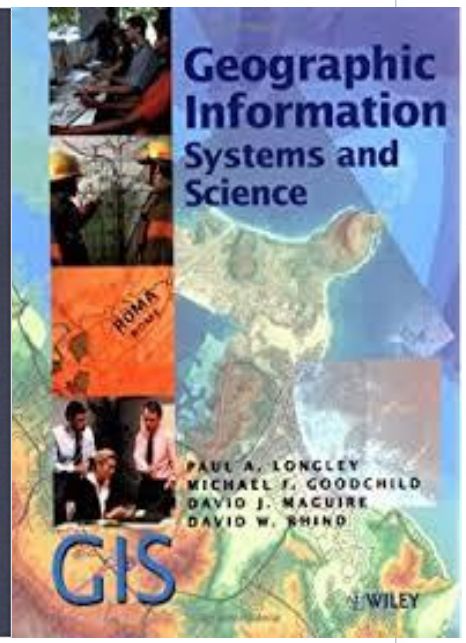


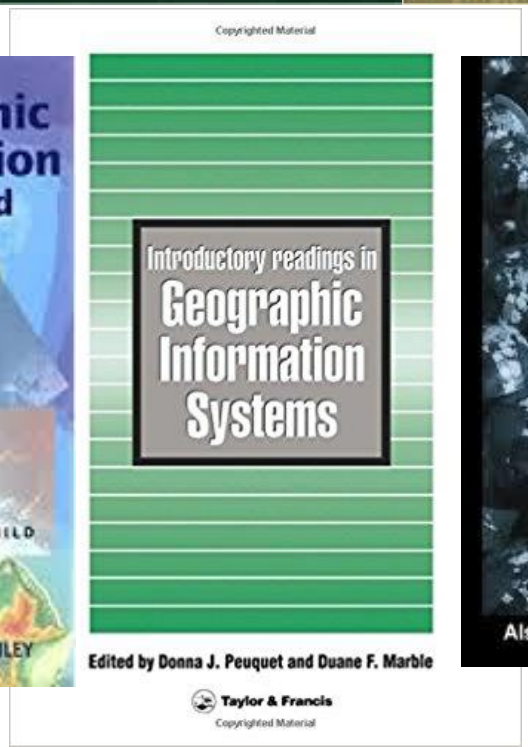


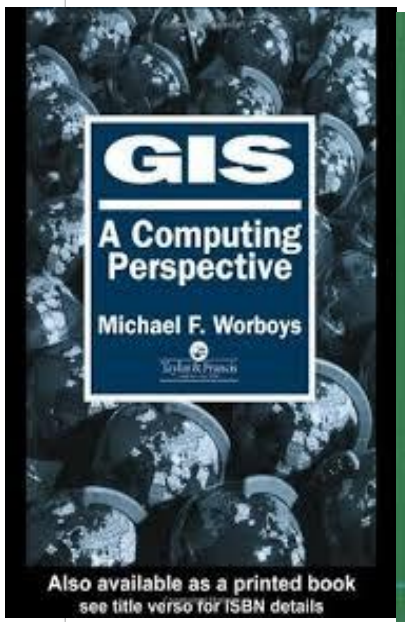


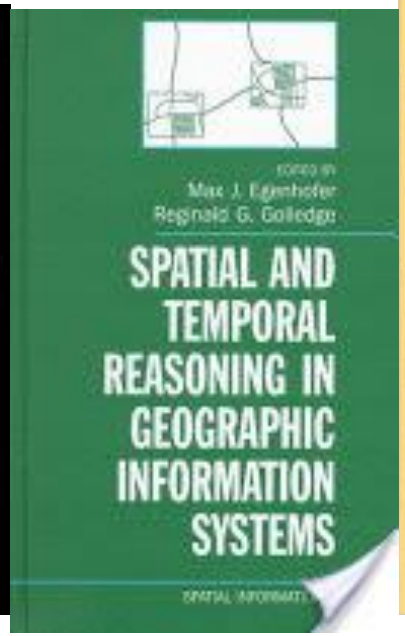


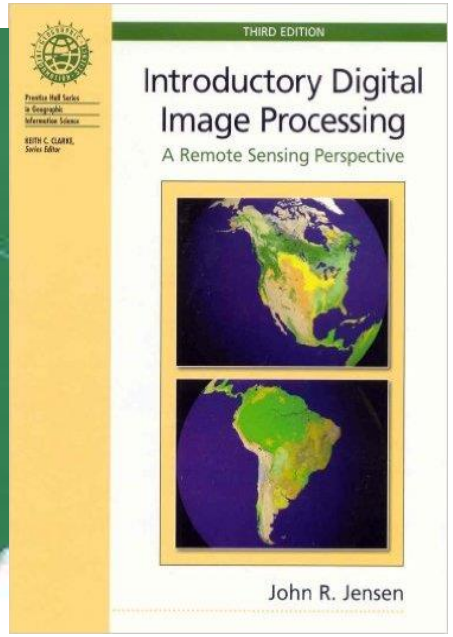




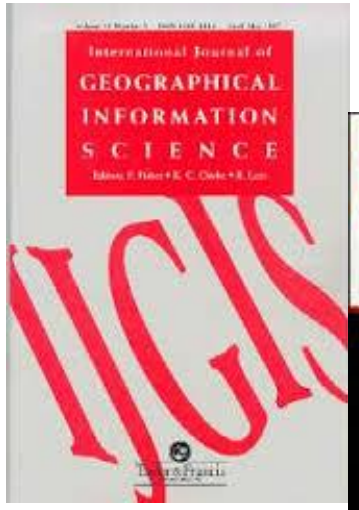


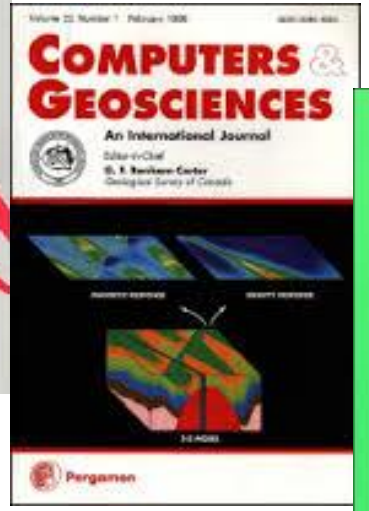


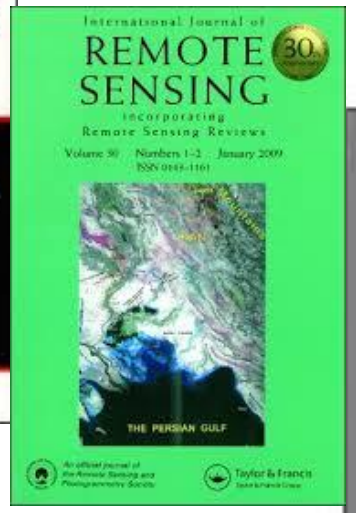


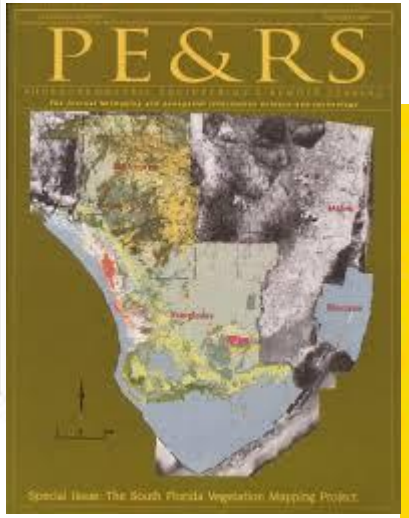


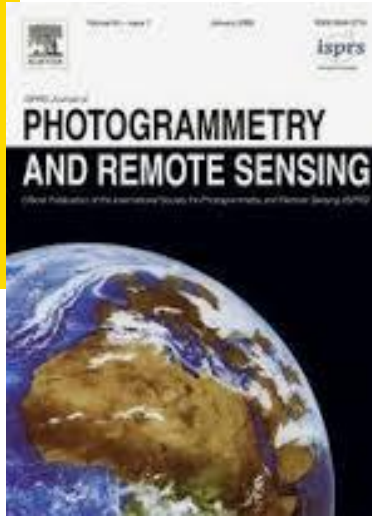
As Grandes Revistas











O que é Geoprocessamento?

Disciplina do conhecimento que utiliza técnicas matemáticas e computacionais para o tratamento da informação geográfica e que vêm influenciando de maneira crescente as áreas de Cartografia, Análise de Recursos Naturais, Transportes, Comunicação, Energia e Planejamento Urbano e Regional (CAMARA & DAVIS, 2000).

O que é Geoprocessamento?

Conjunto de tecnologias de coleta e tratamento de informações espaciais e de desenvolvimento, e uso, de sistemas que as utilizam.

As áreas que se servem das tecnologias de Geoprocessamento têm, em comum, o interesse por entes de expressão espacial, sua localização, ou distribuição, ou ainda a distribuição espacial de seus atributos (RODRIGUES, 1990).

