Advanced GIS Applications in Health Disaster Management

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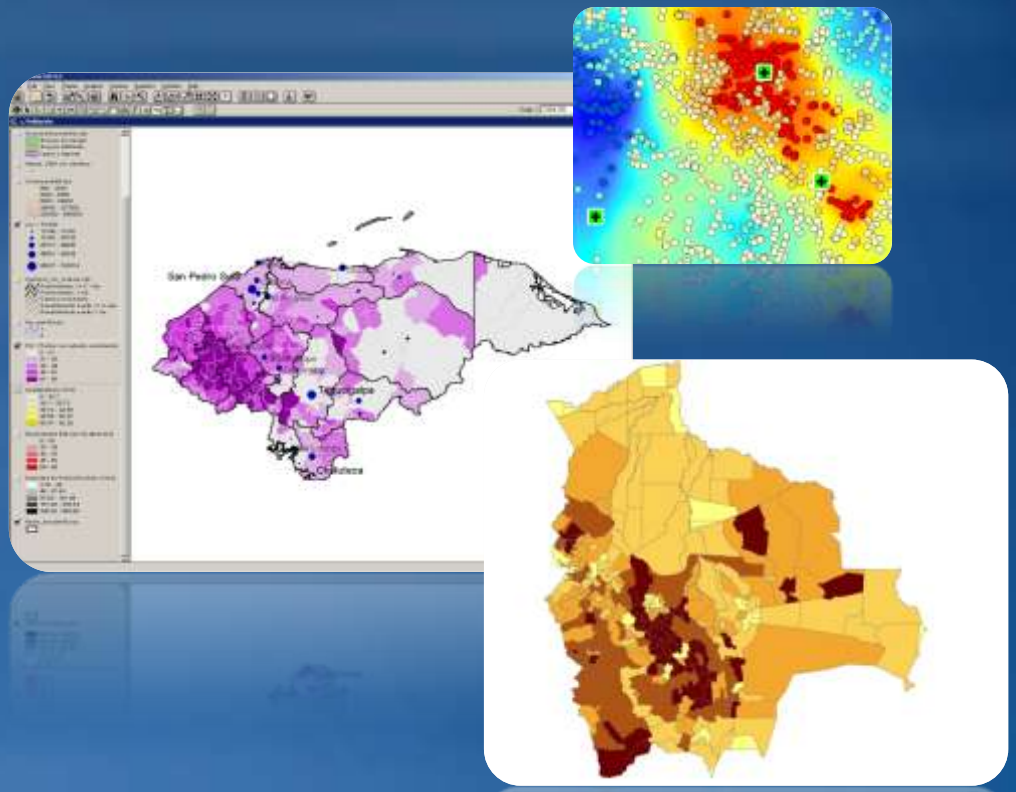
ESRI Federal/Global Affairs

