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Common borders. Common solutions.

A Scientific Network for Earthquake, Landslide & Flood Hazard Prevention - Project Workshop Thessaloniki, 7-9th May, 2015

Using Q-GIS Tools for for Landslide Hazard Assessment in Danube region Ukraine

Draft methodology

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Ekaterina Stepanova

Black Sea Branch of Ukrainian Environmental Academy of Science

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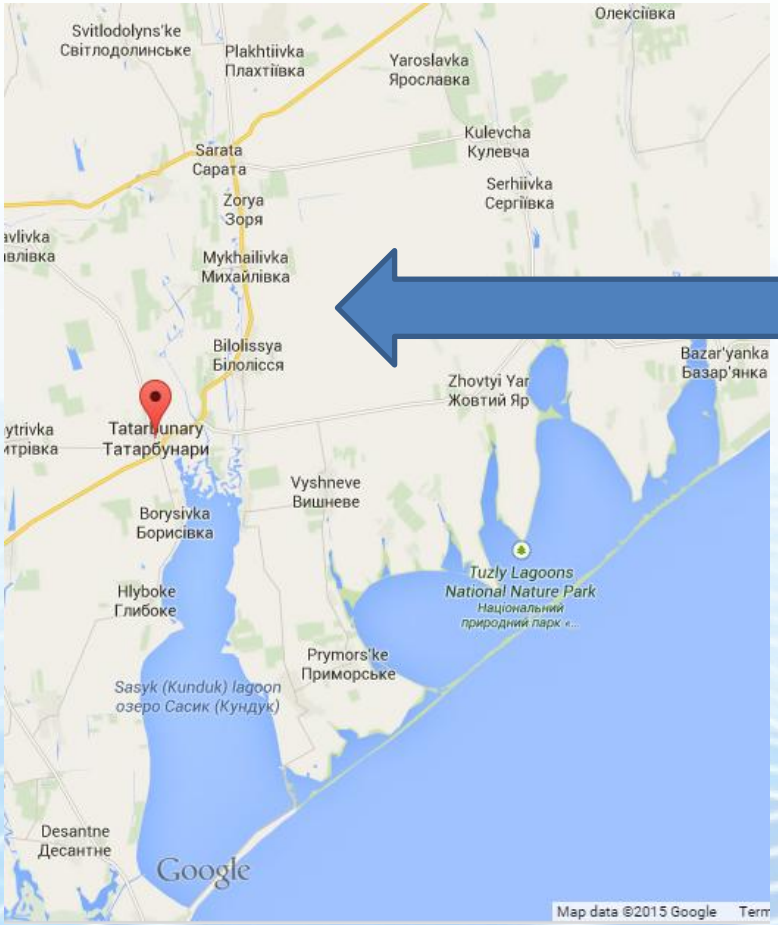
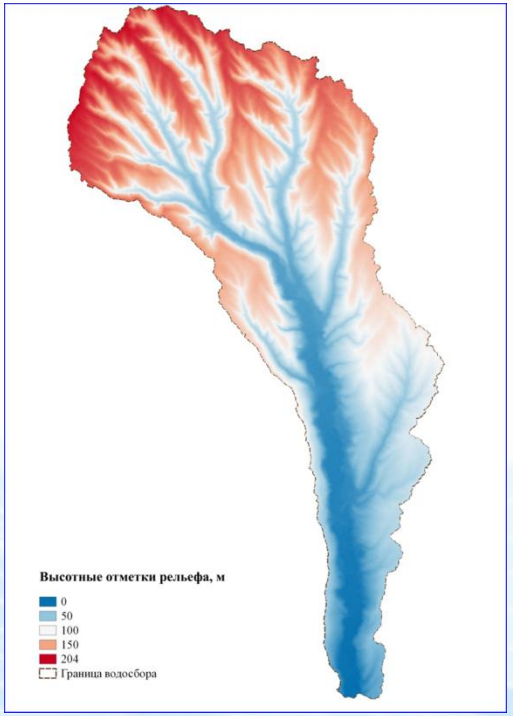


