HSDI

Towards a Humanitarian Spatial Data Infrastructure

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Disasters Strike

We Respond

What Role Does GIS Play?

- Provides maps
- Situational awareness
- Planning tools
- Needs assessment and resource allocation
- Coordinating response

- However, too often we reinvent the wheel with each effort
- Too many players, no common cause or baseline
- Delays in effective response due to data issues

Is This Enough?

- What more can be done to improve the use of our tools to limit the loss of life?
- Why can't a "GIS team" be deployed in 24hrs along with an Urban Search and Rescue team?
  - Or any other organization as determined by the crisis
- Most of the elements are there already
- A coordinated approach is required to build a baseline infrastructure

Humanitarian crises occur worldwide

- Natural disasters
  - Earthquake
  - Famine
  - Tsunami/Flood
- Political disasters
  - War
  - Civil unrest
  - State Failure

Effective Response Requires

- Available of data
- Standardization of data condition
  - Especially for cross-border events
- Effective tools for crisis management
- Rapidly deployable systems
- Interoperability

Data are Hit-or-Miss Right Now

- Haiti
  - Reasonable data primarily due to prior crisis
  - Imagery started coming in the day after (Jan 13th)
- Southeast Asian Tsunami
  - Up to 4 weeks developing datasets for some areas

COMPREHENSIVE BUILDING DAMAGE ASSESSMENT FOR PORT-AU-PRINCE COMMUNE, HAITI

Damage analysis of individual buildings based on post-earthquake aerial photos and pre-earthquake satellite imagery

This map presents a total building count and damages as assessed from both satellite and aerial oblique imagery covering the Commune of Port-au-Prince. Damaged buildings were classified according to visually assessed damage levels and summarized on a per-sq.-commune basis. This work is done at the request of UNDP and in support of the UN-led efforts in the aftermath of the Haiti earthquake. Definiens and the Remote Sensing Laboratories (RSL) at the University of Zurich provided extensive detection building data in order to support of the UN damage analysis. Initial reference data were received from collaboration centers (European Commission JRC with the support of the Satellite monitoring centers/users Charter) and other supporting entities (ITHACA, CUT, CNIG). This analysis will be validated in the field during PDNA and recovery activities.

Earthquake 7.0M

3 February 2010 (20:30:00 UTC)

Version 1.0

Glide No: EQ-2010-000009-HTI

BUILDING DAMAGE ASSESSMENT SUMMARY:
The table presents the total building count and assessed damages for Port-au-Prince Commune. Observed building damages have been summarized for Commune Sector according to the classified damage level. For calculation of percentage damages, identification of all buildings existing in the area prior to the 12 January earthquake was performed using available satellite and aerial imagery. A total of 85,457 buildings were identified and assessed. Of this total, 31,161 were identified as damaged or destroyed, representing approximately 36.5% of all buildings within Port-au-Prince.

Commune/Section Building Damage Classification Summary by Commune Section

Commune Section	Total Bld Count	Destroyed	Severe	Moderate	No Visible Damage	Total Affected Buildings	Percent Damaged
Morne Turgeau	11,956	6,542	1,754	5,041	34,611	17,337	33.4%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Morne Martissant	26,170	1,883	2,038	2,977	19,368	6,781	24.8%
Totals	85,457	8,425	3,792	8,018	53,979	24,118	36.5%

Damage Legend key:

DESTROYED: Complete collapse of building structure recognized

SEVERE DAMAGE: Partial collapse of building structure observed, such as part of roof or one or more exterior walls

MODERATE DAMAGE: Limited damage observed in building, or no damage observed but immediately adjacent to destroyed building

NEGLIGIBLE DAMAGE: Minimal damage observed, or damage may not appear in the damaged

No Roof Damage, Light Surface Damage, Moderate damage and no visible damage. This damage assessment was made with standard image interpretation methods. Detailed damages are likely to represent minimum estimates; actual building damages may be larger due to limits in spatial and spectral resolution of available satellite and aerial imagery.

Building Point Classification

- Destroyed
- Severe Damage
- Moderate Damage
- No visible damage

Main Building Complex
Water Body
Park / Forest
Cemetery
Commune Boundary
Primary / Secondary Road
Section Boundary
Analysis Extent

Map Scale for A3: 1:25,000

UTM grid coordinates given in 1km intervals

Meters

Satellite Data: WorldView-2
Imagery Date: 12 Dec. 2009 / 13 Jan. 2010
Resolution: 50cm
Copyright: DigitalGlobe
Aerial Photos: NASA / Google
Imagery Date: 12, 20 / 17, 20 Jan. 2010
Copyright: NASA / Google
Source: [illegible]
Building Data: [illegible]
Road & Urban Data: Open Street Map
Place Names: CIA WFB, Google Maps, Yahoo
Other Data: MINUSTAH, USGS, NGA
Elevation Data: ASTER GDEM
Source: ME TI & NASA 2009
Damage Analysis: UNOSAT / UNOSAT
Data Processing: UNOSAT / UNOSAT
Projection: UTM Zone 18 North
Datum: WGS 83

The depiction and use of boundaries, geographic names and related data shown here are not warranted to be error-free nor do they imply official endorsement or acceptance by the United Nations. UNOSAT is a programme of the United Nations Institute for Training and Research (UNITAR), providing satellite imagery and related geographic information, research and analysis to UN humanitarian & development agencies and their implementing partners.

