U-Geohaz training
Landslide hazard assessment for Civil Protection
4th June 2019, Athens, Greece

Landslide susceptibility evaluation

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Consiglio Nazionale delle Ricerche

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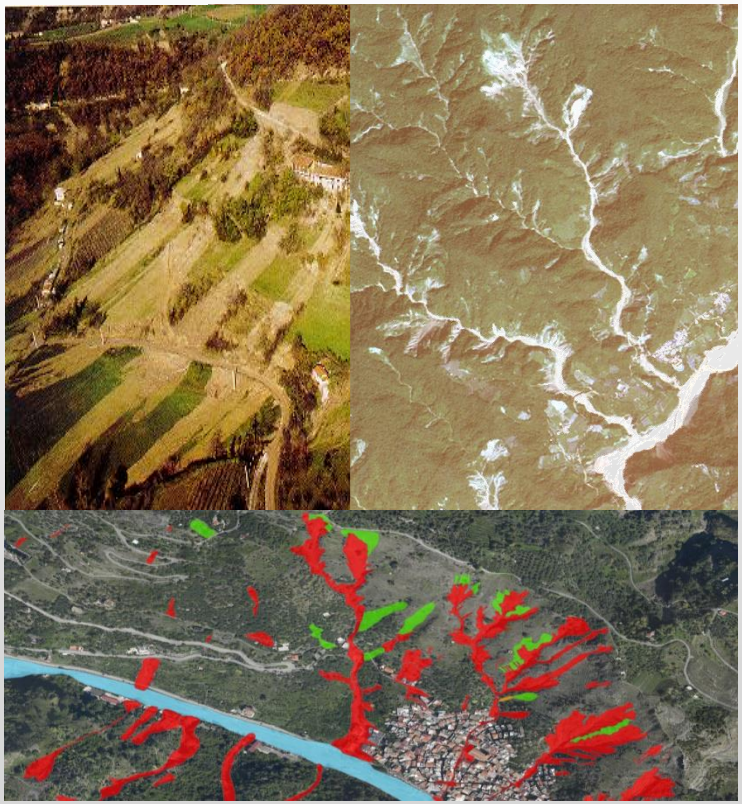
1. Common glossary
2. Landslide susceptibility (definition, variables, mapping units, models)

3. LAND-SUITE

SINGLE VS MULTIPLE

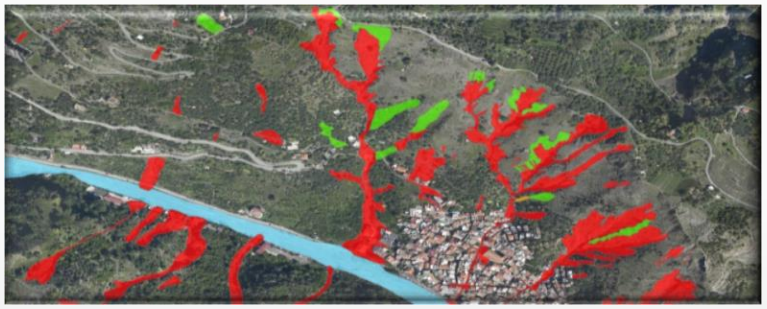
SINGLE LANDSLIDES

MULTIPLE LANDSLIDES



SINGLE VS MULTIPLE

Movement
mechanism
Monitoring



Spatial and temporal
distribution
Impact

Planning
Civil Protection

LANDSLIDE SUSCEPTIBILITY

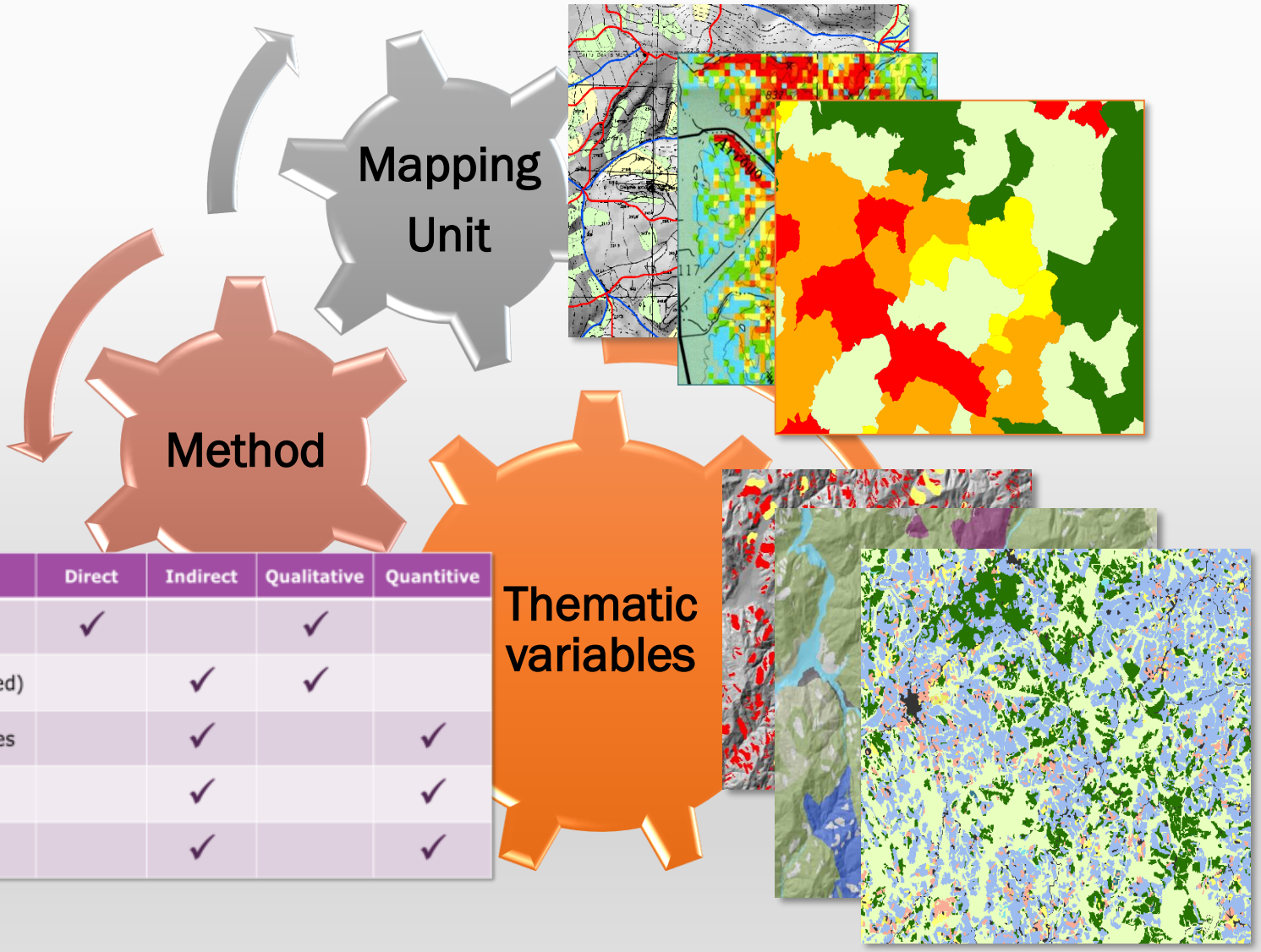
- Landslide susceptibility is likelihood of a landslide occurring in an area on basis of local terrain conditions
- Landslide susceptibility is the degree to which an area can be affected by future slope movements, i.e. an estimate of "where" landslides are likely to occur
- Susceptibility does NOT consider the temporal probability of failure (i.e., when or how frequently landslides occur), nor the magnitude of the expected landslide (i.e., how large or destructive the failure will be).

