

INTERNATIONAL SOCIETY FOR SOIL MECHANICS AND GEOTECHNICAL ENGINEERING



This paper was downloaded from the Online Library of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE). The library is available here:

<https://www.issmge.org/publications/online-library>

This is an open-access database that archives thousands of papers published under the Auspices of the ISSMGE and maintained by the Innovation and Development Committee of ISSMGE.

Disaster risk reduction and emergency management – governmental practice in Sweden

La prévention des catastrophes et la gestion des urgences - la pratique gouvernementale en Suède

HannaSofie Pedersen

Swedish Geotechnical Institute, Sweden, hannasofie.pedersen@swedgeo.se

ABSTRACT:

It is important to reduce a society's vulnerability to the effects of natural disasters. Natural disasters cause great damage, both from a human and from an economical perspective. Considering the ongoing climate change, increased exploitation and increasing pressure on land resources, natural disasters and their consequences are expected to increase. There are two major ways to reduce vulnerability and strengthen societal resilience; by preventative measures to reduce the risk of disaster occurrence and thus avoid serious consequences, and/or by strengthening societal preparedness to the occurrence of a disaster. The Swedish Geotechnical Institute (SGI) is a governmental agency that has developed an approach towards disaster risk reduction and emergency management related to landslides, which works both ways to reduce vulnerability. The purpose of this paper is to describe this approach to disaster risk reduction and emergency management.

RÉSUMÉ:

Il est important de réduire la vulnérabilité d'une société face aux effets des catastrophes naturelles. Les catastrophes naturelles causent de grands dommages, tant d'un point de vue humain que d'un point de vue économique. Compte tenu du changement climatique en cours, l'augmentation de l'exploitation etc., les catastrophes naturelles et leurs conséquences devraient augmenter. Il y a principalement deux façons de réduire la vulnérabilité et renforcer la résilience sociétale : par des mesures de prévention pour réduire le risque de survenue de catastrophes et ainsi éviter de graves conséquences, et/ou par le renforcement de la protection civile en cas d'une catastrophe. L'Institut Géotechnique Suédoise (SGI), qui est un organisme gouvernemental, a développé une approche en vue de la réduction des risques de catastrophe et la gestion des urgences liées aux glissements de terrain, qui travaille avec les deux façons de réduire la vulnérabilité. L'objectif de cet article est de présenter cette approche pour la réduction des risques de catastrophe et la gestion des urgences.

KEYWORDS: natural disaster, landslides, climate change, resilience, disaster risk reduction, emergency management

1 INTRODUCTION

It is important to reduce a society's vulnerability to the effects of natural disasters. Natural disasters cause great damage, both from a human and from an economical perspective. Considering the ongoing climate change, increased exploitation and increasing pressure on land resources, natural disasters and their consequences are expected to increase.

There are two major ways to reduce vulnerability and strengthen societal resilience: by preventative measures to reduce the risk of disaster occurrence and thus avoid serious consequences, and/or by strengthening societal preparedness to the occurrence of a disaster.

2 DISASTER RISK REDUCTION

When it comes to disaster risk reduction, the process of physical planning is the most important tool in Sweden to help society avoid placing new developments on ground that may be threatened by natural disasters in the present or in the future.

To create a sustainable society, it is necessary for decision makers to be able to make decisions that meet a future where the changing climate creates new, and partly unknown, conditions.

2.1 Governmental practice

In Sweden, the monopoly to plan the use of land and water is de-centralized to the local municipalities. The municipalities are responsible for the process of physical planning.

The Swedish process of physical planning includes different stages of planning and reviewing. In the different stages of the planning process, governmental authorities and the general public are invited to review and comment on the planning documents that the municipalities present.

It is possible for the county administrative board to appeal against a plan, if there are important deficiencies according to the Swedish planning and building act and to national interests (the Swedish Parliament, 2010).



Figure 1. The Swedish process of physical planning.

Since different expert authorities are given the opportunity to comment on the planning documents and ideas throughout the process, this provides preventative measures to reduce the risk of disaster occurrence and thus avoid serious consequences.