study area



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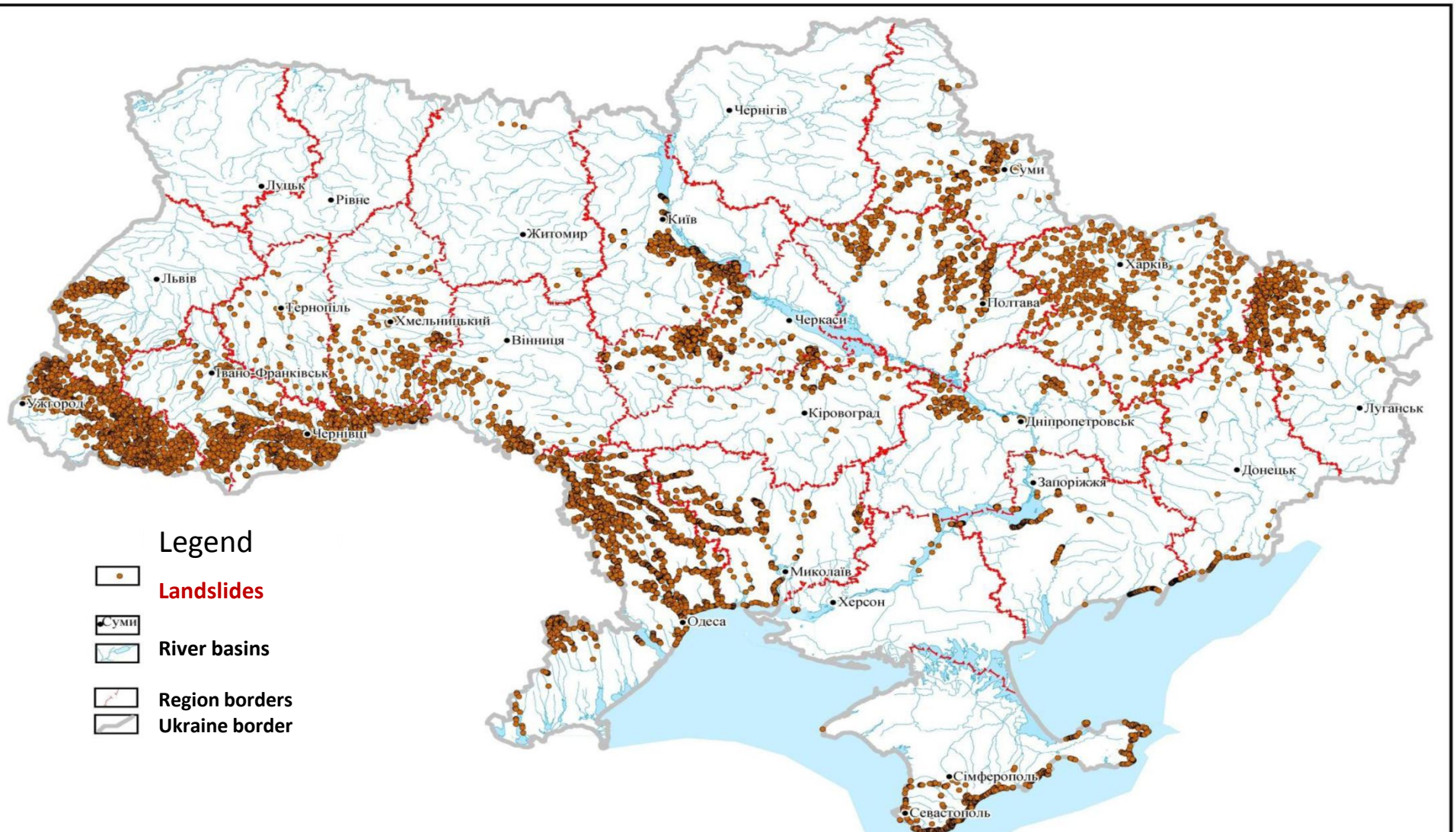
Distribution of landslides in Ukraine



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Distribution of landslides Odessa region