Instrumentos

- Sensoriamento Remoto
- Cartografia Digital
- Sistemas de Navegação por Satélite (GNSS)
- CAD (*Computer-Aided Design*)
- CAM (*Computer-Aided Mapping*)
- **Sistemas de Informação Geográfica (SIG)**
- **Banco de dados**
- Etc.

Sistemas de Informação Geográfica - SIG

Poderoso conjunto de ferramentas para colecionar, armazenar, recuperar, transformar e apresentar dados espaciais do mundo real (BURROUGH, 1986).

Conjunto de procedimentos manual ou computacional usado para armazenar e manipular dados referenciados geograficamente (ARONOFF, 1989).

Definições de SIG

- MAGUIRE (1991) seleciona e analisa 11 definições.
- CÂMARA (1995) cita 4 definições.
- SILVA (1999) cita 17 definições.

- Diversidade de aplicações.
- O espaço é o elemento comum.

Cartografia Digital x SIG

A cartografia digital visa fundamentalmente o mapa (sua automação, elaboração, armazenamento em meio eletrônico para facilitar a atualização, etc.).

Os sistemas de informações geográficas visam fundamentalmente o projeto, o planejamento, etc. e foram elaborados pensando nas respostas às perguntas dos indivíduos envolvidos na área (CINTRA, 1991).

Particularidade do SIG

É um engano considerar que para trabalhar com SIG é necessário apenas habilidades de orientações técnicas. É fundamental que o Geógrafo faça uso das bases conceituais da geografia.

Um dos méritos mais importantes do SIG é a capacidade de combinar o conhecimento geral com o conhecimento específico. O conhecimento geral é materializado pelo *software* e o conhecimento específico belo banco de dados.

Mapping opportunities

Scientists who can combine geographic information systems with satellite data are in demand in a variety of disciplines. Virginia Gewin gets her bearings.

Forest fires ravaging southern California, foot-and-mouth disease devastating the British livestock industry, the recent outbreak of severe acute respiratory syndrome (SARS) — all of these disasters have at least one thing in common: the role played by geospatial analysts, mining satellite images for information to help authorities make crucial decisions. By combining layers of spatially referenced data called geographic information systems (GIS) with remotely sensed aerial or satellite images, these high-tech geographers have turned computer mapping into a powerful decision-making tool.

Natural-resource managers aren't the only ones to take notice. From military planning to real estate, geospatial technologies have changed the face of geography and broadened job prospects across public and private sectors.

Earlier this year, the US Department of Labor identified geotechnology as one of the three most important emerging and evolving fields, along with nanotechnology and biotechnology. Job opportunities are growing and diversifying as geospatial technologies prove their value in ever more areas.

The demand for geospatial skills is growing worldwide, but the job prospects reflect a country's geography, mapping history and even political agenda. In the United States, the focus on homeland security has been one of many factors driving the job market. Another is its vast, unmapped landscape. While European countries are integrating GIS into government decision-making, their well-charted lands give them little need for expensive satellite imagery.

AN EXPANDING MARKET

All indications are that the US$5-billion worldwide geospatial market will grow to $30 billion by 2005 — a dramatic increase that is sure to create new jobs, according to Emily Dellocco, assistant secretary at the US Department of Labor's employment and training division. NASA says that 26% of its most highly trained geotech staff are due to retire in the next decade, and the National Imagery and Mapping Agency is expected to need 7,000 people trained in GIS in the next three years.

Of the 140,000 organizations globally that use GIS, most are government agencies — local, national and international. A ten-year industry forecast put together last year by the American Society for Photogrammetry & Remote Sensing (ASPRS) identified environmental, civil government, defence and security, and transportation as the most active market segments.

Business at the Earth-imagery provider Space Imaging, of Thornton, Colorado, increased by 70% last year, says Gene Colabatistto, executive vice-president of the company's consulting service. To keep up momentum, the company plans to hire more recruits with a combination of technical and business skills. Colabatistto cites the increased adoption of GIS technologies by governments as a reason for the rise. He adds that the US military, the first industry to adopt GIS and remote sensing on a large scale, has spent more than $1 billion on commercial remote sensing and GIS in the past two years.

LOOKING DOWN IS LOOKING UP

The private sector hasn't traditionally offered many jobs for geographers, but location-based services and mapping — or 'geographic management systems' — are changing the field. "The business of looking down is looking up," says Thomas Lillesand, director of the University of Wisconsin's Environmental Remote Sensing Center in Madison, Wisconsin.

Imagery providers such as Digital Globe of Longmont, Colorado, also need more GIS-trained workers as markets continue to emerge. Spokesman Chuck Herring says that the company has identified 54 markets in which spatial data are starting to play a role.

