Erosion Control Performance Studies on Ornamental Vegetation, Compost, and Jute Netting

CASQA 2008
Outline

• Problem Statement
• Rainfall Simulation Experiment
• Overland Flow Experiment
• Conclusions
Problem Statement

- Grass species are effective for stormwater treatment on highway slopes and in biostrips.
- Ornamental plants have not been researched for erosion control effectiveness.
- Do ornamental species provide water quality treatment? Or are grasses the preferred species?
- Should ornamental species be replaced with grasses to provide stormwater treatment?
Two Studies

- Rainfall simulation (RS) on slopes to determine erosion control effectiveness of ornamental species and erosion control materials.

- Raindrop erosion

- Runoff simulation of overland flow (OF) through biostrips to determine effectiveness of ornamental vegetation and erosion control materials.

- Sheet erosion
RS Experimental Design

- Twenty Boxes
- 2:1 slope
- Sandy Clay Loam soil
- Treatments: Bare soil, compost, jute netting, or erosion control blankets (ECB)
- Ornamental vegetation commonly used by Caltrans

Sandy Clay Loam

- Clay 21%
- Silt 21%
- Sand 58%
Erosion Control Materials

• Jute and blankets are often used as temporary erosion control until vegetation establishes.
• Are erosion control materials effective in reduction of erosion on slopes?
RS Vegetation Species

*Carpobrotus edulis*, Hottentot Fig

*Hedera helix*, English Ivy

*Rosmarinus officinalis*, Rosemary

*Myoporum parvifolium*, Creeping Myoporum
RS Key Findings

• Vegetation reduced runoff by more than 90% compared to bare soil.

• Vegetation reduced sediment by 99% compared to bare soil.
Effect of Erosion Control Treatments on Runoff

- **Bare Soil**: 44 L
- **Jute Netting**: 5 L
- **EC Blanket**: 1 L
- **Compost**: 12 L
Effect of Erosion Control Treatments on Sediment Concentration

![Graph showing the effect of erosion control treatments on sediment concentration. The graph indicates that Bare Soil has the highest total sediment (2,146 g), followed by Jute Netting (6 g), EC Blanket (2 g), and Compost (36 g).]
Effect of Different Treatments on Total Runoff

- **Bare Soil**: 27 L
- **100% Jute Net**: 2 L
- **20% Vegetation w/ Jute Netting**: 2 L
- **100% Vegetation**: 0.4 L
Effect of Different Treatments on Sediment Concentration

- Bare Soil: 30 g/L
- 100% Jute Net: 3 g/L
- 20% Vegetation w/ Jute Netting: 3 g/L
- 100% Vegetation: 7 g/L
Experimental Design: OF1 & OF2

- 3:1 Slope
- Sandy Clay Loam
- 15 gal/hr
- Even distribution of drops onto pre-wetted felt
- Dry soil
- Duration of test varied between OF1 and OF2
  - OF1: 1 hour
  - OF2: 2 hours
Runoff on Bare Soil after 12 Minutes
Erosion Control Materials

- Bare Soil
- Compost
- Jute Netting
OF Vegetation

*Carpobrotus edulis*, Hottentot Fig

*Hedera helix*, English Ivy

*Rosmarinus officinalis*, Rosemary

*Myoporum parvifolium*, Creeping Myoporum
*Lonicera Japonica*, Japanese Honeysuckle

*Vinca Major*, Periwinkle

*Lantana Montevidensis*, Trailing Lantana

*Carpobrotus Edulis*, Sea Fig
OF Key Findings

• High infiltration and evapotranspiration provided no runoff in vegetation treatments.
Effect of Erosion Control Treatments on Runoff

Runoff (L)

- Bare soil: 34
- Jute netting: 19
- Compost: 2
Effect of Erosion Control Treatments on Sediment Concentration

Bare soil: 20,090 ppm
Jute netting: 149 ppm
Compost: 1,256 ppm
RS Conclusion

- Ornamental vegetation at 100% cover provided 98% infiltration on slopes.
- No statistical difference could be made between ornamental species.
- Erosion control blanket and jute reduced sediment concentration and runoff.
- Ornamental vegetation at 100% cover provided the best stormwater treatment on slopes.
OF Conclusion

- Biostrips with 100% vegetation cover provided 100% infiltration of stormwater.
- Compost decreased the most runoff as compared to other treatments.
- Jute netting decreased sediment concentration the most.
- Ornamental biostrips performed effective stormwater treatment in both reduction of sediment and runoff.
Summary

• Ornamental vegetation provided effective stormwater treatment both on slopes and in biostrips at 100% vegetation cover.
• With effective cover this suggests that ornamental species are as effective as grasses in stormwater treatment on slopes and in biostrips.
QUESTIONS?