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Soil Map Ukraine

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Soil Map Odessa region

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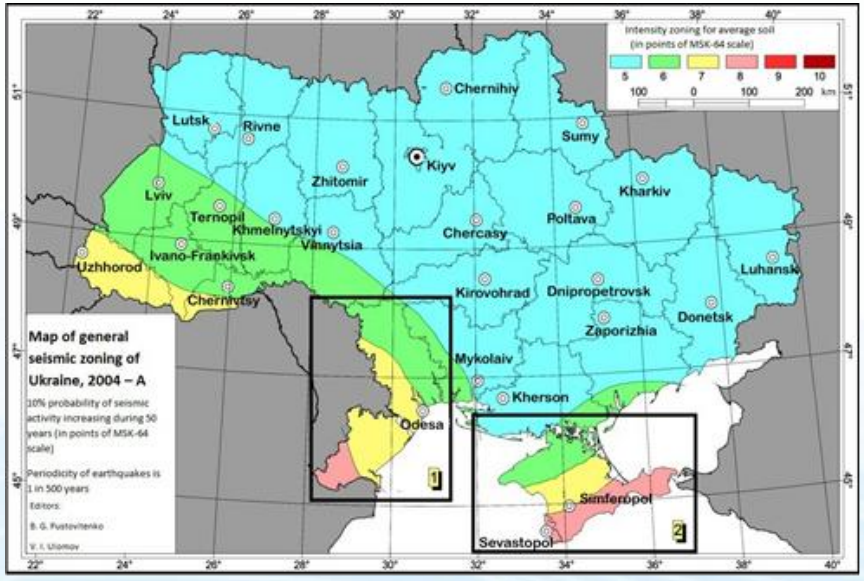
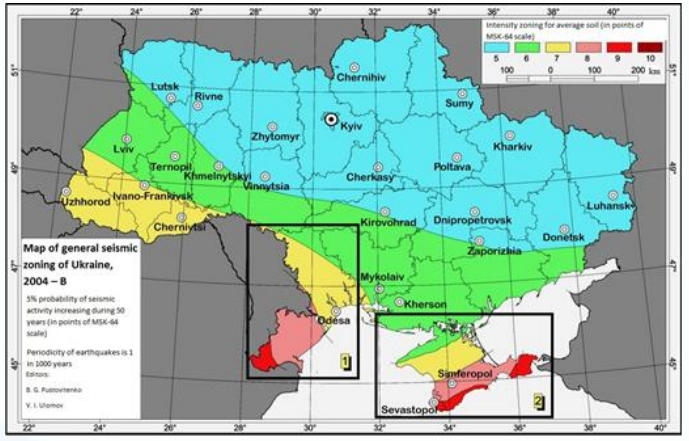
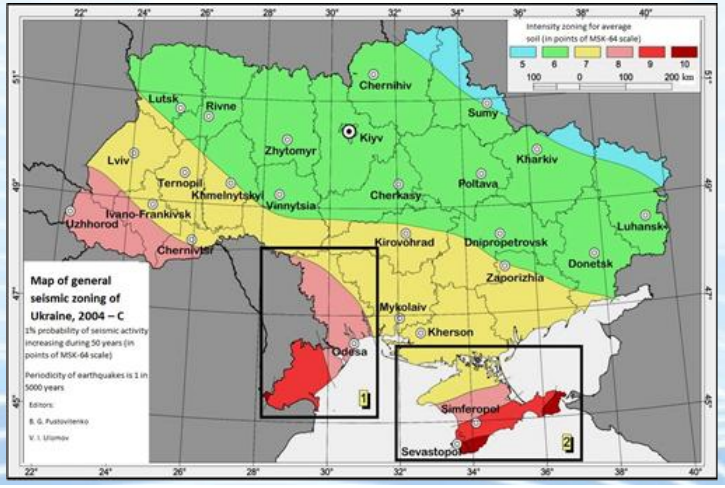
Seismic hazard Maps







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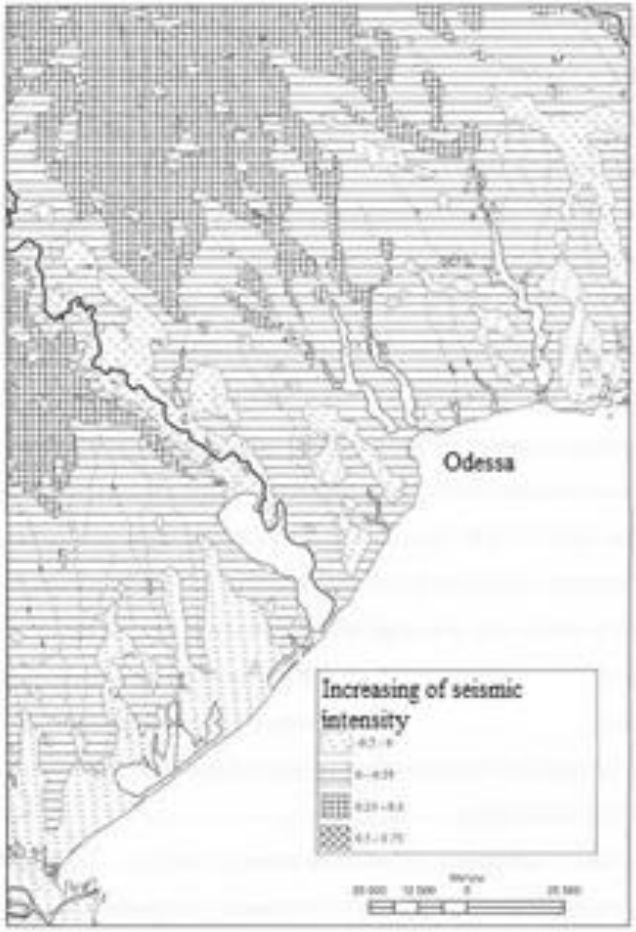
Seismic hazard Maps - Regional



