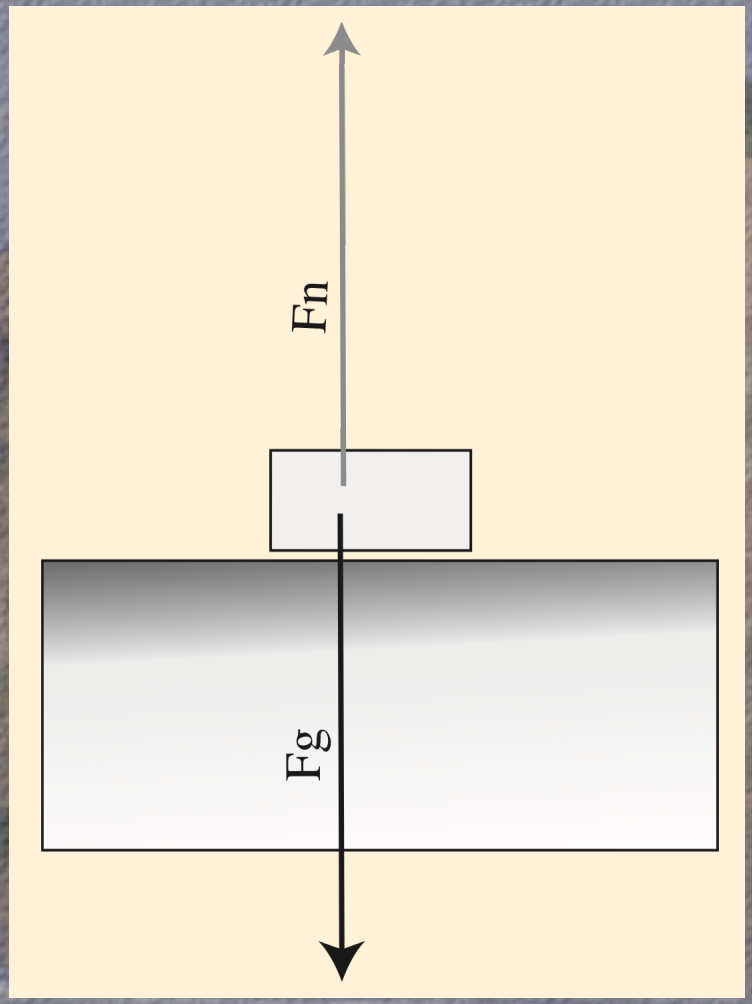
The Role of Gravity – Simple Case

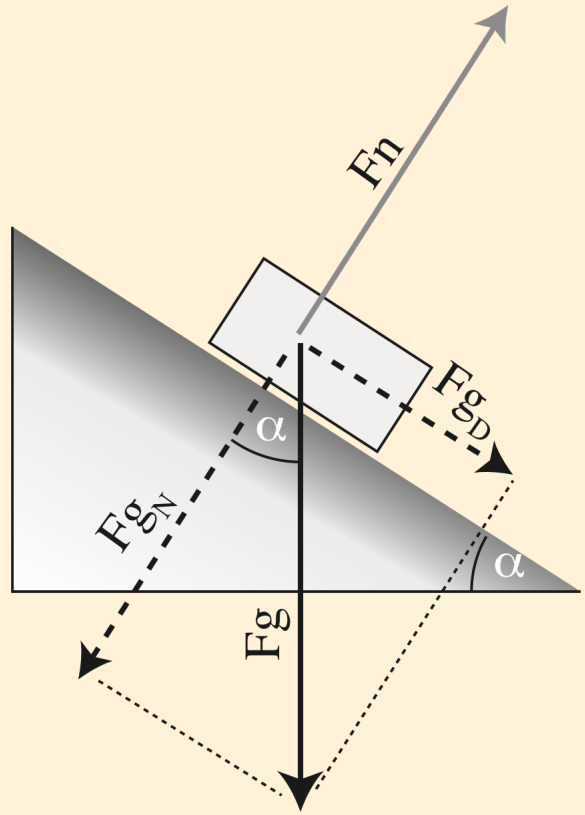
- pull of gravity down -> Fg
- response from ground-> Fn