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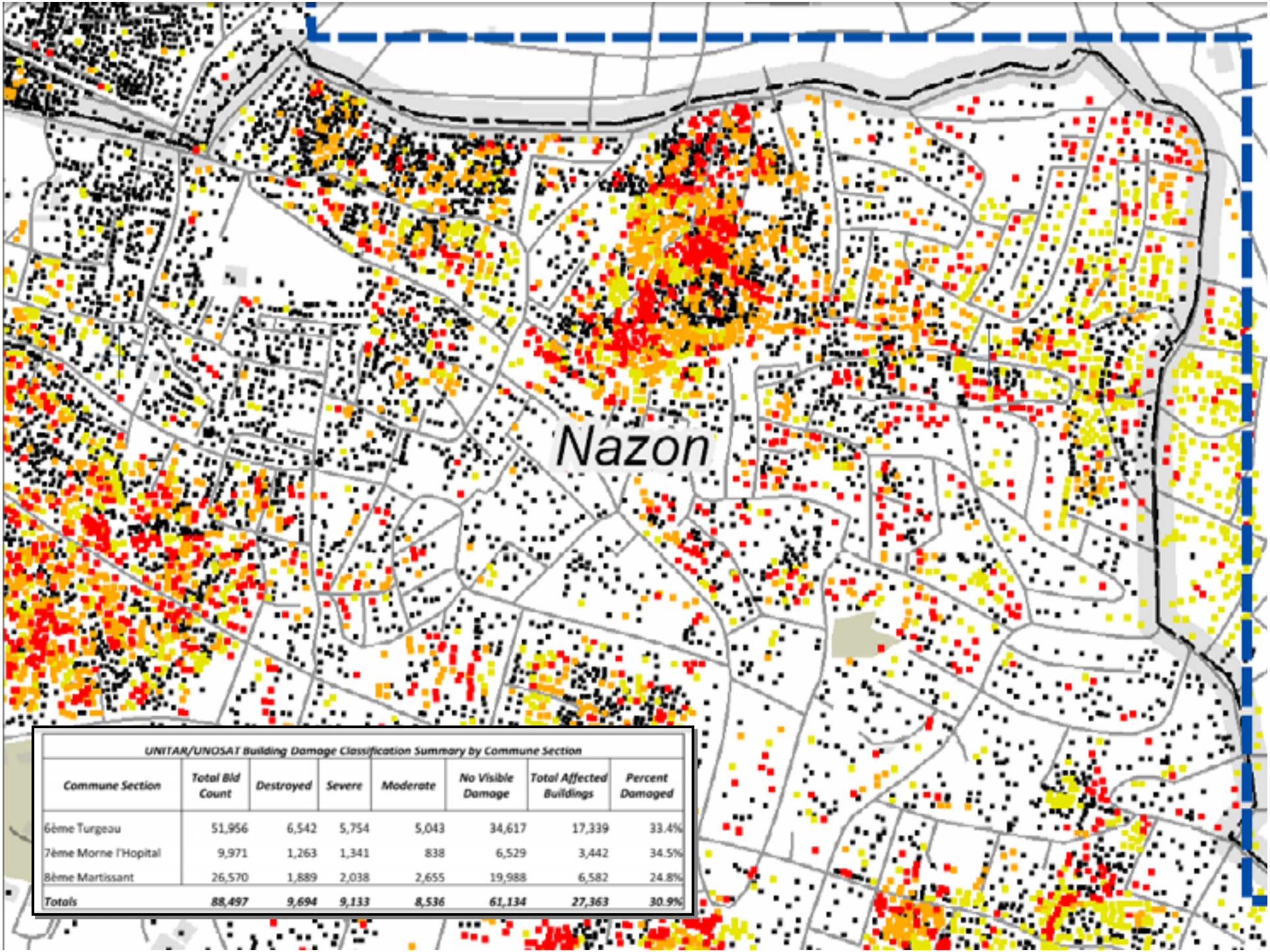


UNITAR/UNOSAT Building Damage Classification Summary by Commune Section

Commune Section	Total Bld Count	Destroyed	Severe	Moderate	No Visible Damage	Total Affected Buildings	Percent Damaged
6ème Turgeau	51,956	6,542	5,754	5,043	34,617	17,339	33.4%
7ème Morne l'Hopital	9,971	1,263	1,341	838	6,529	3,442	34.5%
8ème Martissant	26,570	1,889	2,038	2,655	19,988	6,582	24.8%
Totals	**88,497**	**9,694**	**9,133**	**8,536**	**61,134**	**27,363**	**30.9%**