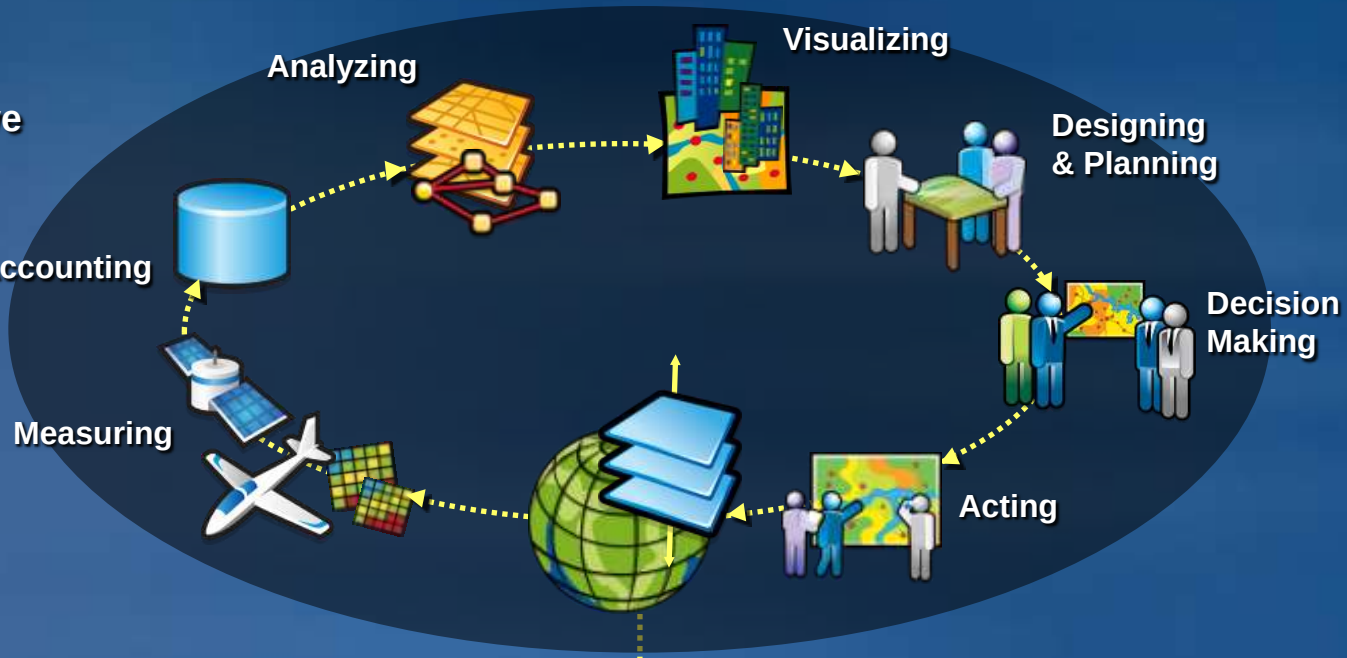
Outline

- 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

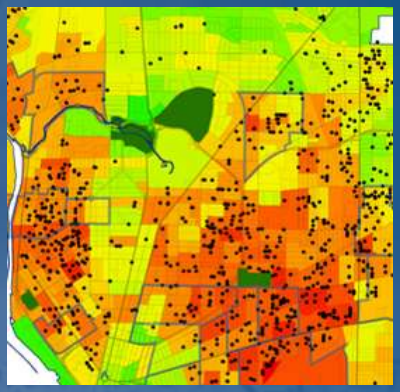


A Science Based Approach

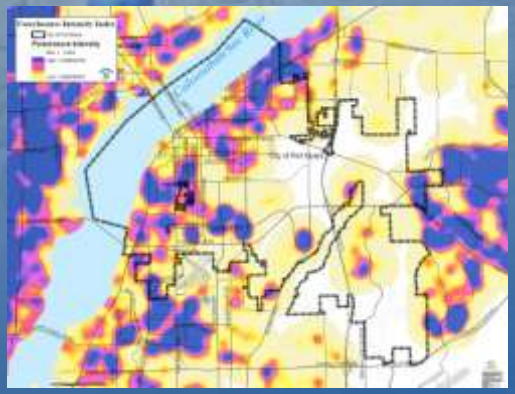
. . . and . . . How We Act

Social Issues & Human Health

Opium Cultivation
Afghanistan



Lead Hazards
Buffalo, New York



Housing Foreclosures
Florida

Humanitarian Aid
Darfur

Children Out Of School
Ethiopia

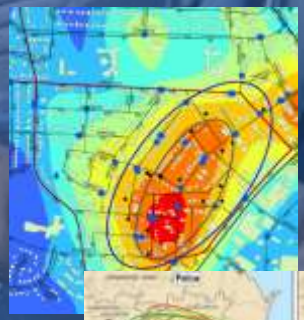
Teenage Births
King County, Washington

Public Safety

E911 / CAD
Bahrain

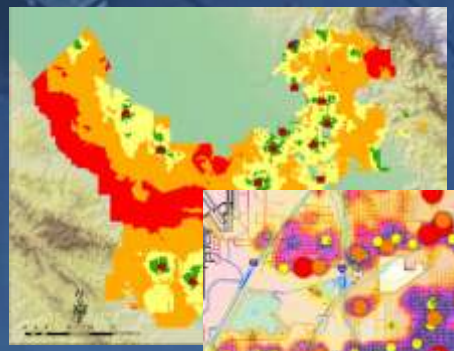
Crime Prediction
Arizona

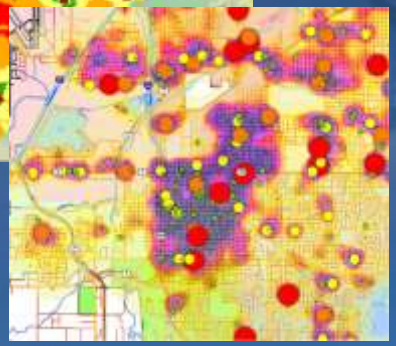
Crime Analysis
Texas



Analysis of Violence
Russia

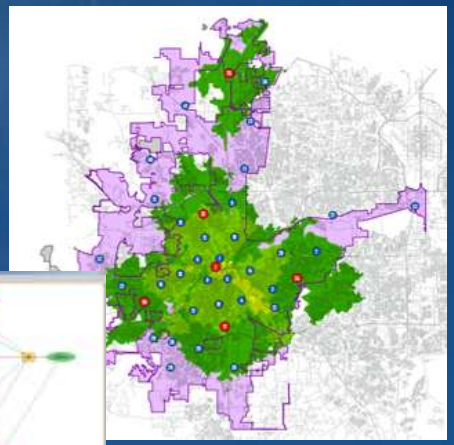
Fire Response
California

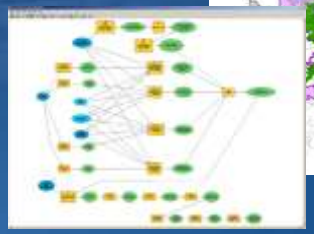




Crime Hot Spot Analysis
Nebraska

NEPA Response Time Model
Texas





Managing Natural Disasters

Flood Mapping
Iowa

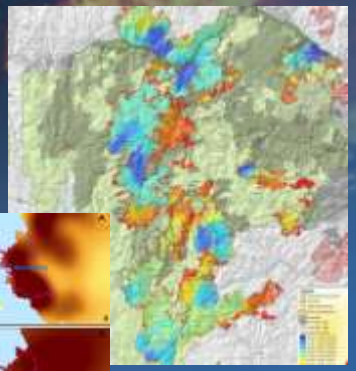
Floods
Bihar, India

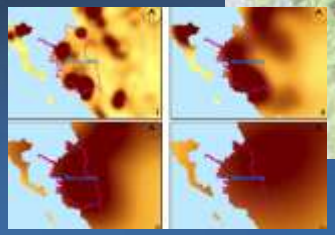
Wenchuan Earthquake
China

Aftershocks

Floods Simulation
Houston

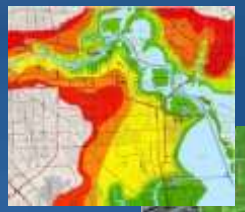
Wildfire
Idaho



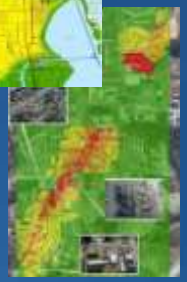


Fire History
Greece

Earthquake
Damage
Japan



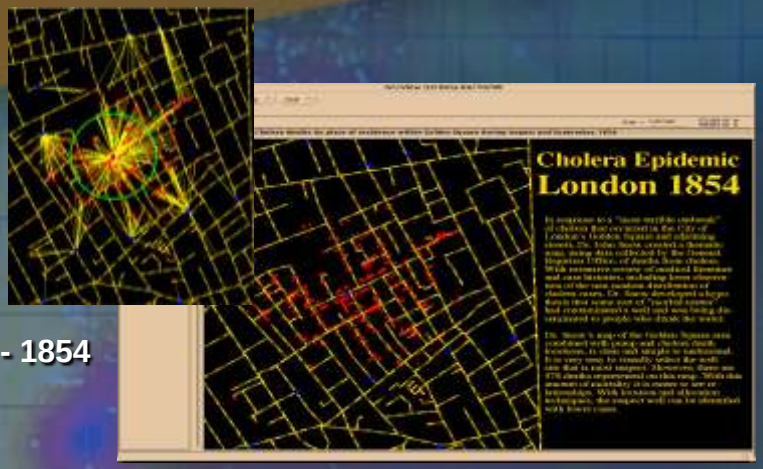
Hurricane Risk
Texas



Tornado
Alabama

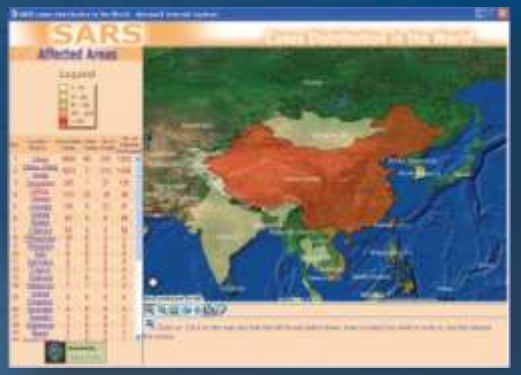
Cyclone
Myanmar (Burma)

Health Disaster Management

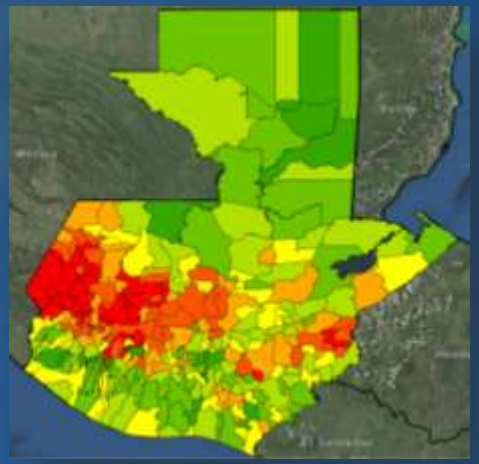


Cholera - 1854

SARS



Avian Flu (H5N1) Outbreak



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

National Health Ministries using GIS

Argentina
Australia
Austria
Bangladesh
Belgium
Belize
Bolivia
Botswana
Bulgaria
Canada
China
Colombia
Congo
Croatia
Czech Republic
Denmark
Dominican Republic
Egypt
Finland
France
Georgia
Germany
Gabon
Ghana
Greece
Guatemala
Honduras
Hong Kong
Hungary
Iceland
India
Indonesia
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kenya
Kyrgyzstan
Laos
Latvia
Lebanon
Lithuania
Malaysia
México
Moldova
Myanmar
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Norway
Panama
Peru
Philippines
Poland
Portugal
Puerto Rico
Qatar
Rwanda
Saudi Arabia
Serbia
Sierra Leon
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
Swaziland
Sweden
Switzerland
Taiwan
Tajikistan
Tanzania
Thailand
Tunisia
UAE
Uganda
United Kingdom
Uruguay
Vietnam
Yemen
Zambia

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

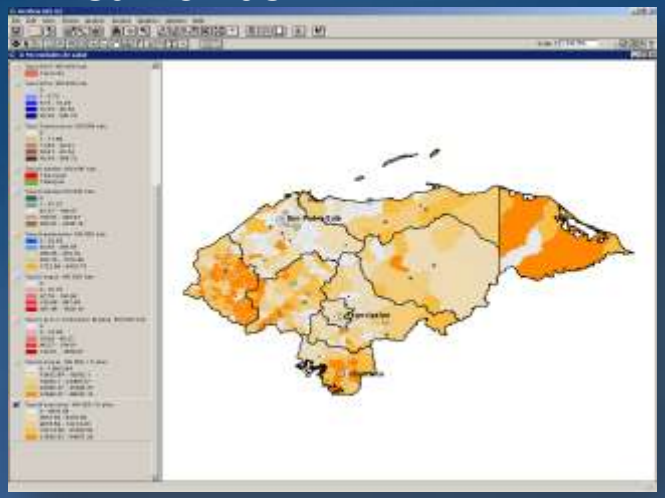
GIS and Health Disasters

- 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)

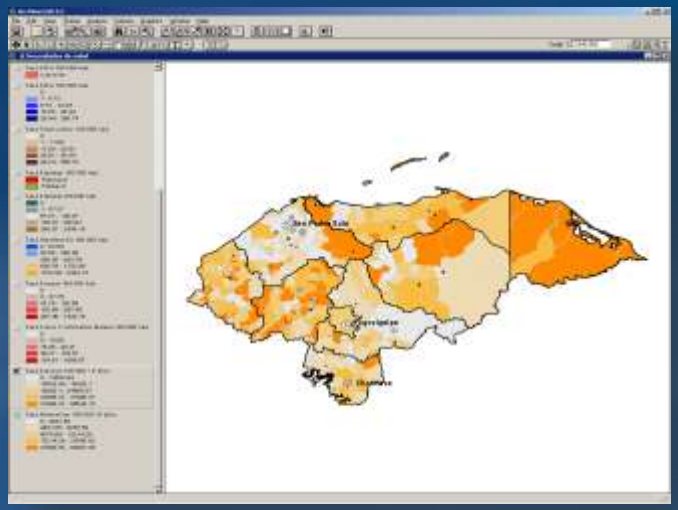
1. Assessment
2. Policy Development, Planning and Implementation
3. Assurance / Mobile Resource Management
4. Situational Awareness / Operational Awareness

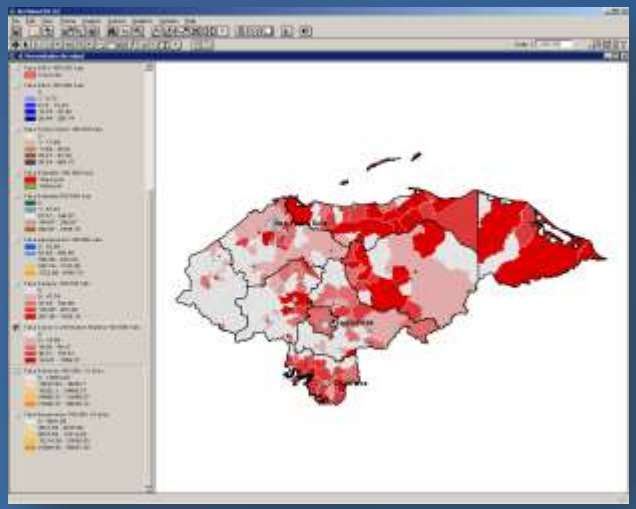
Distribution of Infectious Diseases - by County, 2001