As a part of this preventive work, the Swedish Geotechnical Institute (SGI) has, as a governmental agency, built up an organization to provide the municipalities and county administrative boards throughout the whole country with support regarding geotechnical safety issues (e.g. landslides and erosion) in the process of physical planning. This support has been given to the municipalities in the county of Västra Götaland since the 1980's and to the whole country since 2010. This support is free of charge.

The Swedish Geotechnical Institute is an expert agency that works for a safe, efficient and sustainable development and sustainable use of land and natural resources. SGI's mission includes the prevention of landslides and coastal erosion, sustainable and effective soil works, know-how and methods to remediate contaminated sites and climate adaptation. SGI's mission is governed by an instruction and annual appropriation directions from the Swedish Government.

As support in the physical planning process, SGI's unit of landslide and erosion expertise reviews both the detailed and comprehensive plans – including geotechnical reports – regarding geotechnical safety issues and with respect to the Swedish planning and building act. The review also takes into account if, and how, the effects of a changing climate is being handled.

When reviewing the documents of the planning process, SGI makes sure that the following geotechnical issues have been investigated, considered and presented:

- Geological and geotechnical conditions
- Ground water and pore water pressure conditions
- Erosion conditions
- How the exploitation of the area in question affects the slope stability (soil and rock) of the surrounding area.
- How the slope stability (soil and rock) of the surrounding area affects the planned exploitation.
- How the changing climate affects the slope stability and the probability of landslides.

Throughout the reviewing process, SGI also verifies that the conditions and restrictions given in the geotechnical reports are assured in the planning documents and that the geotechnical reports follow the guidelines in the Eurocode 7 application documents regarding slope stability investigations (SIS, 2005). Eurocode 7 is intended to be used as a general basis for the geotechnical aspects of the design of buildings and civil engineering works.

Beyond the above described reviewing, SGI regularly visits municipalities and county administrative boards to inform about how to consider geotechnical safety issues throughout the process of physical planning.

Also, in the process of planning of infrastructure, such as roads, railroads, power plants etc., SGI provides support regarding geotechnical and environmental issues. This support is free of charge, as is the support for the municipalities and county administrative boards.

Despite the somewhat complicated geotechnical conditions that can be found in many parts of Sweden, there are relatively few landslides occurring in exploited areas. We are willing to believe that the above described reviewing process has a positive effect on reducing the probability of landslides to occur in populated areas.

2.2 Climate Change

The climate is changing and it will have different effects in different parts of the world. In many countries in the northern

part of the hemisphere, the on-going climate change will cause warmer winters with more precipitation and warmer summers with prolonged periods of low rainfall (drought). The climate change will also cause the sea levels to rise and cause more extreme weather in general.

The climate scenarios presented today indicates that the global warming is unequivocal, and since the 1950's, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen. Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. The climate change is to be considered an ongoing process (IPCC, 2014).

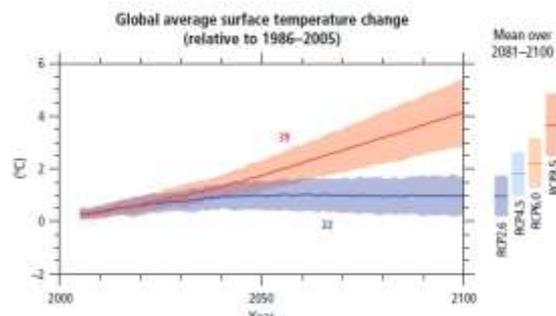


Figure 2. Global average surface temperature change (IPCC, 2014)

2.3 Natural disasters; landslides

The climate change will affect slopes and other structures as a consequence of increased precipitation. Increased precipitation leads to higher ground water levels and increased pore water pressure. This has a negative effect on the slope stability and landslides can occur. Increased precipitation also cause increasing flow in rivers and streams and it causes rising sea levels. The increasing flow affects the process of erosion, which can cause landslides in a longer perspective.

