

# DEVELOPMENT OF AN INTEGRATED WEB-BASED PLATFORM FOR ANALYSIS OF CHANGES

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**Zar Chi Aye (ESR-09)**

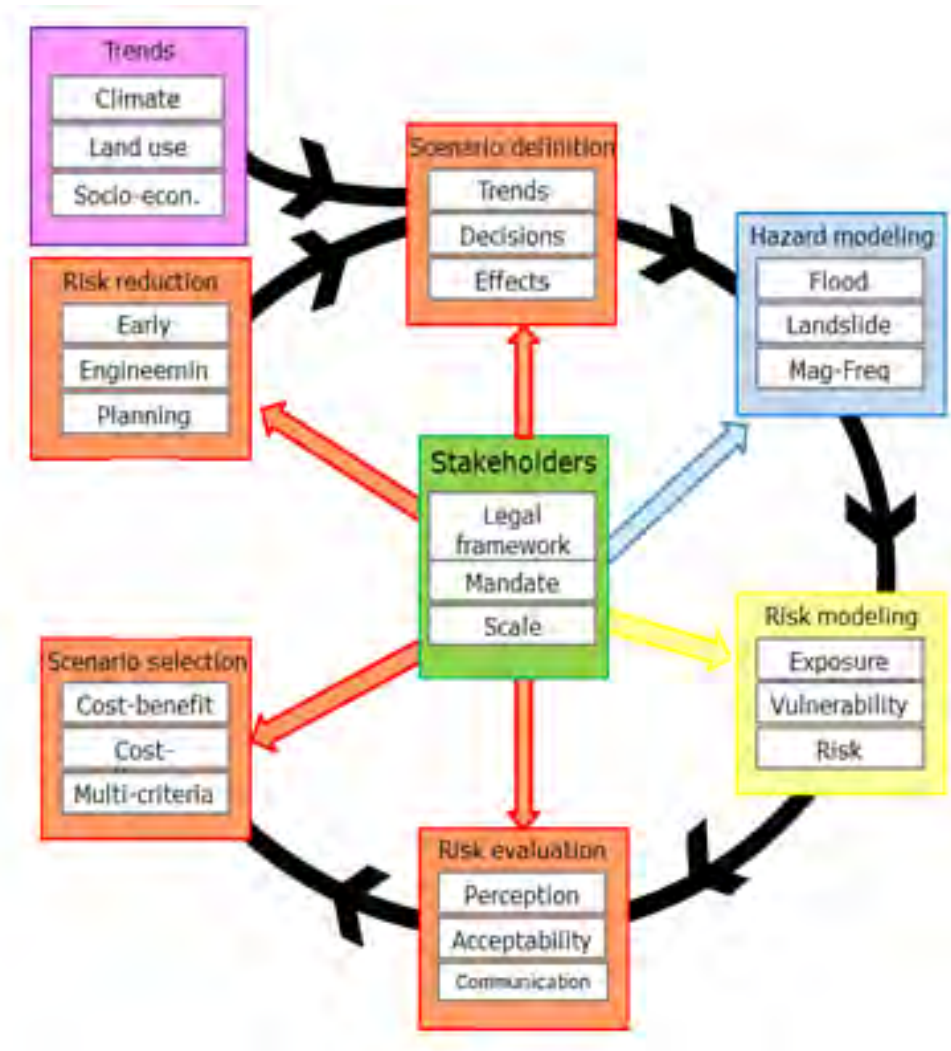
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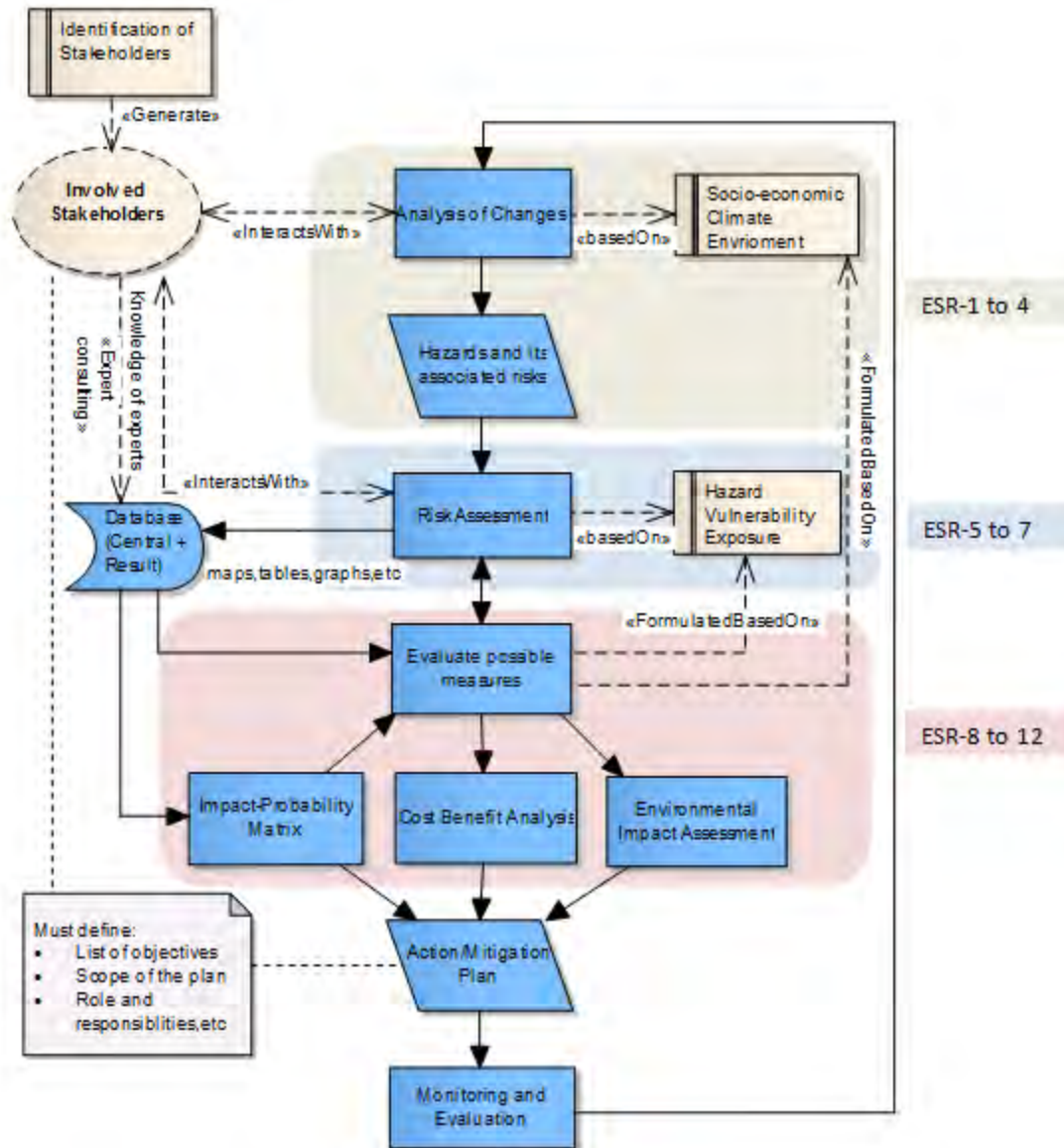


# Introduction



Source: CHANGES mid-term report (2012)

# Workflow of the integrated web platform



# Main Components

- Risk Assessment
- Risk Management
- Risk Communication

# RISK ASSESSMENT

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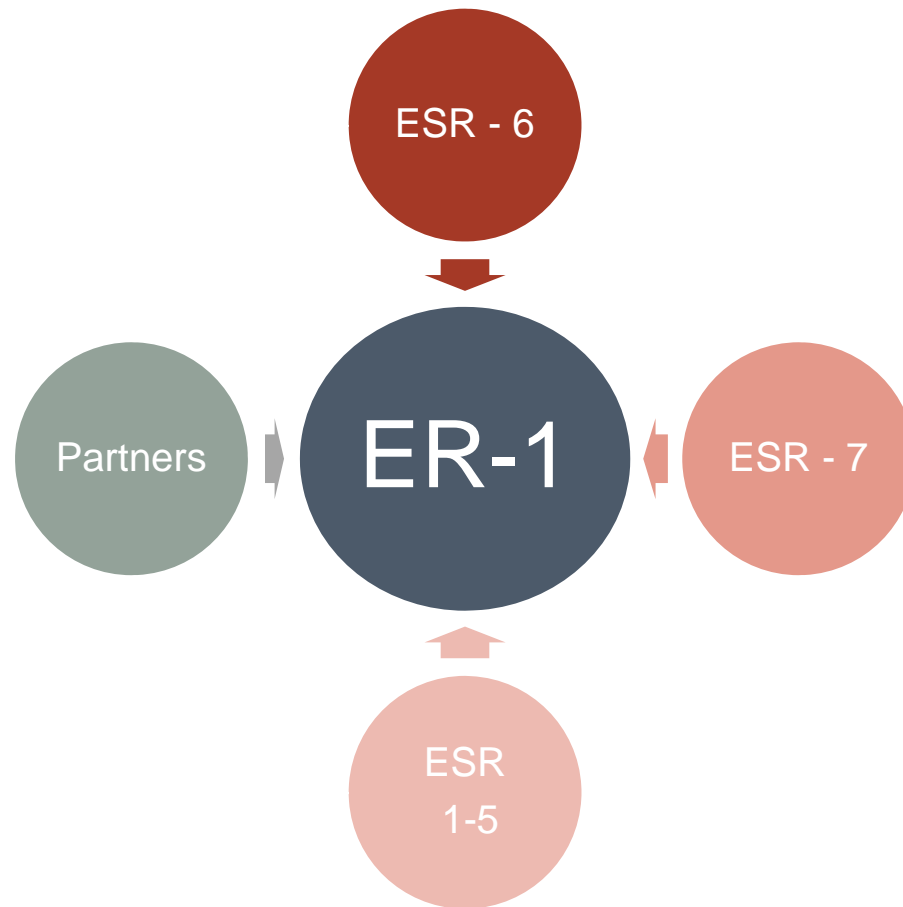
# 1) Risk Assessment

- A web-based tool of PRA with a multi-hazard Spatial Data Infrastructure
  - Conceptual design of the framework
  - Functional requirements
    - Analysis of changes
      - Climate
      - Land use
      - Socio-economic
    - Produce risk scenarios
    - Adaptability
    - ....