The Environmental Systems Research Institute (ESRI), in Redlands, California, sets the industry standards for geospatial software. Most of its 2,500 employees have undergraduate training in geography or information technology, although PhDs are sought after to fill the software-development positions. Many private companies, including the ESRI and Space Imaging, offer valuable work experience to both graduate and final-year undergraduate students.

Graduates in natural-resource management note that GIS and remote-sensing skills are becoming as important as fieldwork. GIS platforms, which manipulate all forms of image data, are transforming disciplines such as ecology, marine biology and forestry.

"Science has discovered geography," says Doug Richardson, executive director of the Association of American Geographers (AAG). Many of the National Science Foundation's multidisciplinary research programmes now include a geospatial component.

SKILLED LABOUR

Some universities are offering two-year non-thesis master's programmes in geospatial technologies, including communication and business courses — perfect for professionals who want to build on existing skills or move into a new field. The non-profit Sloan Foundation has funded several geospatially related professional master's programmes. In addition, numerous short courses are available to bring professionals up to speed. Indeed, the ESRI alone trains over 200,000 people a year. AAG and ASPRS conferences also offer training sessions.

Although technical skills are important, Richardson stresses that employees need a deep understanding of underlying geographic concepts. "It's a mistake to think that these technologies require only technician-oriented functions," he says.

Throughout the European Union (EU), the many top-quality graduate geography programmes remain primarily locally focused grounds. Recently, a few pan-European projects have also emerged, including a new international institute designed to train future geographers. Building on a collaboration between the European Space Agency and the US National Science Foundation, the Vespucci Initiative in 2002 began three-week summer workshops training students from around the world in spatial data infrastructure, spatial analysis and geodemographics. The EU even promotes distance learning: UNIGIS, a network of European universities, prides itself on being the only virtual, global, multilingual GIS programme in the world.

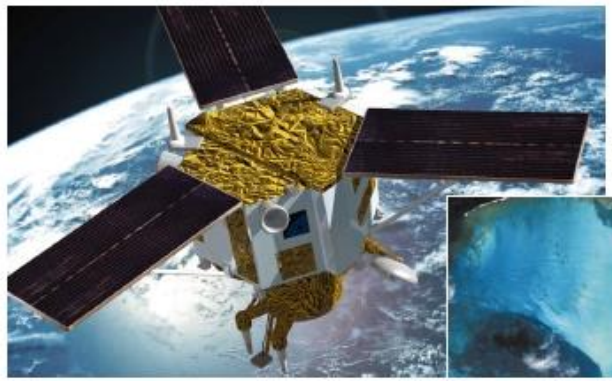
Although GIS is increasingly incorporated into UK government practices, there is little demand for remote-sensing expertise in this small and heavily mapped country. Mark Linehan, director of the London-based Association for Geographic Information, says that although the public-sector market is growing, it remains a struggle to find jobs for MScs at the appropriate pay scale and qualification level.

The European Commission (EC) is laying the groundwork to ease data-sharing across countries in anticipation of wider adoption of GIS among the member-state governments and to cut the costs of data gathering. That process alone will require at least a couple of thousand people trained in GIS, and many more proposals are expected.

Indeed, the EC and the European Space Agency have joined to propose a Global Monitoring for Environment and Security initiative, to provide permanent access to information on environmental management, risk surveillance and civil security. Given the scope of the mandate, this is likely to need people who understand how to interpret, integrate and manage satellite information — those who also have a background in natural-resource issues will be in highest demand.

Considering the role that GIS played in staving the spread of foot-and-mouth disease, such a system will not only increase the prevalence of geospatial skills in Europe, it will better connect data with Europe's resource managers. ■

Virginia Gewin is a freelance science writer in Corvallis, Oregon.



A fresh view: high-resolution imaging satellites such as IKONOS are providing researchers with unparalleled insight and information about the world (inset).

Doug Richardson sees a combination of technological skills and an understanding of geographical concepts as important.

Web links

Environmental Systems Research Institute
www.esri.com

Association of American Geographers
www.aag.org

American Society for Photogrammetry & Remote Sensing
www.asprs.org

The Vespucci Initiative
www.vespucci.org

Global Monitoring for Environment and Security
intelligence.jrc.cec.eu.int/space/forecos/forecos.html

