A Disaster Information System for Resilient Communities

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How is Disaster Information working for Disaster Risk Mitigation and Reduction?

Issues identified from Debris Flow in Shiaolin after Morakot

Issue of Data/Information Uncertainty

Strategy applied to reduce the uncertainty
During Typhoon Morakot, Shiaolin Village was almost vanished and the disaster claimed the life of near 500 people. There were 11 villages need to be relocated after the typhoon.

1. Mountain area in Taiwan is debris flows prone area.
2. Relocation has been an issue for county/city governments.
3. Relocation is difficult and complicated in post-disaster reconstruction.
4. Although each relocation project has its own story, normative procedures is still required.
Strategy for Relocation

- Identifying disaster prone area of Taiwan

Framework for identifying high disaster risk area
Stratrgy for Relocation

- Assessing land safety and its suitability for high disaster risk village relocation

Factors Affecting Planning and Implementation of Relocation Projects
- legality in procedures,
- Safe security in location,
- feasibility in finance,

Maps of Land Regulations and ownerships

Factors Affecting the Well-Being of Surviving Disaster Victims
- identity of society/culture preserved
- opportunity for economic development
- willingness to cooperation

Accessibility was used to measure the well-being factors
## Maps Data for Identifying High Disaster Risk Area

<table>
<thead>
<tr>
<th>Disaster</th>
<th>Maps</th>
<th>Authority</th>
<th>Meta Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debris flow susceptible River</td>
<td>Authority File</td>
<td>Soil and Water Conservation Bureau</td>
<td>Shp Line 2003/12</td>
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<td>Debris Flow</td>
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</tr>
<tr>
<td>Impact area of Debris flow rivers</td>
<td>Authority File</td>
<td>the Central Geological Survey MOEA</td>
<td>Shp Polygon 2004</td>
</tr>
<tr>
<td>Landslide</td>
<td>Authority File</td>
<td>NCDR</td>
<td>Tif Raster Grid 1999-2001年</td>
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<tr>
<td>Flooding</td>
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</tbody>
</table>
Most vulnerable county to debris flow disaster are the county of NanTou, Chiayi, Taichung and Tainan. The area exposed to the disaster are 212.8 Km$^2$、156.83 Km$^2$、72.79 Km$^2$、64.56 Km$^2$ accordingly．
High Debris-flow risk villages
Location assessment for relocation

Factors Affecting Planning and Implementation of Relocation Projects

- Location within village, away from disaster
- Location within neighbor villages, away from disaster
Location assessment for relocation

Factors Affecting the Well-Being of Surviving Disaster Victims
Disaster Susceptibility examination over Google Earth

- Debris Flows
- Flooding Prone Area
- Landslide Prone Area
Land ownership examination over Google Earth
Topographic Examination over Google Earth

2D vs. 3D Visualizations

Surface vs. Current Land-Use Comparison
The procedure very depended on official disaster information systems, which are typically lack community level information.

- What kinds of disaster information are required in the community level?
- How will they be able to collected?
- How those information can be synthesized?
Issue of Data Uncertainty

• Scale: The resolution accuracy may not fit the need for communities
• Up-to-date: short of data maintenance
• Missing or not available
• Redundancy
• Inconsistency in terms of time, purposes, zone scheme etc.
Issue of Information Uncertainty

Risk_25

The graph shows a significant increase in Risk_25 over a period from 1 to 701. The y-axis represents the risk values, ranging from 0 to 40,000,000,000, while the x-axis represents time from 1 to 701.
Classification, ranking and more classification and ranking, the difference between places is smoothed.

Uncertainty is within the processing of data aggregation and we may not really realize its existence, especially when issues are cross-disciplines.
Uncertainty Issues in Strategies for Disaster Mitigation/Reduction

DTM -> Catchment Area -> Flooding Area
Reduce the uncertainty of disaster information to strength community resilience

- Rich in data, Poor in information
- Information for who, who is the user? When and how do they get access to it?.
- Information need to be interpreted to be understood
- Information synthesis is even more important than Information Generation
- Information must be easy to be understood for local communities
Question need to be Rethinking/discussing

- Stick with the approach of Disaster data rich?
- Do those disaster information telling right stories?
- What disaster information should be customized for users of communities?
- How to make sense of disaster data/information for people need it?
- What IT can do in contributing to those issues, such as the strength of internet society?
- Any other innovation ideas
Strategy applied to reduce the uncertainty - Field Survey

Interview for historical disaster experiences, observation of community changes both in physical environment and social environment.
Strategy applied to reduce the uncertainty in Field Survey

Picturing evidences of disaster stroke, and potential factors of disaster susceptibility
IT Framework for a Disaster Resilient Community

- Generate Information for Decisions of Risk Management
- DB
- Information Delivery
- Potential users/Institutions
- NCDR/NGIS
- APP.
- Servers
- DB Servers
- Service Servers
- Low uncertainty Data
- Explore the characteristic of the uncertainty
- Measure the uncertainty
- Reduce the uncertainty
- Efficient of uncertainty reduction
- Project DB
- Community Safety
- Community recovery
- Historical disaster records
- Position disaster damage
- Community recovery
- Application of OpenISDM
- Community resilience Website
- A web-GIS Platform for community participation, by which framework is set and data circulation is establish
- Sahana
- API Library
- DB
- User 1
- User 2
- User 3
- User n
Framework so far

- Explore the characteristic of the uncertainty
- Measure the uncertainty
- Reduce the uncertainty
- Efficient of uncertainty reduction

Project DB

Community resilience Website

A web-GIS Platform for community participation, by which framework is set and data circulation is establish

Community Sectoes’ Open Data

Public Sectoes’ Open Data
Proto-Models: collect and report community level disaster information
Proto-Models: collect and report community level disaster information
Remote Target Positioning Application
Proto-Models: community participation

Taiwan
- Taipei
- Tainan
  - NCKU
  - Station
- Day
- New

Taipei-Night

Tainan-Day

Taiwan-Earthquake
An earthquake (also known as a quake, tremor or temblor) is the result of a sudden release of energy in the Earth’s crust that creates seismic waves. The seismicity, seismism or seismic activity of an area refers to the frequency, type and....
Proto-Models: data and information synthesis
Illustration of the Interface for information syntheses
Thanks and Questions Welcome