Advanced GIS Applications in Health Disaster Management

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ESRI Federal/Global Affairs
Outline

- GIS for Health Disaster Management
- Advanced GIS Applications
  - Mobile
  - Situational Awareness
- Resources on this topic
GIS is also Changing How We Work

• Systematic
• Holistic
• Analytic
• Quantitative
• Visual

A Science Based Approach

... and ... How We Act
Managing Natural Disasters

- Cyclone: Myanmar (Burma)
- Floods Simulation: Houston, Texas
- Wildfire: Idaho
- Earthquake: Wenchuan, China
- Earthquake Damage: Japan
- Aftershocks: Japan
- Hurricane Risk: Texas
- Tornado: Alabama
- Floods: Bihar, India
- Flood Mapping: Iowa
- Fire History: Greece
- Earthquake Damage: Japan
- Cyclone: Myanmar (Burma)
Health Disaster Management

Cholera - 1854

Avian Flu (H5N1) Outbreak

SARS

Food Insecurity
How GIS is used in Health Sector?

**Essential Uses**
- Disease Surveillance & Tracking
- Policy Analysis & Planning
- Environmental Health Monitoring
- Vital & Immunization Registries
- Population Health Research
- Field Data Collection
- Internet Map Publishing
- Resource Locators
- Routing & Travel Directions

**Emerging Uses**
- Managing Workforce
- Logistics
- Disaster Response
- Consumer Empowerment
- Disease Management
- Situational Awareness
- Health “business” Analysis
- Biomedical Applications
GIS applications specifically designed for Public Health

- **HealthMapper** – World Health Organization (WHO)
  10,000 distributed since 1993

- **EpiMap** – United States Centers for Disease Control and Prevention (CDC)
  1,000,000 distributed since 1996

- **SigEpi** – Pan American Health Organization (PAHO)
  5,000 distributed since 1998
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Why care about global health & health disasters?

• Ministries of Health (MoH) need accurate geographic data from the NMAs
  – Vectors are people, germs, animals, and environments
    • have specific geographic dimensions
    • capable of broad geographical re-distribution
  – Demographics – condition of the people
  – Location – jurisdiction

• Relationship between health disasters and …
  – Economy
  – Trade
  – Tourism
GIS and Health Disasters

- **Time Dimension**
  - rapid vs. slow onset
  - opportunity for planning and mitigation

- **Geographic Dimension**
  - vector borne diseases (human, livestock, poultry, migratory birds, insect)
  - reporting (local, national, global)
  - field (operations) vs. headquarters (administration)

1. **Assessment**
2. **Policy Development, Planning and Implementation**
3. **Assurance / Mobile Resource Management**
4. **Situational Awareness / Operational Awareness**
Modeling of Dengue Transmission

Image from Dr. Dana A. Focks  http://www.id-analysis.com/pages/
HIV/AIDS Mapping

Percentage of Seropositive Pregnant Women at Kenyan Surveillance Sites

Distribution of HIV/AIDS services and interventions - Mapping Indicator 2.2

HIV Prevalence by Sample Cluster, Kenya, 2003

Sources: NIMA, DoS/HIU, Gov't of Uganda
West Nile Virus (1999-2002)
Severe Acute Respiratory Syndrome (SARS) - 2003

Source: Los Alamos National Laboratory

Source: ESRI China

Source: NGA
Avian Flu (H5N1)

- Risk of Pandemic - factors may include:
  - rate of transmission
  - geographical location and spread
  - severity of illness
  - presence of genes from human strains (if derived from an animal strain) and/or
  - other scientific parameters

Source: WHO
As of August 7, 2009, a total of 102,905 confirmed cases have been notified in all 35 countries in the Americas Region.

A total of 1,274 deaths have been detected among the confirmed cases in 20 countries of the Region.
Note the relationship between: Human Health & Agriculture

• Mad Cow Disease
• Avian Flu
• Swine Flu

Source: unknown, but with a sense of humor!
GIS Supports Mobile Applications

Multiple Solutions for Working in the Field

- Mapping
- Editing
- Query
- GPS
- Navigation

Connecting & Integrating the Mobile Work Force
GIS for Situational Awareness
Supporting a Common Operating Picture

- Emergency Management
- Community Awareness
- Homeland Security

GIS Infrastructure

Replication/Integration

Situational Awareness

Explorer

Web

Mobile

Providing Integrated Situational Awareness
Situational Awareness

- Syndromic Surveillance
- Laboratory Testing
- Disease Surveillance
Communicating & Responding

- Rapid Alerting
- Telemedicine
- Managing Bed Capacity
- Risk Assessment

Source: Pacific Disaster Center

Source: CDC
Avian influenza – situation in Indonesia – update 44

10 September 2008 -- The Ministry of Health of Indonesia has retrospectively announced two confirmed cases of human infection with the H5N1 avian influenza virus. The first case, a 38 year old male from West Java, died of pneumonia and renal failure on 10 July 2008. He had been hospitalized on 7 July and died on 10 July. There were free roaming poultry throughout his neighbourhood, including a commercial poultry pen owned by a neighbour.

The second case, a 20 year old female from Tangerang District, Banten Province developed symptoms on 20 July, was hospitalized on 29 July, and died on 31 July. Reports indicate that chickens from the case’s household had died in the week preceding the onset of his symptoms and that he had slaughtered and consumed some of his stock during this period.

Of the 137 cases confirmed to date in Indonesia, 112 have been fatal.
Server GIS Patterns

- Mobile
- Mapping
- Enterprise Integration
- IT System
- Fusion Center
- Mashups
- Web GIS
- Applications
- Distributed (SDI)
- Departments
- Replication
- Enterprise
Server GIS Supports Multiple Web Development Environments

*Rich Internet Applications*

- Web Map App
- JavaScript
- SilverLight
- Flex
- Web ADF (.net/Java)
- REST
- Web 2.0
- Server GIS

... Fast, Flexible & Agile
ArcGIS Online - Sharing Your Work

Encapsulates Your Data and Cartography

- Easily Created
- Multiple Dissemination Methods
- Directly Usable

... Packages Data and Symbology
ArcGIS Explorer is Expanding GIS for Everyone

*Integrating, Visualizing & Analyzing Geographic Information*

- Fast
- Intuitive
- Web Centric

Accessing Maps, Models & Globe Services

ArcGIS Online  ArcGIS Server

...Creating a New Community of Users
Bioterrorism... another scale of health disasters
Further Reading

- Health
- Disaster Response
Your work is already making a difference...

• Providing the Foundation
• Making Communities Livable
• Supporting Economic Development
• Increasing Efficiency
• Improving Human Health
• Mitigating Conflicts

... Improving How We Manage Our World
Thank you!