Association for Geographic Information
www.agi.org.uk

UNIGIS
www.unigis.ac.at/int

US Department of Labor's Career Voyages
www.careervoyages.gov

Sloan Foundation professional master's programmes
www.sciencemasters.com

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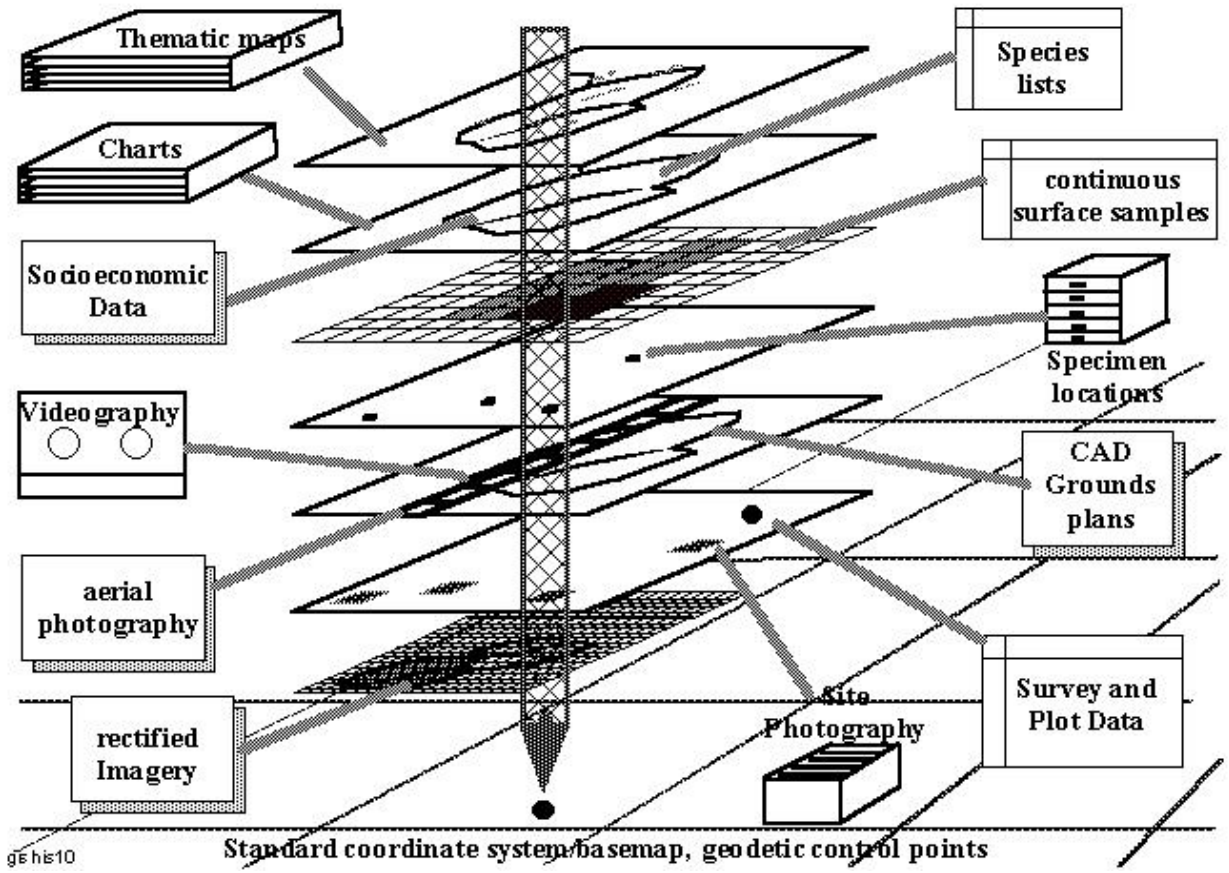
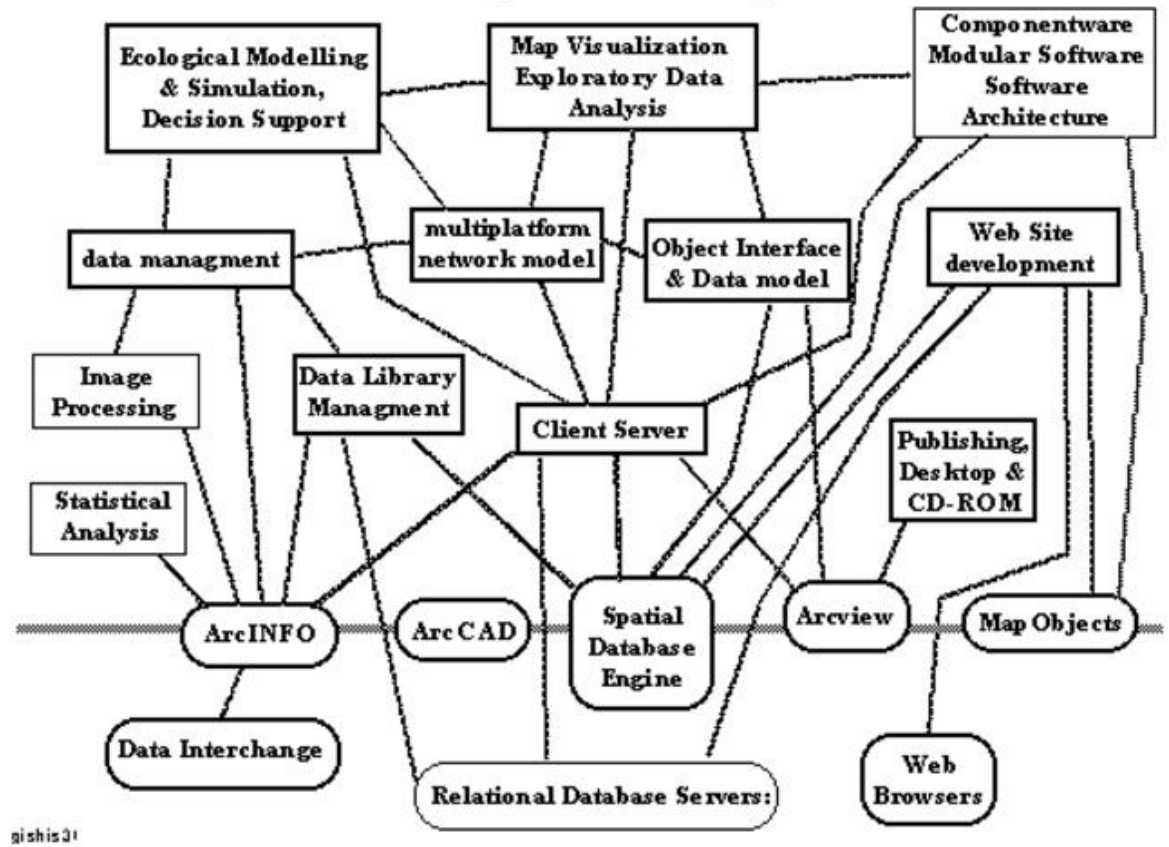
GIS Integrates Data in a Common Data Model