LANDSLIDE HAZARD

- Landslide hazard is the probability of occurrence in a specified period and within a given area of a potentially damaging landslide of a given magnitude

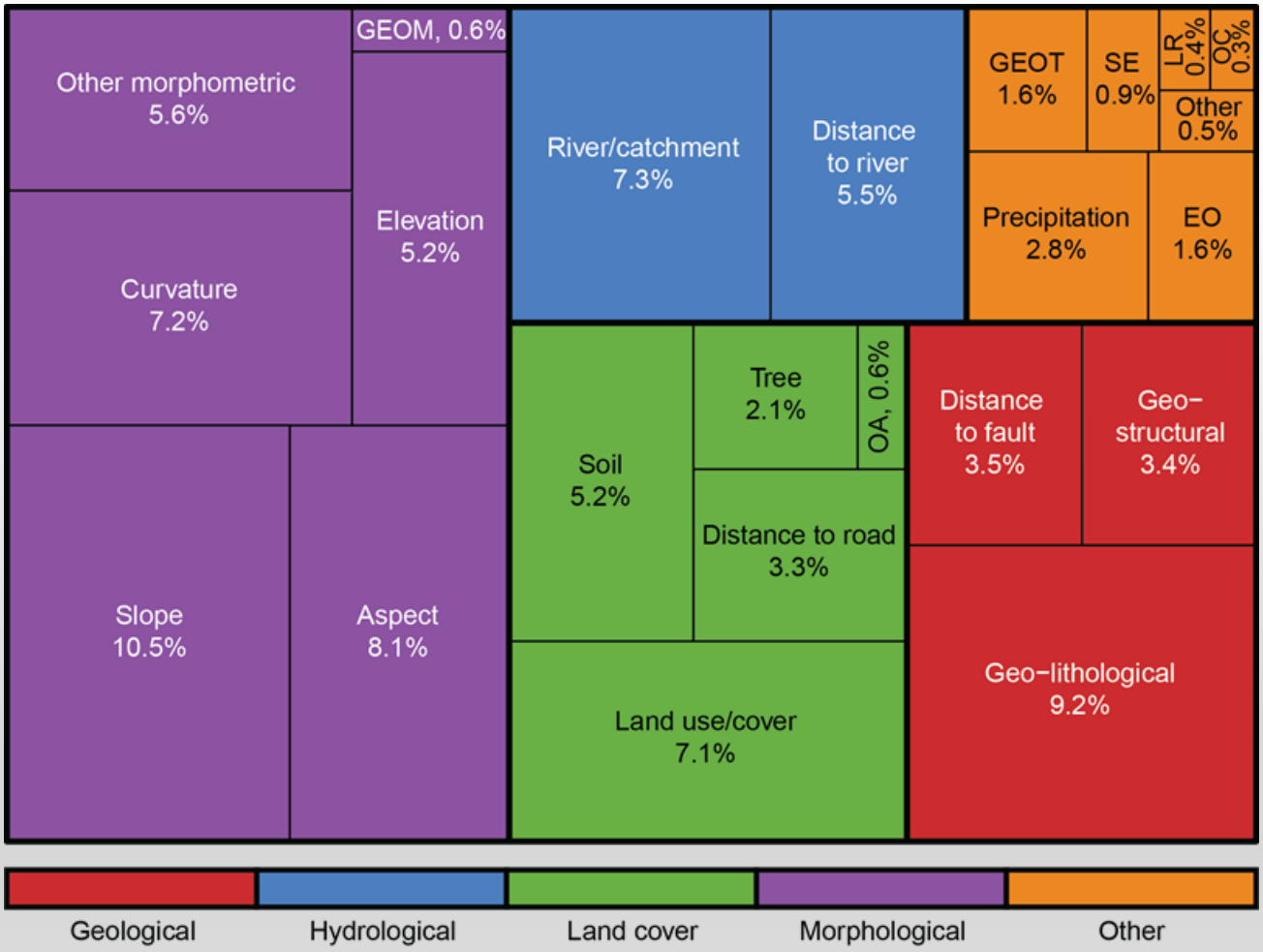
- The definition incorporates the concepts of location (where?), time (when, or how frequently?) and magnitude (how large?)