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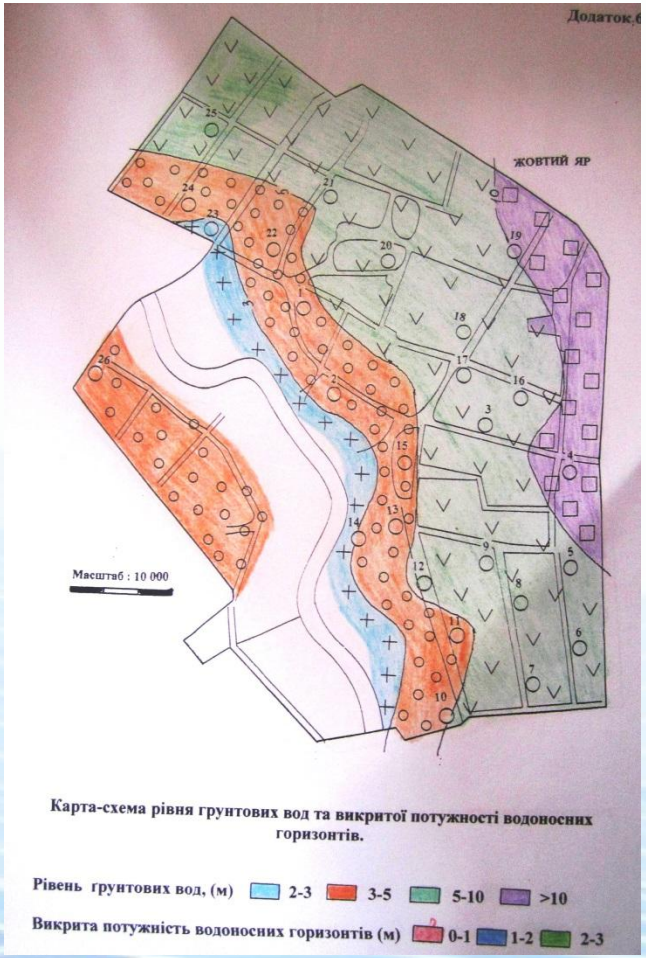
Depth-to-water map



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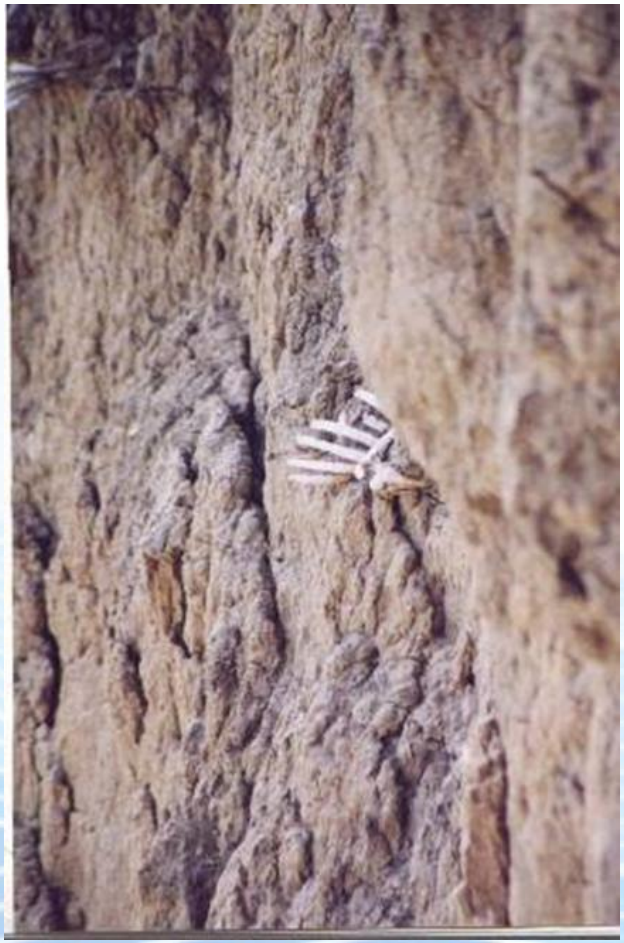

