



# Software based early recognition of unidentified dangers from nature processes on the earth's surface

Damage events due to nature processes occur ever more frequently in areas which so far were not affected or only rarely. As conventional diagnosis methods are limited, it is difficult to implement preventive measures. The Ladweinian


map of Geoka makes it possible for the first time to uncover nature processes automatically by pointing out the locations of future, unidentified damage events through a surface covering analysis - before a damage has occurred.



**Example: Infrastructure**  
This road was damaged by a hidden undercutting. The Ladweinian map tells the road builders at which places the road is on endangered grounds, therefore requiring a thicker protective layer. By applying a more efficient building method, approx. 20% of the annual maintenance budget for existing infrastructure can be saved for roads and rails.



**Example: Settlement planning**  
Parts of the village Gondo in Switzerland were destroyed by a landslide in November 2000. 13 people died. "Nobody had expected a landslide there. The hazard map was created only for falling rocks, from which a wall should have protected." (Landslide in the Wallis, 3Sat online, 9.11.2000)  
The Ladweinian map is the ideal instrument for the spatial planning. Decision makers can recognize objectively where it can be allowed to build and where it should be prohibited. The European Union guideline for environmental compatibility testing (see "legal conditions") requires the municipalities to conduct settlement planning starting from July 2004. The Ladweinian map is the suitable instrument for this task.



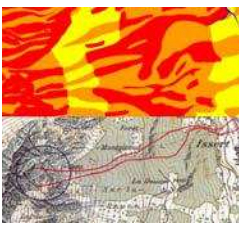
**Example: Rinsing off from flood**  
The Ladweinian map uncovers that the bank was already weakened on this location at the Rhine. This is the reason why the bank and parts of the hinterland were rinsed away with a flood. The Ladweinian maps can be used for the examination of the steadfastness of banks, dykes and dams - before a damage or a disaster occurs.



**Example: Landslides after strong rainfall**  
The Ladweinian map shows that several areas in the entire slope are threatened by landslides. The retaining wall can not stabilize the entire slope.  
Out of ignorance and based on faulty analyses, wrong security measures are built, where maintenance costs are extremely high. The Ladweinian map shows in which places security measures are useful. The cost savings are enormous, even in small, limited areas.




**Example: Undercutting caused by general watering**  
The Ladweinian map shows that a hidden undercutting transforms the soil of this new residential housing area into mud after strong precipitation. The new houses stand partly inclined and exhibit already fears. By using the Ladweinian map, bad building grounds can be avoided or prevention measures can be built in the correct places.



**Example: Avalanches after heavy snows**  
Conventional danger maps cannot predict avalanches such as the one in Isert in 1999: "A large avalanche in this area has never been observed." (from: The avalanche winter of 1999, Swiss research institute for avalanches) The Ladweinian map uncovers this avalanche course automatically - just as other so far unknown avalanche courses.


## SPIRS - Structure Process Inclination Response System

The procedure of Geoka recognizes the respective tendencies to certain reactions by the slope in the diagnosis of the future form development and surface dynamics through the genetic analysis of the digital terrain model. The different angles of inclination and radii at each slope (from the slope head over the central slope to the slope foot) refer to different reactions, shaped for example by physical and chemical decomposition of the rocks. Conclusions on the geological formations are won through the analysis and interpretation of the geomorphologic conditions. External geological and geomorphologic input factors are not required by the SPIRS procedure ("Structure Process Inclination Response System") of Geoka, as they are determined by the procedure.



Ladweinian map from a study by Mihai Micu, Institute of Geography, Geomorphology and Natural Hazards Lab, Romanian Academy of Sciences.

The "Structure Process Inclination Response System" (SPIRS) interprets the endangerments at different angles of inclination which exhibit different reactions through different radii and locations of the slope. The system recognizes in each case the existing tendencies towards a certain equilibrium resulting from the natural procedure of evacuation and deposit. The climate change underlines its importance for the diagnosis of the form development in a landscape.

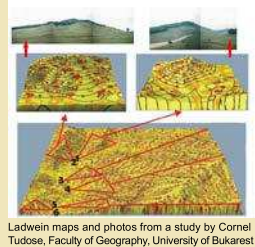


Ladweinian map from a study by Cornel Tudose, Faculty of Geography, University of Bukarest.

The SPIRS procedure of Geoka seeks out two places that are important for the nature processes: first of all the "loci minoris resistentiae" - the places of slighter resistance on the earth's surface, and secondly the locations of the groundwater regimes near the earth's surface. The GIS based procedure results in the Ladweinian map which is suitable for the surface covering early recognition of important nature processes on the earth's surface and the locations of future natural hazards. The software-based, automated system needs no additional information as for example observations, field work, drilling, satellite photos etc. and is therefore strongly cost-lowering.

## The Ladweinian maps of Geoka

The results from independent reference projects with experts in the area of natural hazards prove that the Ladweinian maps uncover unidentified locations of nature processes on the earth's surface.



Ladweinian maps and photos from a study by Cornel Tudose, Faculty of Geography, University of Bukarest

The Ladweinian maps of Geoka can be used for the entire spatial planning, for the planning of settlements and industrial buildings, for the evaluation of building sites, for route planning (roads and rails), examination of hydraulic engineering and flood protection. The procedure can be used worldwide.

The application of the Geoka procedure leads to immense cost savings: On the one hand by decreasing or preventing the damages from disasters, which is of particular interest for insurance companies, and on the other hand by avoiding unsuitable building undergrounds.

The Geoka procedure was programmed by specialists of ESRI Switzerland on the platform of the world market leader for geographical information systems ArcGIS. The software is proprietary to Geoka which owns the exclusive rights.

According to Geoka's status of information, the Ladweinian map is the only procedure worldwide which can uncover nature processes on the earth's surface and endangered places without requiring to fall back on information from already well-known dangers ("land register information"). The suitability of the procedure has already been proven in different national and international studies. The results from independent reference projects prove that Geoka maps actually uncover unidentified locations of nature processes before a damage must have been reported.

## Advantages of Ladweinian maps

Conventional preventive measures are largely based on well-known damage events and subjective appraisals by specialists, so called statistical hazard maps. The terms "danger maps", "danger reference maps", "danger plans" or "hazard maps" are common. They often express very different facts, and rate the same hazards differently. Their meaning has been diminished. Hazard maps operate with very long periods (known as: event of a century). Therefore the uncertainties are often considerable for these long periods. The mapping methods consider different aspects for the analysis and of the land register information, which often leads to different results and assumptions. The subjective assessment of the expert who is responsible for the analysis plays a crucial role for the evaluation.

The technology of Geoka makes it possible for the first time to automatically uncover the most important nature processes on the earth's surface that threaten areas or properties. Geoka concentrates only on the locations, where dangerous effects for humans and buildings arise. The Geoka procedure for the pre-diagnostic disclosure of hazards represents a paradigm change in the handling of natural processes: Nature occurs and follows its own laws of endogenous and exogenous forces. The Geoka maps permit a change from reactive handling on damage events to a proactive damage prevention. Thus the danger evaluation can be separated from statistic probabilities.

Because the Ladweinian maps are a fundamentally new procedure for the diagnostics of natural processes of the earth's surface, the conventional terms such as natural hazard research, natural catastrophe, nature, hazard et cetera., which have been shaped in different times by different conditions and emphasis, must be discussed anew.