

coverage, structure

40% of the forests affected did not meet the "minimum standards" of cover, structure, and development.

For optimal protection against shallow landslides, canopy and total cover should be above 40% and 70%, respectively and the length of gaps in the line of slope not exceed 20 m. A certain diversity in vertical and horizontal structure is required as well as different succession stages of the path towards the target association aimed at.



layering, development

## Introduction

Retrospective analysis of 218 shallow landslides with a serially applied "3-step filter" explained ~97% (212) of the events. The filter consists of a **soil mechanical** (a), **vegetation** (b), and **topographic** (c) part:

- a) slope angle  $\alpha \leq$  angle of internal friction  $\Phi' + 5^\circ$
- b) diverse, multi-layered forest with canopy >40% and total cover >70%, gap-length < 20 m, and different succession stages
- c) terrain morphology **not** flat-convex (6), concave-flat (8), concave-convex (9)

soil mechanics

slope inclination



50% of the landslides were triggered at slope inclinations  $\alpha$  more than  $5^\circ$  steeper than the angle of internal friction  $\Phi'$ .

angle of internal friction

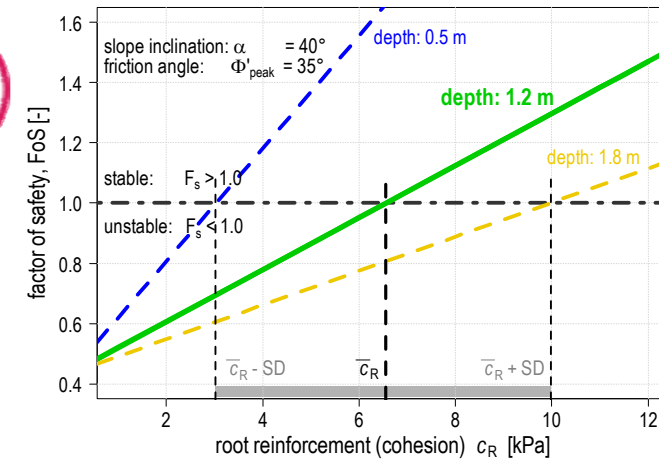
# filter for shallow landslides

7% of the remaining events occurred in terrain highly susceptible to shallow landslides (types 6, 8, 9).

topography

slope-transverse profile

curvature		profile in the line of slope		
		concave	flat	convex
transverse profile	convex	1	2	3
	flat	4	5	6
	concave	7	8	9



Direct shear tests (specimen size: 50x50x40 cm) clearly show the stabilising effect of vegetation. The **mean rooting** of the samples is sufficient to keeping a slope stable at **~5° steeper** ( $\alpha=40^\circ$ ), as compared to the angle of internal friction ( $\Phi'=35^\circ$ ), down to ~1.2 m depth of the slip plane.