Pneumonias

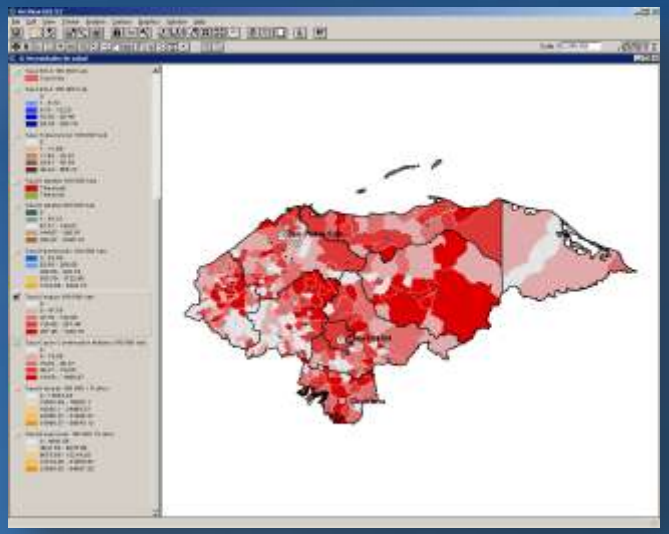


Diarrheas





Malaria



Dengue

Source: PAHO

Modeling of Dengue Transmission

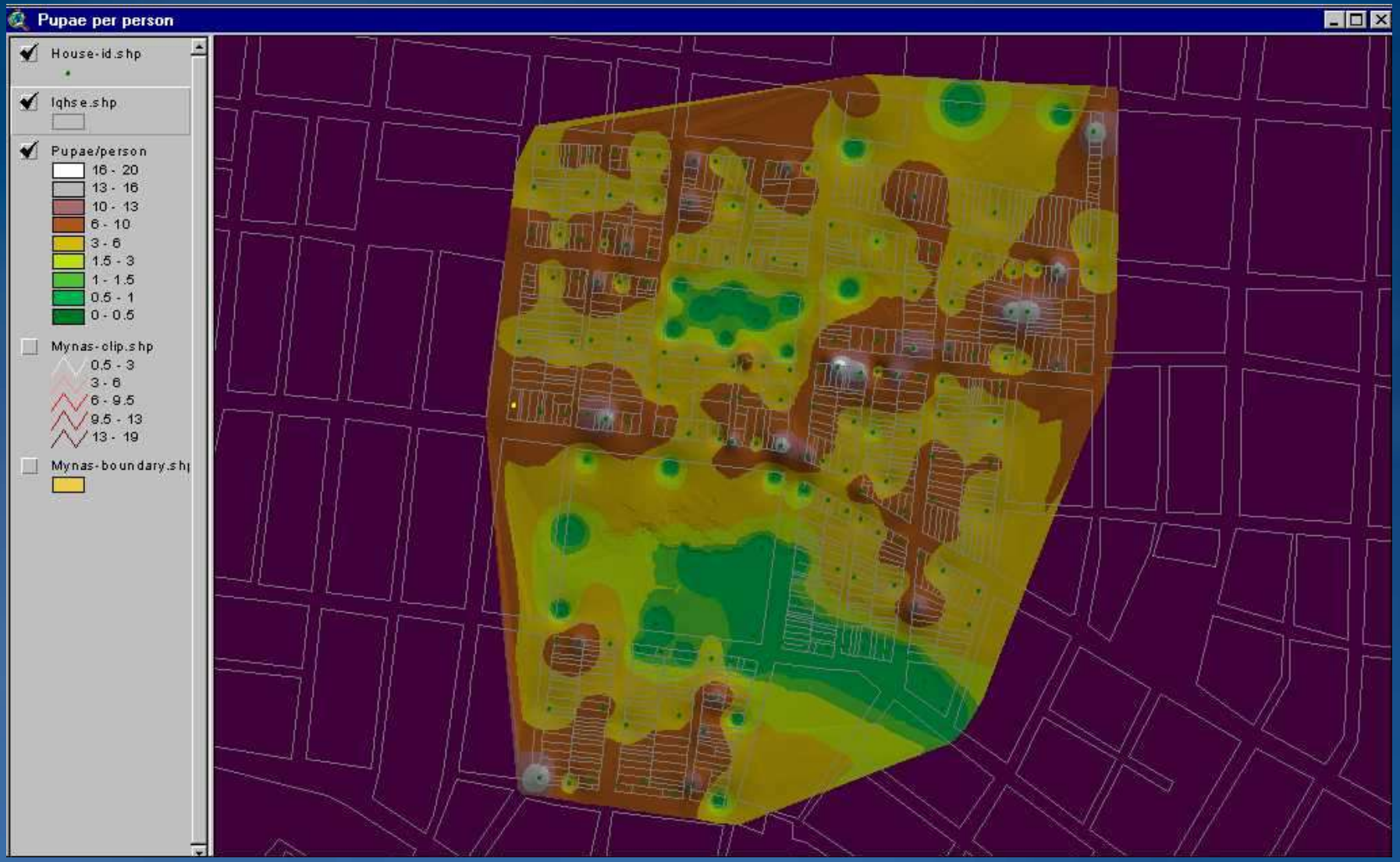
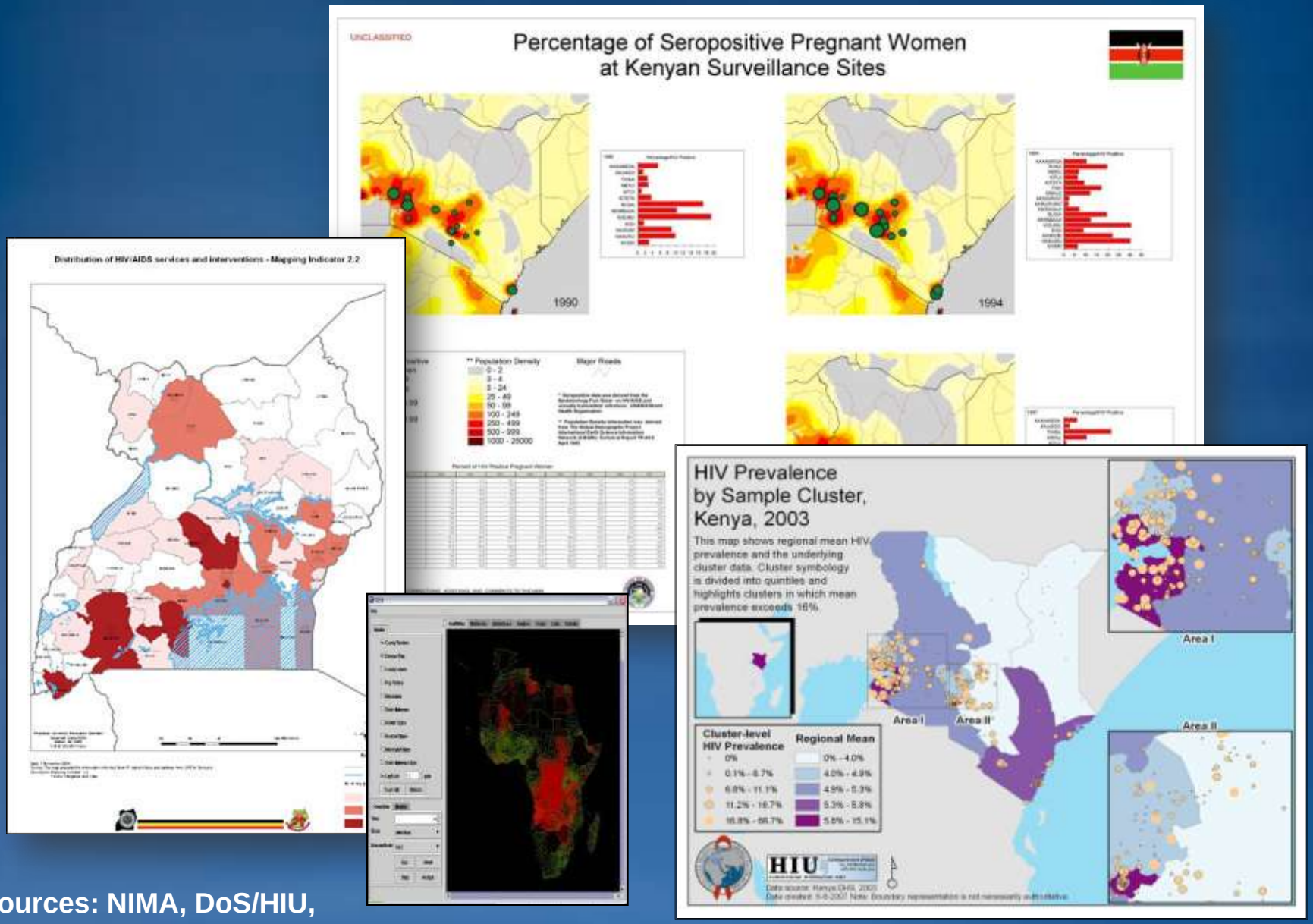


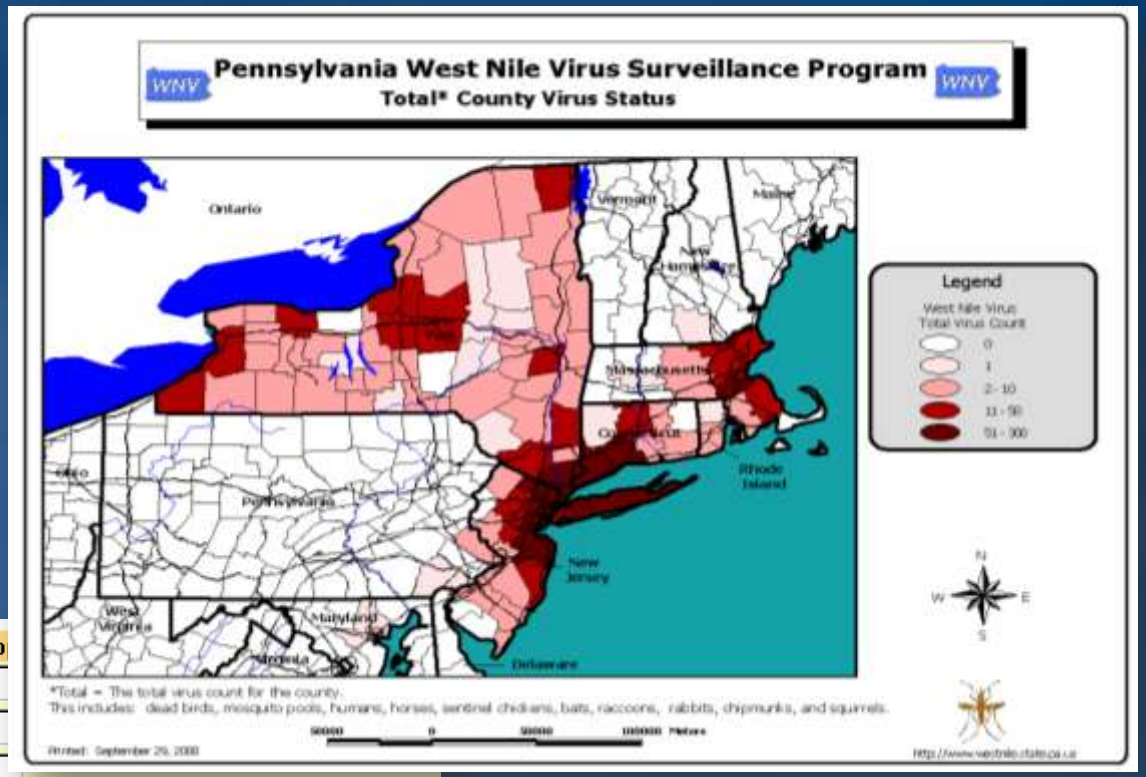
Image from Dr. *Dana A. Focks* *http://www.id-analysis.com/pages/*

HIV/AIDS Mapping



Sources: NIMA, DoS/HIU, Gov't of Uganda

West Nile Virus (1999-2002)



Mosquito Field Data: **Dip**

Employee number:

USI:

Collection time:

Collection date: Calendar

EXISTING Site Section

Select Existing Site Name: Select a site

NEW Site Section Add County ID to beginning of Site Name!