3 EMERGENCY MANAGEMENT

Over the past 100 years, major landslides have become more common. In addition to climate change, one probable cause is man's increasing intervention in nature that effects the natural equilibrium.

Landslides larger than one hectare occurs on average every two to three years in Sweden. (MSB, 2016) Even though many of the landslides occur in unpopulated areas, occasionally landslides affect exploited areas and infrastructure.

According to the Swedish act for protection against accidents the country's municipal Rescue Services are responsible to take action when an accident occurs or when there is an immediate risk for accidents to occur (the Swedish Parliament 2003).

3.1 Landslides in Sweden

Over the years, Sweden has been affected by several severe landslides.

The landslide in **Tuve**, on November 30th 1977, caused the death of nine people and injured sixty. 436 people lost their homes and 65 houses followed the landslide masses and were destroyed. The landslide covered an area of 27 ha. The total economic loss is estimated to 14 million EUR (1977 monetary value).

In the landslide in **Vagnhäräd**, on May 23rd 1997, seven houses were destroyed and 30 homes were evacuated because of the risk of further landslides. The landslide caused no

fatalities. The landslide covered an area of 1.5 ha and included a 200 m long stretch along the Trosa River. The total economic loss is estimated to 12-13 million EUR (1997 monetary value).

On December 20th 2006, there was a major landslide in **Småröd**, a few kilometers south of Munkedal, Bohuslän. Parts of the European highway 6, E6, and 200 m of the rail road Bohusbanan were destroyed. A total of 28 people were rescued from the area. Three people were injured, but there were no fatalities. The landslide covered an area of 8.5 ha. The total economic loss is estimated to 53 million EUR (2007 monetary value) (Naturolycksdatabasen, 2016).

3.2 Official on call

A part of SGI's emergency management routine is to support the Rescue Services in Sweden in case of emergencies related to landslides. This support is free of charge.

On behalf of the Swedish Government, SGI has – since December 1st 2015 – established an organization for official-on-call with preparedness on a 24/7 basis. This is done in order to offer expert knowledge when it comes to landslides and geotechnical safety issues.

3.2.1 Organization

The organization for SGI's official on call consists of 10-15 geotechnical experts and one coordinator.

The official-on-call is responsible for being the contact person for all Rescue Services in Sweden in case of emergencies related to landslides. She/he is also responsible to

inform the coordinator and the Director General immediately in case of emergency.

3.2.2 Working routine

Every official-on-call is on duty for one week at a time and is during that time available on phone every hour, every day of the week. In case of emergency, she/he provides geotechnical information and advice to the Rescue Services on how to act when a landslide has occurred or is about to occur in that specific area.

If needed, the official-on-call – or someone within the organization – meets up with the Rescue Service on site to decide on what preventive measures to take to minimize the damage and to prevent further landslides.

3.2.3 Example: Tool for emergency communication

In order to correctly describe the exact position of the site, and to share information such as pictures, reports, calculations and notes, SGI has developed a GIS-based on-line-application used for communication between the Rescue Services and SGI's official-on-call.

This on-line-application enables the Rescue Services to mark the GPS-position of the area of interest and also to send pictures and comments directly to the official-on-call.

The official-on-call has through this application, in addition to the possibility to communicate, access to a lot of geological and geotechnical information. This information can be used to assess the situation and further on, to give recommendation for further action to the Rescue Services.