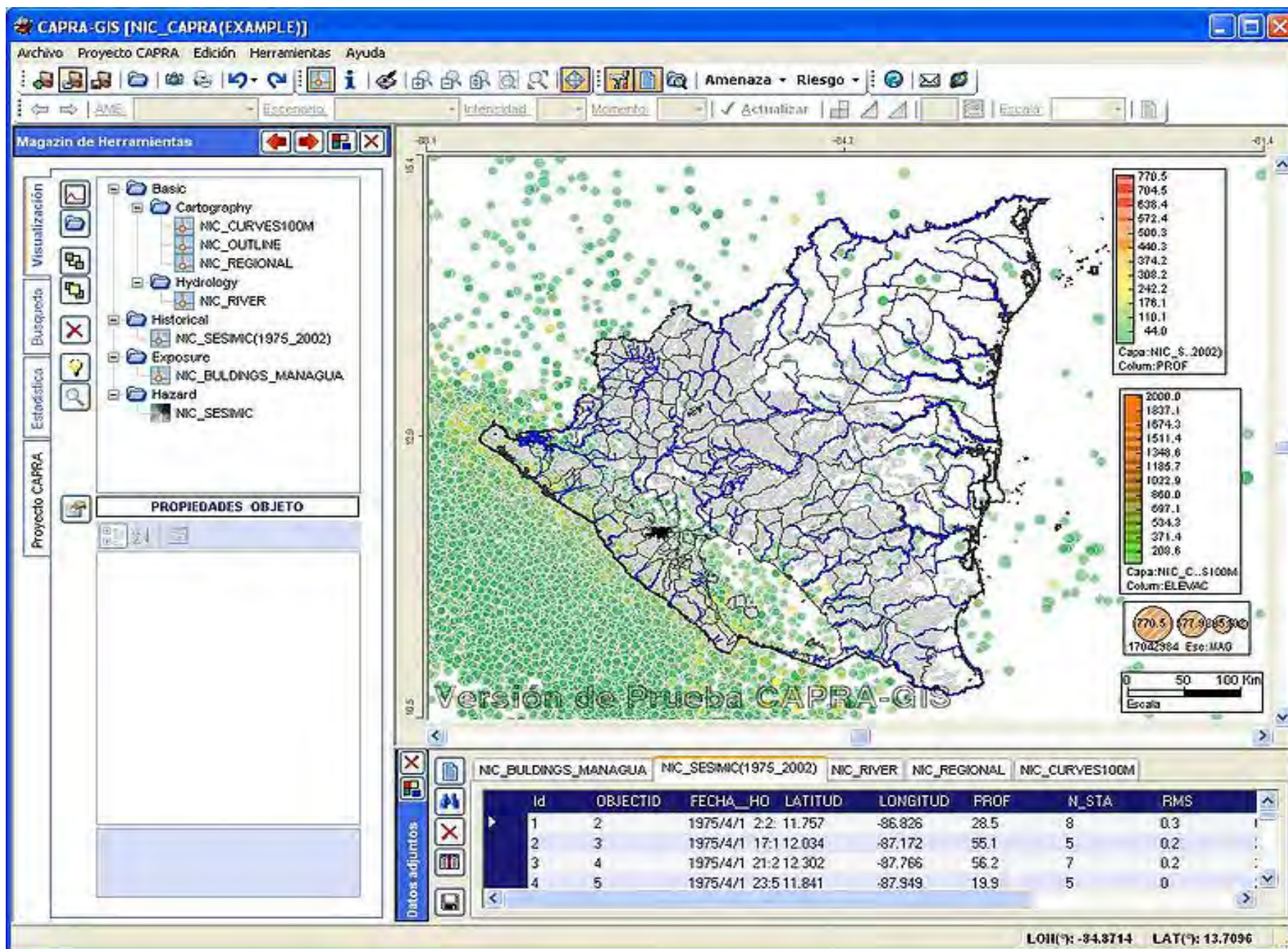
# 1) Risk Assessment

- Input-output
  - Data standardization
  - Scale
  - Parameters
  - Relationships
  - ....
- Visual interface representation
- Open source s/w and tools

# 1) Risk Assessment



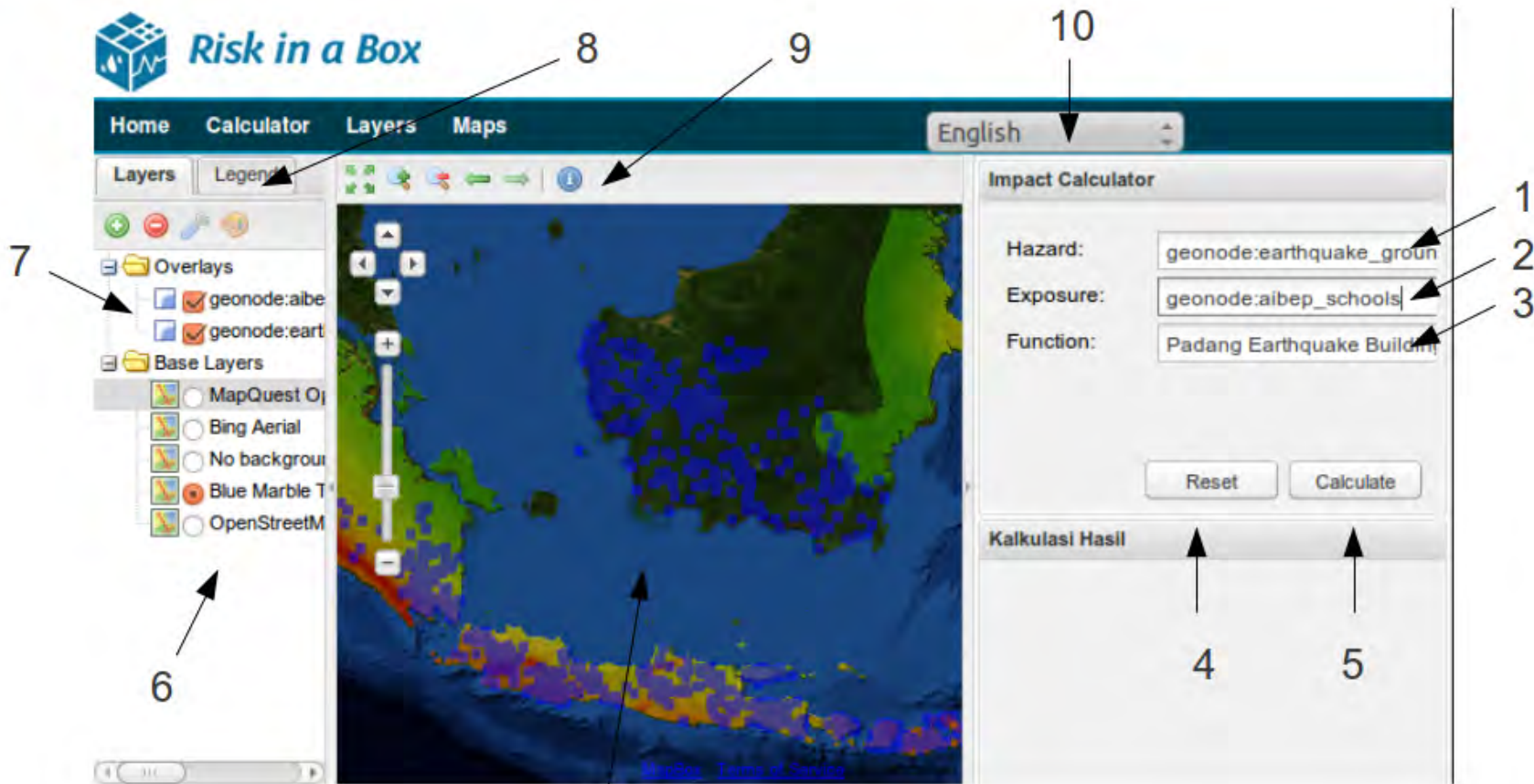






- Extended on GeoNode
- A web based tool that models impacts of different hazard events on population or infrastructure
- Provides modules for risk calculations with plugin management using Python
- Limitations:
  - Does not yet run with data loaded locally
  - Hazard layers must be raster
  - Exposure must be raster or point vector
  - Data provided in WGS 84 projection