New Site Name:

Click to Locate the Site: PointLocator

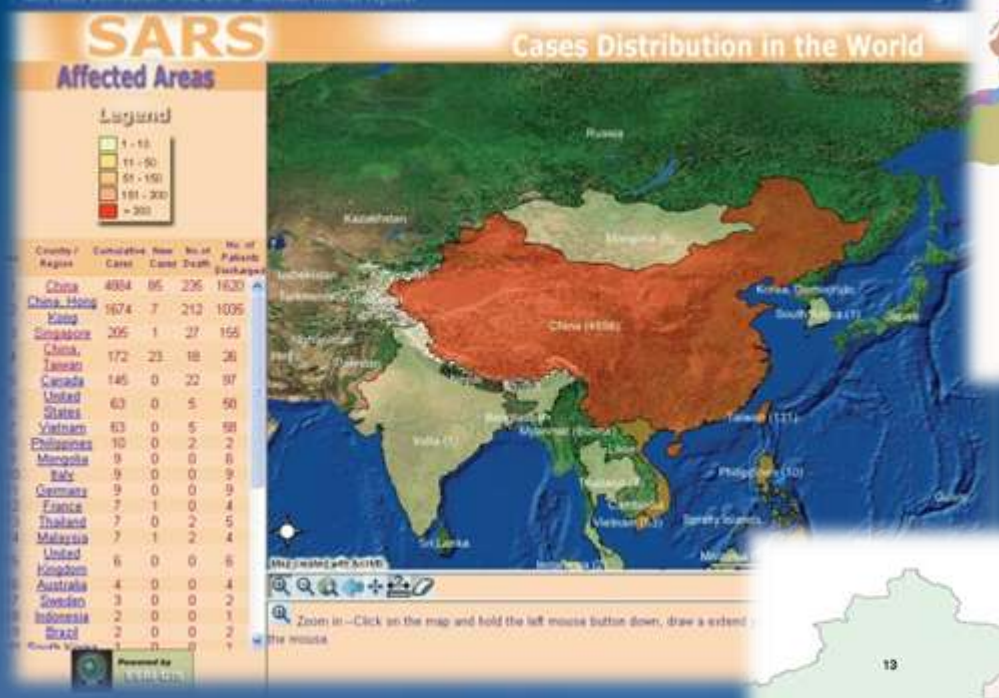
Site Latitude: 200 0

Site Longitude: 200

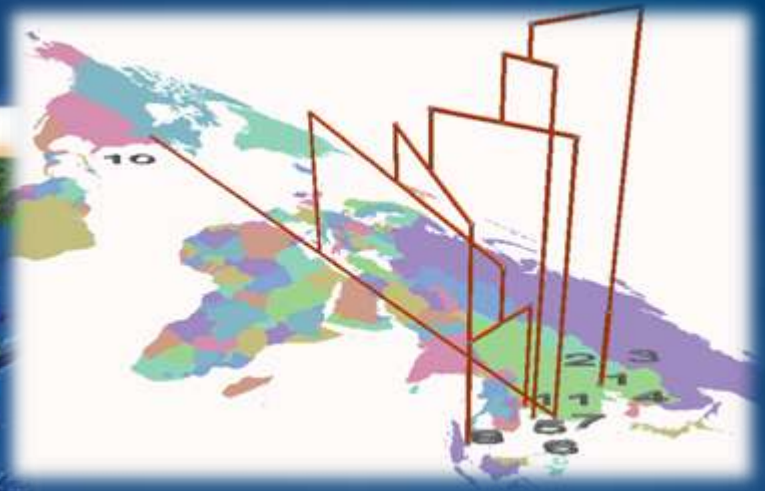
To complete adding the site: Create New site

Sample Info Section

Severe Acute Respiratory Syndrome (SARS) - 2003



Source: ESRI China



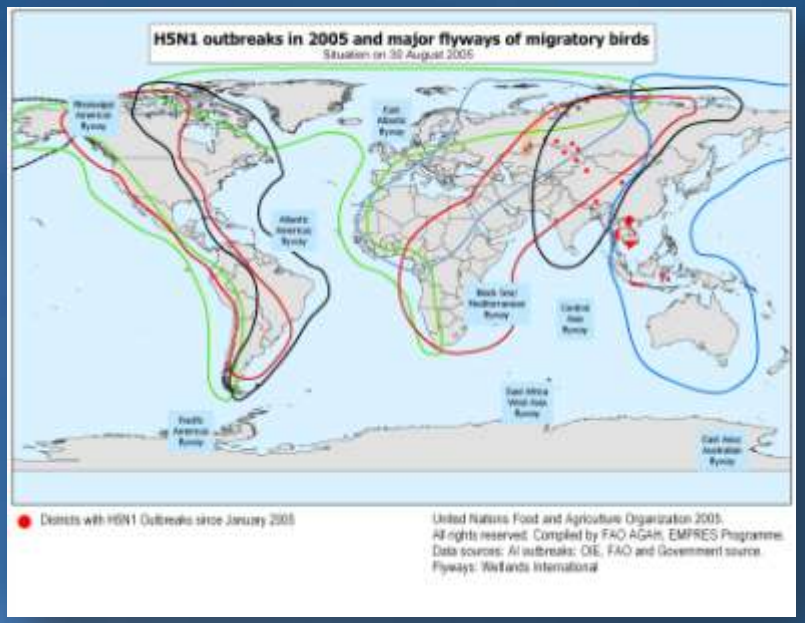
Source: Los Alamos National Laboratory

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**

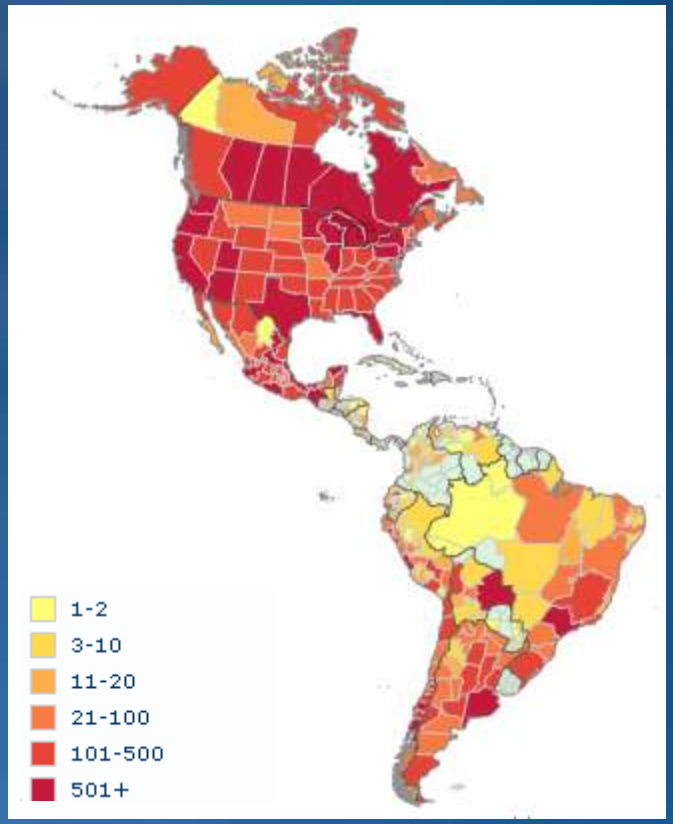
Source: WHO



Source: FAO

Status in the Americas – Swine Flu (H1N1)

