78 Development Of A Virtual Learning Unit About The Topic: Cost-Effectiveness Of Measures To Prevent Natural Hazards

BACKGROUND

The learning unit was developed within the context of the project "Swiss Virtual Campus' Dealing with natural hazards" In the past, prevention measures against natural hazards have been applied without that the costs have been seriously taken into account, since the constructions of protection measures was subsidized by the Swiss federal government. Since the financial situation of the federal government is worsen in the last years, all protection measure projects have to be evaluated with regard to their cost-effectiveness In order to educate the natural hazard experts the basic principles of cost-effectiveness assessment, an internet based learning unit was developed. This learning unit provides the necessary theoretical background and illustrates the application of the cost-effectiveness method with a few case studies.

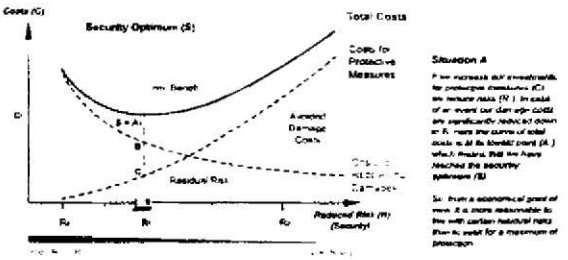
OBJECTIVES

The objectives were:

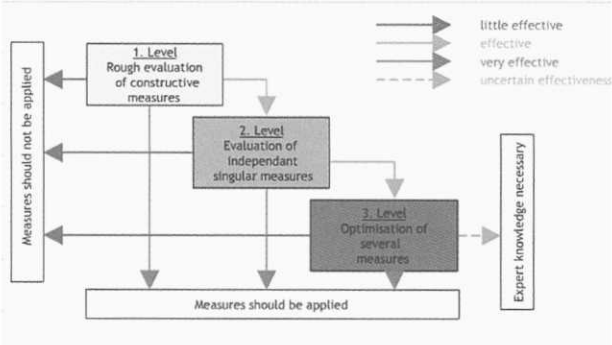
- To introduce the topic "Cost-effectiveness of measures to prevent natural hazards" with a few practical problem situations.
- To give general information about the effectiveness and efficiency of different measure types in order to be able to assess measures quickly on a rough scale.
- To provide an introduction to different methods to assess and quantify the effectiveness and efficiency of particular singular measures in detail.
- To demonstrate a method to combine different types of measures in order to achieve an optimum security level.
- To present a threefold procedure to evaluate a particular measure project according to its cost-effectiveness.

ACTIVITIES

We implemented as much of the cost-effectiveness theory with interactive graphics in order to improve the learning curve of the course participants An example of such an interactive graphic is shown where the participants can drag and drop the slider bar from High Risk to Low Risk and directly see the consequences with respect to costs and effectiveness.



Another important focus was the practical applicability for the end users. Therefore, simplified procedures where presented that allow a stepwise approach to evaluate a particular prevention measure project. A threefold approach is presented in the attached figure. The learning unit will be online starting January 1, 2005.



LESSONS

The resources to develop such virtual learning units that are highly interactive have been underestimated significantly. However, it is hoped, that with this experience, the resources for other learning units will be allocated more appropriately

FUTURE

Development of a meta-database for internet-based learning units dealing with "Case studies and best practices on education for sustainable development."

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79 Effects Of Vegetation On Shallow Landslides: A Case Study In Sachseln, Switzerland

BACKGROUND

In areas with steep slopes, hazard events are often accompanied by shallow landslides. Mostly, the slope movements are triggered off by heavy rainfall and cause vast losses in areas with high damage potential. Comprehensive risk management in connection with landslides involves not only the identification of hazard zones and the implementation of technical protection structures but also includes biological measures, both in terms of landslide prevention and regeneration of eroded slopes.