# Risiko 1.0



Input:

- 1) Hazard and Exposure map
- 2) Plugin for impact calculation

Output:

- 1) Map of calculated impact
- 2) Specific statistics

# Buncombe county – Multi Hazard risk tool

www1.nemac.unca.edu/Renci/MultiHazardRiskTool/bunc\_hazard\_tool\_public.html

**Buncombe County Multi-Hazard Risk Tool**

Basemap: Topo Map | Theme: Flood | Map Zoom: Woodfin | Reports: Parcel Value Risk Report | Run

**Parcel Value for Floods for Woodfin**

DRAFT - Do not use numbers for any official capacity. Adjusted Value Factor: 1.25 | Excel Export

Floodway	100 Year Floodplain	500 Year Floodplain	Information
<b>Agricultural</b>	<b>Adjusted Value</b>	<b>Total Value</b>	<b>Land Value</b>
Occupied	\$0.00	\$0.00	\$0.00
Vacant	\$233,750.00	\$187,000.00	\$185,700.00
<b>Total</b>	<b>\$233,750.00</b>	<b>\$187,000.00</b>	<b>\$185,700.00</b>
<b>Commercial</b>	<b>Adjusted Value</b>	<b>Total Value</b>	<b>Land Value</b>
Occupied	\$19,296,375	\$15,437,100.00	\$7,680,200.00
Vacant	\$1,490,500	\$1,192,400.00	\$1,188,300.00
<b>Total</b>	<b>\$20,786,875.00</b>	<b>\$16,629,500.00</b>	<b>\$8,868,500.00</b>
<b>Industrial</b>	<b>Adjusted Value</b>	<b>Total Value</b>	<b>Land Value</b>
Occupied	\$5,331,250.00	\$4,265,000.00	\$1,274,100.00
Vacant	\$0.00	\$0.00	\$0.00
<b>Total</b>	<b>\$5,331,250.00</b>	<b>\$4,265,000.00</b>	<b>\$1,274,100.00</b>
<b>Residential</b>	<b>Adjusted Value</b>	<b>Total Value</b>	<b>Land Value</b>
Occupied	\$1,929,750.00	\$1,543,800.00	\$765,800.00
Vacant	\$398,250.00	\$318,600.00	\$285,400.00
<b>Total</b>	<b>\$2,328,000.00</b>	<b>\$1,862,400.00</b>	<b>\$1,051,200.00</b>
<b>Other</b>	<b>Adjusted Value</b>	<b>Total Value</b>	<b>Land Value</b>
Occupied	\$9,396,875.00	\$7,517,500.00	\$5,576,900.00
Vacant	\$3,944,625.00	\$3,155,700.00	\$3,137,200.00
<b>Total</b>	<b>\$13,341,500.00</b>	<b>\$10,673,200.00</b>	<b>\$8,714,100.00</b>
<b>Total</b>	<b>Adjusted Value</b>	<b>Total Value</b>	<b>Land Value</b>
Occupied	\$35,954,250.00	\$28,763,400.00	\$15,297,000.00
Vacant	\$6,067,125.00	\$4,853,700.00	\$4,796,800.00
<b>Total</b>	<b>\$42,021,375.00</b>	<b>\$33,617,100.00</b>	<b>\$20,093,800.00</b>
	<b>Building Value</b>	<b>Improved Value</b>	
	\$7,639,700.00	\$117,200.00	
	\$7,639,700.00	\$121,300.00	
	\$2,984,700.00	\$6,200.00	
	\$2,984,700.00	\$6,200.00	
	\$777,100.00	\$900.00	
	\$777,100.00	\$34,100.00	
	\$1,863,500.00	\$77,100.00	
	\$8,700.00	\$9,800.00	
	\$1,872,200.00	\$86,900.00	
	\$13,265,000.00	\$201,400.00	
	\$8,700.00	\$48,400.00	
	\$13,273,700.00	\$249,800.00	

Map Layers: Frances Highwater Marks, NCFMP Floodway 2007, Parcels in Floodway, NCFMP 100yr Floodplain 2007, Parcels in 100yr Floodplain, NCFMP 500yr Floodplain 2007, Parcels in 500yr Floodplain

Map Tools: Legend, Interstates, Major Roads, Major Streams, City Limits Outlines, Asheville, Biltmore Forest, Black Mountain, Montreat, Weaverville, Woodfin, NCFMP Floodway 2007, NCFMP 100yr Floodplain 2007, Print Map, Export Map to JPG, Find Parcels, Calculate Drive Times

Lat/Long is: 35.600534 / -82.685508

## Tools applied

- ArcGIS server serves map layers
  - ArcGIS server API for JavaScript and Dojo
  - ArcGIS server API for Flex (Adobe flex builder)
- ArcSDE database
- Model Builder and Python for spatial queries
- ColdFusion to generate property value reports

# RISK MANAGEMENT

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## 2) Risk Management

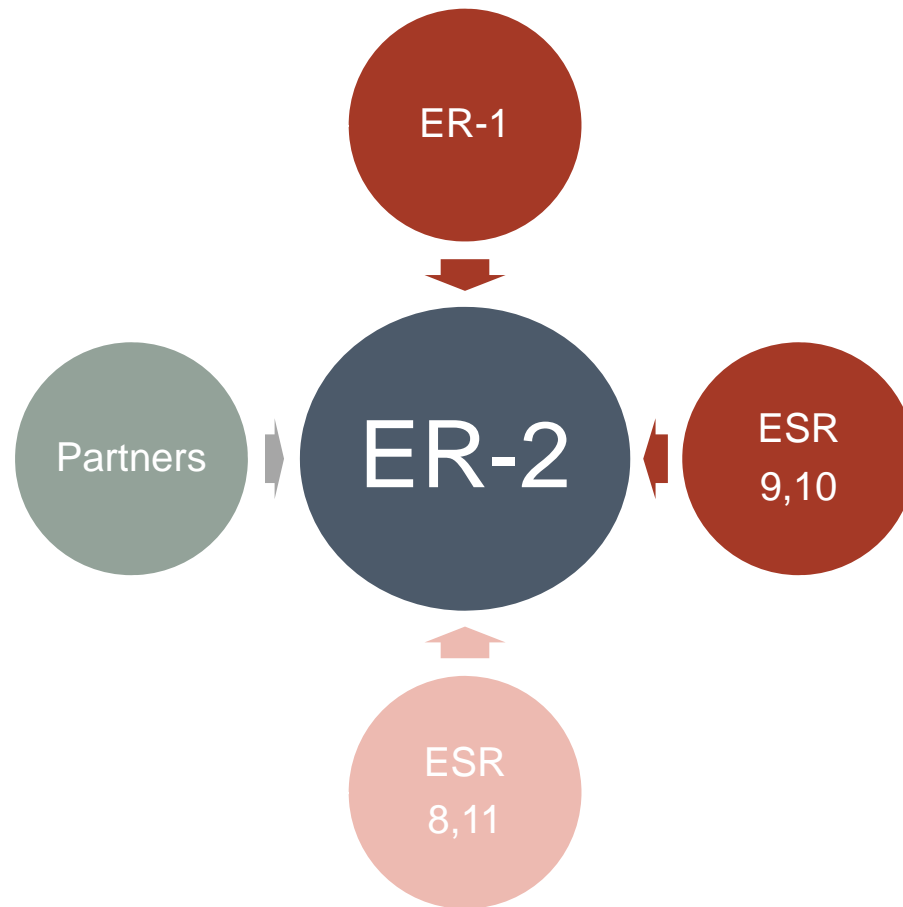
- A web-based DSS for risk reduction
  - Conceptual design of the framework
  - Functional requirements
    - Analysis of changes
      - PRA tool
    - Formulate risk reduction scenarios
      - Structural and non-structural measures
        - Mitigation measures
        - Spatial planning
        - Emergency preparedness and responses, EWS, ..
    - Selection of scenarios
    - CBA, MCE,...