$|Fg| = |Fn|$

The Role of Gravity - Slope

- pull of gravity down -> $\overrightarrow{Fg} = \overrightarrow{Fg_N} + \overrightarrow{Fg_D}$
- response from ground-> Fn

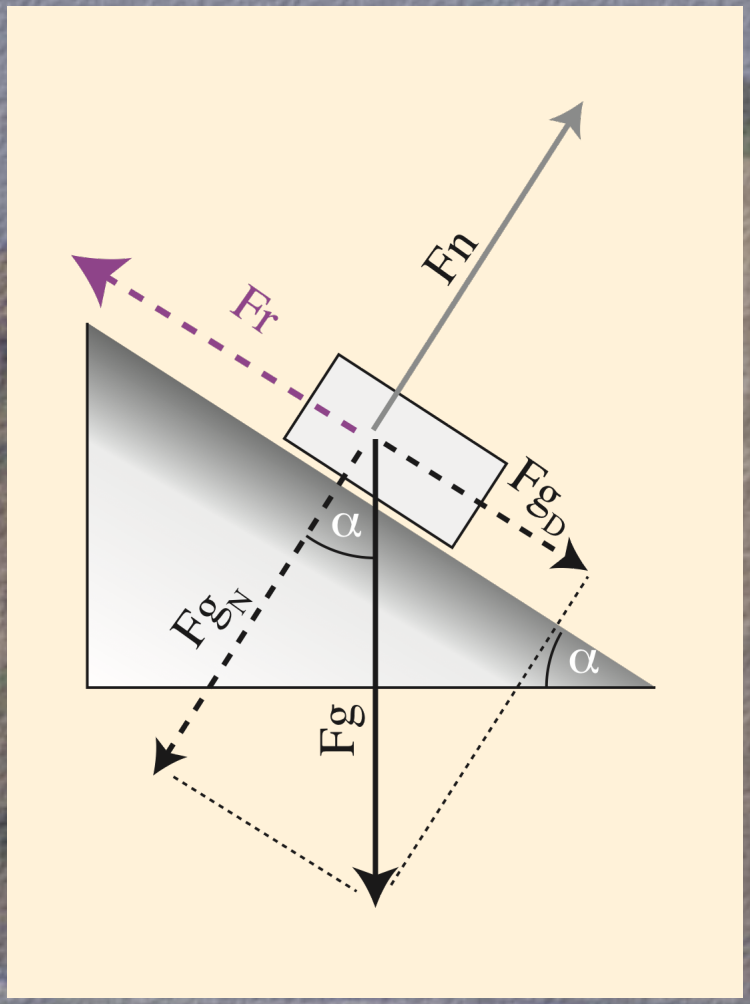


- gravity Fg
- downslope force Fg_D
- normal component Fg_N

$$| Fg_N | = | Fn |$$

The Role of Gravity – Resistance Force