GIS Integrates Technology



http://www.conservationgis.org/gishistory/gishistry3.html

GIS Integrates Theories and Methods

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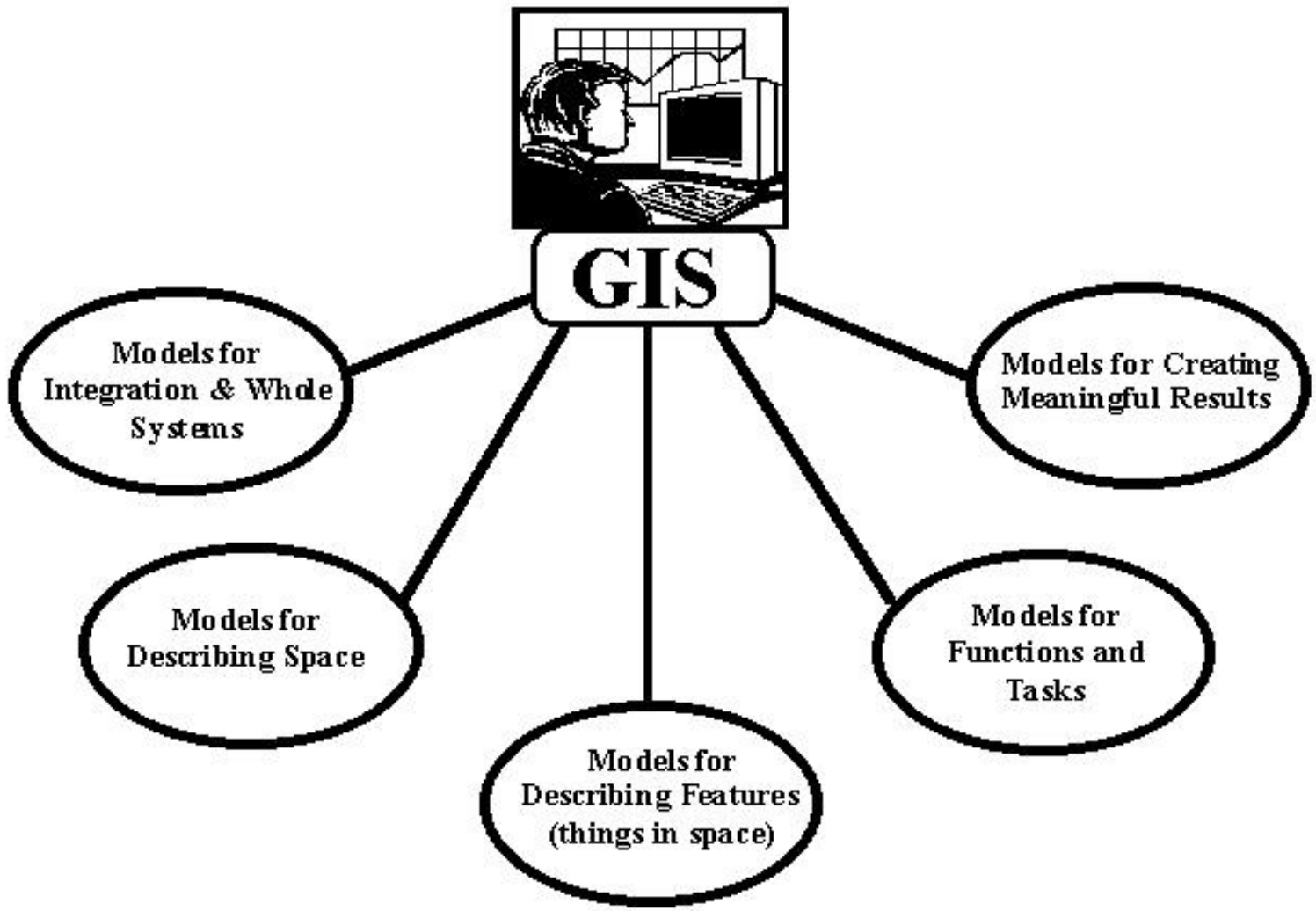


