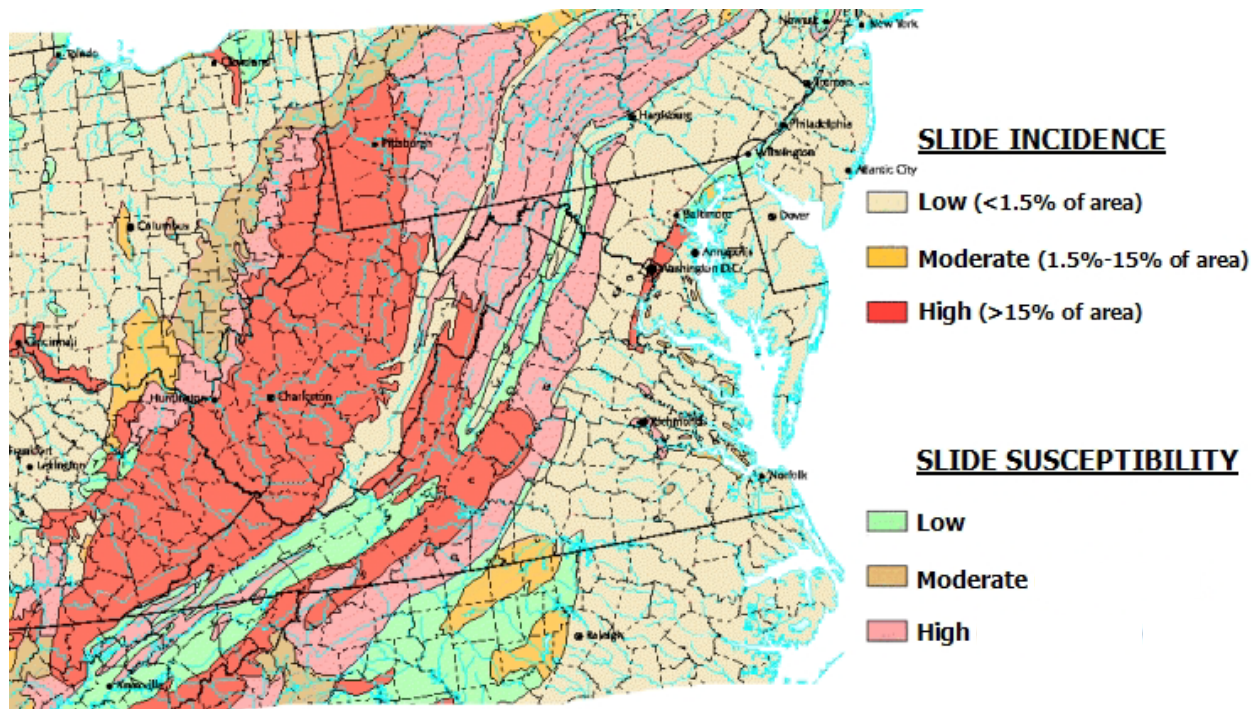


LECTURE #13: Landslide Assessment, Mitigation and Case Studies

Date: 26 February 2025

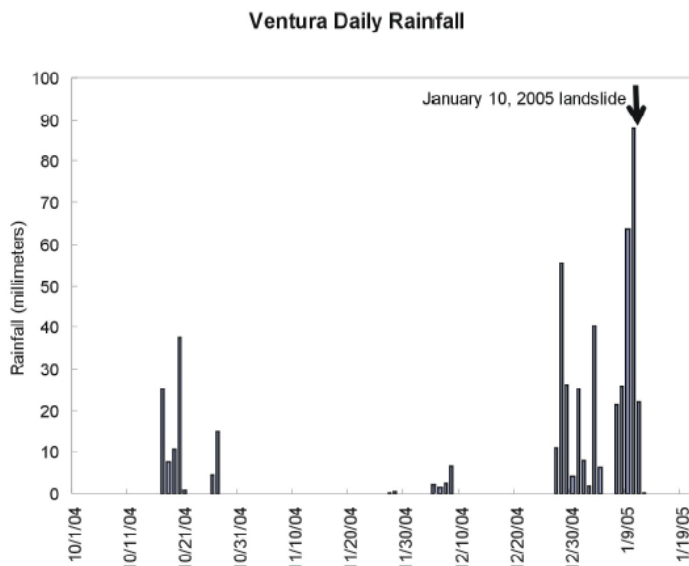
I. Landslide Assessment (Monitoring)