Some effects of landslides

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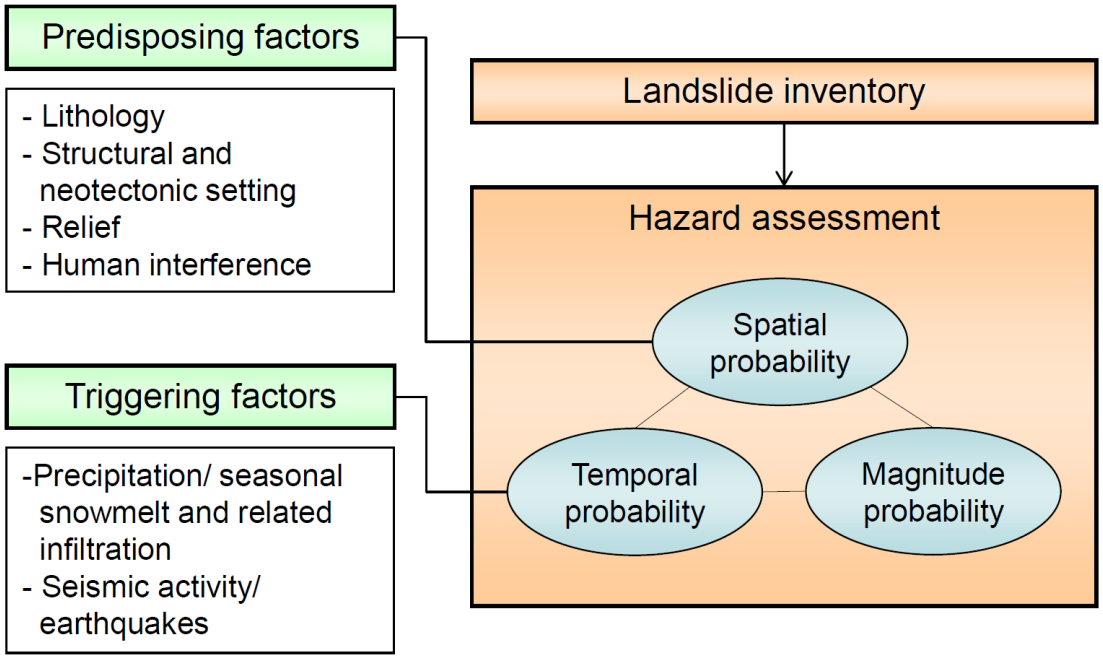
Landslide Hazard Assessment



after Guzzetti et al. 2005

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Data Queries

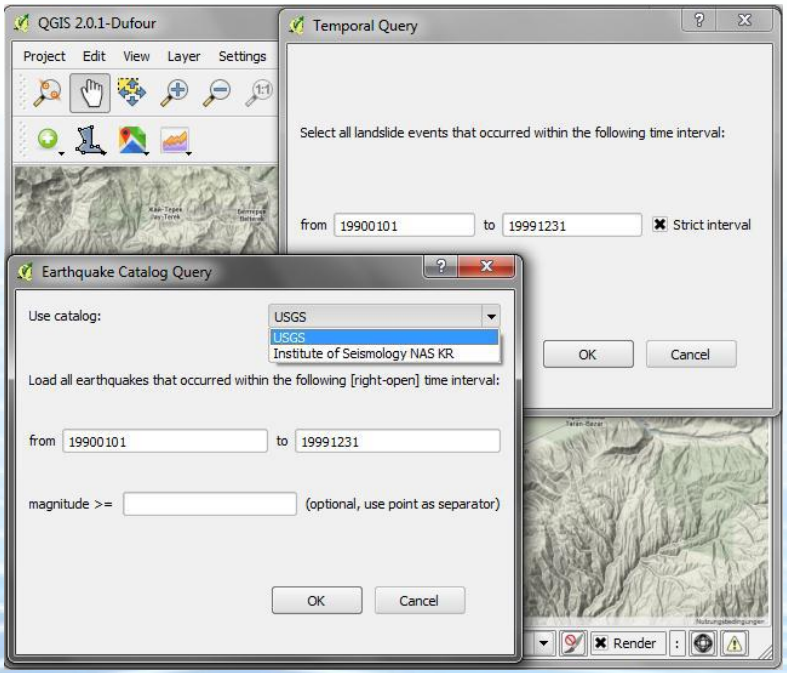
(QGIS Tool for Landslide Hazard Assessment)

Typical workflow: selecting landslide / factor data for a certain time period and assigning them to mapping units for further analysis

Summary of remote sensing data sources and methods used for building a landslide inventory

Data source	Method	Explanation	Advantages	Disadvantages
Multispectral data (IKONOS, Quickbird, SPOT, ASTER, Landsat)	Manual interpretation	Use appearance (context, shape & size) to delineate landslides	Most accurate (expert knowledge); immediate vector output file	Time consuming; subjective; non-repeatable; person needs to manually trace the landslide
Multispectral data (IKONOS, Quickbird, SPOT, ASTER, Landsat)	Image thresholding	Use band ratios (such as NDVI) to pick up spectral properties of landslides	Can be used as part of manual interpretation, simple & rapid, band ratios reduce illumination variability, can be applied with panchromatic data	Determination of threshold values may be subjective, landslides do not have unique properties – non-landslides may be incorrectly identified
ALOS PALSAR	Change detection	Measures how the vertical position of an area has changed between two or more time periods (using Synthetic Aperture Radar)	Automatically creates polygons, no need to trace; rapid	Requires expensive software, may incorrectly identify forestry or other land clearing as landslides, may not pick up landslides where there has not been a significant change in elevation