LANDSLIDE SUSCEPTIBILITY

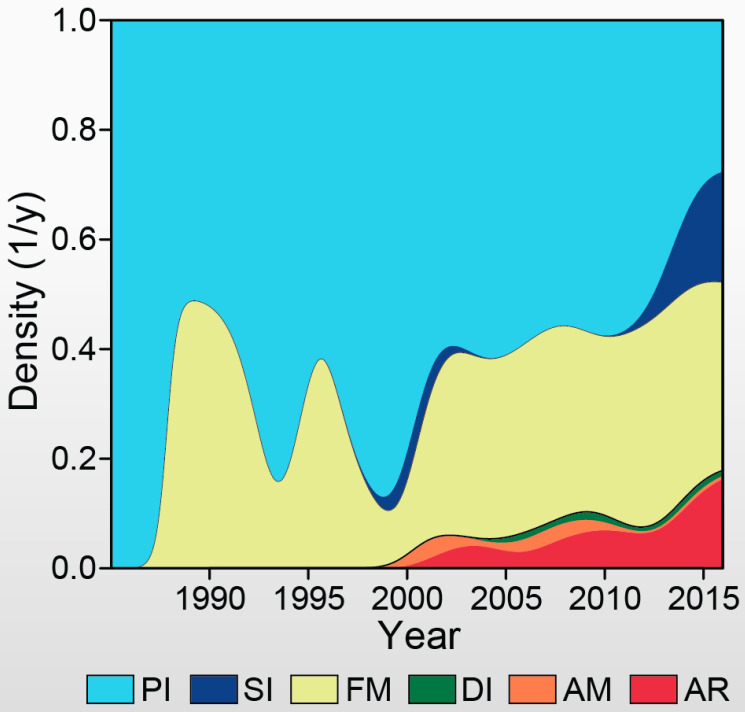


	Direct	Indirect	Qualitative	Quantitive
Geomorphological mapping	✓		✓	
Heuristic (index-based)		✓	✓	
Analysis of inventories		✓		✓
Statistical modelling		✓		✓
Process based (conceptual)		✓		✓