- 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



Source: PAHO

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

Desktop GIS on Tablet PC

Full Feature

PDAs with GPS and Mobile GIS

General Purpose

Mobile GIS on Mobile Phones

Server Based

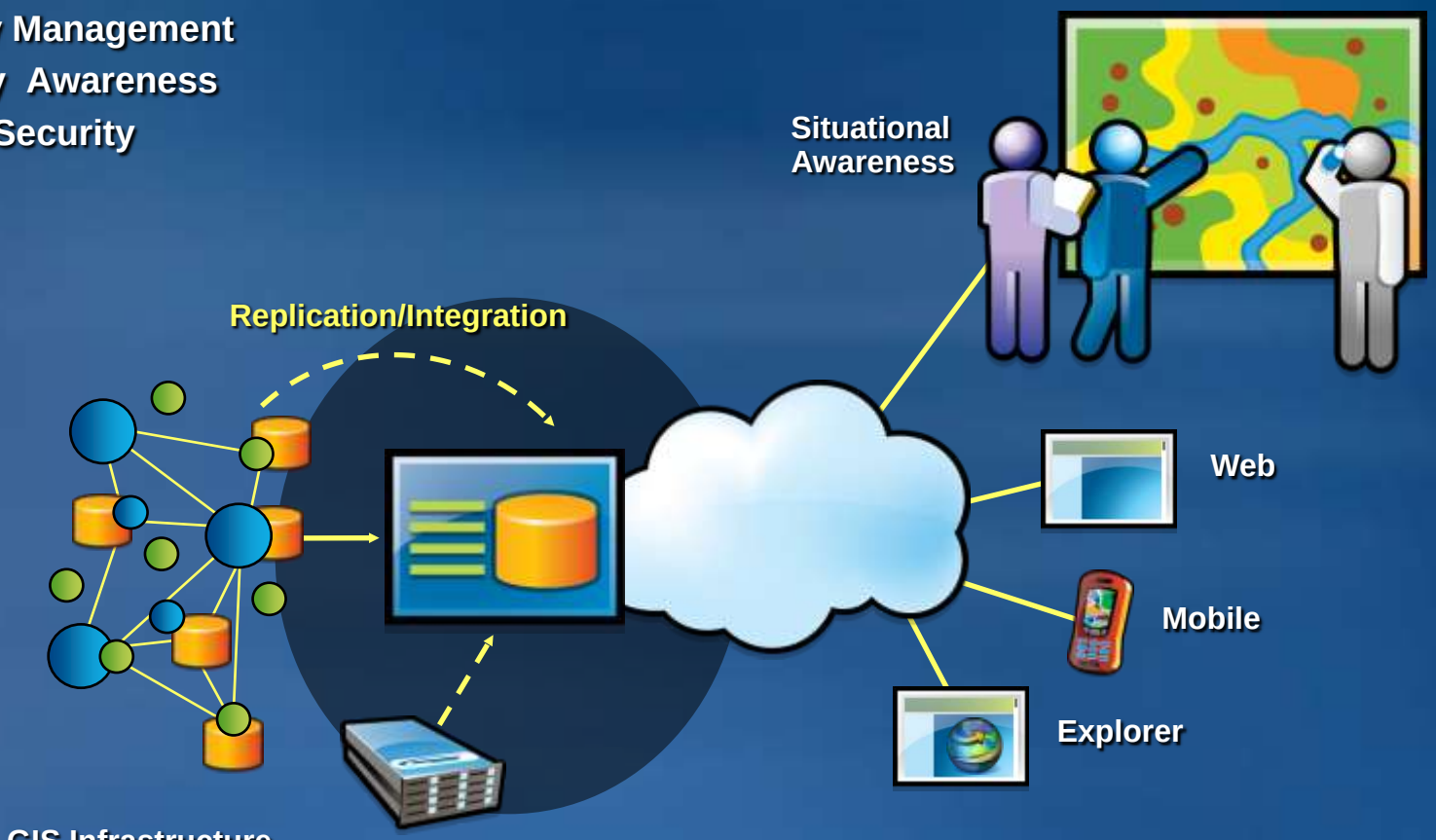
Synchronized with Geodatabase

. . . Connecting & Integrating the Mobile Work Force

GIS for Situational Awareness

Supporting a Common Operating Picture

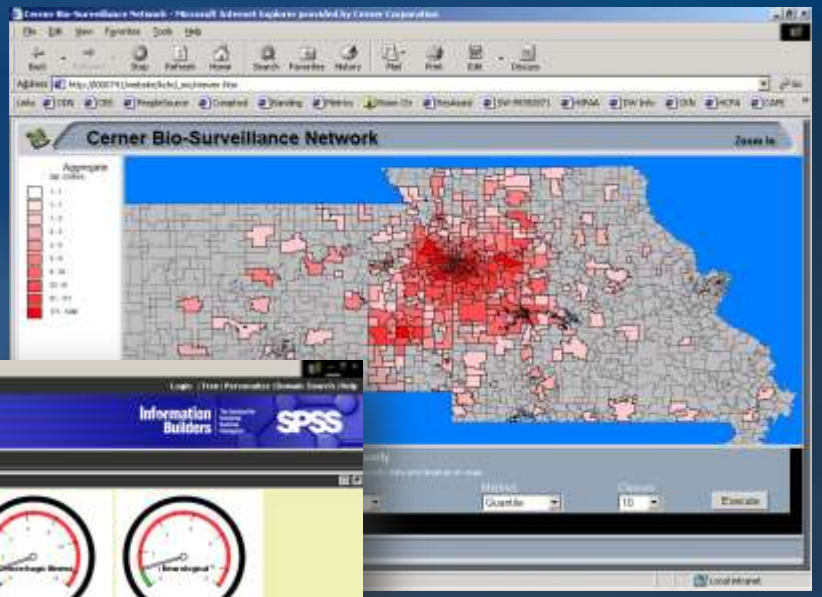
- Emergency Management
- Community Awareness
- Homeland Security

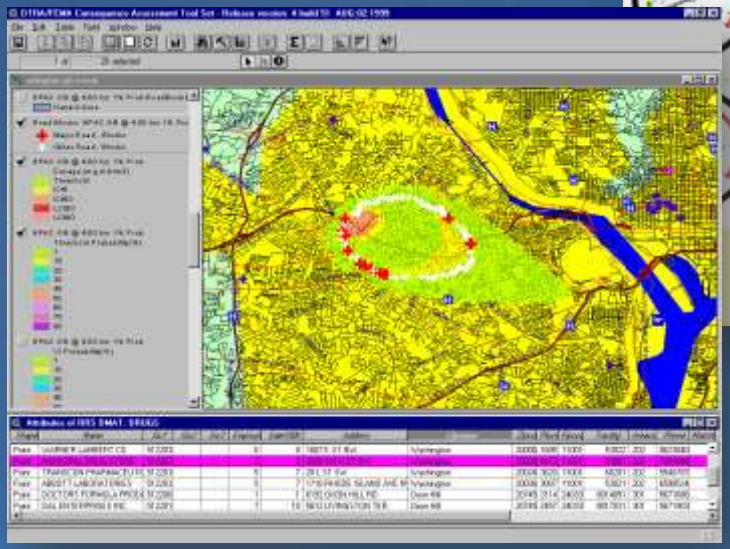


. . . Providing Integrated Situational Awareness

Situational Awareness

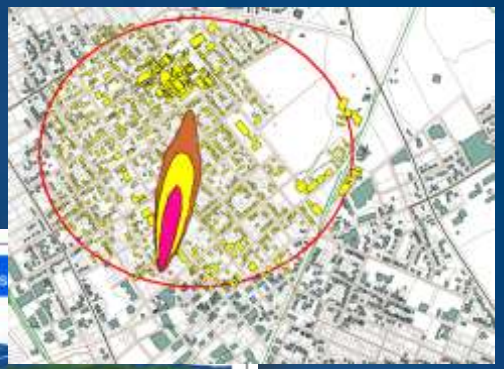
- Syndromic Surveillance
- Laboratory Testing
- Disease Surveillance





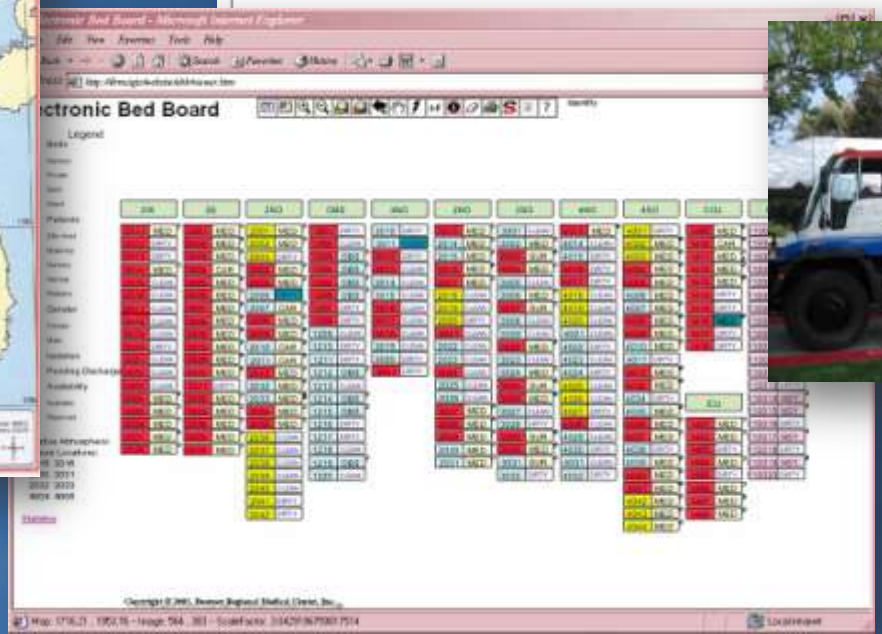
Communicating & Responding

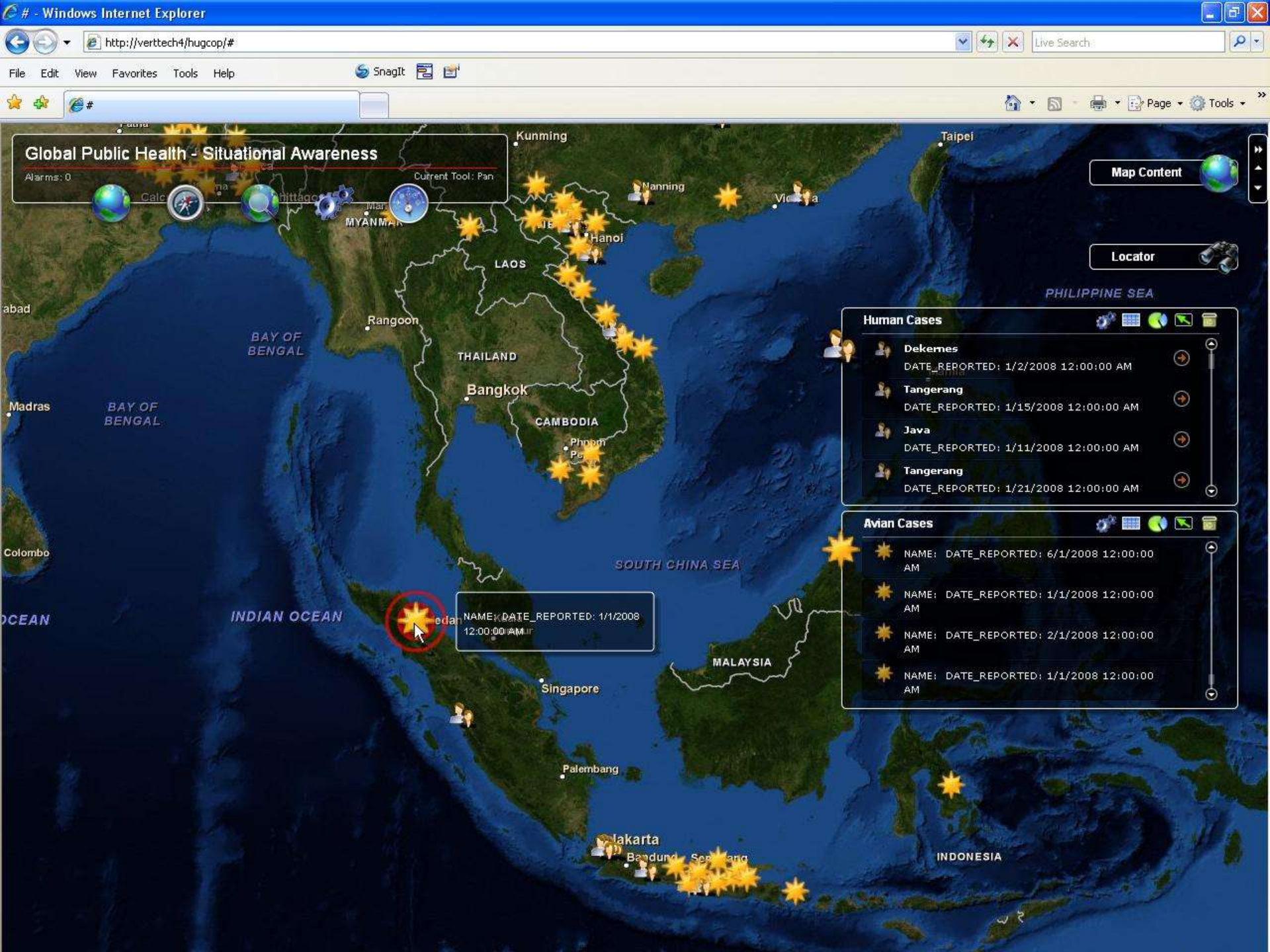
- Rapid Alerting
- Telemedicine
- Managing Bed Capacity
- Risk Assessment