## 2) Risk Management

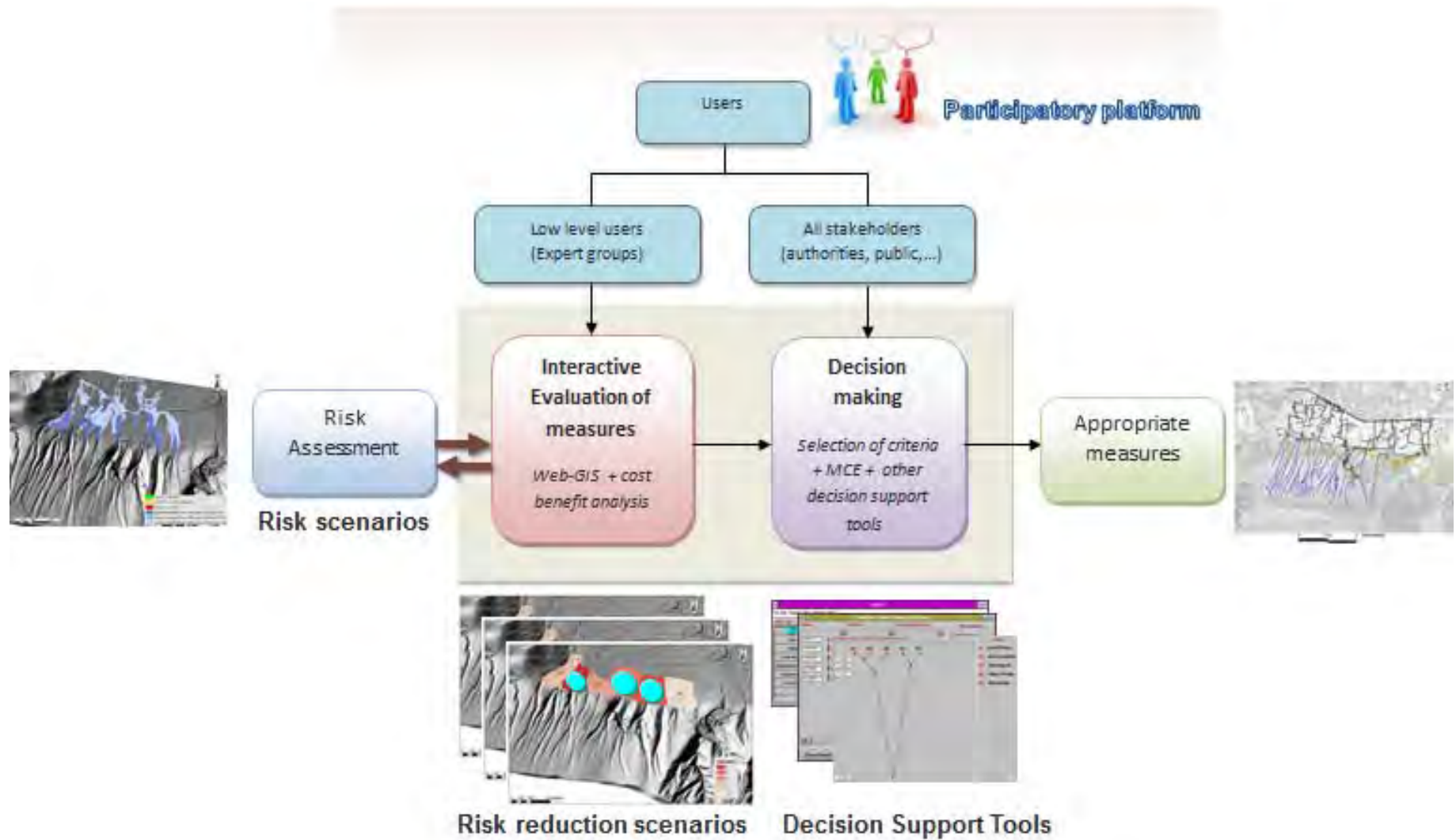
- Input-output
  - Parameters linking to PRA tool
  - Criteria and Preferences of stakeholders
  - Risk reduction scenarios
  - ....
- Visual interface representation
- Open source s/w and tools



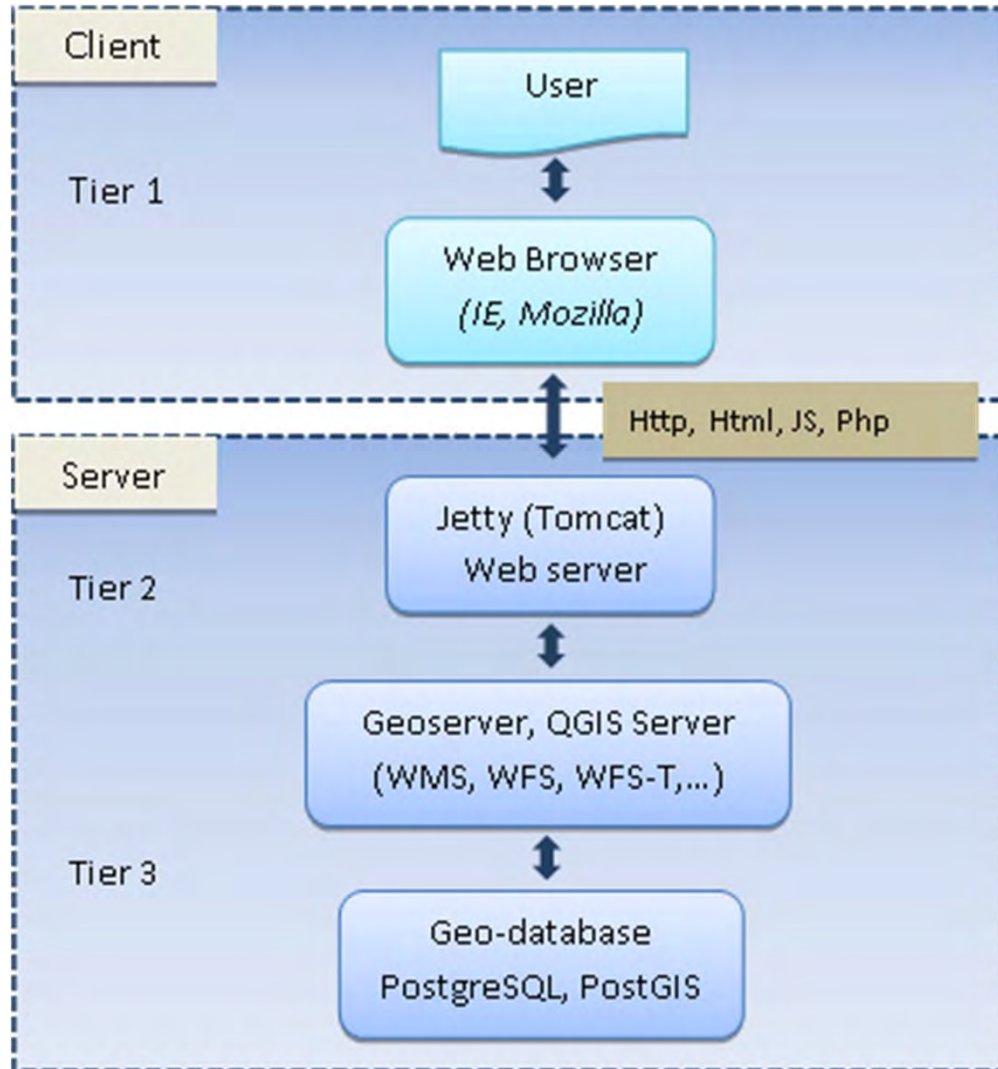
## 2) Risk Management



# Workflow of web-DSS



# Three-tier architecture



The screenshot displays a web browser window with a GIS application. The browser's address bar shows 'localhost:9080'. The application interface includes a 'Layers' panel on the left with 'test\_propa2\_CopyRaster' selected, a 'Map' area showing a satellite view with a blue polygon overlay, and a 'Legend' panel. A data table is visible at the bottom of the map area.

Name	Value
objectid	
text	
feature	
featureid	
shape_leng	
shape_area	

Map data ©2012 Google Imagery ©2012 Cnes/Spot Image, DigitalGlobe, GeoEye - Terms of Use

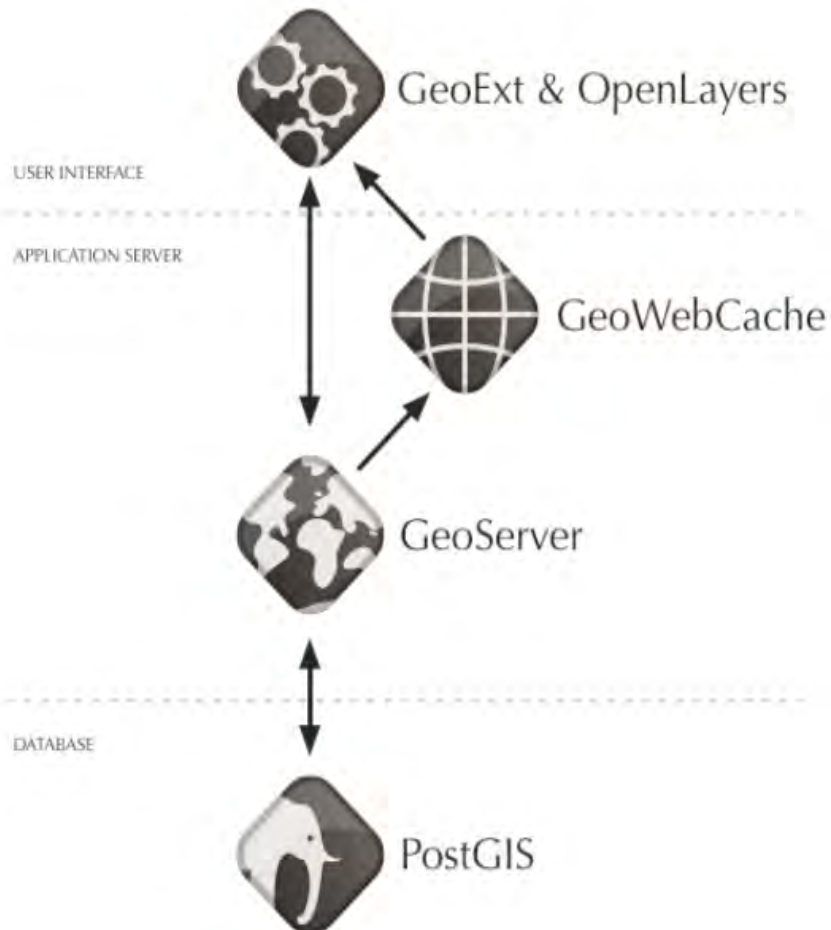
localhost:9080/# Display on map Query

## GIS functionalities

- Styling
- Querying/Editing



# OPENGEO



- A complete web mapping platform
- Available in two versions:
  - Fully supported OpenGeo Suite Enterprise Edition
  - Freely available (unsupported) OpenGeo Suite Community Edition
- <http://opengeo.org/>

- **Study Site:** Implemented in the Friuli –Venezia-Giulia
- **Target user:** Local municipalities
- **Main functionalities:** Tools to create the emergency plans, identify resources and responsables for activities. Share hazard maps available for each community.