THEMATIC VARIABLES

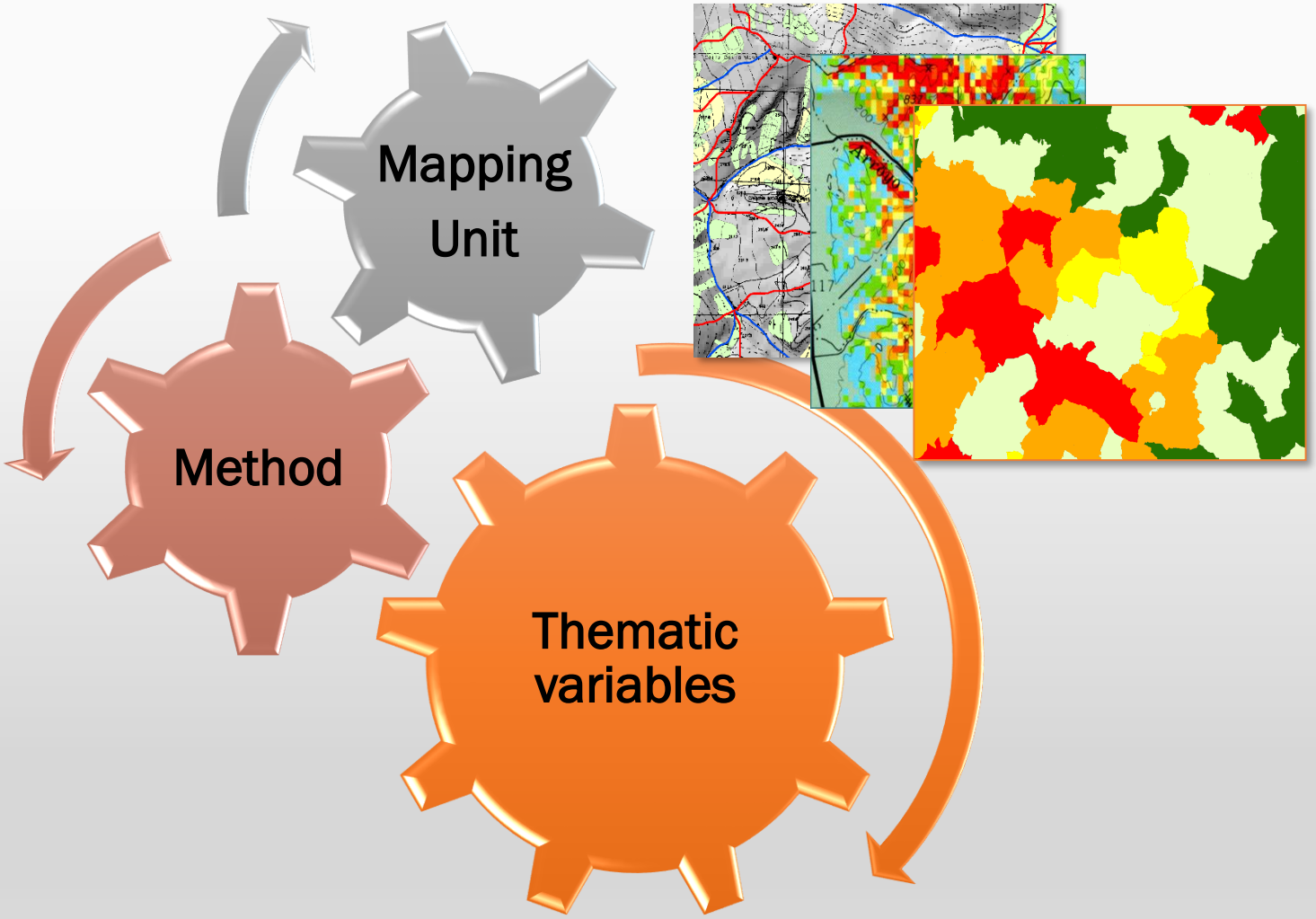


LANDSLIDE INFORMATION

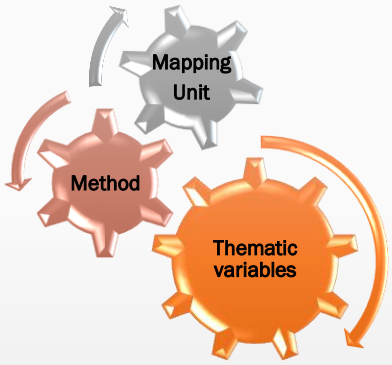


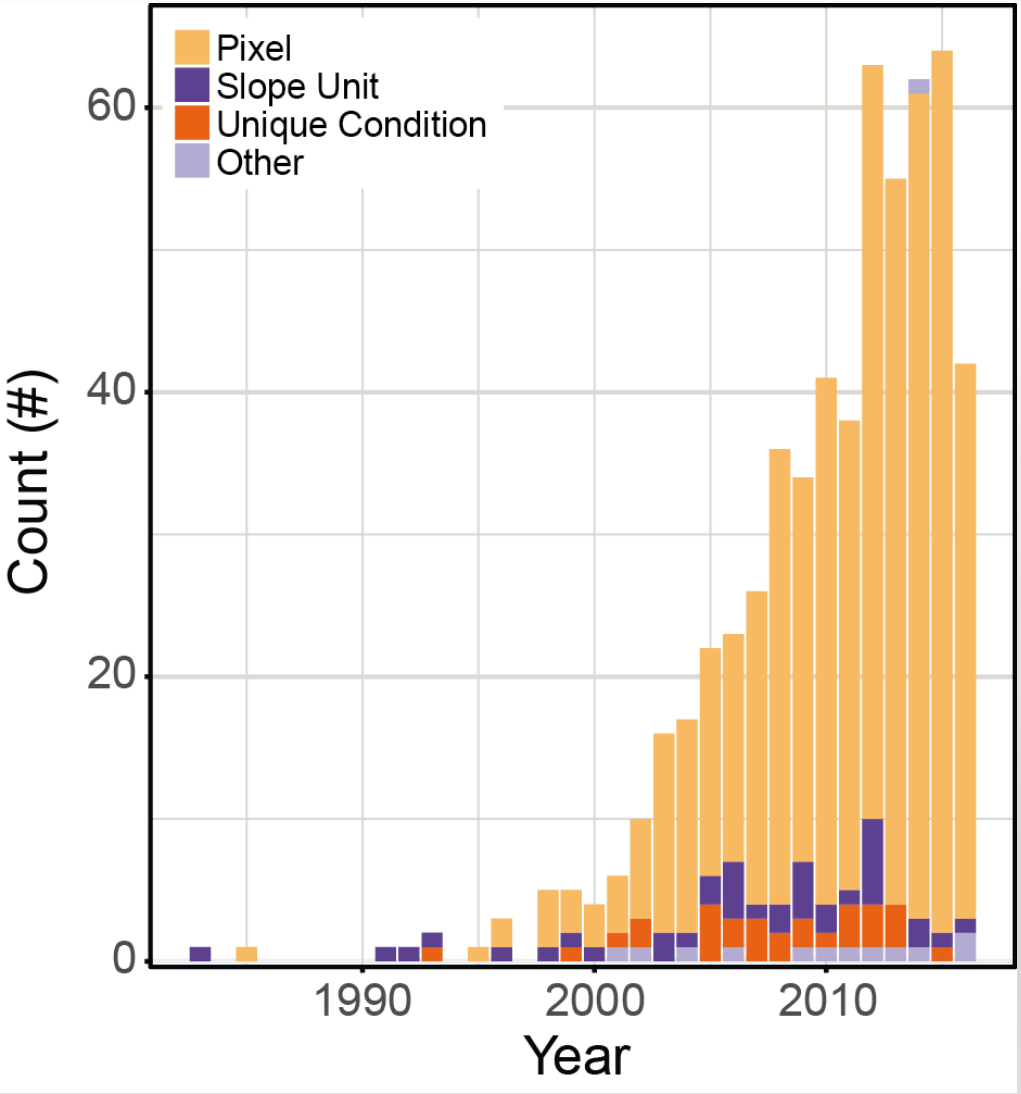
PI - visual interpretation of aerial photographs;
SI - visual interpretation of satellite images;
FM - field mapping;
DI - visual interpretation of DEM derivatives;
AM - automatic/semi-automatic mapping with remote sensing imagery;
AR - analysis of archive/historical sources.