- landslide potential maps
 - used to identify slide prone areas
 - the distribution of past landslides
 - identify potentially unstable slopes
 - terminology
 - incidence: the percentage of slope failure over a given area (e.g., county)
 - can be high, moderate, or low incidence
 - susceptibility: the probable degree to slope failure of rocks and soils due to natural or artificial cutting, loading of slopes, or anomalously high precipitation
 - high, moderate, or low susceptibility



II. Case Studies

- case study #1: La Conchita, CA (2005)
 - prior slope failure (landslide) in 1995
 - after which, the homes were rebuilt
 - excessive rain in January, 2005
 - 1995 debris was mobilized, and a new slide/flow created
 - destroyed 15 homes
 - killed 12 people



La Conchita, CA (1995)



La Conchita, CA (2005)



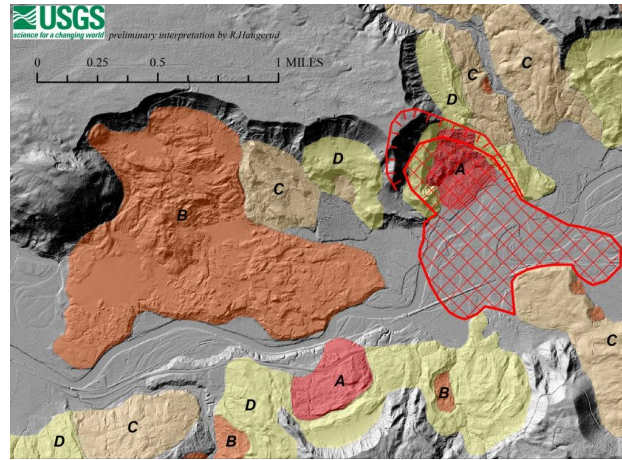
La Conchita, CA (2005)

○ notes:

- case study #2: Oso, WA (2014)
 - landslide transitioning into a mud/debris flow
 - engulfed a rural neighborhood
 - covering 1 square mile
 - 43 people were killed
 - 49 homes and other structures destroyed



Oso slide, WA (2014)



maps of past slides in the Oso area

- notes:

III. Predicting Mass Movements

- slopes
 - over-steepened slopes can be a problem especially in:
 - seismically active areas
 - regions of large earth moving activity
 - during large rainfall events
 - geology and rock structure
 - examples:
 - weak base of slope
 - orientation of bedding planes, fractures
 - evidence of prior falls or slides
 - leads to assessments of high, moderate, or low susceptibility
- surface water buildup
 - saturation indicated by springs, wet ground, and pools of standing water
- vegetation
 - vegetation of different ages (*why?*)
 - fallen or bent vegetation
 - accelerated creep
 - can occur prior to failure
- visible damage to structures



safe or not?



damage following a small slide

- morphologic features resulting from old slides
 - indicative of prior mass movement
 - scarps & “hummocky” topography

IV. Prevention & Mitigation

- slope drainage
 - interceptor drains
 - concrete lined drains that capture runoff and transport it away from slope

- perforated pipe
 - driven into slope to collect water and drain it away from slope



- wells into sloped terrain
 - pumped to remove water rapidly

- ***all very costly***

- slope reduction
 - reduce slope by grading
 - excavate terraces or benches into slope
 - especially important in regions of large earth moving activity

- engineering structures
 - seal crevices and apply shotcrete
 - 8 - 10 cm thick layer of sprayed on concrete
 - minimizes frost wedging
 - keeps loose rocks from eroding



- retaining walls with drains
 - stabilize base of slope
- rock bolts
 - steel rods in cement
 - stabilize inclined layers
- cable nets, wire fences, intercept ditches or berms
 - to catch rock falls



- rock sheds and tunnels
 - landslide
 - snow avalanches