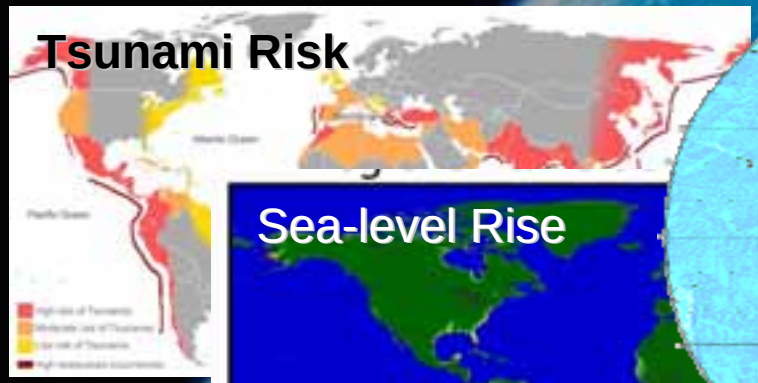
Availability of Data

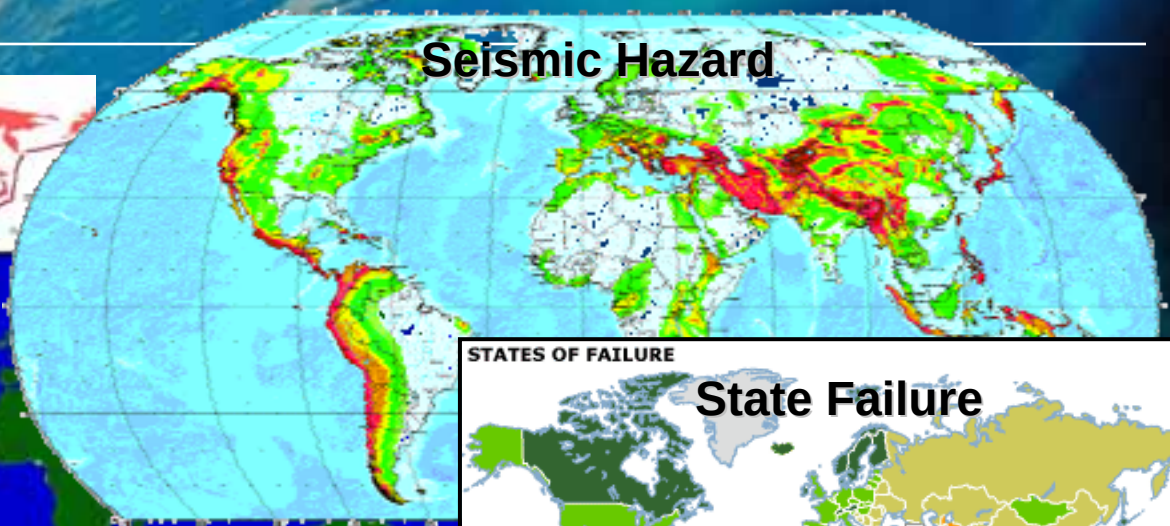
- Data are available for many regions of the world
- Available at multiple scales
- Regions where disasters are most catastrophic tend to be data deficient
  - Less infrastructure
  - Incomplete warning systems
- Data for effective disaster response requires data of a specific scale
  - What scale would be ideal? (1:100,000?)
    - Cost/benefit

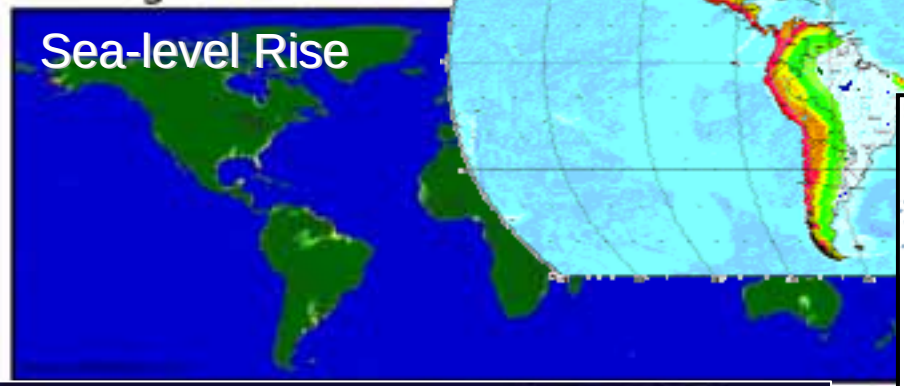
Humanitarian Spatial Data Infrastructure

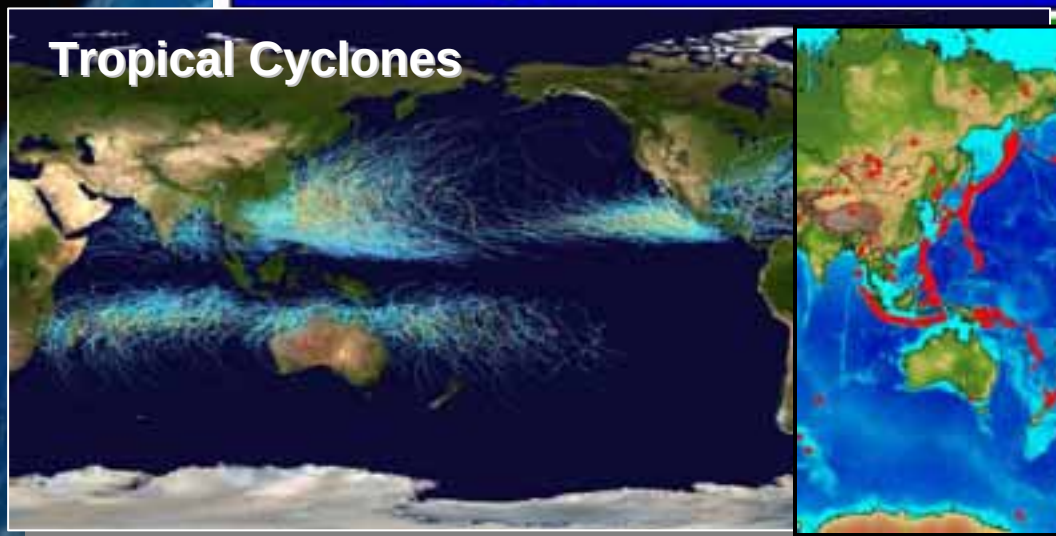
- Build out a collection of trusted data for humanitarian purposes
  - Standard “Framework” Data
- Identify regions of the world with the greatest need
- Identify current extent of spatial data coverage
  - 1:1,000,000 — Entire world
  - <1:250,000 — Selected countries/regions
  - <1:100,000 — Primarily developed nations
- Perform GAP analysis to identify gaps
  - For regions at highest risk