LANDSLIDE SUSCEPTIBILITY



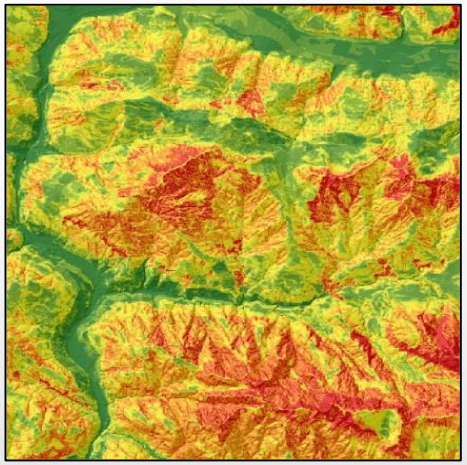
MAPPING UNIT





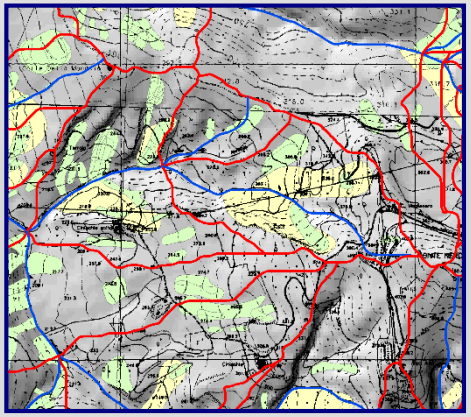
MAPPING UNIT

GRID CELL



- Cells divide the territory into regular squares of pre-defined size
- Each cell is assigned a value for each theme
- Preferred by more than 85% of the users

SLOPE UNITS



- Slope-units partition the territory into regions between drainage and divide lines
- Automatically derived from DEM
- Bear a physical relationship with slopes, where mass movements take place

SLOPE UNITS DELINEATION

Geosci. Model Dev., 9, 3975–3991, 2016
www.geosci-model-dev.net/9/3975/2016/
doi:10.5194/gmd-9-3975-2016

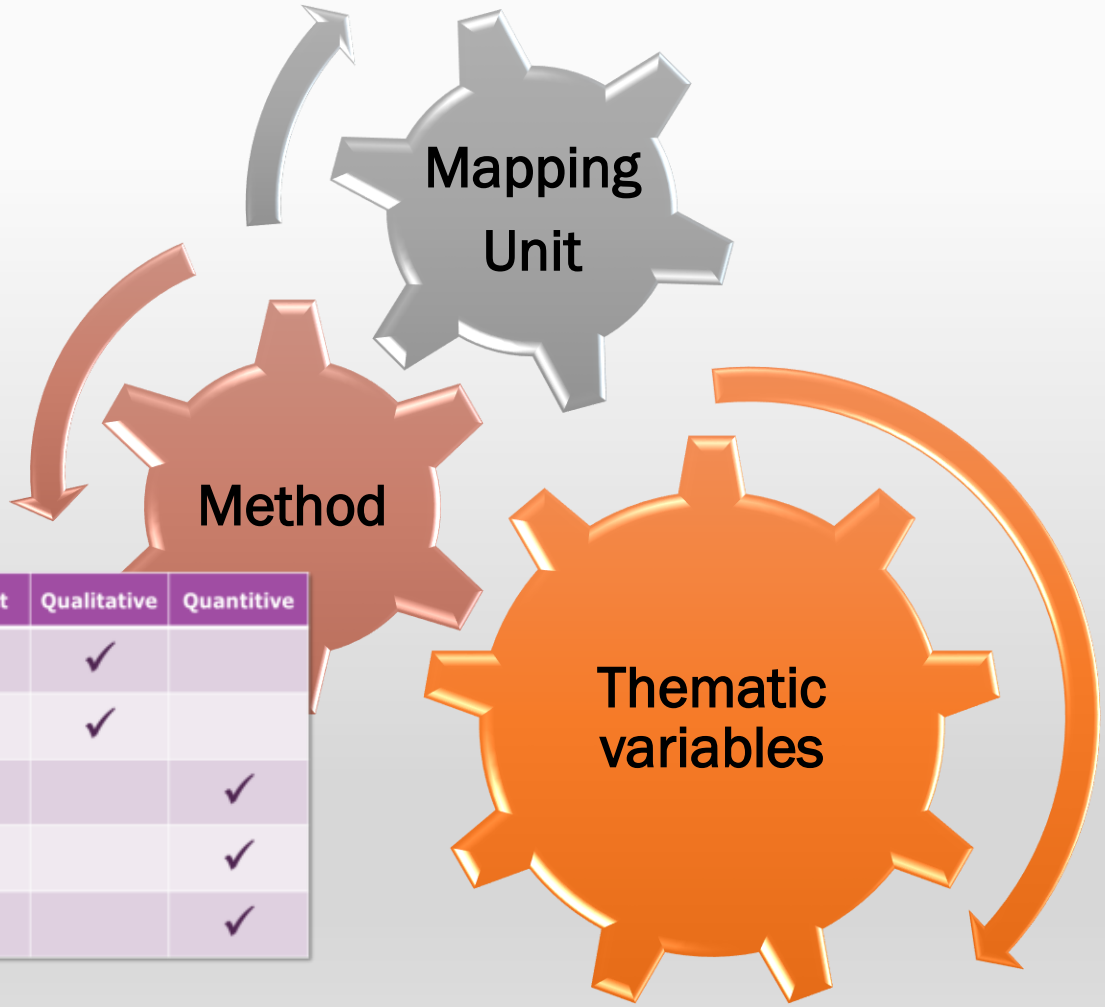
Geoscientific Model Development
Open Access
EGU