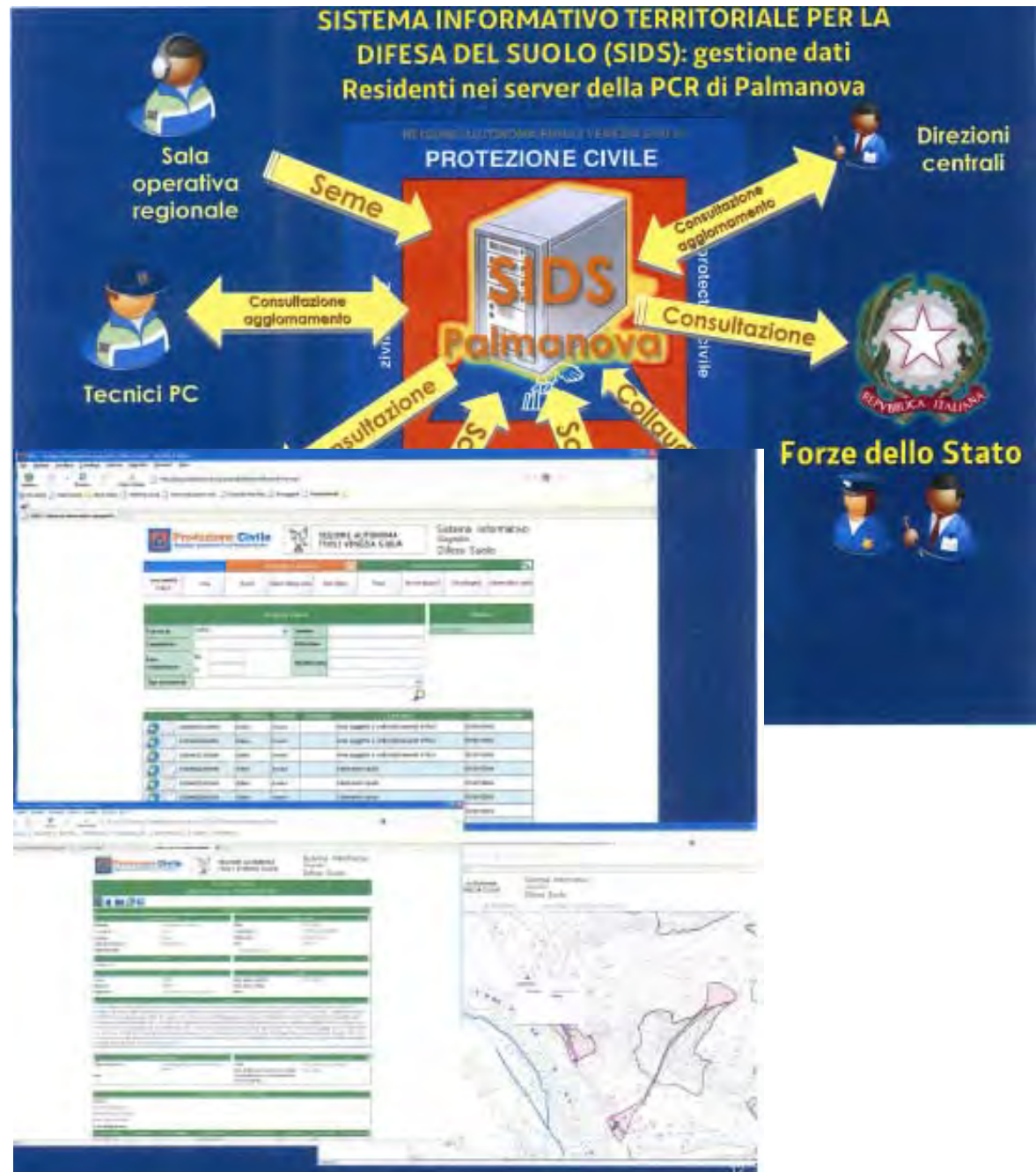
**Protezione Civile**  
Regione Autonoma Friuli Venezia Giulia

Comune di Vivaro  
Piano Regionale delle Emergenze

**1** A - Area di Attesa  
B1 - Area di Ricovero Scoperta (600 posti stimati)  
B2 - Area di Ricovero Coperta  
C - Area di Ammassamento Soccorritori  
D - Elisuperficie  
**2** E - Feno Culturale  
001 - Mulino  
002 - Chiesa di Santa Fosca e Santa Maura  
003 - chiesa San Paolo Apostolo  
004 - chiesa San Rocco  
005 - casa  
006 - Villa Cignoni, Miniscalco, Cristofori  
007 - casa  
008 - casa a schiera  
009 - casa a schiera  
010 - Casa Tommasini  
011 - Chiesa di Santa Maria Assunta  
012 - Anbiquarium  
013 - Scuola materna  
014 - Capitello detto Il gliisut  
015 -

**3** Dettagli

- **Study Site:**  
Implemented in the Friuli –Venezia-Giulia
- **Target user:**  
Regional authorities
- **Main functionalities:**  
Share databases of event documentation, resources and infrastructure in the region. Cross validation of citizen reports.



Web-portal with free access by browser to communicate to the volunteers and students that participate on the activity.

**PLATFORM FOR FIRST LEVEL INSPECTION OF TORRENT CONTROL AND CROSSING STRUCTURES**

**INTRODUCTION**    WHAT ARE THE HAZARDS?    LOCATION OF THE STRUCTURES    WHICH FACTORS TO INSPECT?    BE A VOLUNTEER (LOG-IN)

- Main pannel, content changes with selection of main navigation tabs
- Other interface elements as needed (e.g. google maps, videos, pictures)

REGISTER AND LOG-IN	NOT REGISTER AND LOG-OUT
FREE INTERACTION + INSPECTION SUBMISSION	VIEWER NOT ACCESS INSPECTION MODULE

Web-portal with free access by browser to communicate to the volunteers and students that participate on the activity.

**PLATFORM FOR FIRST LEVEL INSPECTION OF TORRENT CONTROL AND CROSSING STRUCTURES**

INTRO    WHAT ARE THE HAZARDS?    LOCATION OF THE STRUCTURES    WHICH FACTORS TO INSPECT?    BE A VOLUNTEER (LOG-IN)    **FIRST LEVEL INSPECTION**