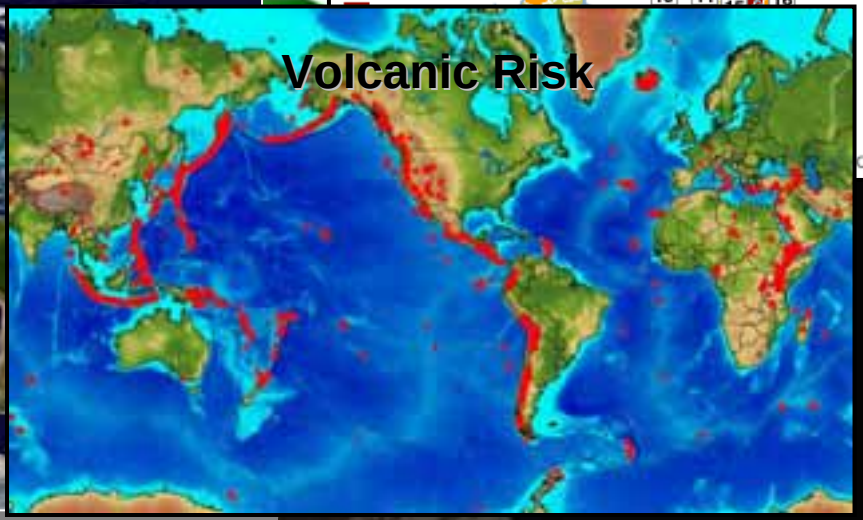
Regions of Need





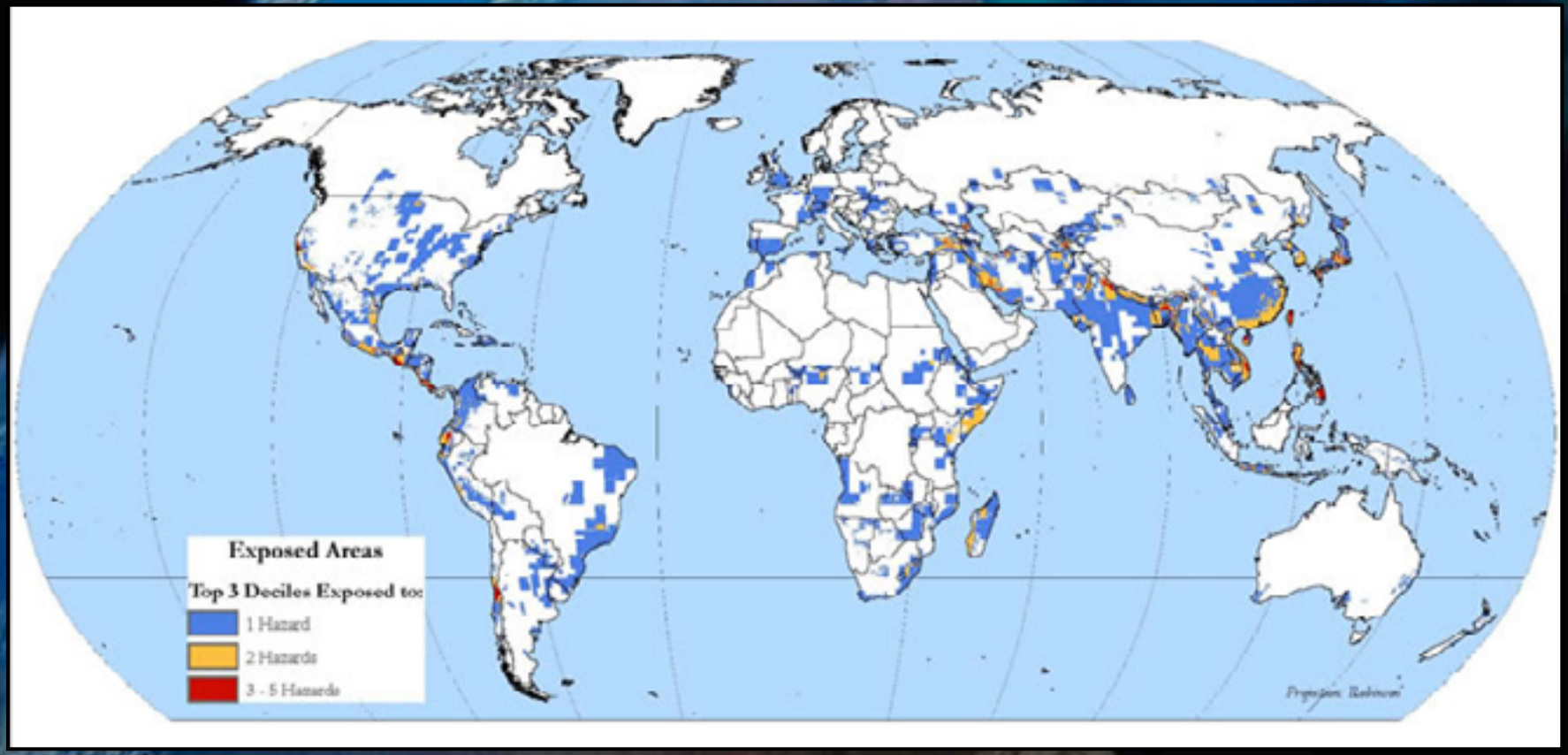






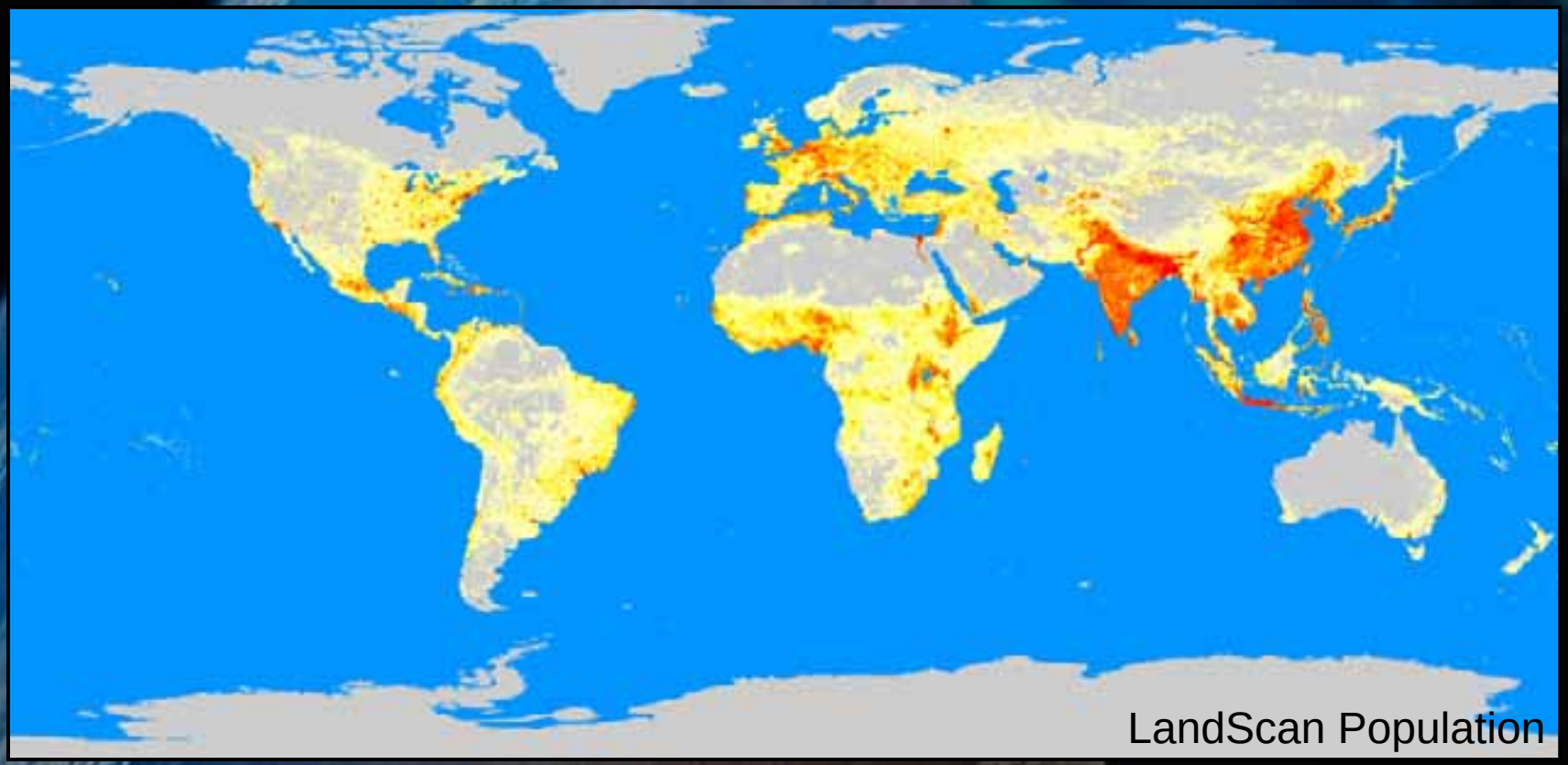
Aggregate the Threat

- Develop a model to identify the key regions of the world most at threat based on the key risks