Automatic delineation of geomorphological slope units with `r.slopeunits v1.0` and their optimization for landslide susceptibility modeling

Massimiliano Alvioli, Ivan Marchesini, Paola Reichenbach, Mauro Rossi, Francesca Ardizzone, Federica Fiorucci, and Fausto Guzzetti

CNR IRPI, via Madonna Alta 126, 06128 Perugia, Italy

LANDSLIDE SUSCEPTIBILITY

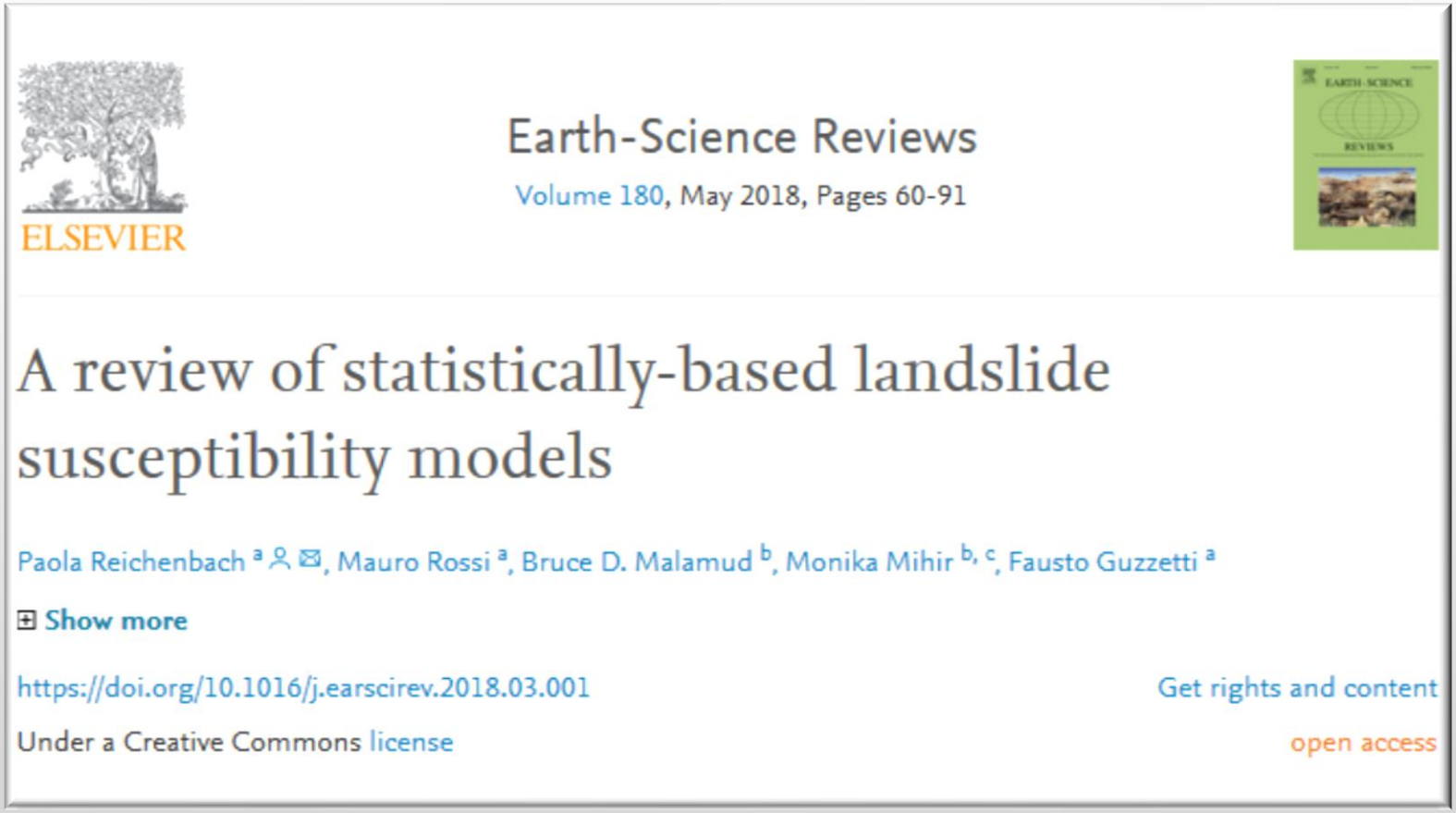


	Direct	Indirect	Qualitative	Quantitive
Geomorphological mapping	✓		✓	
Heuristic (index-based)		✓	✓	
Analysis of inventories		✓		✓
Statistical modelling		✓		✓
Process based (conceptual)		✓		✓

SUSCEPTIBILITY METHODS

	Direct	Indirect	Qualitative	Quantitive
Geomorphological mapping	✓		✓	
Heuristic (index-based)		✓	✓	
Analysis of inventories		✓		✓
Statistical modelling		✓		✓
Process based (conceptual)		✓		✓

STATISTICAL MODEL



ELSEVIER

Earth-Science Reviews

Volume 180, May 2018, Pages 60-91

A review of statistically-based landslide susceptibility models

Paola Reichenbach [a], Mauro Rossi [a], Bruce D. Malamud [b], Monika Mihir [b, c], Fausto Guzzetti [a]