- Trained Volunteers
- Students

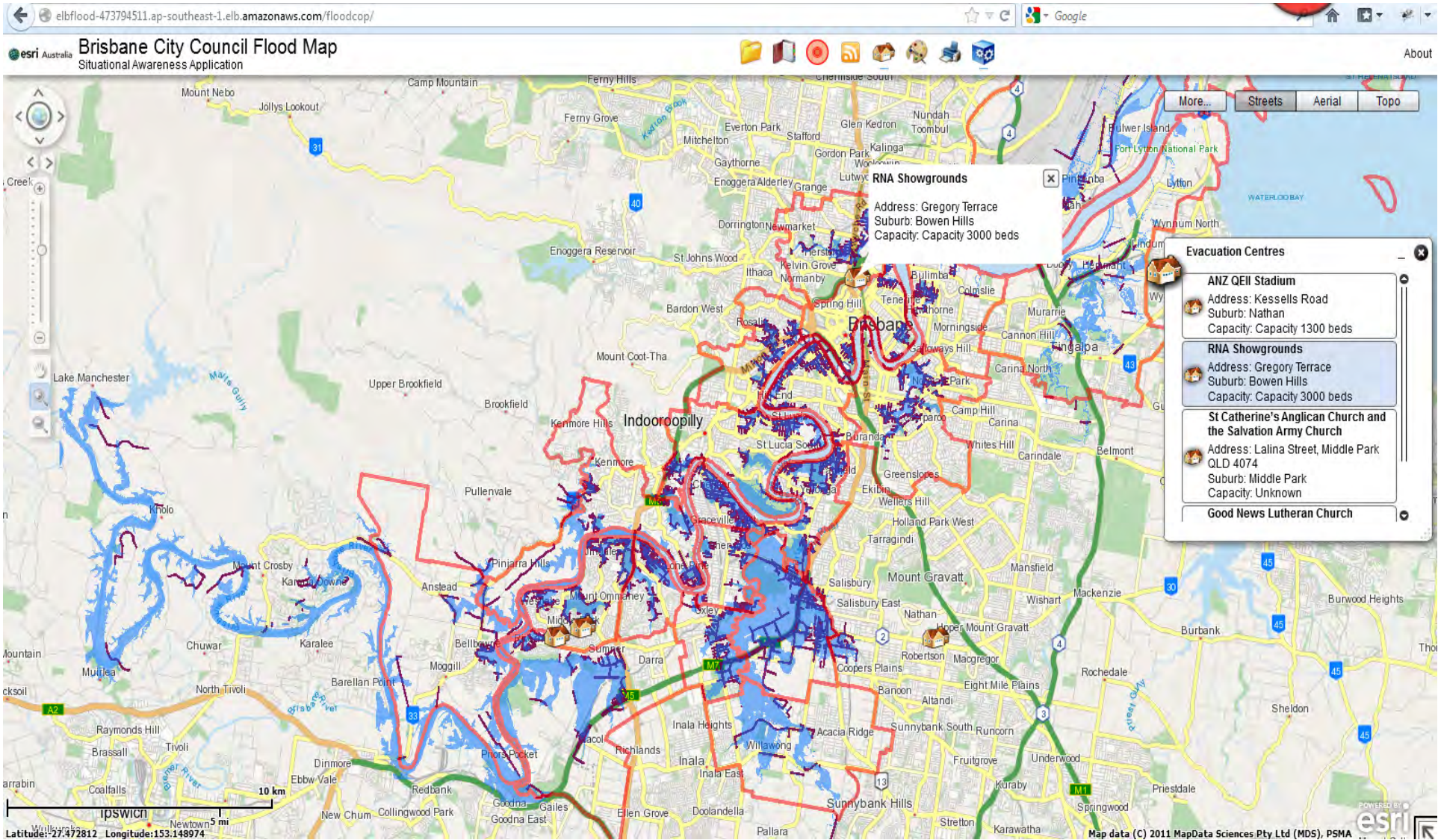


A preliminary example is presented below with the land cover factor.

E) LAND COVER AND PRESENCE OF HUMAN-MADE INFRASTRUCTURE Level of land cover inside a 20m distance from the river bank. *specify type	1) 50m upstream FOTO #: _____			2) 50m downstream FOTO #: _____		
	R.B.	L.B.	Level of use	R.B.	L.B.	Level of use
No land development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> Non-noto (-1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> Non-noto (-1)
Forest and pasture	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Crops/*	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Constructions*	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Shelters/ service infrastructure*	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	





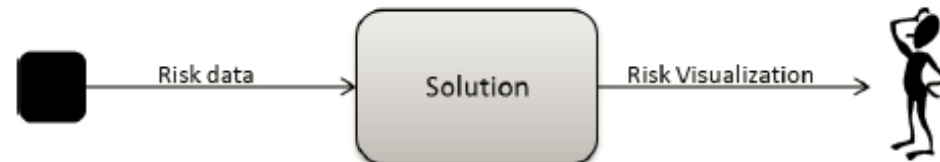


# RISK COMMUNICATION & VISUALIZATION

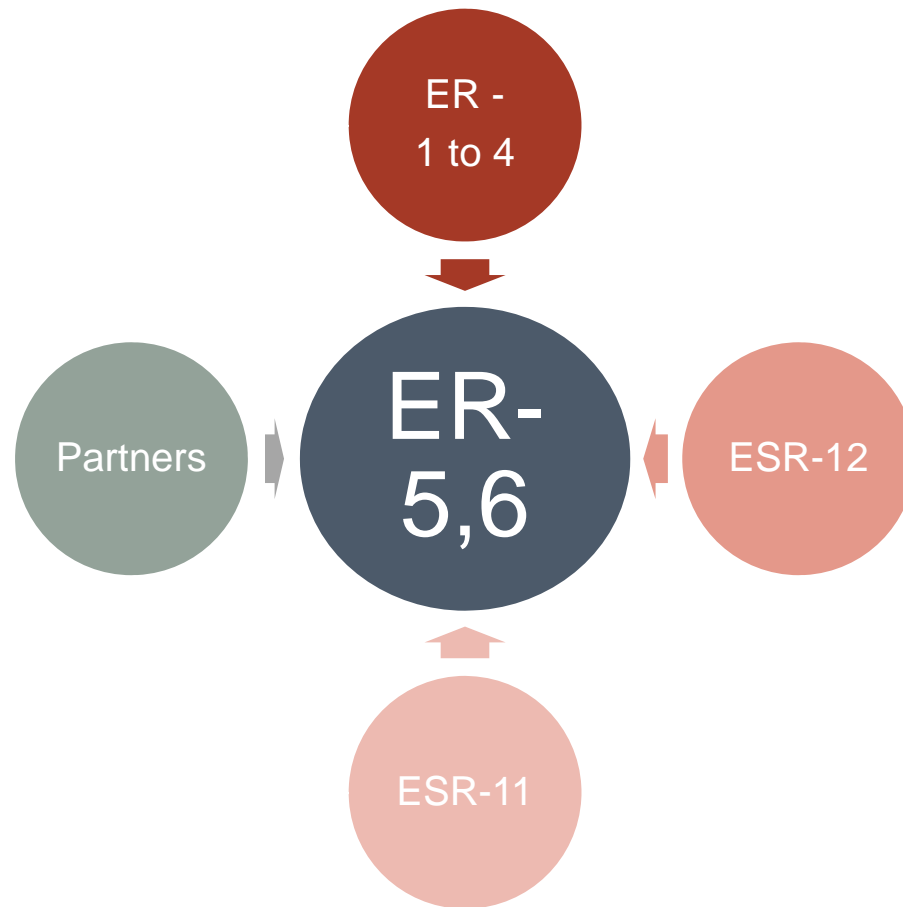
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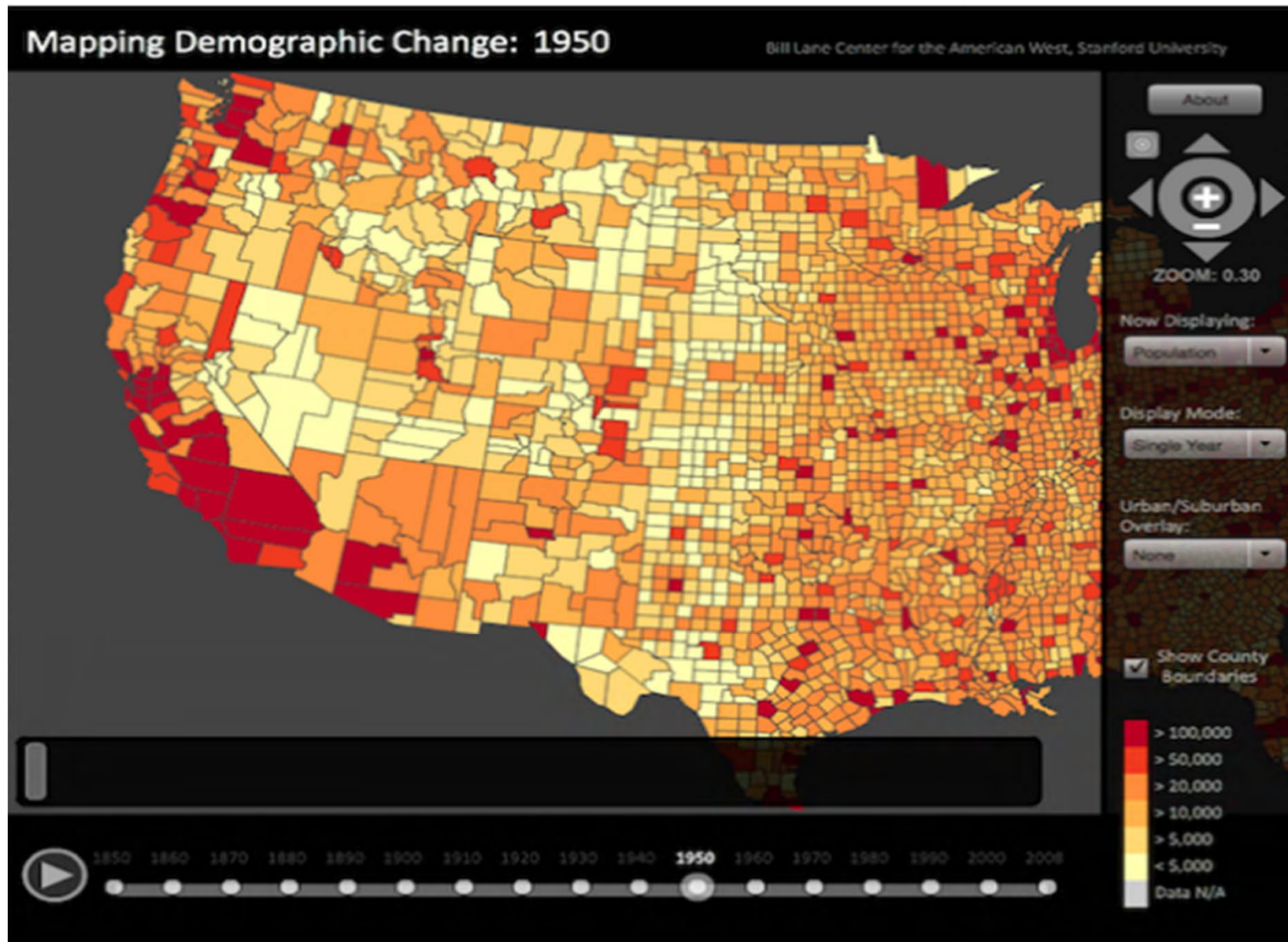
## 3) Risk Communication

