RiskCity
Training package on the
Application of GIS for multi-
hazard risk assessment in an
urban environment.

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Our aim is to provide international postgraduate education through knowledge exchange directed primarily at capacity building and institutional development for and in countries that are economically and technologically less developed (LCDs).

Our knowledge field is centred on geo-information science and earth observation.

We work with partner organisations in Africa, Asia and Latin America.
DGIM - School for Disaster Geo-Information Management

According to the Agreement between United Nations University (UNU) and ITC, the long-term objective is "to strengthen the capacity of institutions at national and local level in developing countries to reduce the vulnerability to natural hazards".

The overall objective of the School for Disaster Geo-Information Management is to support capacity building of organizations in developing countries through training of individuals in the collection, management, analysis and dissemination of spatial information before, during and after disaster events, in order to reduce the impacts of natural and related environmental and technological hazards.

Activities related to training, education and curriculum development

- Joint educational programmes
- Short courses and workshops
- Distance education courses
- University Networks
- Fellowship opportunities

Activities related to knowledge development and research collaboration

- Research projects
- PhD research
- Visiting scientists
- Small grants

Activities related to provision of project services

- Disaster Information Analysis Group (DIAG)
  - Damage assessment in Yogyakarta, Indonesia.
  - Production of base maps for earthquake affected areas in Pakistan.
  - Tsunami disaster information.
RiskCity training package

• A training package on the use of GIS for multi-hazard risk assessment in an urban setting in developing countries.
• A series of exercises, presentations, lectures, data and software.
• The basis for courses with duration of 2 days to 3 months.
• Distance education course.

Exercise 3: Generating a database of elements at risk


GIS case study exercise materials

RiskCity
Application of GIS for multi-hazard risk assessment in an urban environment.

Version: June 2008
Cees Van Westen

UNU – ITC School for Disaster Geo-Information Management
http://www.itc.nl/unu/dgim

International Institute for Geo-Information Science and Earth Observation (ITC)
Objectives of RiskCity

The objective of this training package is to demonstrate the concepts of the use of GIS for susceptibility, hazard, vulnerability, capacity and risk assessment in an urban setting.

- It deals with the following questions
  - Which spatial data are important?
  - How to get spatial data?
  - How to do hazard assessment?
  - How to generate an elements at risk database?
  - How to estimate vulnerability?
  - How to make a qualitative and quantitative loss estimation?
  - How to do a cost-benefit analysis for disaster reduction options?
  - How to use risk information in spatial planning and disaster preparedness?
Open-Source software: ILWIS

Open Source software, so no restrictions for use.

Complete stand-alone software that can be used by NGO’s, Universities and Government organizations working with spatial information.

Some key features
- Import and export of widely used data formats;
- On-screen and tablet digitizing;
- Comprehensive set of image processing tools;
- Orthophoto, image georeferencing, transformation and mosaicing;
- Advanced modeling and spatial data analysis;
- 3D visualization with interactive editing for optimal view findings;
- Rich projection and coordinate system library;
- Geo-statistical analyses, with Kriging for improved interpolation;
- Production and visualization of stereo image pairs;
- Spatial Multiple Criteria Evaluation.

RiskCity training package is currently also being developed for use with ARCGIS

ILWIS is an Open source GIS and Image Processing software
Can be downloaded from: http://52north.org/
The city could be anywhere...

• The RiskCity training package is based on a dataset from Tegucigalpa, Honduras.

• This dataset had been modified to improve the didactical aspects.

• RiskCity is a generic method that could be applied in cities in developing countries.
Flowchart

**Elements at risk**
- High res image
- Ward & census
- DEM Lidar
- Thematic layers:
  - Flood discharges
  - Seismic catalogs
  - Soil and rock data
  - Landslide information
  - Technological information
  - etc.

**Hazard maps**
- Landslides
- Flooding
- Technological
- Earthquake

**Risk maps**
- Landslides
- Flooding
- Technological
- Earthquake

**Risk = Hazard * Vulnerability * Amount**

**Risk curve**
RiskCity exercises

- Introduction to data and software,
- Obtaining image data and image interpretation;
  - Downloading Google Earth data and referencing
- Remote sensing
- Hazard assessment:
  - Landslides, Earthquakes, Flooding, Technological
  - Additional: coastal, tsunami, forest fire, drought, volcanic
- Elements at risk
  - Assuming new data is available: start from Google Earth
  - Assuming more data available (cadastral, census, DEM)
- Loss estimation
  - Annual loss estimation using risk curves
  - Qualitative loss estimation using matrices
- Spatial Multi Criteria Evaluation
  - Using indicators for social, physical, economical, environmental vulnerability, and for capacity
- Annual loss estimation
- Cost benefit analysis
- Using risk information in spatial planning
Planning

• Available in English, Spanish and Chinese.
• Distance education course planned for spring 2009.
• Used as basis for courses with different duration
• Short courses annually in various locations:
  • Netherlands (ITC: July)
  • Central America (Mexico: June)
  • South America (Bolivia: September)
  • China (Chengdu: November)
  • SE-Asia (Bangkok: May and October)

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Input data

- Image data
- Hazard data
- Elements at risk
- Height data

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<th>Type</th>
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Flood hazard modeling

- **Sobek**: a two dimensional hydraulic model.

- **Input**:
  - Digital Surface Model (Lidar)
  - Discharge data
  - Roughness data (landuse)

- **Output**:
  - Flood depth
  - Flow velocity (Per time step)
Flood risk

5 years

50 years

10 years

100 years

25 years

Mapping units

25 years

Hazard polygons

Buildings Affected
Vulnerability assessment using Spatial Multi-Criteria Evaluation

Risk = Hazard * Vulnerability

Capacity
The criteria tree

One main goal is obligatory for any criteria tree. The main goal is also called the main root.

The **Standardization** method is indicated here.

The **Composite Index** map contains the final output.

**Benefit**: contributes positively to the output; the more you have (the higher the values), the better it is.

A **Group** defines an intermediate or a partial goal. Under a Group, you can add one or more Factors and/or other Groups of Factors. Click the plus sign in front of a Group of Factors to expand the group.

Here are the input tables and columns that contain the data related to the factor.

Click the plus sign in front of a Group of Factors to expand the group.