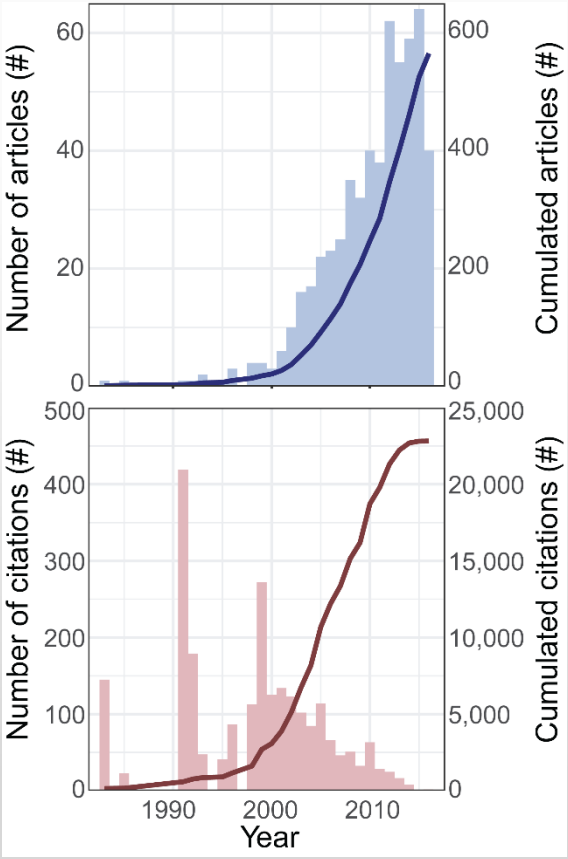
Show more

https://doi.org/10.1016/j.earscirev.2018.03.001

LITERATURE REVIEW

565 articles in **35.5** years from January **1983** to June **2016**

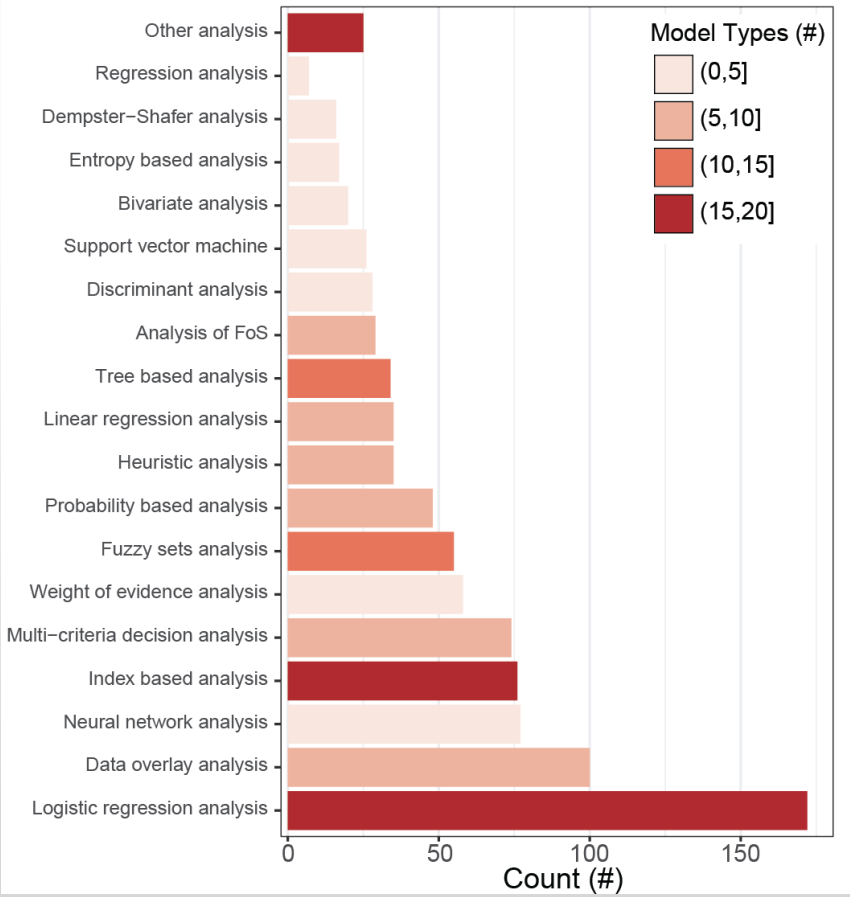
Source: Web of Science™



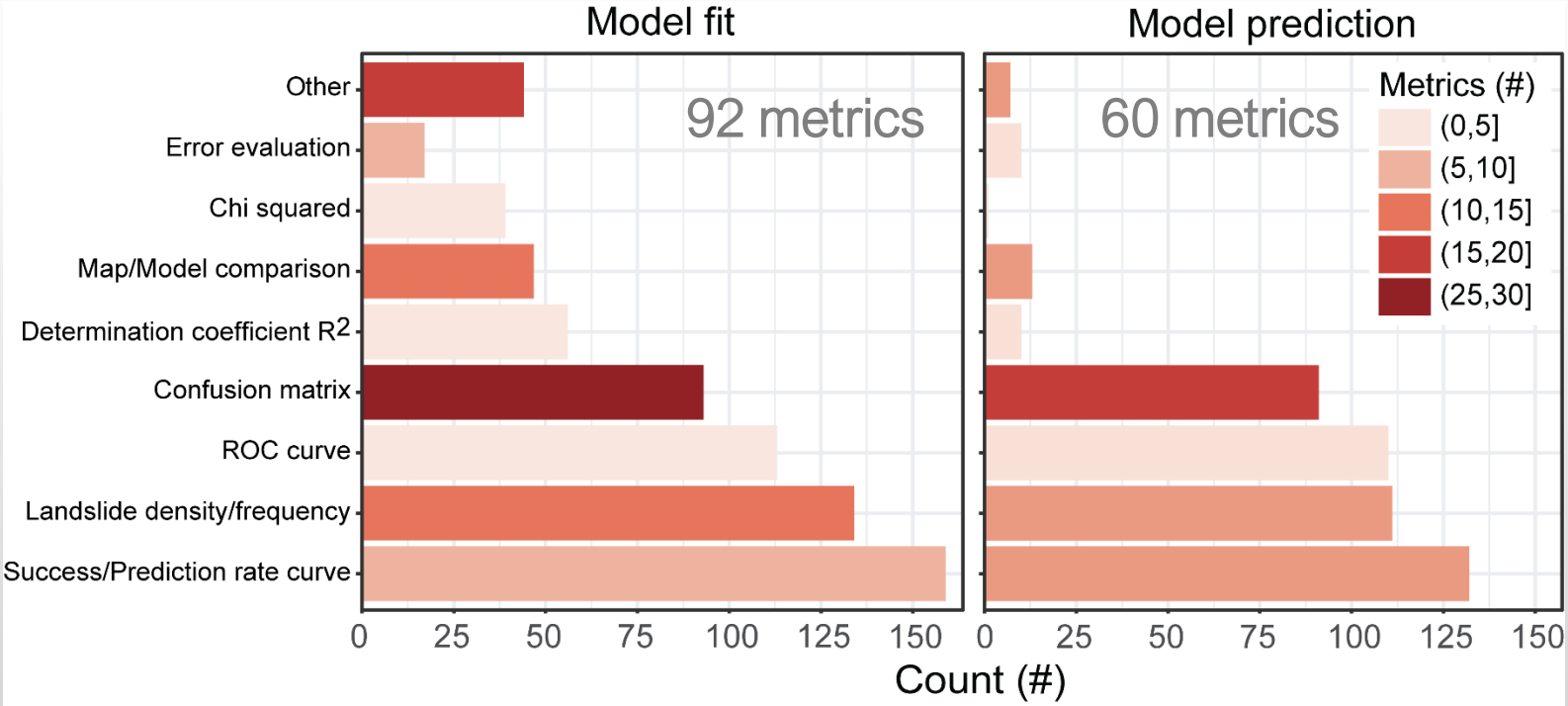
MODEL TYPES

163 model type names

19 preferred model types



MODEL PERFORMANCE



MODEL QUALITY

Susceptibility Quality Level

7 Highest quality

6

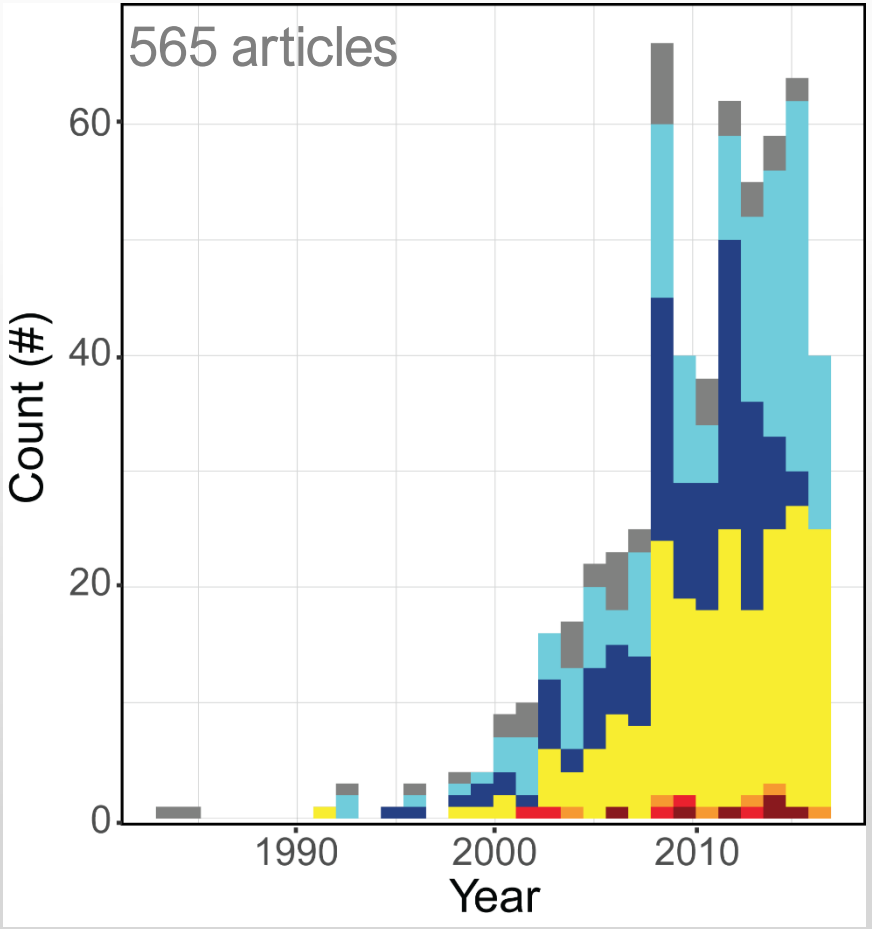
5

3

2

1

0 Lowest quality



LAND-SUITE

LAND-SUITE (**LAND**slide - **SU**sceptibility **I**nferential **T**ool **E**valuator) is a suite of R tools designed to **support** the landslide susceptibility inference process. LAND-SUITE is composed by:

- **LAND-SE**: **LAND**slide - **S**usceptibility **E**valuation
- **LAND-SIP**: **LAND**slide - **S**usceptibility **I**nput **P**reparation
- **LAND-SVA**: **LAND**slide - **S**usceptibility **V**ariable **A**nalysis