Menus for querying landslide and earthquake data



Normalised Difference Vegetation Index (NVDI)

NDVI is the Normalised Difference Vegetation Index, an indicator of the presence or absence of live green vegetation in an area (Tarpley et al. 1984). It is calculated using the formula:

$$NDVI = \frac{NIR - VIS}{NIR + VIS}$$

Where VIS and NIR stand for the spectral reflectance measurements acquired in the visible (red) and

Spectral Reflectance Measurement	Wavelength (μm)	Landsat 5 (μm)	Landsat 8 (μm)
Near Infra-red (NIR)	0.73-1.1	Band 4 (0.76-0.90)	Band 5 (0.85-0.88)
Visible (VIS)	058.0.68	Band 3 (0.63-0.69)	Band 4 (0.64-0.67)

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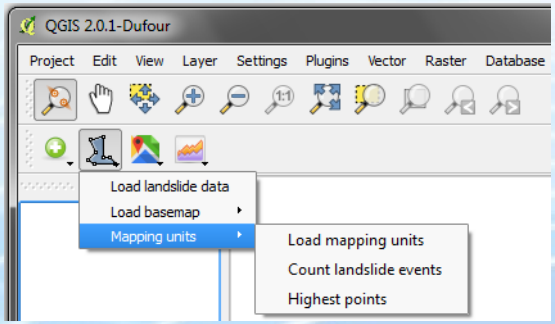
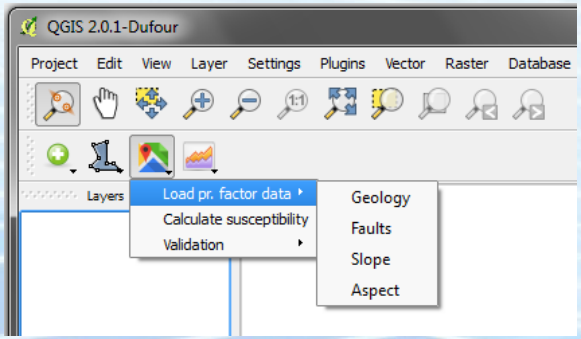
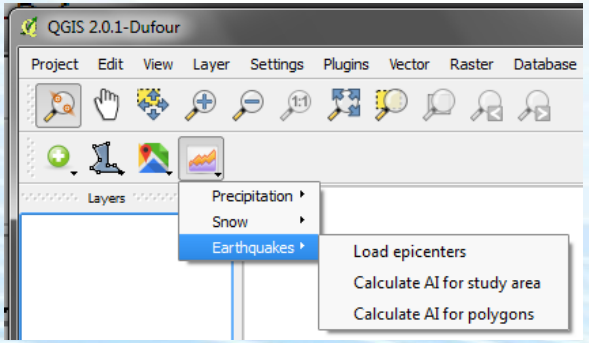
QGIS Plugin

(QGIS Tool for Landslide Hazard Assessment)

- QGIS plugin offering customized data queries and spatial analysis tools
- Open-source software in order to reduce costs and meet requirements of multiple end users
- Possibility of data updates in a single location
- Incorporation of data on landslide predisposing and triggering factors







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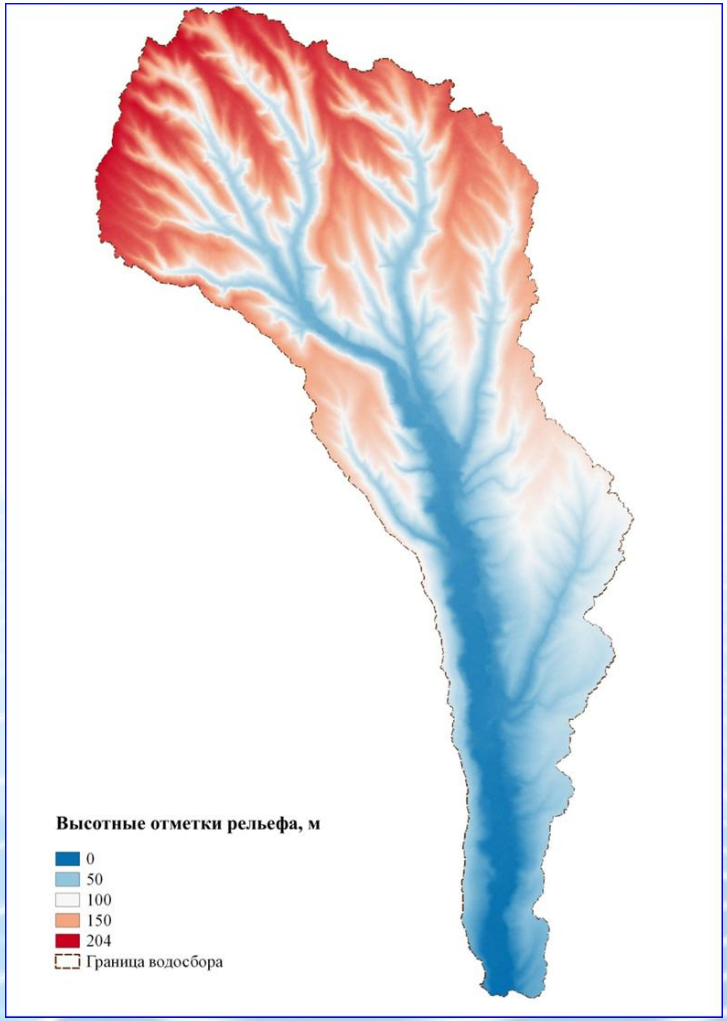

