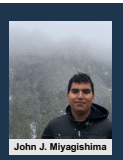
Green earthen embankments for controlling soil erosion

Unit process wetlands and riparian zones

Re-Inventing the Nation's Urban Water Infrastructure (ReNUWIt)



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Introduction

Protection of earthen embankments from erosion in the arid regions where water is scarce has been a challenge. Soils of embankments, for example in the southern parts of New Mexico, are often sandy and are vulnerable to erosion from wind and water. While these earthen embankments can be protected by gravel and rocks, the cost of material and labor is high and often are not aesthetically pleasing; and using grasses requires irrigation. This method investigates the use of beneficial plants (e.g. produce flowers to support insects) that can withstand drought as well as aesthetically pleasing. It is hypothesized that these plants will also control soil erosion.

Methodology

Delosperma cooperi succulents were planted on an embankment at Sunland Park ReNUWIt study bed-site. The experiment was conducted on an embankment which will be divided into triplicates of 3 ft. by 8 ft. sections per soil treatment (**Fig. 2**). Treatment one included the use of native riparian sandy soil and treatment two included a 3-inch layer of zeolite; a total of six 3 ft. by 8 ft. sections (**Fig. 3**). Two additional sections were added to the experiment as a control (**Fig. 4**).

Each 3 ft. by 8 ft. section was further divided into 24 sub-sections of 1 ft. by 1 ft. Cuttings from the succulents were planted in the center of the sub-sections. Each 3 ft. by 8 ft. section has 24 plants. The plants will then be irrigated until they establish the roots (**Fig. 7,8**). Once the plants establish the roots, minimum amount of water will be applied if necessary to observe plant response to dry climate.

Objective

The objective of this project is to set up a pilot scale experiment in the field to study the use of plants such as succulents on an earth embankment. The goal of the study is to improve our understanding of plant growth/survivability and density, root distribution and control of erosion on slopped surfaces. The long-term goal is to provide a guideline of using plants as a "green" tool for protecting earthen embankments in arid environments.

Figure 1. Embankment during cleaning showing sandy soil prone to erosion (side slope: 30 %).

Figure 2. Installation of experimental plots in the embankment.

Figure 3. Pouring zeolite in designated experimental plots (3 in. layer).

Figure 4. Set up of experimental plots on the embankment (3ft x 8 ft.) at ReNUWIt testbed site.

Figure 5. Cuttings of succulents planted in the experimental plots.

Figure 6. *Delosperma cooperi* succulent grows dense, attracts insects and is drought tolerant.

Figure 7. Experimental plot with zeolite after irrigation.

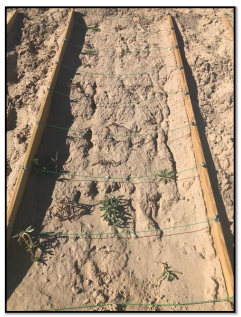

Figure 8. Experimental plot without zeolite after irrigation showing soil erosion.

Results

This project started in September 2017. The following has been completed:

- Setup of the experimental plots in the field
- Placement of zeolite layer in the plots
- Planting of succulent (*Delosperma cooperi*) cuttings

The plants were monitored through winter. Some of the plants have shown stress. This was expected since the plants have not fully developed their root system. Winter low temperatures and humidity at the study site also stressed the plants. However, in early Spring of 2018 the plants are again showing recovery.

Next Steps

The following are anticipated during growing season of 2018:

- Design a rainfall simulator and collect sediment to study the effects of plants and zeolite in controlling soil erosion and sediment transport.
- Monitor plant survival and density distribution.

Conclusions

Preliminary results show that the succulent cuttings started to establish after the planting in October, 2017. As the temperature and humidity dropped during November though January, some of the plants exhibited stress probably due lack of developed root system. The study will continue during the growing season of 2018 and data will be collected to assess the erosion control, plant survival and spread of the plants.

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