Source: CDC

Source: Pacific Disaster Center

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Live Search
File Edit View Favorites Tools Help
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Page Tools
Global Public Health - Situational Awareness
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Locator
Kunming
Taipei
Nanning
Hanoi
MYANMAR
LAOS
PHILIPPINE SEA
Rangoon
BAY OF BENGAL
THAILAND
Bangkok
Madras
BAY OF BENGAL
CAMBODIA
Colombo
SOUTH CHINA SEA
INDIAN OCEAN
MALAYSIA
Singapore
Palembang
Jakarta
INDONESIA
Human Cases
Dekernes
DATE_REPORTED: 1/2/2008 12:00:00 AM
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DATE_REPORTED: 1/15/2008 12:00:00 AM
Java
DATE_REPORTED: 1/11/2008 12:00:00 AM
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DATE_REPORTED: 1/21/2008 12:00:00 AM
Avian Cases
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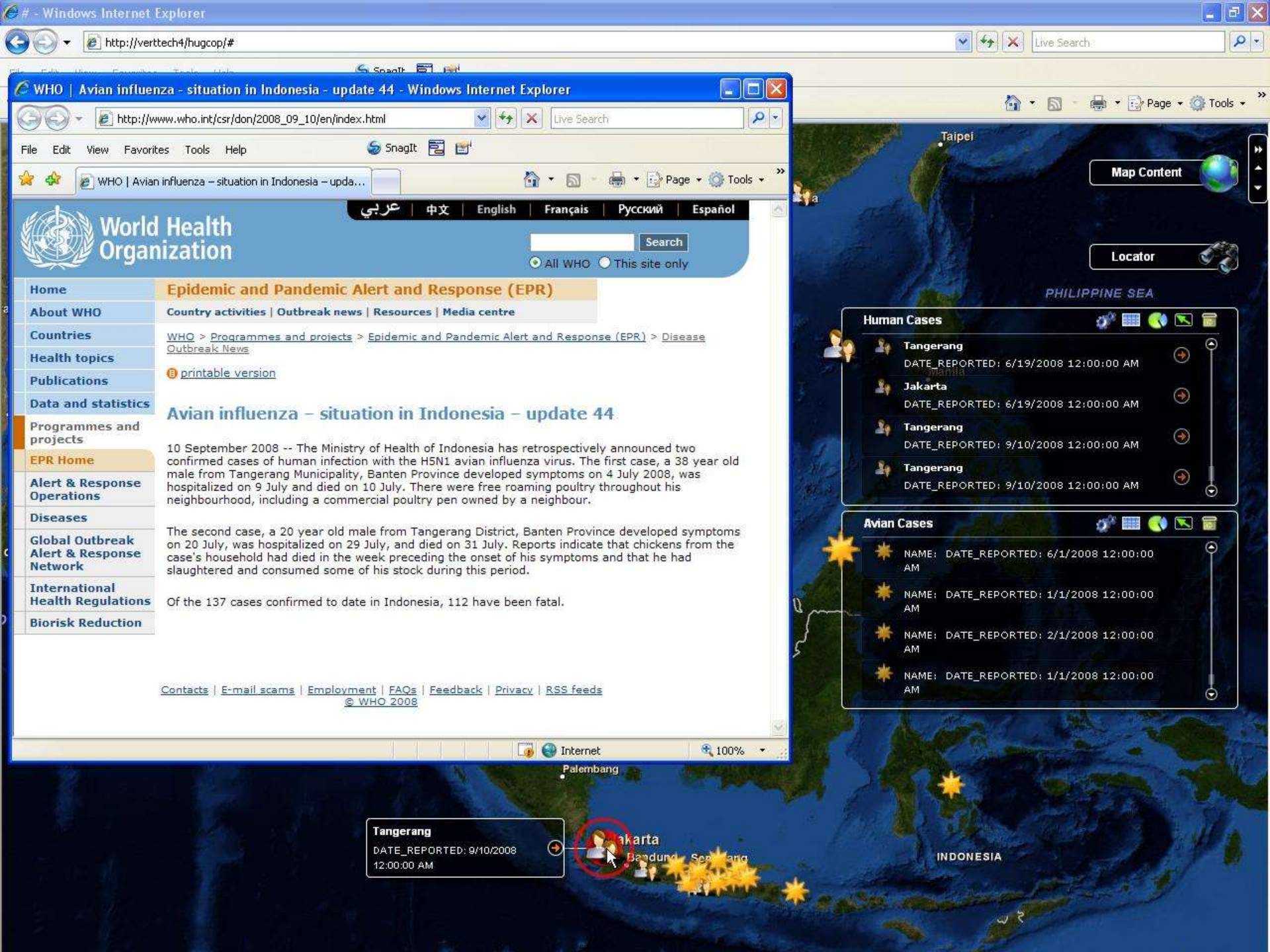
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Live Search
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http://www.who.int/csr/don/2008_09_10/en/index.html
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WHO | Avian influenza – situation in Indonesia – upda...
Page Tools
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World Health Organization
Search
All WHO This site only
Home
About WHO
Countries
Health topics
Publications
Data and statistics
Programmes and projects
EPR Home
Alert & Response Operations
Diseases
Global Outbreak Alert & Response Network
International Health Regulations
Biorisk Reduction
Epidemic and Pandemic Alert and Response (EPR)
Country activities | Outbreak news | Resources | Media centre
WHO > Programmes and projects > Epidemic and Pandemic Alert and Response (EPR) > Disease Outbreak News
printable version
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 Tangerang Municipality, Banten Province developed symptoms on 4 July 2008, was hospitalized on 9 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 male 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.
Contacts | E-mail scams | Employment | FAQs | Feedback | Privacy | RSS feeds
© WHO 2008
Internet
100%
Taipei
Map Content
Locator
PHILIPPINE SEA
Human Cases
Tangerang
DATE_REPORTED: 6/19/2008 12:00:00 AM
Jakarta
DATE_REPORTED: 6/19/2008 12:00:00 AM
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Avian Cases
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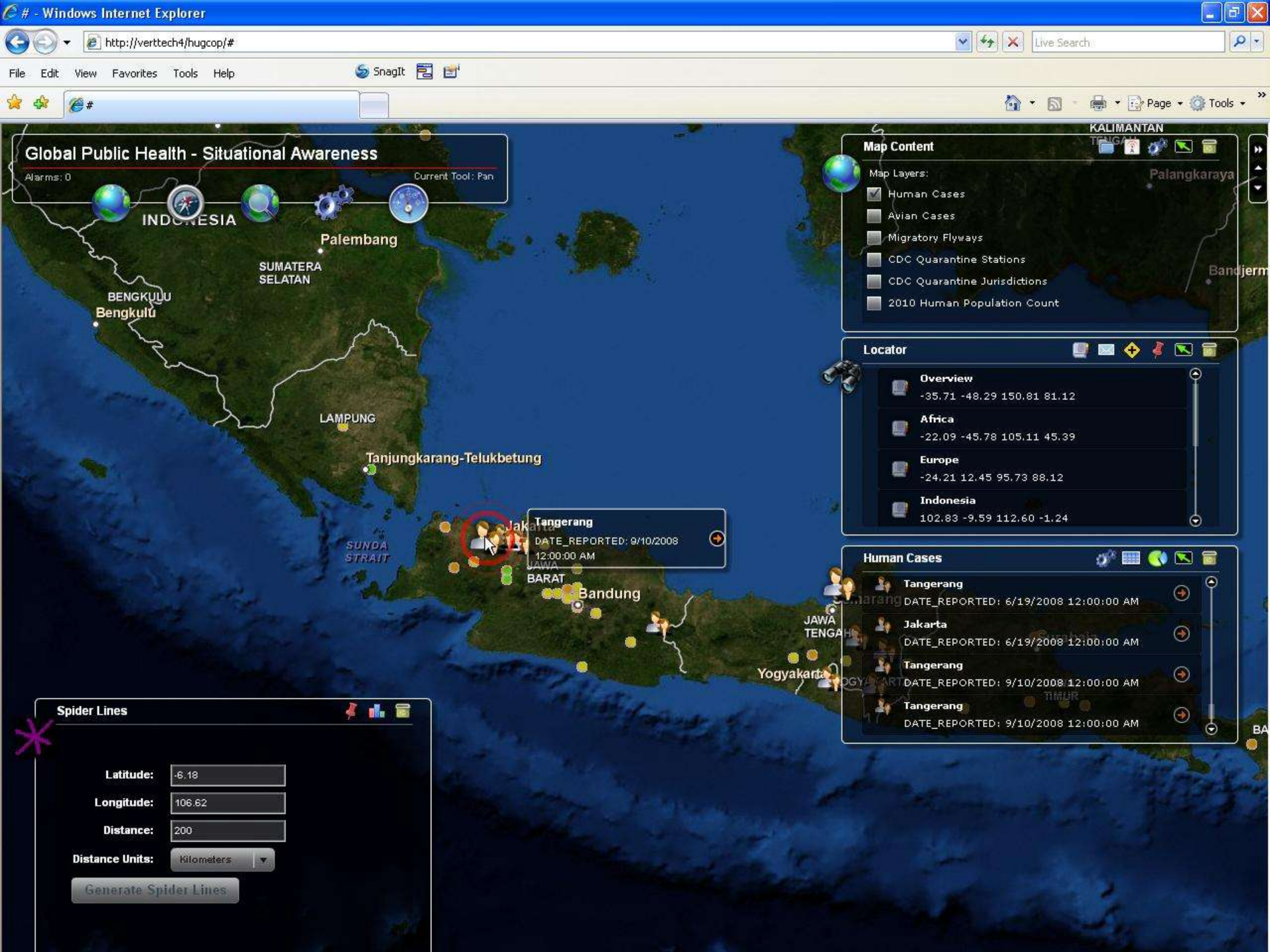
Palembang
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
INDONESIA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INDONESIA
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SUMATERA SELATAN
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Bengkulu
LAMPUNG
Tanjungkarang-Telukbetung
SUNDA STRAIT
Jakarta
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
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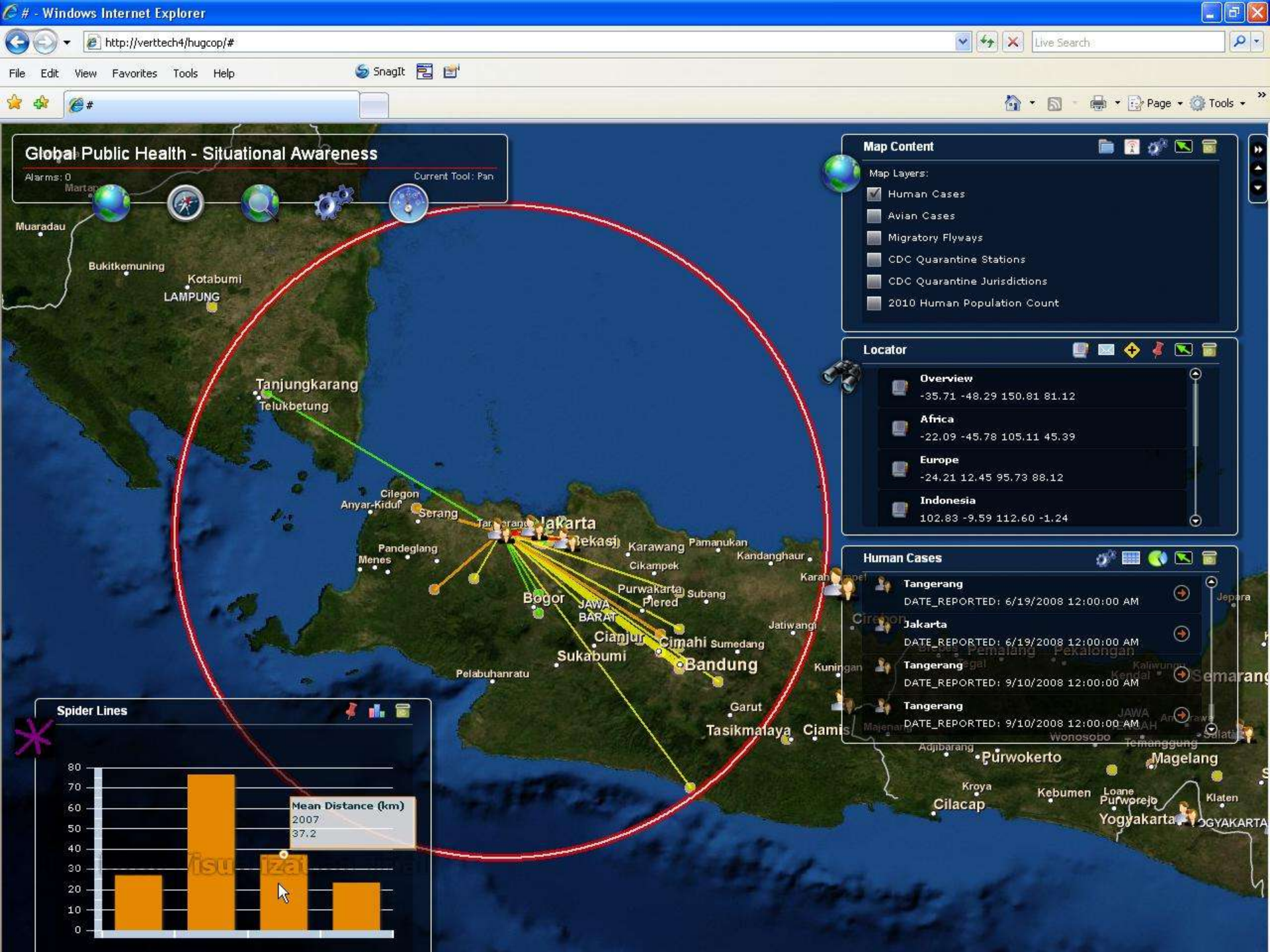
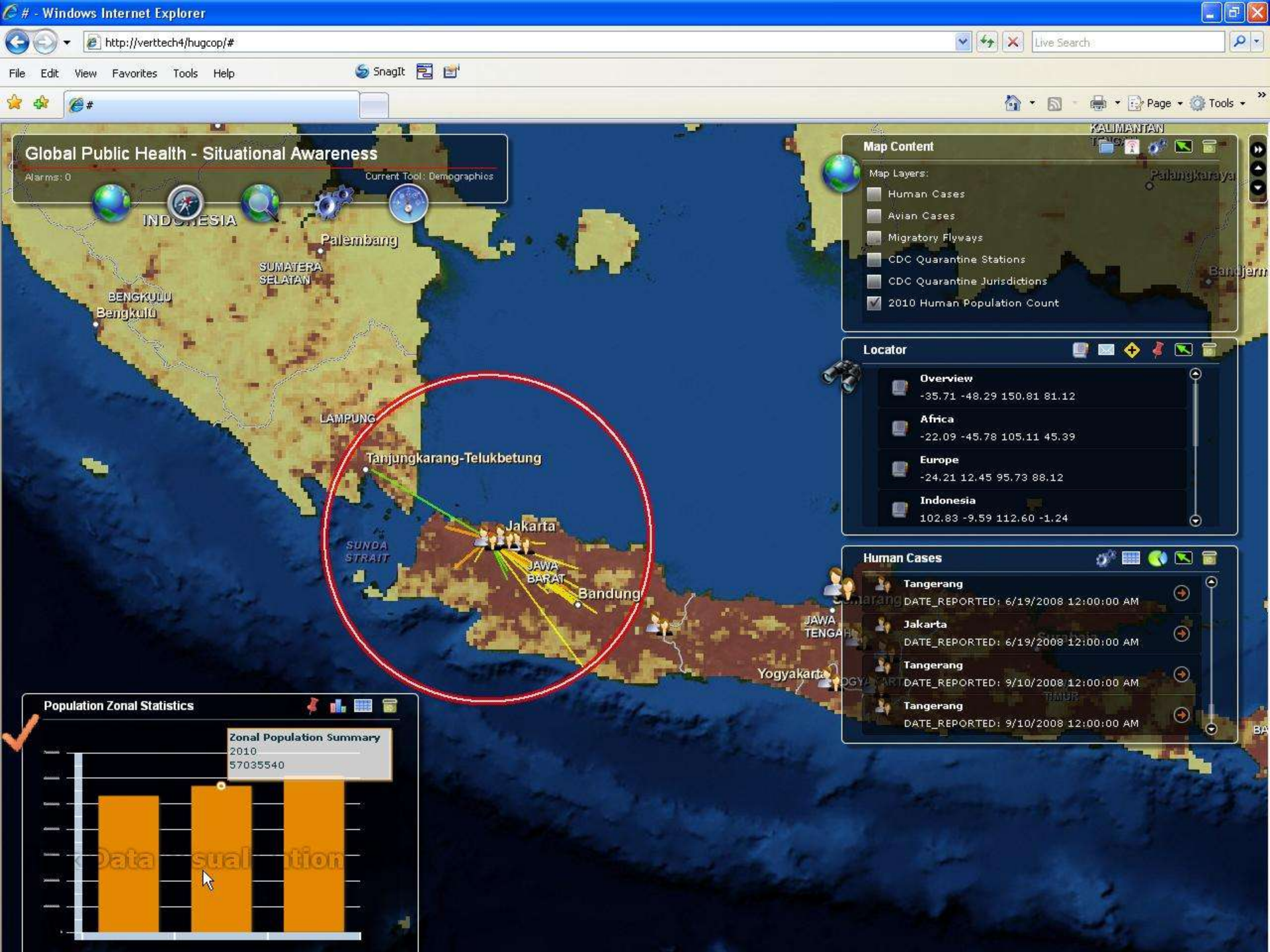
JAWA TENGAH
Yogyakarta
KALIMANTAN
Palangkaraya
Map Content
Map Layers:
Human Cases
Avian Cases
Migratory Flyways
CDC Quarantine Stations
CDC Quarantine Jurisdictions
2010 Human Population Count
Locator
Overview
-35.71 -48.29 150.81 81.12
Africa
-22.09 -45.78 105.11 45.39
Europe
-24.21 12.45 95.73 88.12
Indonesia
102.83 -9.59 112.60 -1.24
Human Cases
Tangerang
DATE_REPORTED: 6/19/2008 12:00:00 AM
Jakarta
DATE_REPORTED: 6/19/2008 12:00:00 AM
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Spider Lines
Latitude: -6.18
Longitude: 106.62
Distance: 200
Distance Units: Kilometers
Generate Spider Lines


