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Assessing the stabilising effect of forest cover on landslide-prone terrain in the French Alps

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A modelling approach was used to quantify the contribution of the current forest cover to the stability of an Alpine slope prone to shallow landsliding. Slope stability was calculated under variable meteorological conditions, taking into account the present forest cover and a scenario of a fully non-vegetated slope. The model used was a coupled, distributed hillslope hydrology and stability program developed to assess the hydrological and mechanical effects of vegetation on slope stability. Soil depth, slope angle, cohesion, angle of internal friction, bulk density, root reinforcement and surcharge were used to calculate the factor of safety (FS) for four different areas in the study area. The model showed that the fully vegetated condition sustains the highest evapotranspiration losses being 73% vs. 66% of total precipitation for the case of fully non-vegetated conditions over the simulated 7 year period (1999-2005). The FS calculated was lowest for the areas mapped as marginally stable (current forest cover the FS=1.44; fully non-vegetated conditions FS=0.97) and indicated the stabilising role of the current forest cover in localised areas. The minimum FS is associated with fully saturated conditions that recur within each year. In the case of fully non-vegetated conditions, the lowest FS is generally obtained during winter and spring following episodes of snow melt. Over the entire area instability occurs on average 9 times, extending over a period of 22 days (1% of the total time). The simulation results clearly indicated the current forest cover significantly contributes to the stability of the slopes in the study area. It can therefore be assumed that slope instability could increase after clear-cutting.