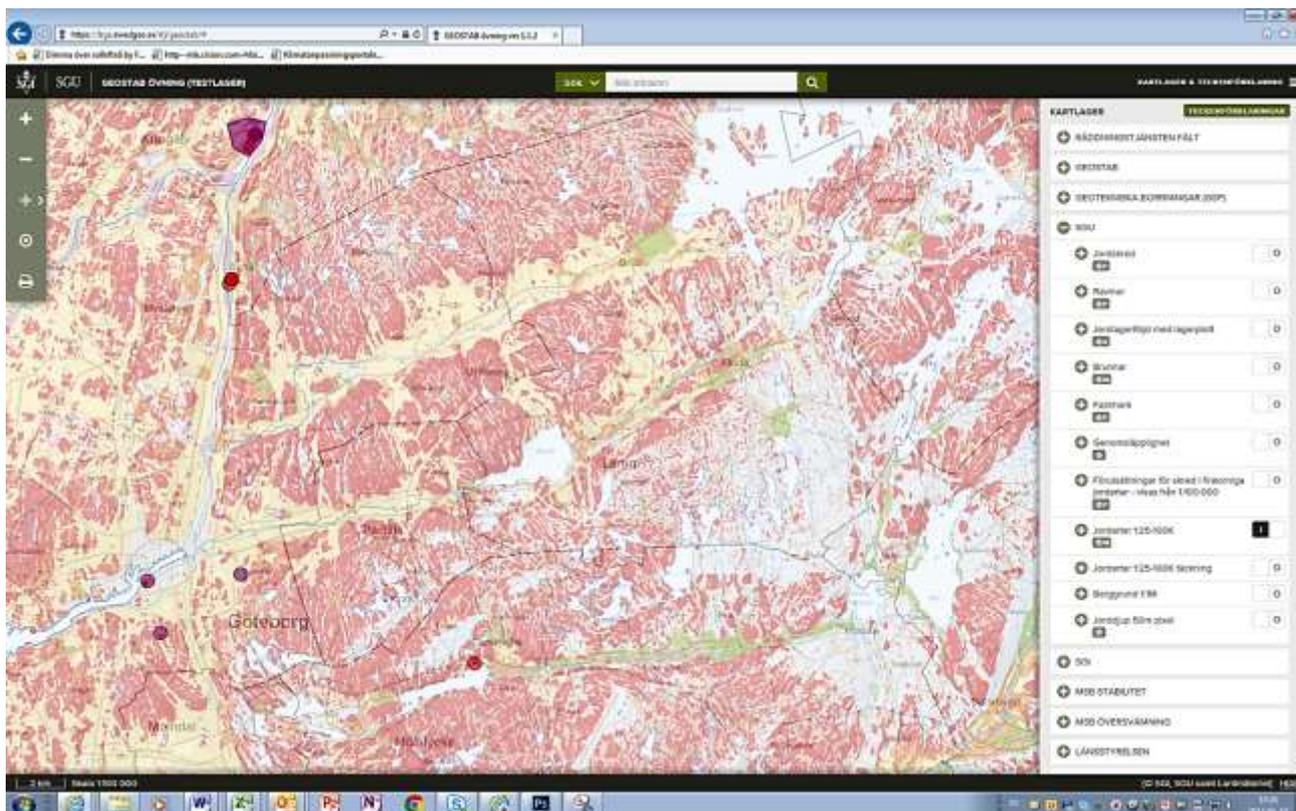


Figure 3. On-line-application for emergency communication

3 CONCLUSIONS

By the described processes in this paper, the Swedish Geotechnical Institute aims to reduce the society's vulnerability to the effects of natural disasters such as landslides. It is the idea that these processes have a positive effect on both reducing the risk of disaster and, through emergency management, minimize the damage if a landslide nevertheless occurs.

4 REFERENCES

IPCC (2014). *Climate Change 2014. Synthesis Report. Summary for Policymakers*. Intergovernmental Panel on Climate Change (IPCC)

SIS (2005). *Eurocode 7: Geotechnical design. SS-EN 1997-1:2005*. Swedish Standards Institute (SIS)

The Swedish Parliament (2010). *Plan- och bygglag (2010:900). Svensk författningssamling 2010:900 (Plan and building act)*

The Swedish Parliament (2003). *Lagen om skydd mot olyckor, 2003:778. Svensk författningssamling 2003:778 (Act for protection against accidents)*

Naturolycksdatabasen (2016). <http://ndb.msb.se/>

MSB (2016). <http://www.sakerhetspolitik.se/Hot-och-risker/Naturkatastrofer-och-olyckor/Ras-och-skred/>