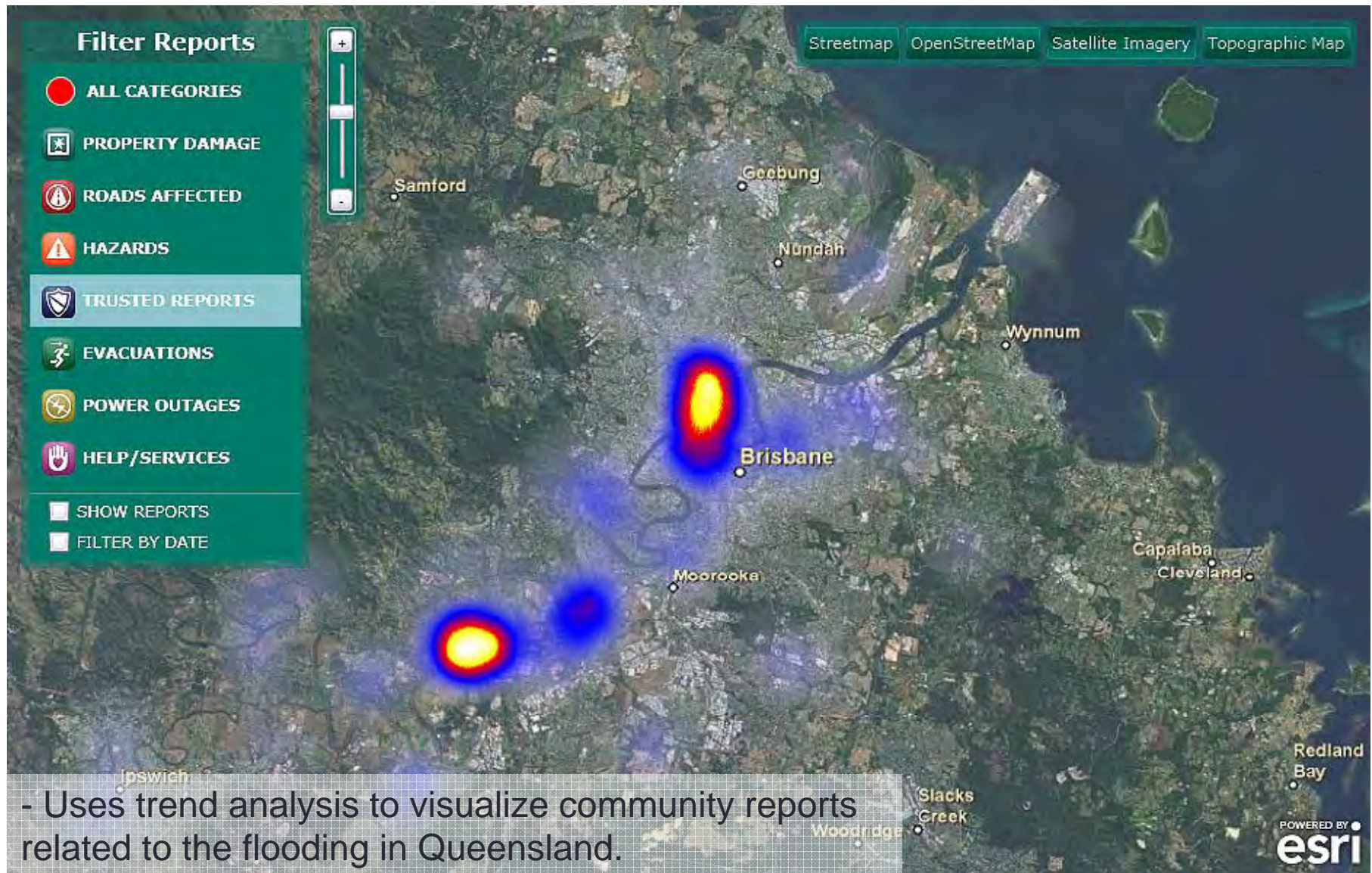
- A web-based tool of risk communication and visualization
  - Conceptual design of the framework
  - Functional requirements
    - Visualization of risks
    - Visualization of changes in time
    - Communication of scenarios to different stakeholders
    - ....
  - Input-output
    - Data Format
    - ....
  - Visual interface representation
  - Tools