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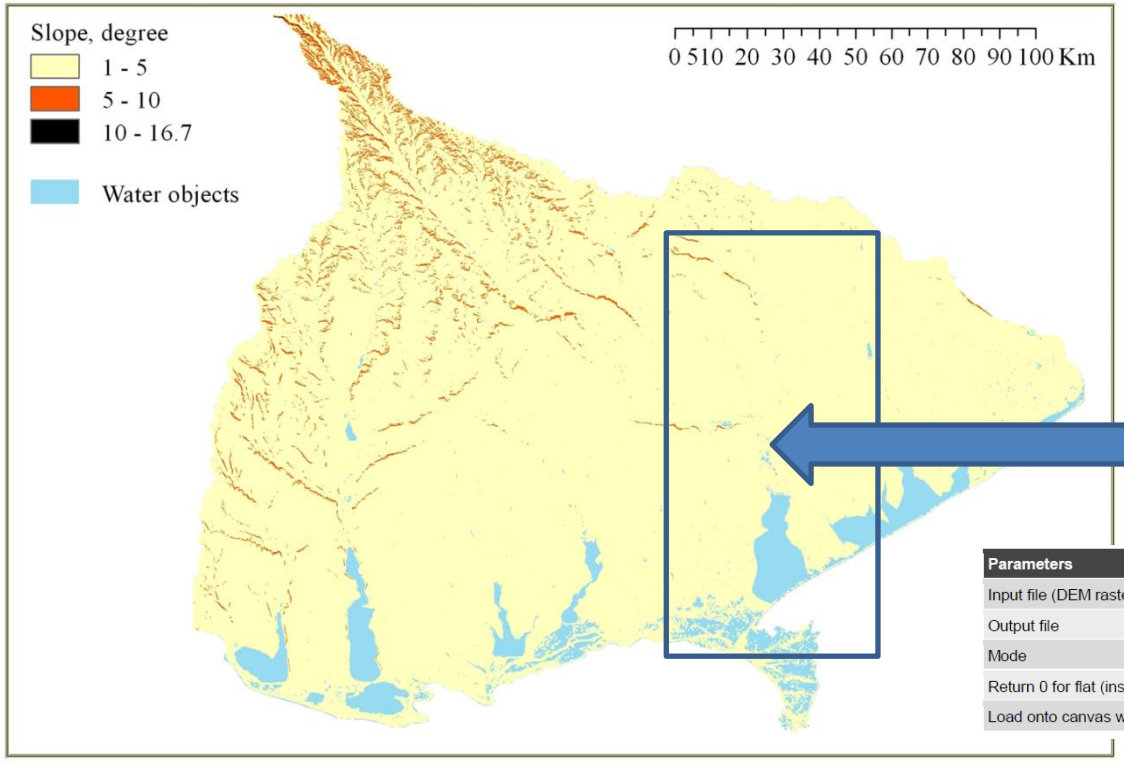

Calculating slope aspect

Parameters	Input
Input file (DEM raster)	png_dem_UTM.tif
Output file	slpang.tif (navigate to base_data)
Mode	aspect
Return 0 for flat (instead of -9999)	Check box indicated
Load onto canvas when finished	Check box indicated