- Windows Internet Explorer
http://verttech4/hugcop/#
Live Search
File Edit View Favorites Tools Help
SnagIt
Page Tools
Global Public Health - Situational Awareness
Alarms: 0
Current Tool: Pan
Map Content
Map Layers:
Human Cases
Avian Cases
Migratory Flyways
CDC Quarantine Stations
CDC Quarantine Jurisdictions
2010 Human Population Count
Locator
Overview
-35.71 -48.29 150.81 81.12
Africa
-22.09 -45.78 105.11 45.39
Europe
-24.21 12.45 95.73 88.12
Indonesia
102.83 -9.59 112.60 -1.24
Human Cases
Tangerang
DATE_REPORTED: 6/19/2008 12:00:00 AM
Jakarta
DATE_REPORTED: 6/19/2008 12:00:00 AM
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Spider Lines
Mean Distance (km)
2007
37.2
Muaradau
Bukitkemuning
Kotabumi
LAMPUNG
Tanjungkarang
Telukbetung
Cilegon
Anyar-Kidul
Serang
Jakarta
Bekasi
Karawang
Pamanukan
Kandanghaur
Pandeglang
Menes
Cikampek
Purwakarta
Subang
Pierod
Bogor
JAWA BARAT
Cianjur
Cimahi
Sumedang
Jatiwangi
Sukabumi
Bandung
Pelabuhanratu
Garut
Tasikmalaya
Ciamis
Cirebon
Kuningan
Jepara
Semarang
Pekalongan
Pemalang
Purwokerto
Magelang
Kroya
Cilacap
Kebumen
Loane Purworejo
Klaten
Yogyakarta
Wonosobo
Temanggung
Adjibarang
80
70
60
50
40
30
20
10
0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Global Public Health - Situational Awareness
Alarms: 0
Current Tool: Demographics
INDONESIA
Palembang
SUMATERA SELATAN
BENGKULU
Bengkulu
LAMPUNG
Tanjungkarang-Telukbetung
SUNDA STRAIT
Jakarta
JAWA BARAT
Bandung
JAWA TENGAH
Yogyakarta
KALIMANTAN
Palangkaraya
Banjarmasin
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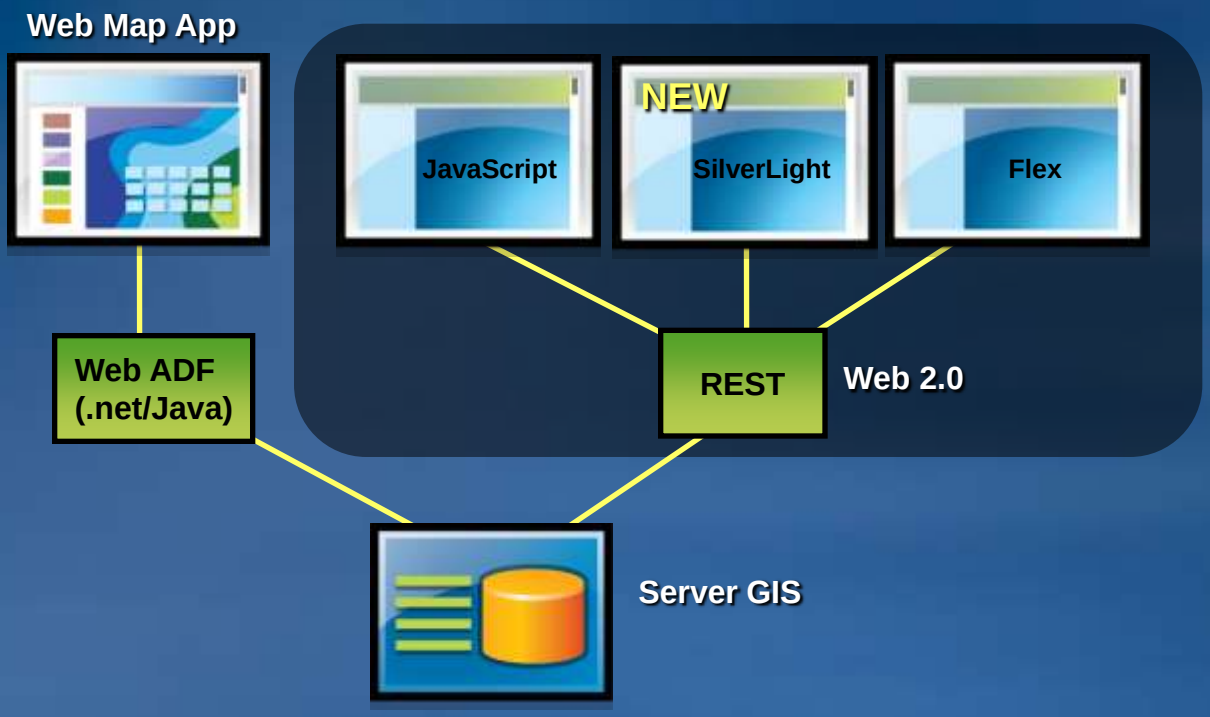
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Tangerang
DATE_REPORTED: 9/10/2008 12:00:00 AM
Population Zonal Statistics
Zonal Population Summary
2010
57035540

