Soil Bioengineering Webinar
October 15, 2020

Streambank Stabilization

Luis H. Rosado Rivera, PE
USDA-NRCS Caribbean
OBJECTIVES

1. Identify two basic categories of protection measures
2. Define Soil Bioengineering
3. Describe selected bioengineering techniques
4. Present some bioengineering projects done by NRCS in PR
Streambank stabilization consists of restoring and protecting banks of streams, lakes, estuaries, and excavated channels against scour and erosion by using vegetative plantings, soil bioengineering, and structural systems.
Categories of protection

1. Reduce the force of water against a streambank

2. Increase their resistance to erosive forces
Reduce the force of water

- Stormwater reduction
- Retention methods
- Grade reduction
- Design to reduce flow velocity
Increase streambank resistance

- Channels lining Grass, riprap, gabions, concrete, cellular concrete, erosion control blankets or other revetment designs.
Most designs that employ brushy vegetation, e.g., soil bioengineering protect from erosion in both ways.

Revetment designs do not reduce the energy of the flow significantly, so using revetments for spot protection may move erosion problems downstream.
Appropriate selection of streambank protection measures should vary in response to specific objectives and site conditions.
STRUCTURAL MEASURES – CONCRETE LINING
STRUCTURAL MEASURES – CONCRETE BAG MATTRESS
STRUCTURAL MEASURES – GABION WALLS
STRUCTURAL MEASURES – ROCK RIP RAP
Soil bioengineering is a system of living plant materials used as structural components. Adapted types of woody vegetation (shrubs and trees) are initially installed in specified configurations that offer immediate soil protection and reinforcement. In addition, soil bioengineering systems create resistance to sliding in a streambank as they develop roots.
Why Soil Bioengineering?

- Is self sustaining or reduce requirements for future human support;
- Use native, living materials for restoration;
- Restore the physical, biological, and chemical functions and values of streams;
- Improve water quality through reduction of temperature and chronic sedimentation problems;
- Provide opportunities to connect fragmented riparian areas;
- Retain or enhance the stream corridor system
SOIL BIOENGINEERING TECHNIQUES – LIVE STAKE

Cross section
Not to scale

- Streambank
- Erosion control fabric
- Dead stool stake
- 2 to 3 feet
- 2 to 3 feet (triangular spacing)
- Live cutting
  - 1/2 to 1 1/2 inches in diameter

Note: Rooted/leafed condition of the living plant material is not representative of the time of installation.
SOIL BIOENGINEERING TECHNIQUES – VEGETATED ROCK GABION
Success Story

EWP Soil Bioengineering
Nigua River, Arroyo, PR
Completed 12/23/1997

(After Hurricane Hortense – 1996)
9 MONTHS (9/11/1998) INAUGURAL DATE
9 MONTHS (9/29/1998) AFTER HURRICANE GEORGE
9 MONTHS (9/11/1998) INAUGURAL DATE
Success Story

EQIP Soil Bioengineering
Loco River, Guanica, PR
Susua Segment
Completed 12/16/2015

Guanica Bay Coral Reef Protection Initiative – 2010
Sediment resulting from bank erosion
Loco River—Susua Segment
Guanica, PR

Area = 518 m²
Volume = 2,590 m³
Mass = 3,658 tons

Area = 1,289 m²
Volume = 6,445 m³
Mass = 9,104 tons

Area = 1,242 m²
Volume = 6,210 m³
Mass = 8,771 tons
Success Story

EQIP Soil Bioengineering
Loco River, Guanica, PR
Las Latas Segment
Completed 9/28/2015

Guanica Bay Coral Reef Protection Initiative – 2010
Sediment resulting from bank erosion
Loco River—Las Latas Segment
Guanica, PR

Area = 600 m²
Volume = 2,880 m³
Mass = 4,068 tons

Area = 2,654 m²
Volume = 12,654 m³
Mass = 17,859 tons

Area = 360 m²
Volume = 1,728 m³
Mass = 2,440 tons
“A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.”

Aldo Leopold
REFERENCES

USDA - Natural Resources Conservation Service
NEH Part 650 - Engineering Field Handbook
Chapter 16 Streambank and Shoreline Protection

USDA - Natural Resources Conservation Service
NEH Part 650 - Engineering Field Handbook
Chapter 18 Soil Bioengineering for Upland Slope Protection and Erosion Reduction

USDA - Natural Resources Conservation Service
NEH Part 653 - Stream Corridor Restoration: Principles, Processes, and Practices
https://directives.sc.egov.usda.gov/

USDA - Natural Resources Conservation Service
Part 654 - Stream Restoration Design
https://directives.sc.egov.usda.gov/
“In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA’s TARGET Center at (202)720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866)632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202)690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.”
ROCK STREAM BARBS
GRADE STABILIZATION STRUCTURE (DROP)