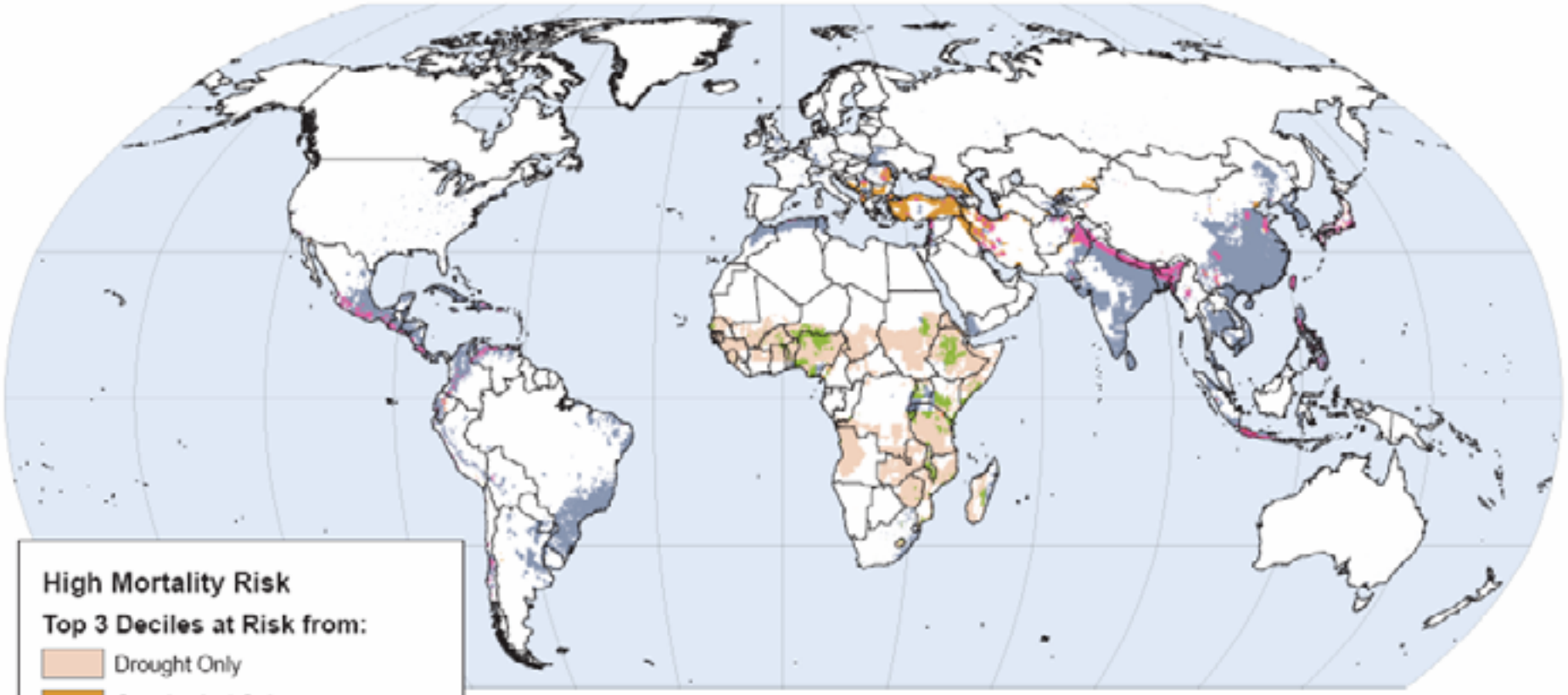
Aggregate Multi-Hazard Exposure

- Weight the results by regions with greatest population density/developed infrastructure



Global Distribution of Highest Risk Disaster Hotspots by Hazard Type

Mortality Risks



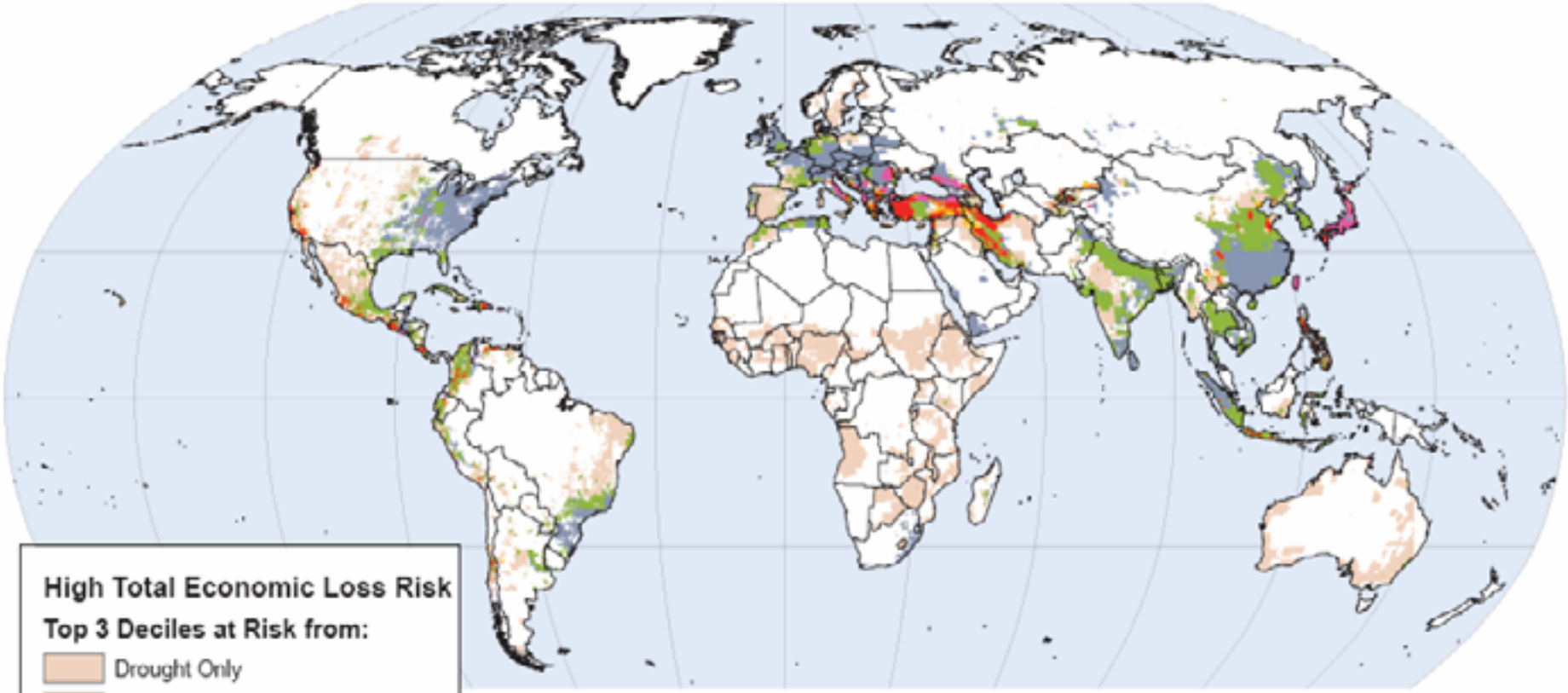
Center for Hazards and Risk Research
The Earth Institute at Columbia University
www.ldeo.columbia.edu/chrr/research/hotspots