http://www.conservationgis.org/gishistory/gishistry3.html

História do SIG

Primeiro SIG:

- 1963 no Canadá.
- ***Canadian Geographic Information System - CGIS***
- Roger **Tomlinson**
- Programa governamental para criar um inventário de recursos naturais – ***Canadian Land Inventory***.

História do SIG

CGIS:

- Capacidade de armazenamento.
- Recuperação dos dados.
- reclassificação de atributos.
- Mudança de escala de apresentação.
- Operações de superposição entre polígonos.
- Criação de novos polígonos .
- Apresentação de relatórios estatísticos.

História do SIG

Ainda na década de 1960:

- 1964: SYMAP (primeiro SIG matricial).
- 1969: formação da ESRI Inc.
- 1969: formação da Intergraph Corp.

História do SIG

Ano 1970:

1972: Lançamento do Landsat 1.

- Novos Hardwares um pouco mais acessíveis.
- Fundamentos matemáticos voltados para a Cartografia.
- Geometria Computacional.

Dificuldades:

- Alto custo dos computadores.
- Complexidade para o manuseio.
- Exigência de mão-de-obra altamente especializada.
- Baixa capacidade de armazenamento.
- Imagens de baixa qualidade.

História do SIG

Anos 1980:
1981: Lançamento do ArcInfo.
1985: GPS operacional.
1986: Formação da MapInfo Corp.

- Acelerado crescimento dos SIG's.
- Avanço da microinformática.
- Surgimento e evolução dos computadores pessoais.
- Barateamento dos PC's.
- Desenvolvimento dos Sistemas gerenciadores de banco de dados relacionais.

História do SIG

Anos 1990:

1999: Lançamento do satélite de alta resolução Ikonos.