OBJECTIVES

Little is known about the influence of forest conditions on slope stability. In 1997, an extreme thunderstorm triggered off more than 400 shallow landslides within an area of 20 km2 in the region of Sachseln, Switzerland (See *Rickli, Ch., Zimmerli, P. & Böll, A., 2001: Effects of Vegetation on Shallow Landslides - an Analysis of the Events of August 1997 in Sachseln, Switzerland. In. Kühne, M., Einstein, H.H., Krauter, E., Klapperich, H., Pöttler, R. (eds) Proc. Internat Conf on Landslides 2001, Davos: 575-584.*). These events provided a unique opportunity to investigate the effects of different types of forest management and land use on landslide activity.

ACTIVITIES

A study area covering a total of 8.2 km2 was defined Within this zone, all landslides with a volume of at least 20 m3 were investigated. All relevant factors were recorded for a total of 280 slides, 136 in forested areas and 144 in open land. They include the condition and management of the vegetation cover, the characteristics of the soils, loose material and bedrock, slope inclination and certain aspects of the geomorphology

To examine the question of whether forest conditions affect landslide activity, three categories of forest conditions were defined and plots adjacent to the slides accordingly classified. Further, using the same criteria of assessment the forested areas of the entire study area were similarly allotted to one of these three categories on stand by stand basis

ACHIEVEMENTS

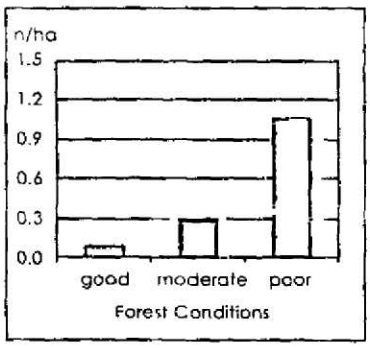
Within the study area, shallow landslides occurred on slopes with inclinations from 28° to 45°. On slopes with an inclination of up to 39° the landslide activity (number of slides per hectare) was noticeably greater on open land than on forested sites. In steeper areas there was no difference This finding indicates that forest enhanced the stability of moderately steep slopes. However, this effect is not unlimited: in very steep areas the difference in landslide activity between forest and open land diminishes.

In addition, the condition of the forest was found to have affected the landslide activity. Hardly any slides occurred within stands consisting of site adapted tree species, few gaps and a diverse stand structure. Markedly more slides were triggered off within stands in less favourable condition, e g. with many gaps Finally, a great number of slides occurred on stands damaged by wind throw or bark beetles.

LESSONS

The results of the case study point to the importance of forest conditions to slope stability during severe rainfall events. Within limits, forest conditions can be controlled by appropriate silvicultural measures. In forest stands with unfavourable conditions, measures that promote a sustainable and stable stand structure, tree species adapted to the site, and sufficient regeneration may help to reduce the activity of shallow landslides The figure shows number of landslides per hectare (n/ha) in relation to forest conditions. Forest conditions are indicated as follow

good: species and stand structure suitable for site, few gaps; *moderate:* species and stand structure not suitable for site, many gaps, and *poor:* parts previously damaged (wind throw, bark beetles), loose stands



FUTURE

The findings described above are based on a single case study. They have to be verified by additional investigations, i.e. in different regions with other geology, topography and rainfall intensity.

A major challenge is the environmentally compatible restoration of areas affected by landslides with soil bioengineering methods. They offer the possibility to combine emergency measures with medium- and long-range targets. Measures taken into consideration should aim to a close vegetation cover in due time on the one hand and, on the other hand, to integrate this immediate step vegetation into natural succession processes such that a self-sustaining climax association develops in the long-term.

With these objectives, the careful selection of the "starting ensemble" is of particular concern. To be able to cope with the manifold challenges, it is most important to consider not only the relevant plants but their symbiotic partners (mycorrhizal fungi) too. The species composition of the mycorrhizal fungi community has the potential to determine plant community structure and, therefore, plays a key-role in the development of the plant associations. However, depending on the climax vegetation in mind, and particularly in view of an effective protection against natural hazards, tending will be essential in the one or other phase of development.

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