

## Shallow landslides: lessons from Sachseln 1997

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A retrospective analysis of the heavy rainstorm in 1997 in Sachseln with almost 500 shallow landslides – half of them within forests, the other half in open land – reveals interesting perspectives. A total of 218 of these landslides were comprehensively documented, including 107 events triggered in forests that have been subjected to a more accurate analysis.

A preliminary statistical approach based on distribution functions applied to slope inclination  $\alpha$  and shear angle  $\Phi'$  gives rise to the assumption that optimally managed forests have high protection potential – optimally managed in this context means the NaiS standard improved by findings of our project SOSTANAH.

NaiS: [www.bafu.admin.ch/publikationen/publikation/00732/index.html?lang=de](http://www.bafu.admin.ch/publikationen/publikation/00732/index.html?lang=de)

SOSTANAH: [www.slf.ch/ueber/organisation/oekologie/gebirgsoekosysteme/projekte/SOSTANH/index\\_EN](http://www.slf.ch/ueber/organisation/oekologie/gebirgsoekosysteme/projekte/SOSTANH/index_EN)

Thus, it can be speculated that up to about four-fifths of these landslides could have been prevented, provided the forests fit the corresponding requirements. In an exemplary calculation, only about 80 ha of the investigated forest area (~400 ha) would have been affected or roughly 20 landslides triggered of the 107 analysed.

Given the specific characteristics for sites and improvement in Sachseln, the approximate costs for forest management, starting from an almost uncovered landslide area up to a mature protection forest (120 years), are estimated at about 35'000 CHF ha<sup>-1</sup>, yielding yearly 300 CHF ha<sup>-1</sup> (price basis: 2016). The expected average annual expenditure to sustainably ensure continued existence of optimal protection forests is slightly lower. In the case of Sachseln, this amounts to about 12 Mio CHF for the whole area of 400 ha and a 100-year period (cost estimate by oeko-b, Stans: [www.oeko-b.ch](http://www.oeko-b.ch)). The total damage of the 1997 event in Sachseln, with an estimated return period of 100 years, exceeded 120 Mio CHF. Of course, destruction was not merely caused by or obviously linked to shallow landslides. Nevertheless, from a long-term perspective, it is most likely that the investment into forest management meeting the requirements of most effective protection against shallow landslides will by far pay off the roughly 10% of the costs for clean-up and repair operations.

It would be valuable to have further investigations on cost-efficiency and potential trade-offs of adapted protection forest management for slope stabilisation. For it is only when providing a broad and sound basis that recommendations for enhanced maintenance of protection forests will be reliable and acceptable. Furthermore, if the focus is primarily on "natural protection measures", it has to be kept in mind that respective investments will not amortise immediately! This is an issue not to be neglected since it is well known that "society does not necessarily perceive what cannot be seen" ...