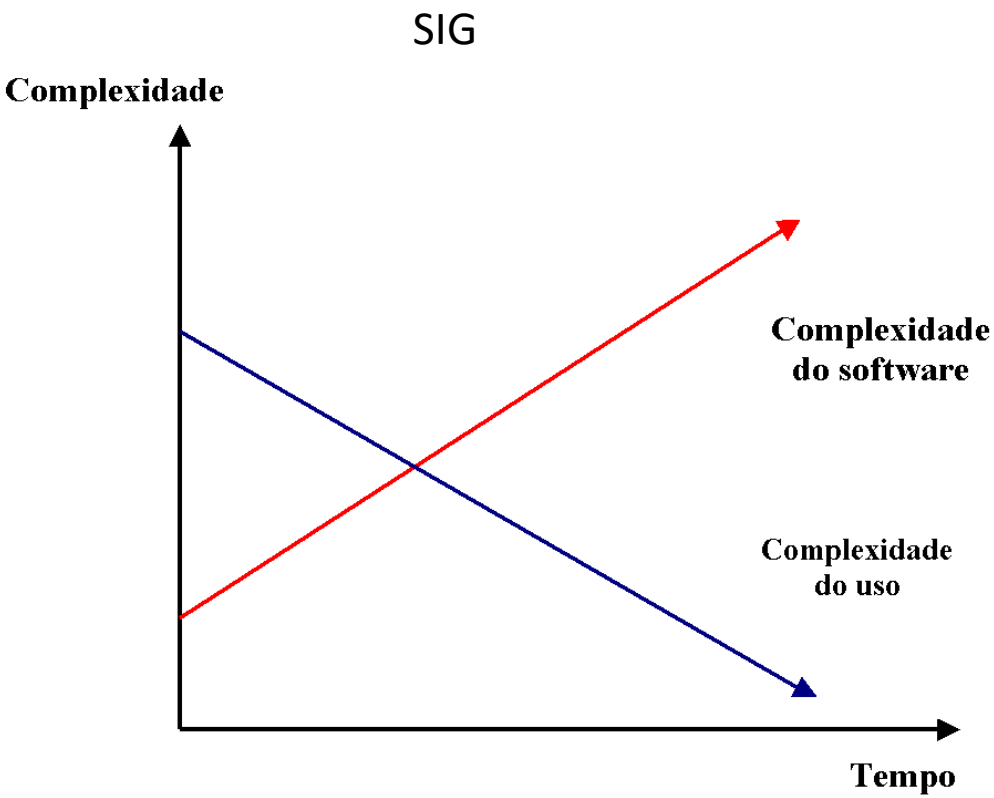
- Aumento da capacidade de armazenamento e processamento dos computadores pessoais.
- Softwares “mais amigáveis”.
- Difusão das imagens de satélites e bases de dados geográficas.
- Crescimento das pesquisas cientificas com uso de SIG.
- Utilização dos SIG’s em prefeituras, órgãos ambientais, empresas de consultoria, etc.

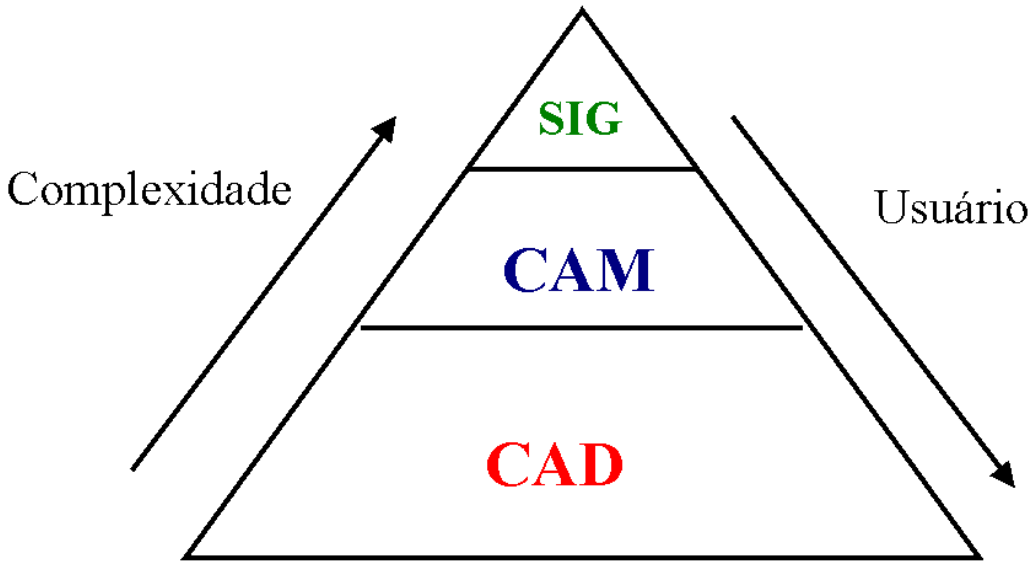
História do SIG

Anos 2000:

- Maior disponibilidade de ***bases de dados***, ***imagens de satélite*** e de ***softwares livres*** ou com ***custos decrescentes.***
- Massificação do Geoprocessamento - GIS na internet: ***Google Earth*** e ***Google Maps.***
- Popularização do GPS nos celulares, veículos, etc...

História do SIG





Machado (2000)

História do SIG

Primeiro SIG Brasileiro:

- Sistema de Análise GeoAmbiental: **SAGA**
- Início dos anos 1980
- Prof. Jorge Xavier da Silva
- Laboratório de Geoprocessamento do Departamento de Geografia da UFRJ

História do SIG

- Sistema SITIM/SGI – SPRING
- Instituto Nacional de Pesquisas Espaciais - INPE
- 1986: **SITIM** - Sistema de Tratamento de Imagens (rodava em MS-DOS)
- Paralelamente Sistema de Informações Geográficas denominado **SGI**
- **Sistema SITIM/SGI**
- 1991: desenvolvimento do Sistema de Processamento de Informações Georeferenciadas - **SPRING**
- 1996: SPRING disponibilizado na internet