- resistance force Fr
- downslope force Fg_D

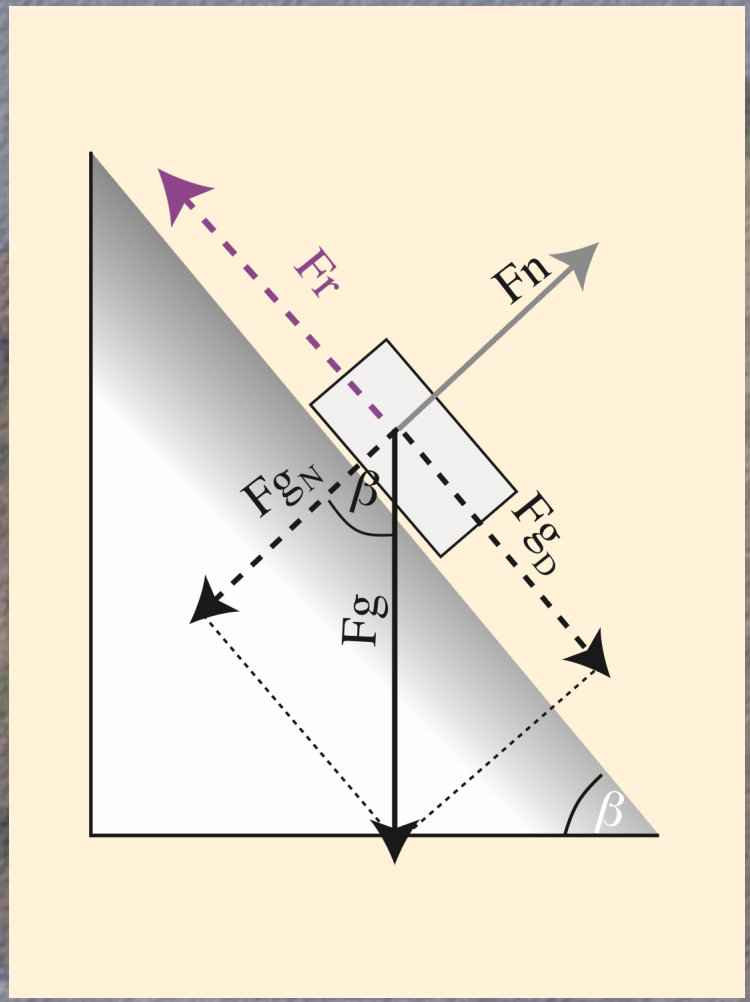


resistance force due to friction

- $Fr > Fg_D$ -> mass stays put
- $Fr < Fg_D$ -> mass slides down

The Role of Gravity- Increasing Fg_D

- resistance force Fr
- downslope force Fg_D

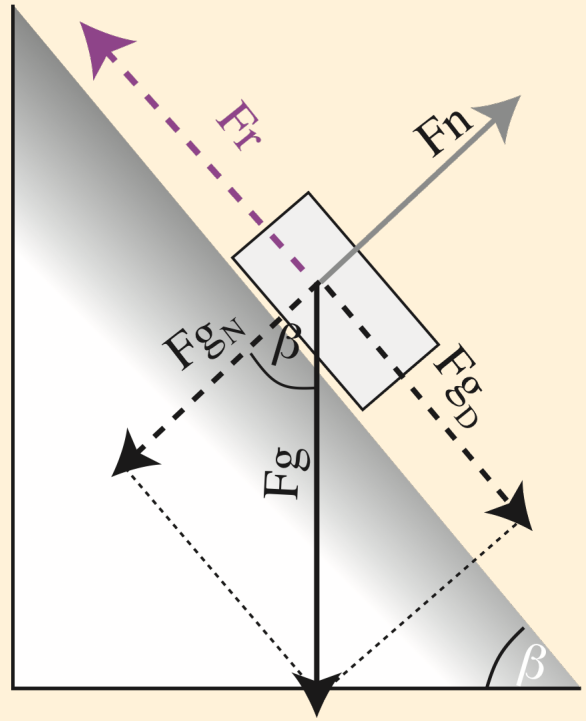


steeper slope