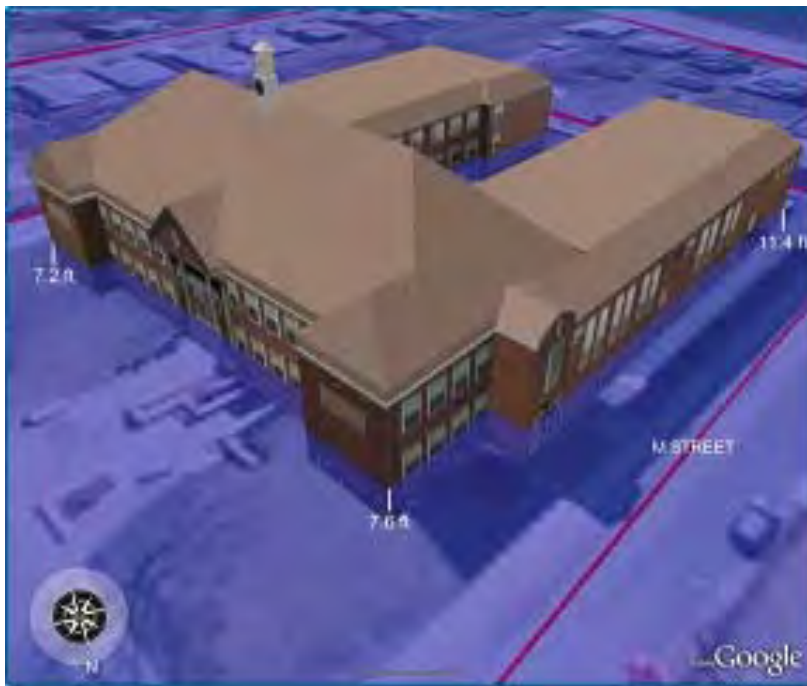
# 3) Risk Communication



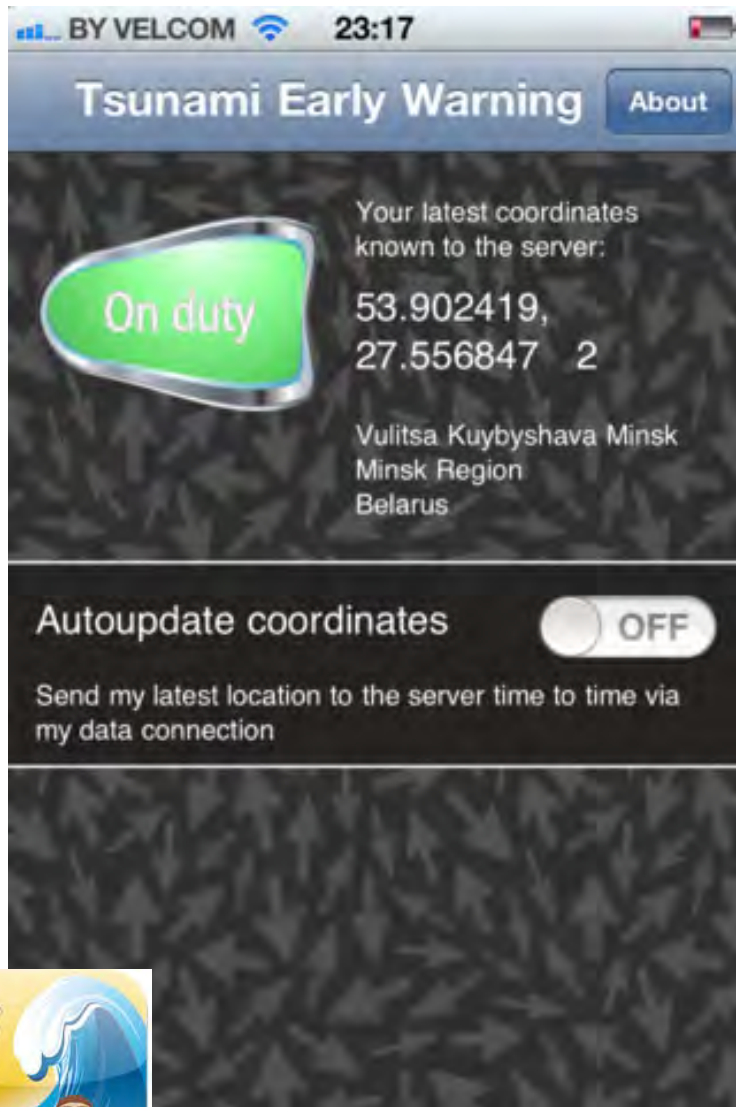




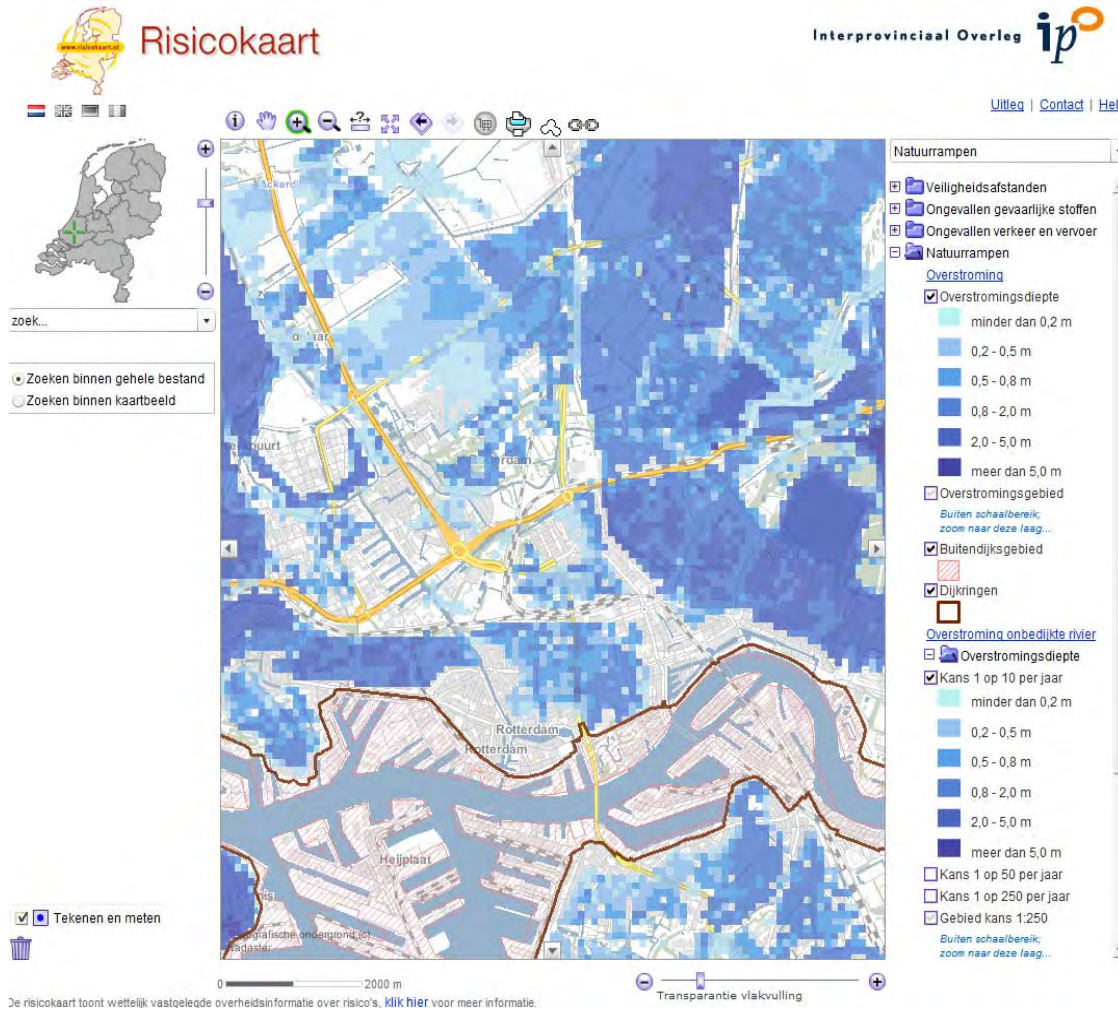
## Tool to visualize inundation scenarios



- generated 3D simulations of sea level rise and flood event inundation
- used LIDAR and survey data to create 3D models of flooding scenarios
- enhances hazard mitigation planning, emergency response, and public awareness through improved flood visualization products







<http://www.risicokaart.nl/>



[www.hochwasserschutz-regensburg.de](http://www.hochwasserschutz-regensburg.de)



Roo Su flood

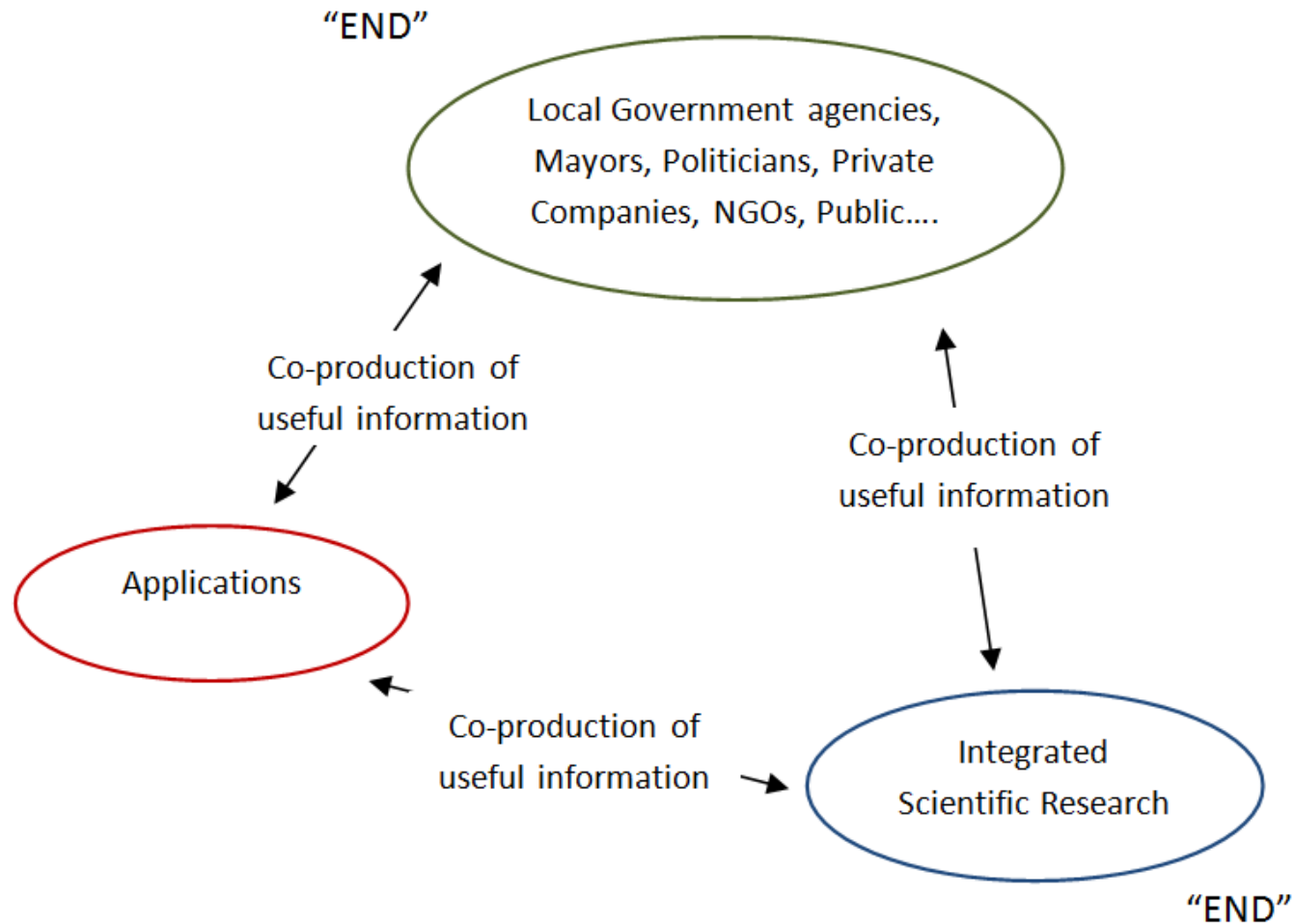
Source: Flood Risk Communication: Visualization Tools and Evaluations of Effectiveness (Marie et al, 2012)

# NEXT STEP

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# Involvement of stakeholders



Source: End-to-end-to-end research (Simplified version of Morss et al, 2005)

# Identification of stakeholders

- Who are the *users*?
- What are their *roles and responsibilities*?
- What are the user *requirements*?
- What is the *legal framework*?
  
- In which *scale* do they work?
- *Communication and exchanges of activities* between stakeholders?
- How can they get *involved* in the process?

# Technical requirements...

- Modular, interoperable open-source architecture
- Thin-client (or) Thick-client application
- Handling of data comes from different sources
- Data validation and standardization
- Geo-processing and running models over the web
- Minimize the processing and response time
- User-friendly platform for non-expert stakeholders
- ....

# Functional requirements.....

- Allowing users to upload data for analysis?
- Data validation procedures?
- Flexibility of the methodology applied?
- Separate module for hazard assessment?
- Vulnerability, damage curves,.. scenarios to be included?
- Modify risk scenarios to produce new scenarios?
- Request for new scenarios after getting preliminary risk reduction scenarios?
- Need to model to calculate cost-benefit analysis?
- Linkages to other tools developed?
- .....

All working in the same direction?