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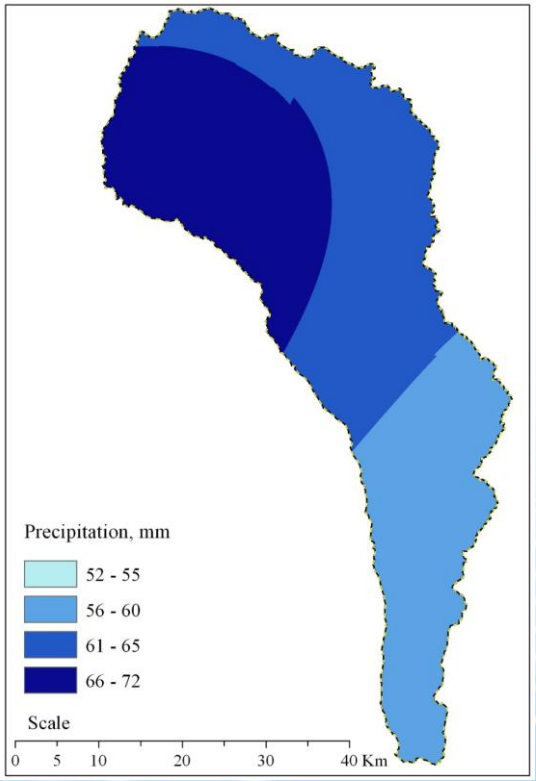
Rainfall



Parameter	Input
Input raster layer	slpaspC.tif
File containing reclass rules	C:\Training\processing\slpasp_reclass.txt [navigate to processing
Output raster layer	slpasp_study_area.tif (in processing)
Open output file after running algorithm	Check box indicated

ID.No.	Rainfall (mm) per year)
12	2100-2200
13	2200-2300
14	2300-2400
15	2400-2500
16	2500-2600
17	2600-2700
18	2700-2800
19	2800-2900
20	2900-3000
21	3000-3100
22	3100-3200

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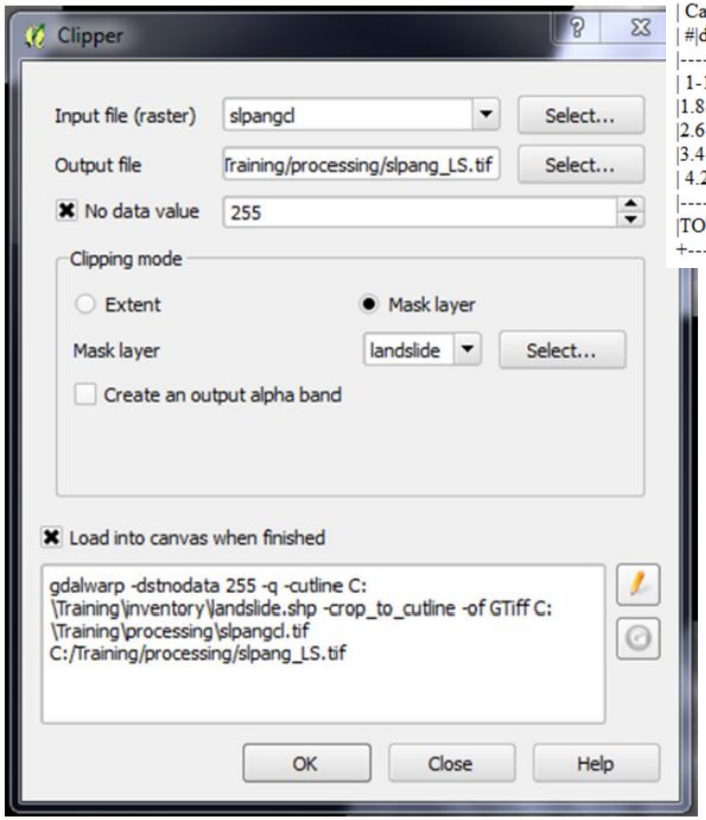
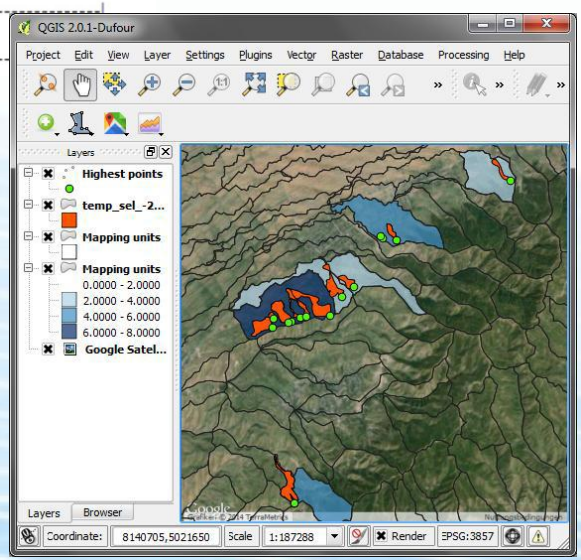
Clipping rasters to the area of the landslide inventory



Calculating the area of landslides for each

r.report

Category Information	square
# | description	meters
1-1.8 | from to	643,543
1.8-2.6 | from to	870,036
2.6-3.4 | from to	246,657
3.4-4.2 | from to	51,782
4.2-5 | from to	10,606
TOTAL	1,822,624



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Thank you for attention!