or
larger mass
-> larger Fg_D

- $Fr > Fg_D$ -> mass stays put
- $Fr < Fg_D$ -> mass slides down

The Role of Gravity – Decreasing Fr

- resistance force Fr
- downslope force Fg_D



NATURAL:
earthquakes lower Fr

HUMAN:
- vibrations
- heavy traffic

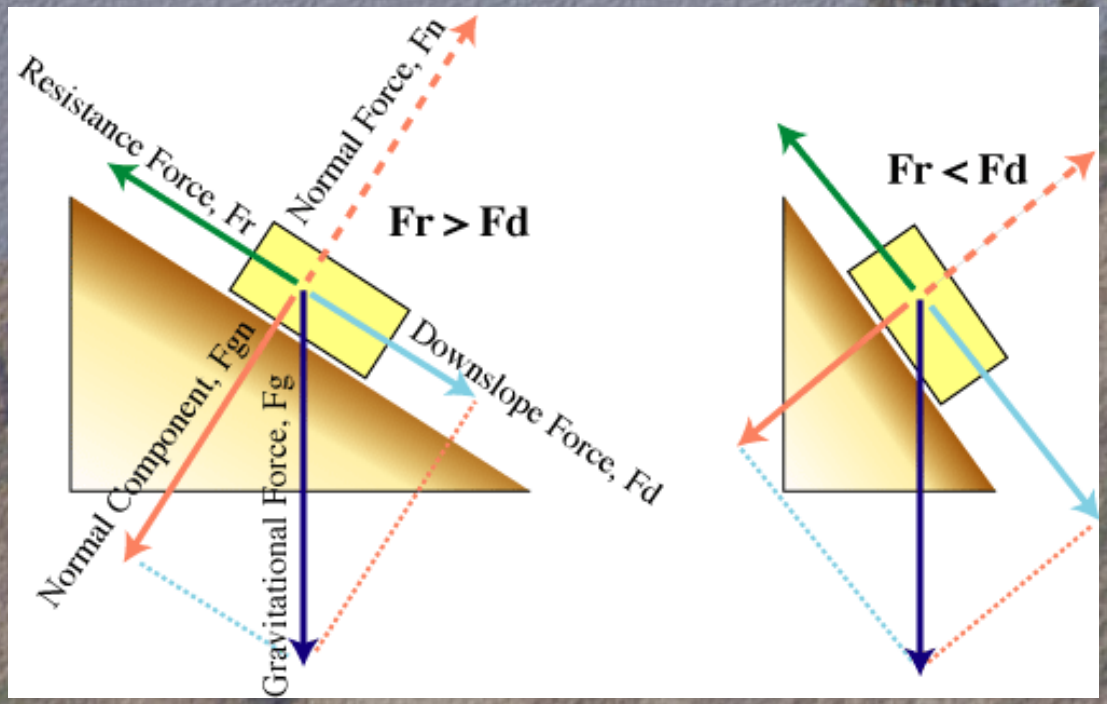
NATURAL:
rain; rise of ground water table

