SHALSTAB

Model Uses SHALSTAB is a physical model used for mapping the patter of shallow slope instabilities.

Major Categories Geomorphology

Subject Knowledge Level
Intermediate

Minor Categories Erosion

Technical Difficulty Level
Intermediate

Model Type Physical Model

Geographic in Nature?
Yes

Abstract
SHALSTAB started as a digital terrain model for mapping the pattern of potential shallow slope instability (Dietrich et al., 1992, Dietrich et al., 1993, Montgomery and Dietrich, 1994) by building upon the hydrologic model, TOPOG, developed by O'Loughlin (1986) and colleagues at CSIRO in Australia. TOPOG uses a "contour-based" digital terrain model in which cells are created by projecting across the landscape approximate flow lines normal to contour lines (each cell being bounded by two contour lines and two flow lines). While such an approach captures beautifully the effects of surface topography on shallow runoff and overland flow, the model turned out to be very difficult to use over large areas. Consequently, since 1994 efforts have shifted to a more conventional grid-based model and relies on tools in ARC/INFO for data display. The basic code is a combination of C++ programs and ARC/INFO AMLs, and most of it was created by Rob Reiss with modifications by Dino Bellugi and Harvey Greenberg.

The model relies on the concept that typically the boundary between the soil (the solum or O, A, and B horizons) and the underlying variably weathered bedrock is abrupt. This model correctly predicts the observed tendency for soils to be thick in the un-channeled valleys and thin on ridges. Hence, the soil mantle is a mobile, highly conductive layer of colluvium which varies in thickness in a relatively systematic way across the landscape.

This physical digital terrain based model takes advantage of digital elevation data and fast computing that is now available and allows users to predict that flat areas are stable, that ridges (with divergent subsurface flow) may be steep enough to fail but require unusually large storms to generate instability, and that steep unchanneled valley axes (hollows) require the smallest rainstorms to fail (because of the convergent subsurface flow) and are therefore most susceptible to increased instability due to environmental change (such as clear cutting). Many landslide-producing terrains differ from the landscape we describe above and the model may simply be an inappropriate approximation of the surficial mechanics controlling slope stability.

Landscapes for which the model is not expected to perform well include areas that have been glaciated (or may still be adjusting to post-glacial climatic conditions), terrain dominated by deep-seated landslides, areas dominated by rocky outcrops or cliffs, and areas with deep groundwater flow and locally emergent springs. As we will repeat several times in this document, SHALSTAB predictions should be compared with mapped landslide features whenever possible.

Future Developments
Unknown

Model Limitations
Was developed for 'hilly' terrain and may not be suitable for steeper slopes or more mountainous terrain.

Model Features
- Uses Digital Terrain Data as the basis for the model
- Incorporates GIS data and technology as a method of mapping and modeling

Required Data Types
Digital Elevation Models and terrain data in ArcINFO GRID format.

Model Outputs
GRID data sets, which can be viewed in ArcINFO.

Hardware Requirements
None specified

Software Requirements
ArcINFO and GRID

Supported Platforms

DOS	☐	**UNIX**	☒
Windows	☒	**Macintosh**	☐

Cost, Licensing and Availability
Model is provided free of charge from link below.

Source
UC Berkeley

Source URL
http://ist-socrates.berkeley.edu/~geomorph/shalstab/