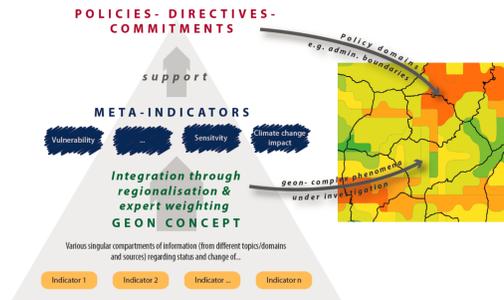


Integrated geons: Spatially explicit modelling of latent phenomena

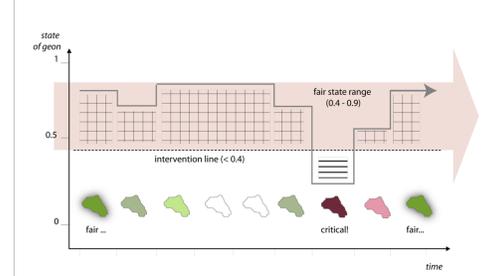
S. Kienberger, M. Hagenlocher, L. Pernkopf, S. Lang
[all] Interfaculty Department of Geoinformatics – Z_GIS
University of Salzburg - Austria

What are integrated geons?

- **spatial objects, homogenous** in terms of varying spatial phenomena under the influence of policy intervention ('**policy-oriented**')
 - generated by scale-specific spatial regionalization of a **latent, complex, multidimensional geographical reality** (non-a priori, expert-based)
 - **systemic, scale-dependent and hierarchical earth-** (or 'geographical') **holon**
 - unit that is **suited, most appropriate** to the given application context, and decomposable
 - **key reference units for policy-related action**
- "As small as necessary, as big as possible"



Geons as an **integration of different dimensions** to support **policy** in a **spatially explicit way**



Illustrative example: **Monitoring integrated geons** supports a scenario of '**threshold-based intervention planning**'

How are 'integrated geons' modelled?

1 Definition of conceptual framework

> Definition of risk and vulnerability concept
> Identification of relevant **vulnerability indicators**
>> Literature/expert knowledge
>> Criteria: Salience, Credibility, Legitimacy
>> Data availability

2 Indicator pre-processing

Commonly used composite indicator pre-processing methods are **not optimized for continuous geospatial datasets** → potential for **spatially-explicit approaches**

3 Regionalization

Regionalization – **similarity in attribute and real space**. Next to similarity in **feature space**, the classification of spatial data is **controlled by location**. Spatially constraint classification is called regionalization.

Index construction → calculated as the **(weighted) vector magnitude**

$$|a| = \sqrt{w_1 a_1^2 + w_2 a_2^2 + w_3 a_3^2}$$

- Work in progress: identify spatially explicit weighting approaches (e.g. GWR, Bayesian approaches...)

4 Sensitivity Analysis

'Local' Sensitivity Analysis

Choice of weighting: Evaluating the impact of the choice of the weighting scheme (panel 1: expert weights; panel 2: equal weights) on the modelling outputs

Discarded Indicator: Evaluating the impact of individual indicators on the modelling outputs (panel 1: use of full indicators set; panel 2: agricultural land use indicator was discarded) on the modelling outputs

'Global' Sensitivity Analysis (work in progress)

→ Evaluate the influence of **varying 'parameters' simultaneously**, e.g. through Monte Carlo simulation

→ **Need for spatially explicit approaches** and metrics to evaluate 'impact'

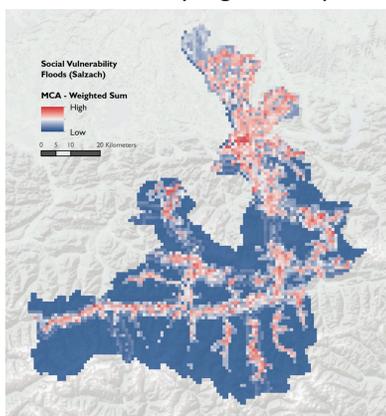
5 Visualization

The figure shows levels of **social vulnerability to malaria**. The pie-charts show the **varying contribution of the single vulnerability indicators for different geons**. Such pie-charts can be visualized for each geon, thus **guiding the identification of targeted intervention options**.

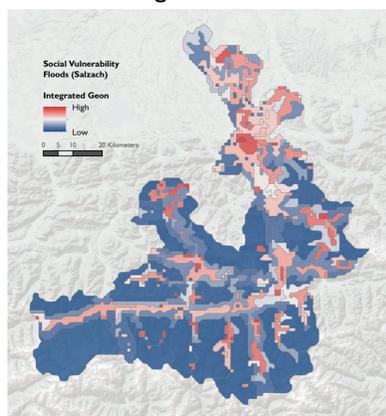
Comparison: Grid-based weighted sum (MCA) vs. Integrated Geon approach

Meaningful units!!

Grid-based (weighted sum)

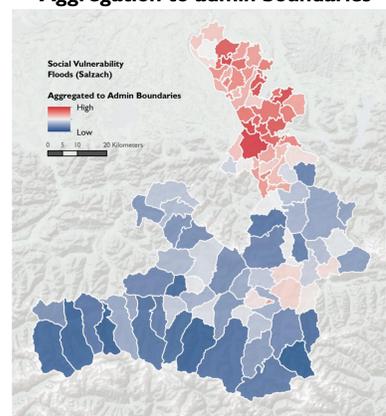


Integrated Geons



Aggregation: Integrated Geons aggregated to administrative boundaries (community level, 'Gemeinde')

Aggregation to admin boundaries



Aggregation (left) of vulnerability units based on **'area-weighted mean'** per **'Gemeinde'**

Statistics (below) : **area-weighted mean** and **min/max value** for each **'Gemeinde'**