Server GIS Patterns

Server GIS Supports Multiple Web Development Environments

Rich Internet Applications



. . . Fast, Flexible & Agile

ArcGIS Online - Sharing Your Work

Encapsulates Your Data and Cartography

- **Easily Created**
- **Multiple Dissemination Methods**
- **Directly Usable**

. . . Packages Data and Symbology

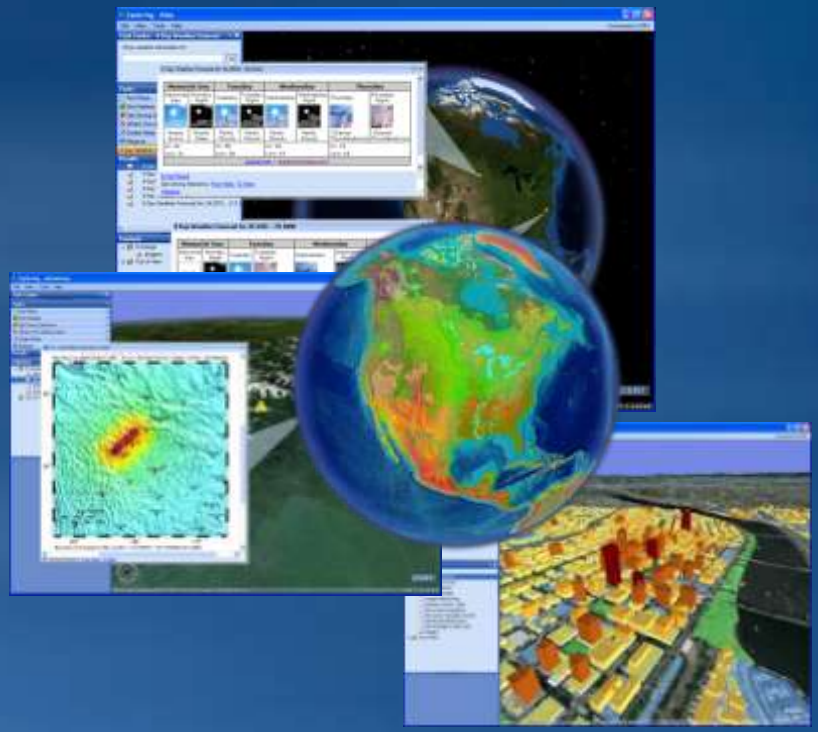
ArcGIS Explorer is Expanding GIS for Everyone

Integrating, Visualizing & Analyzing Geographic Information

- **Fast**
- **Intuitive**
- **Web Centric**

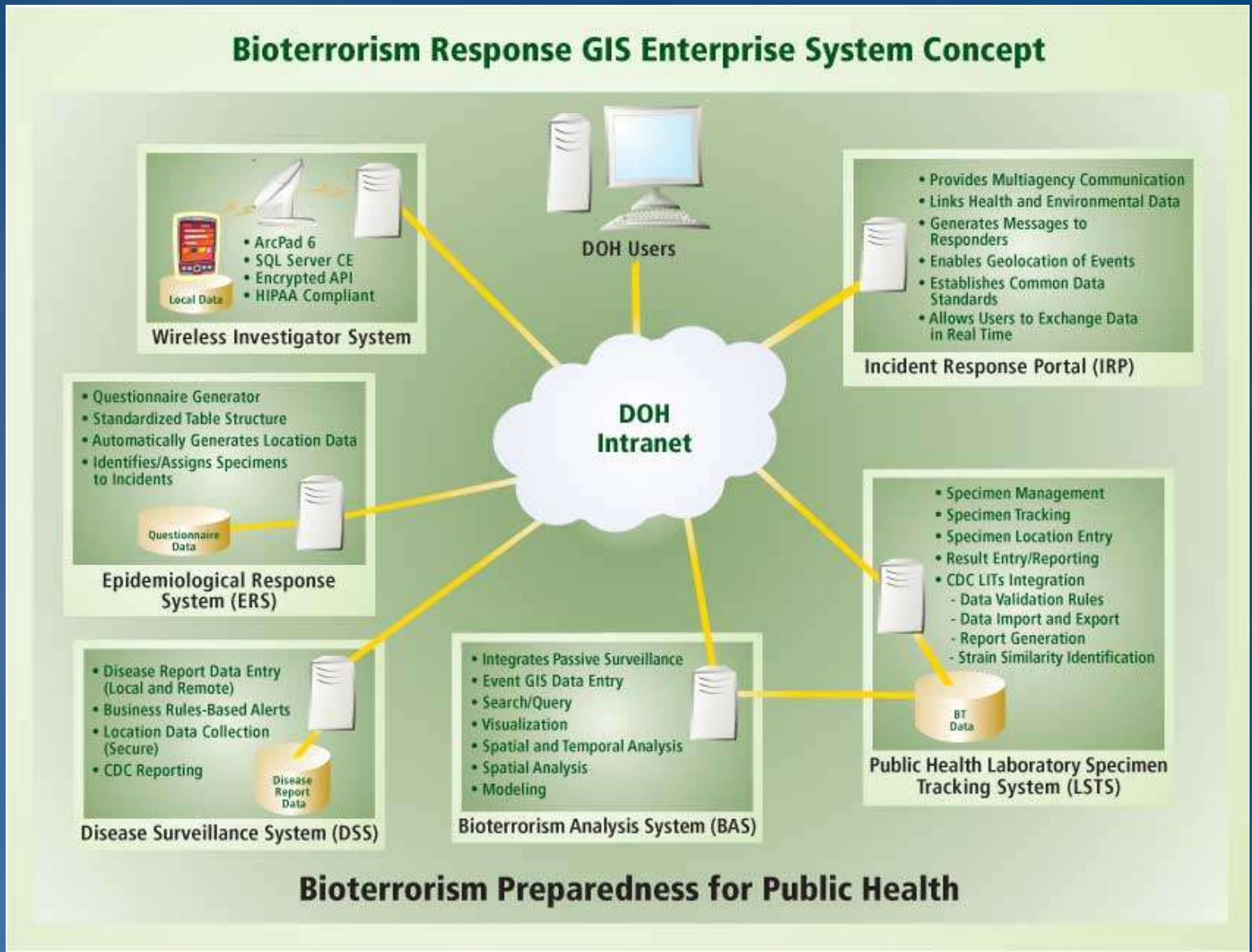
Accessing Maps,
Models & Globe Services

ArcGIS Online **ArcGIS Server**



. . . Creating a New Community of Users

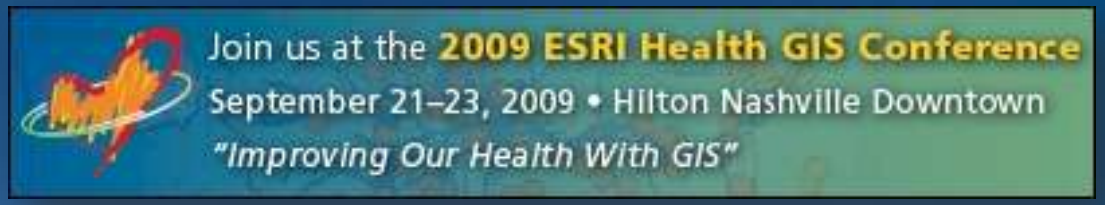
Bioterrorism… another scale of health disasters



Further Reading

- Health
- Disaster Response

Healthy GIS Newsletter & Annual Health GIS Conference




World Health Organization Forum Supports GIS for Public Health in the Americas


World Health Organization Forum Supports GIS for Public Health in the Americas

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!