Note: Geophysical hazards include earthquakes and volcanoes;
hydrological hazards include floods, cyclones, and landslides.

Source: Figure 1.2a. *Natural Disaster Hotspots - A Global Risk Analysis*

Global Distribution of Highest Risk Disaster Hotspots by Hazard Type

Total Economic Loss Risks



High Total Economic Loss Risk

Top 3 Deciles at Risk from:

- Drought Only
- Geophysical Only
- Hydro Only
- Drought and Hydro
- Geophysical and Hydro
- Drought and Geophysical
- Drought, Hydro and Geophysical

But, $14 Billion in New Orleans is not $14 Billion in Haiti

Center for Hazards and Risk Research
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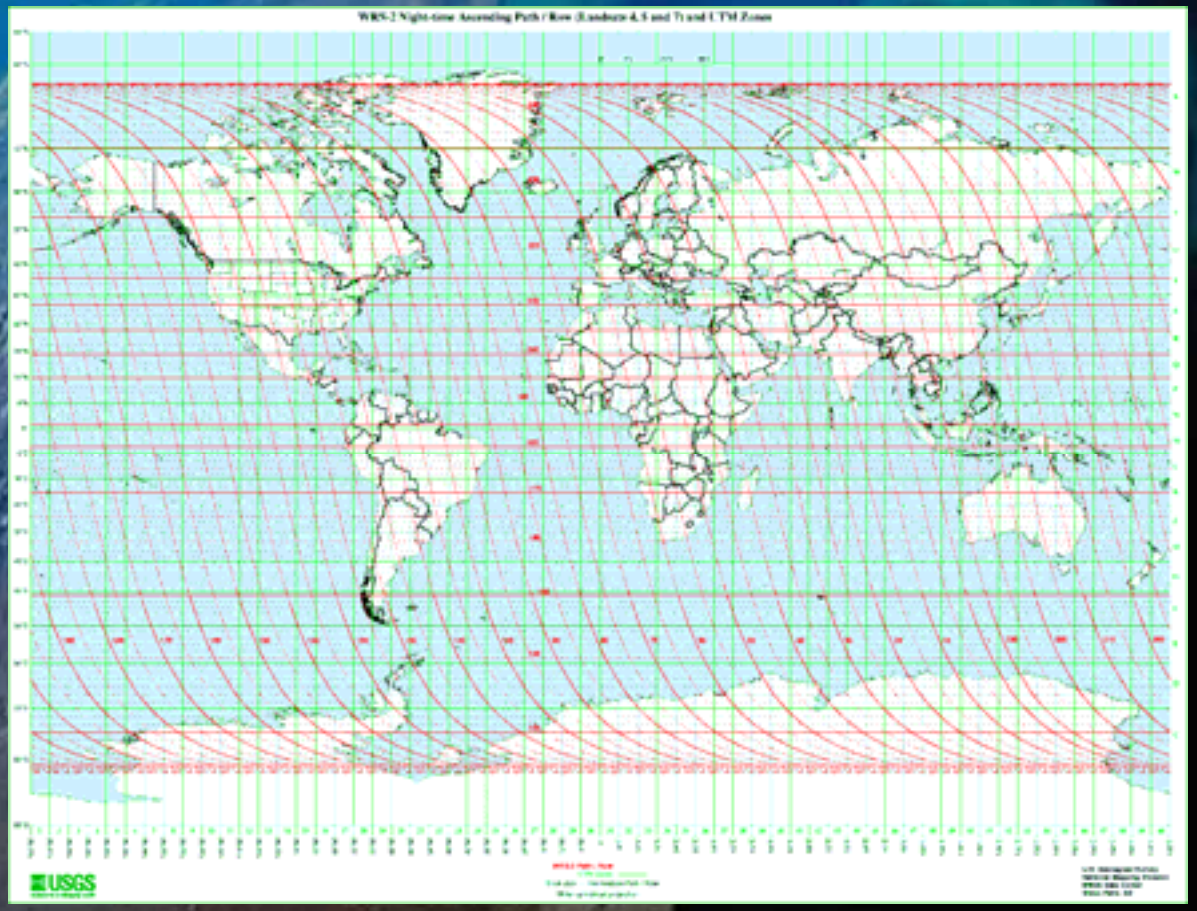
www.ldeo.columbia.edu/chrr/research/hotspots

Note: Geophysical hazards include earthquakes and volcanoes; hydrological hazards include floods, cyclones, and landslides.

