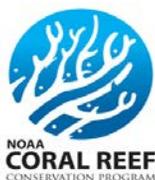
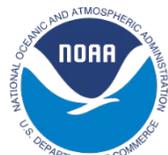


Expanding Erosion and Sediment Control Capacity throughout Guanica and Cabo Rojo Watersheds, Puerto Rico

FINAL REPORT



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1 SUMMARY

Land cover disturbances result in reductions in vegetative cover and exposure of bare soils. If left unvegetated these bare soils will erode and lead to significant sediment loads to coral reefs. Highly erodible lands (HELs) and are generally defined by a combination of clayey soils, steep slopes, minimal vegetated cover, and high volume/intensity rainfalls. These sites pose the greatest threat to erosion, sediment transport, and sediment loadings to coral reef habitats.

Both the Guánica and Cabo Rojo Watershed Restoration Plans identified the need to implement hydroseeding and other erosion control practices to stabilize HELs in the watershed. From 2012 through 2014, NOAA, NFWF, and NRCS provided funding to regionally adapt and refine erosion and sediment control (E&SC) techniques (e.g., hydroseeding) and build capacity for E&SC across the Guánica watershed. This investment has led to the stabilization of nearly 20 acres within the Guánica watershed and, more importantly, has provided the foundational support for partnerships in LBSP management across the watershed. NOAA subcontractors, Protectores de Cuencas (PC) and Ridge to Reefs (RTR), have utilized this funding as an opportunity to support overlapping priorities and partner with DNER, USFWS, NRCS, NFWF, Municipality of Yauco, Municipality of Guánica, and Southwest soil conservation district to leverage over \$200,000 to reduce LBSPs in the Guánica watershed.

This project utilized lessons learned and partnerships gained through the Guánica hydroseeding effort to expand E&SC and capacity building into the Cabo Rojo watershed. This project targeted partnerships with USFWS, NRCS, DNER and local municipalities to leverage funding and technical support to provide E&SC for overlapping priority regions. This project stabilized a total of 4 acres of highly erodible soils across the Guánica and Cabo Rojo watersheds. Three acres were stabilized in Cabo Rojo and one acre in Hacienda Candelaria located within the Guanica Bay watershed.

In our efforts to support and implement the Guanica Watershed Management Plan, we continue to collaborate with other agencies to continue with the restoration efforts of the Guanica Bay and Cabo Rojo watersheds. Hydroseeding has proven to be an effective technique for erosion control and sediments stabilization of erodible lands. This effort continues to develop on the more than 25 acres of bare soils that have been stabilized by hydroseeding across the Guánica/Río Loco watershed with the ongoing funding support of the NOAA's Restoration Center and with the local support of Municipalities and Environmental agencies.

2 INTRODUCTION

Hydroseeding refers to a process of planting grass using a mulch mixture that is fast, efficient and an economic alternative to restore areas of high slopes with difficult access when compared to other techniques such as turf grass. This process has proven to be more effective than traditional sowing and with lower costs than conventional transplantation. A mulch mixture composed of fibers, seeds, fertilizer and water is added to the tank of the machine. Once the appropriate mulch mixture is achieved, the mixture is pumped from the tank and applied on the soil. Once the materials come in contact with the soil, they easily adhere and create favorable conditions for seed germination.

The hydroseeding method is mostly used to restore areas devoid of vegetation affected by erosion processes and sedimentation in order to protect bodies of water and marine ecosystems from the adverse effects of sediment laden runoff. Other common uses of hydroseeding include: at construction sites, cover crops for farm lands, revegetate green areas after road construction, residential and commercial landscaping, as well as extensive areas such as golf courses and stadiums.

A large amount of mulch options is available, from the most inexpensive (composed of 100% recycled paper or a mixture of 50% recycled paper and 50% wood fiber), intermediate costs (composed of 100% wood fiber), and the most costly, the Bounded Fiber Matrix or BFM (composed of 100% wood fiber with added polymers and other additives that maximize its attachment to the soil). Typically, the mixture chosen depends on the degree of the slope, the available budget and the quality of the desired product.

Studies by the University of North Carolina in the United States have shown that the mulch mixture composed of paper fibers results in low quality and poor germination rates. It is for this reason that we have decided not to use paper fiber mixtures for our hydroseeding projects. We've had excellent results using mixtures of 100% wood fiber with the addition of some products found in the BFM, allowing us to reach optimum results with an intermediate budget.

There are different types of machinery or hydromulchers on the market. The main difference between these different options is the size of the machine and its tank capacity. In order to work with wood based mixtures, a specialized machine with greater power is needed. Protectores de Cuencas, Inc. has one of these specialized machines for wood based mixtures, with a water storage capacity of 325 gallons, making it the perfect combination of power and size adequate to reach areas that would be impossible to reach with larger equipment. With this equipment we can cover an area between 1,200 and 1,500 ft² per tank applying close to 6 tanks daily in order to cover one acre of land between 4 and 7 days, depending on the slope angle and accessibility to the area.