HUMAN:
- irrigation
- leaky infrastructure

GLIDE HORIZON
surface between
unstable mass and solid ground

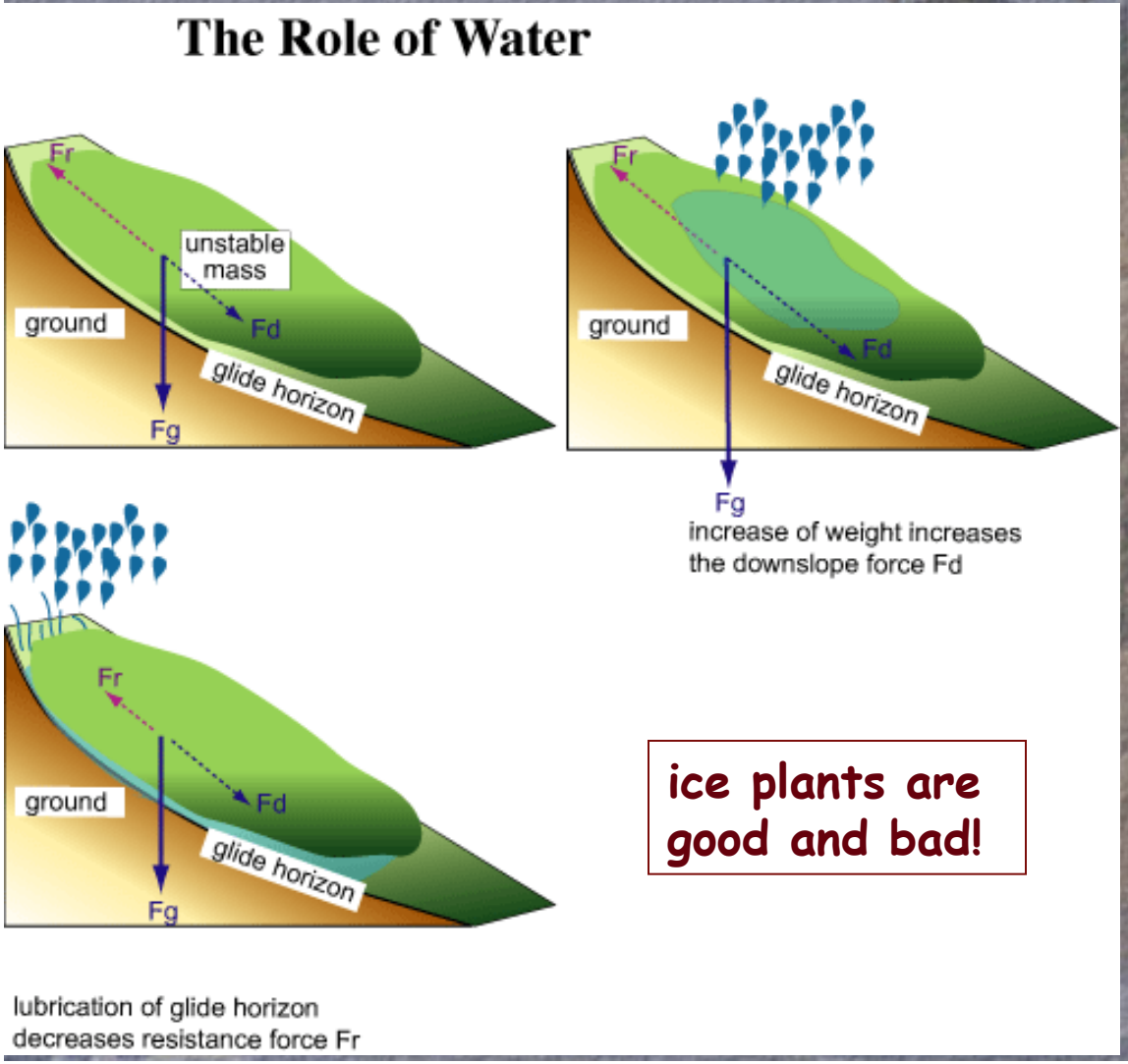
The Role of Gravity

- pull of gravity downslope -> Fd
- resistance force due to friction -> Fr



The Role of Water

- pull of gravity downslope -> Fd
- resistance force due to friction -> Fr

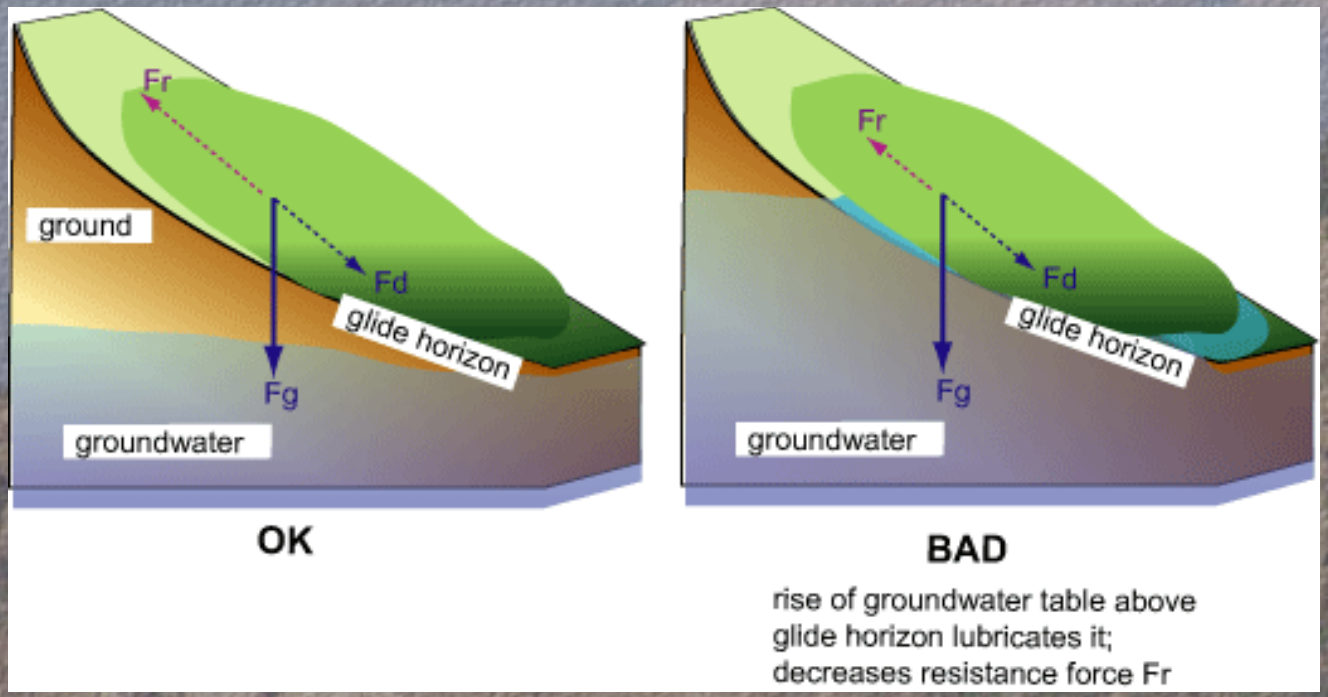


ice plants are good and bad!

NATURAL: rain
- adds mass
- reduces frictions

HUMAN:
- irrigation
- failing pipes
- leaky pools

