



## **How much for the beetles and the church? — Landslide effects on nature and cultural environments**

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The Swedish Geotechnical Institute is currently engaged in evaluating the consequences of landslides in the Göta älv river valley. The overall risk assessment method is to multiply landslide probability with consequence, expressed in monetary terms. Landslide damage may either be direct on the landslide area itself, or indirect through water pollution and shock waves.

The intention is a holistic view of the entire consequences. These include road and rail transport systems, agriculture and forestry, life and inhabitants, buildings, contaminated sites and hazardous industries, . . . , and the special subject of this presentation: values of the natural and cultural environment.

Biodiversity, landscape, recreation and fishing were the four functions that had caused designation of areas as of special interest from a nature perspective. The inventory comprised all areas designated as of national interest, all Natura 2000 areas, and a sample of the nature reserves in the area. Biodiversity may be either decreased or increased by landslides. The damageable part consists for example of old deciduous forests, fish spawning sites, or marsh areas with high biological diversity. Trees are disturbed by landslides; marsh areas may slide into the river or dry out. At the same time, landslides and mass movements contribute to biodiversity because they enable pioneer vegetation and natural succession of vegetation, cause dead trees and create a landscape with many micro-habitats. The landscape function includes a geodiversity value, biophysical diversity, an opportunity to study natural processes, and an educational possibility. These gain rather than lose by each landslide. Recreation and fishing are ecosystem services that may be hindered by landslides.

Designated cultural values of national interest were primarily architectonic: City blocks from the 17th century or the 1920s own-home movement, a village structure from prior to the major land consolidation, a church village etc. There were also prehistoric relics like hill forts and burial sites. Churches and cultural heritage sites were not designated of national interest, but have a cultural value just the same.

Different methods are expected to be necessary for the valuation of different categories. A literature survey indicates that willingness-to-pay (WTP) may play an important role for the consequences, both to natural and cultural environments. This may take the form of revealed preferences, e.g. the contribution of the Swedish state to maintain church antiquarian values, or stated preferences, e.g. fishermen's answers in interviews as to the value of catching fish. Replacement costs and direct economic damage may be more appropriate for e.g. the transport sectors. The final result will be an estimate of all damage done by a landslide in a particular part of the Göta älv river valley, which then may be used to prioritise mitigating measures.