Regular irrigation of restored areas during the first four to six weeks after hydroseeding is necessary in order to obtain optimum results. We include this service in our projects to guarantee best results. Application should occur during dry periods, where heavy rain is not anticipated during 48 to 72 hours following application in order to allow product fixation to the soil.

3 IMPLEMENTATION

Based on our field evaluations, recommendations from the farmers and technical assistance from site visits and discussions with DNER, NRCS, the Municipality of Yauco and the farmers, we conducted restoration components that are discussed in detail in this report. The target implementation areas included: Cabo Rojo and Hacienda Candelaria, a farm located within the Guanica Bay watershed. This project utilized regionally adapted hydroseed to stabilize HELs in the Guánica and Cabo Rojo watersheds, provided onsite training for local stakeholders, and built capacity for erosion control and prevention of the creation of exposed highly erodible lands throughout Puerto Rico. The following components were implemented at the selected sites for this project:

1. Stabilized 4 acres of highly erodible lands in the Guánica and Cabo Rojo watersheds
2. Provided stakeholder training of erosion control practices
3. Built partnerships to enhance capacity for erosion control in the watersheds
4. Created reports on the progress of the work

3.1 Stabilization of erodible lands

Through the completion of this project, PDC was able to apply hydroseed and additional E&SC techniques to highly erodible lands in the Guanica Bay and Cabo Rojo watersheds, that are typically characterized by slopes that range from 30 to 75 degrees. A total of 4 acres were included in the stabilization work completed for this task. Site selection was determined through the use of previous analyses that included GIS analyses, real-time

ground truthing, and from visits during the development of the Cabo Rojo Watershed Management Plan. Preference was given to those sites that could leverage partnership funding and resources and that are located on public property. For Cabo Rojo, the project implemented was in private lands and consisted of a pilot project for the area.



Figure 1. Conditions of Cabo Rojo project site prior to implementation.



Figure 2. Process of project implementation of hydroseeding in Cabo Rojo.



Figure 3. Process of project implementation of hydroseeding in Cabo Rojo and response during rain event.



Figure 4. Process of BMP project implementation in Cabo Rojo.



Figure 5. Completion of BMP in Cabo Rojo.

Private land owners of the Cabo Rojo project site provided logistic support, as well as provided the access to water for irrigation purposes. The Municipality of Cabo Rojo was also largely engaged with the implementation of this BMP project, providing assistance with the logistics and the heavy equipment used during the process of project implementation. Three acres were stabilized in Cabo Rojo thanks to the partnership with the Municipality of Cabo Rojo and the private land owner.

Another acre was stabilized in Hacienda Candelaria located within the Guanica Bay watershed. A large sediment trap was created to help detain sediments in stormwater runoff to protect receiving streams, lakes, drainage systems, and the surrounding area. An outlet or spillway is often constructed using large stones or aggregate to slow the release of runoff. At this farm, in-kind contributions included meeting participation, aid during

project design, provided personnel to assist with labor during BMP implementation, and water for irrigation purposes.



Figure 6. Completion of BMP in Hacienda Candelaria, Guanica Bay Watershed.

3.2 Provide stakeholder training of erosion control practices

Erosion control and HEL stabilization was coupled with on-site demonstrations to provide technical training of private and public contractors in hydroseed application and implementation of additional erosion control technologies. This training targeted both public and private sector employees to reduce standard land clearing practices and increase opportunities for future application and erosion control.

3.3 Build partnerships to enhance capacity for erosion control

This project was built on existing partnerships and lessons learned to continue to expand efforts to stabilize HELs, while building capacity of local communities and professionals to stabilize existing exposed HELs and prevent the addition of exposed HELs in the future. This project focused on partnerships with USFWS, NRCS, DNER and local municipalities to leverage funding and technical support to provide E&SC for overlapping priority regions.

3.4 Creation of Progress Reports

Summary report was created with the results of implementing regionally adapted hydroseed to stabilize HELs. The report also included a summary of efforts to build capacity of local communities and professionals for preventing and reducing production and erosion of bare soils in the future. Reports detailing the work completed toward stabilizing highly erodible lands in the Guánica and Cabo Rojo watersheds as part of the deliverables for this task order.

4 HYDROSEEDING TECHNIQUE SUCCESS

Stabilization occurs best immediately after disturbance, longer time frames between clearing and stabilization results in a less favorable substrate. Often good soil for germination and growing can be washed away prior to hydroseeding efforts. Despite this, we are able to achieve >90% vegetative cover in the majority of sites stabilized by hydroseeding. It is important to point out that the soil has to be dry for the hydroseeding mixtures to bond correctly to the exposed soils. Hydroseeding mixture should be sprayed to the slopes from the bottom up for it to bond properly. The installation of two pumps in the water truck allows us to cut our watering time in half and allow for extra watering. In addition to using rye and Bermuda grass, it is possible to incorporate native tree and shrub species into hydroseeding mixtures. Most native species seeds are collected by local biologists and community volunteers. Maintenance and watering of the sites was provided for over 1 month to ensure project success.