Source: Figure 1.2b. *Natural Disaster Hotspots - A Global Risk Analysis*

Identify Global Data Holdings

- 1:1M scale
- 1:250,000
- 1:100,000
- Urban areas?
  - 1:50k
  - 1:25k



Key Datasets

- Background Data
- Situational Data
- Operational Data

- Elevation
- Imagery
- Landcover
- Hydrography
- Transportation
- Population
- Population Centers
- Building infrastructure

Perform GAP Analysis

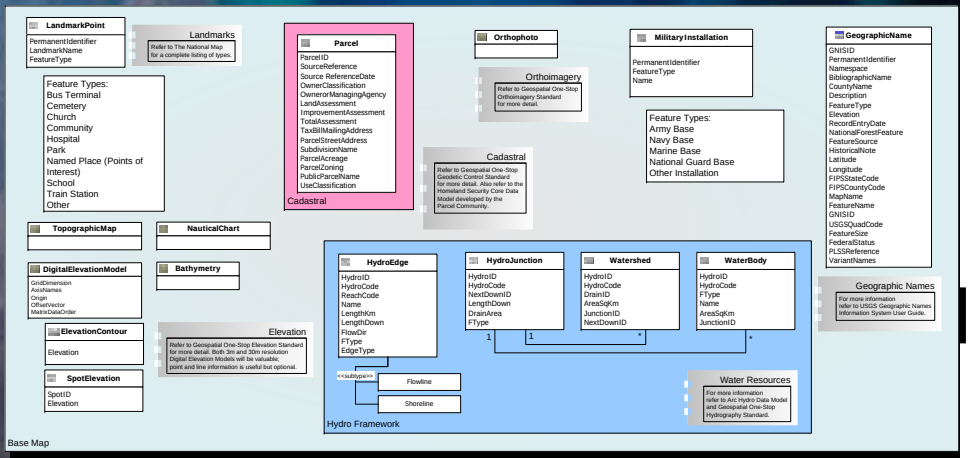
- Take areas of high risk to population
- Compare to areas of available data
- Identify “Gaps” in data at the requisite scales.

Focus on regions of greatest need and least availability

Database Models

- Provide a standard content and structure to data holdings

- Focus on critical datasets
  - Then expand
- Focus on critical regions
  - Then expand
- Focus on available scales
  - Then improve
- Allow cross-border integration
- Standard interface for tool development



Start with the Basemap DB Model

Add EM and HU relevant elements

Develop Tools For Rapid Response

- GIS goes in with first responders

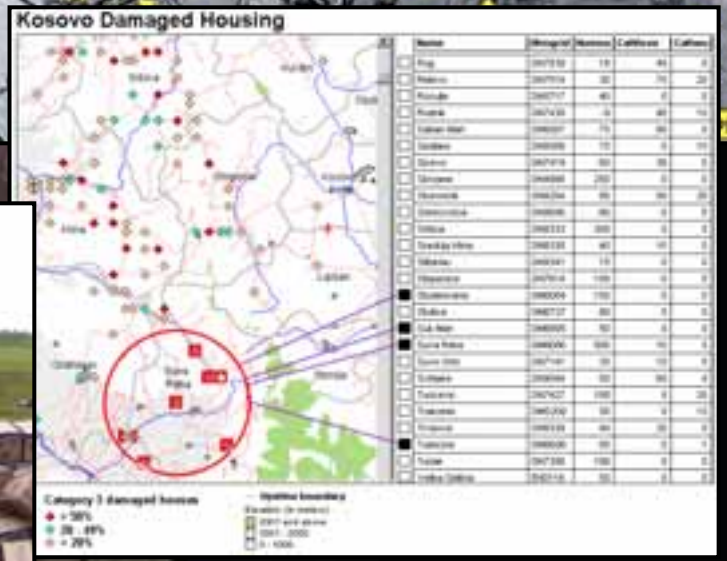
Develop Tools For Rapid Response

Cloud
Computing

Inform and Coordinate Response Process

- Food
- Shelter
- Medical attention

- Standard tools
- Developed from standard datasets
- Providing services

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The GSDI Association is an inclusive organization of organizations, agencies, firms, and individuals from around the world. The purpose of the organization is to promote international cooperation and collaboration in support of local, national and international spatial data infrastructure developments that will allow nations to better address social, economic, and environmental issues of pressing importance.
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What do we need?

- The Humanitarian Spatial Data Infrastructure

- Database models for Framework data
- Established functions and services
  - Standard, Automated tools for crisis management and response
  - Damage assessments
  - HU needs assessment
  - Coordination and application of responding organizations and resources
- Develop the Process of Response with GIS
- Ready to go datasets for areas of highest risk
- Rapid infrastructure deployment
  - WIMAX, Datasets, Handhelds etc.

Towards an HSDI

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