# *Slope Stabilization* Techniques and Applications

USDA, Natural Resources Conservation Service

Background

Eroding slopes release sediment which can contaminate nearby waterways. This tipsheet discusses several techniques for slope stabilization which can be used alone or in combination: Vegetation, Retaining Walls, Rip-Rap, and Terracing.

The type of slope stabilization needed depends on the steepness of the slope. For slopes under 50% (approximately 30 degrees), establishing vegetation may be all that is needed to stabilize the slope and control erosion. On slopes greater than 50%, engineered structures may be necessary.
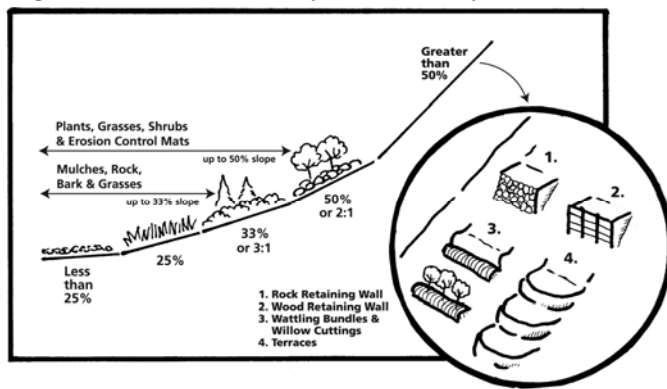
An inexpensive handheld inclinometer or a protractor can be used to determine the degree of slope in your project area and help you develop the most effective treatment for erosion control.

Techniques

Vegetation

Establishing vegetation can be a very effective way to stabilize a slope. Plant roots help anchor the soil and reduce compaction, allowing precipitation to infiltrate rather than flow down the slope. Above ground structures such as leaves and stems protect the soil surface from the impact of raindrops and slow down surface flow so that it has a better chance of infiltrating. Vegetation can be used alone, on slopes less than 50% or in combination with any of the structural techniques mentioned below.

See the *Slope Stabilization Using Vegetation* tipsheet for instruction on establishing vegetation on an eroding slope.

Retaining Wall

The purpose of a retaining wall is to decrease the severity and length of a slope, and to prevent the toe of the slope from further encroachment. Retaining walls can be constructed from stone, masonry, or in areas where soils are deep and not encumbered by high ground water, timber. On sites with longer slopes the retaining wall can also be applied to create terraces.

Retaining walls provide an excellent landscaping opportunity when backfilled with amended soils and planted with native or adapted plants. When properly constructed, maintenance should be minimal requiring only an annual inspection and performing the necessary repairs.

Rip-Rap can also be used to protect the backslope of a retaining wall as show in the image below.

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Rip-Rap

Rip-Rap refers to the use of durable materials to armor a fragile surface. The most common type of Rip-Rap used for slope stabilization is Hand Placed Rip-Rap. This involves placing rough, angular natural stone with a typical diameter of approximately 4-12 inches on the slope surface. The stones are placed so that they interlock and form a tight, dense barrier that will protect the slope from erosion. This type of Rip-Rap should only be used for slopes less than 66% (34 degrees). Steeper slopes require larger anchored stones or different techniques.

Terracing

Terraces prevent erosion by shortening a long slope into a series of shorter, more level slopes which allow water to move more slowly and soak into the soil. Terraces have been used since the dawn of agriculture to cultivate hillsides and can be used on a small scale for landscaping purposes.

Small terrace walls (less than 2 ft in height) can often be constructed by a capable homeowner. Larger projects require the services of a professional engineer. Always verify permitting requirements before beginning any project. Improperly designed terraces can be a safety hazard and can increase erosion and sediment delivery if they fail.

Terraces can be constructed from pressure treated lumber, natural stone, or masonry products such as modular blocks. Building techniques will vary depending on the material used.

For any large project, a Civil Engineer or other qualified professional should be consulted as a part of your planning process to insure all applicable design needs are met.

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