What is Health Geomatics?

Dr. Bob Maher
Senior Research Scientist
Applied Geomatics Research Group
Nova Scotia Community College
Middleton, NS
October 29, 2007
The Geographic Scientist Perspective

- People and the landscape
- Spatial relationships
- Environmental processes

Source: ESRI, 2007
The Health Scientist perspective

- Landscape and its impact on human health
- Human relationships
- Biological processes
Science and Technology

Geomatics technology
- GPS
- Remote Sensing
- GIS

Source: AGRG
Global Positioning System

- Data collection units which provides accurate positioning of people, objects and activities on the earth’s surface. Co-ordinates are available in latitude/longitude or in a map projection system e.g. Universal Transverse Mercator (UTM)
Remote Sensing

Sensor systems can be placed in an aircraft or on a satellite. Systems can be traditional e.g. aerial photographs, LANDSAT images. They can be non traditional e.g. LiDAR, multi-beam sensor, hyperspectral.

The end result is a digital raster with pixels and intensity values.

Source: Webster, AGRG
Geographic Information System (GIS)

GIS is a software system used:

1). To store spatial and non-spatial information
2). To conduct spatial analysis
3). To display the results in graphs or statistical form
4). To share information across the Internet
Geographic Information System (GIS)

Data Collection → DBMS → Visualization

In-Situ Sensing
Maps
GPS
Remote Sensing

DBMS
Spatial Analysis
Dissemination

Data Source: Colville, AGRG
What is Applied Geomatics?

Application domain can be Health or Agriculture or Business or Tourism

The use and integration of all three technologies to address spatial questions in a given application domain.
What is Geographic Information Science?

It is the conceptual basis for conducting spatial analysis. It includes questions of scale, resolution, error, relationships, models, representations, statistics.
Examples of Applied Geomatics

- Physical landscape
- Socio-economic landscape
- Three-dimensional representation
- Four-dimensional representation

Source: ESRI
Socio-Economic Landscape

UBEY Project
Social Risk Index

Number of Social Risk Factors

Data Sources: Province of Nova Scotia, Community Counts, and Understanding The Early Years, 2007

Sources: Statistics Canada & Community Counts
3-D Visualization and Analysis

Source: AGRG & Service NB, 2007

Jan. 2000 Event - Pointe-du-Chene
Nitrates in Groundwater

Groundwater Nitrate Concentration for August 1999

Legend
Aug99_NO3_Conc Value (mg/L)
High : 44
Low : 0

Legend
Aug99_NO3_Conc Value (mg/L)
High : 44
Low : 0

Legend
Aug99_NO3_Conc Value (mg/L)
High : 44
Low : 0

Legend
Aug99_NO3_Conc Value (mg/L)
High : 44
Low : 0

Legend
Aug99_NO3_Conc Value (mg/L)
High : 44
Low : 0
Example of Health Geomatics

(from Geographer’s perspective at AGRG)

- Resource reliant industries
- Environmental health
- Data - Civic address
- Network analysis
- Mobile GIS
Relationship between Health Geography and Technology

Concepts
- Geographic Information Science

Technology
- Geomatics
- Health

Application
- Health Geomatics
Why the Role of Place in Health Research

*Mapping Health Geography in Nova Scotia: Opportunities in Health Geomatics*
Nova Scotia Health Research Foundation
October 2007

Dr. Judy Guernsey
The emergence of place as a framework for understanding health

- Public Health as a classical modernist institution
- Ottawa Charter of Health Promotion
- Widespread adoption of Population Health Framework and the Determinants of Health
Most Public Health Interventions

Health Outcomes

Most Health Care

Population Health Framework

Political Social Cultural Economic Spiritual Ecological Technological

Forces

Biological Endowment

Physical & Social Environmental Exposures

Gene-Environment Interactions

Nation-States Regions (Urban Entities)

Neighborhoods / Communities

Families / Couples / Households

Lifecourse of Individuals

Source: E. DeRuggiero, IPPH, CIHR

Most Public Health Interventions

NSHRF - Guernsey – October 2007
Locating the new ‘Public Health’

- Wylie recently described public health as being “everywhere and nowhere”
- New rubrics -- new models and new contexts for understanding the interplay between these factors
- Compounding this are the full range and ever increasing amounts of administrative and other forms of data (remote sensing, etc!)
- How do we sort through all of this information to make meaningful analyses to support effective decision making?
Recognizing the value of ‘settings’...

Integrating social theory into public health practice (Potvin et al, 2005)

- "social epidemiology has shown that health and diseases are affected not only by the conditions in which people live but also by social organization”

- "the existence of spatial configurations in the distribution of health and disease suggests that human environments vary according to the degree they facilitate or impede health”
Opportunity structures inherent in “Place”  
- MacIntyre, MacIver, and Sooman (1993)

- **Physical features of the environment**  
  - air, water, built environment, climate, infectious agents

- **Availability of healthy environments**  
  - housing, non-hazardous employment, safe play areas for children, access to green space

- **Access to services** to support people in activities of daily living  
  - education, transport, power, policing, health services

- **Socio-cultural features of a neighbourhood**  
  - political and economic dimensions, ethnic, religious history, norms and values, social networks

- The reputation of a “place”
Dimensions of ‘Place Effects’
An operational context
Curtis and Jones 1998

- The patterning and diffusion of physical and biological factors that impact health
- The role of space and place in social relations important for health
- Sense of place
Dimensions of ‘Place Effects’
An operational context
Terashima 2007

- How does it distribute or disperse across the landscape?
- Strength of influence (how concentrated or strong)?
- Significance of influence (impact on health)?
- Meanings (what does it mean to individuals/groups?)

Differences in above aspects by context—culture, gender, age, country, communities, rural/urban, economy—are important
What is GIScience?

GIScience: “the discipline that uses geographic information systems as tools to understand the world.”

“the science behind the systems,” concerned with the set of fundamental questions raised by GIS and allied technologies

Geographic Information Systems (GIS) were devised in the 1960s for automating the handling of large volumes of geographic information
Foundations of GIS

- Builds on geographical scientific foundations (cartography, etc)

- Tobler’s First Law of Geography: “All things are related, but nearby things are more related than distant things.”

- Anselin’s second principle of spatial heterogeneity argues that expectations vary across the Earth’s surface, with the important consequence that the results of any analysis depend explicitly on the bounds of the analysis.
Contributions of GIScience to Place and Health Research

- **Theoretical foundations and approaches to understanding spatial data**
- **Methodological tools**
  - Appreciation for challenges of working with spatial data
  - Eg. Modifiable Areal Unit Problem (MAUP)
  - Network analysis and Locational analysis
  - Suite of other spatial analytic methods
  - Working with raster data vs vector data
- **Visualization**
  - Impact of information presented as ‘maps’
  - Confidentiality issues