The Role of Groundwater



ok:
water table below
glide horizon

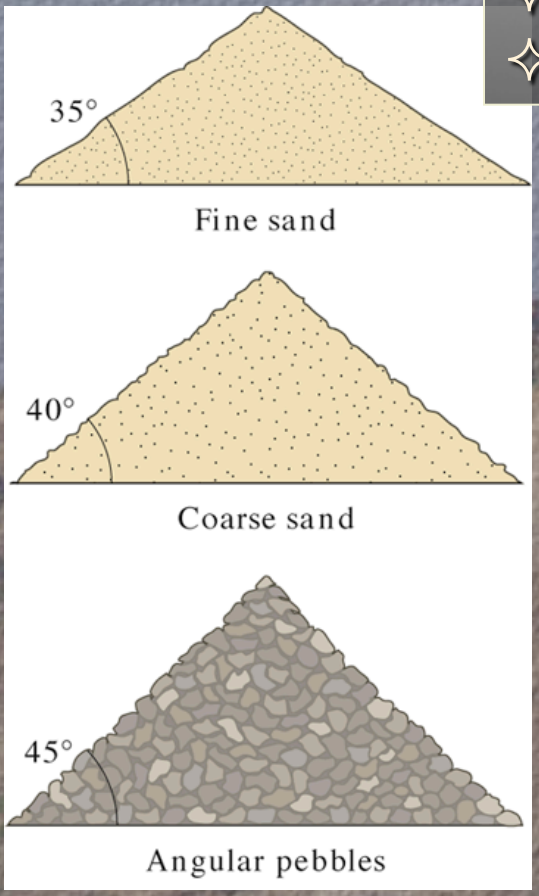
bad:
water table above
glide horizon

NATURAL:
long rain
tectonic changes

HUMAN:
excessive irrigation

The Angle of Repose

✧maximum angle a pile can retain without disintegrating
✧depends on grain properties (size, roundness, cohesion)



Sunset Crater, AZ (cinder cone)

source: volcano.und.edu

WATER
✧a little: adds cohesion, may increase angle of repose (sand castle)
✧a lot: reduces friction, accelerates erosion