Eradication of Invasive Grass Species, Native Forest Regeneration and Forest Fire Prevention in the Guánica Dry Forest, Puerto Rico

Final Report

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1. SUMMARY

Through this project, Protectores de Cuencas, Inc. (PDC) completed the eradication of invasive grasses in 3 of the 25 affected acres in the Guánica Dry Forest (GDF). The eradication was followed by a reforestation project with native tree species. This project was supported by the Department of Natural and Environmental Resources (DNER) of Puerto Rico, the U.S. Forest Service, the Municipality of Guánica, the National Resources Conservation Service, local schools, adjacent residents and community groups, and was funded by the U.S. Fish and Wildlife Service. PDC has a co-management agreement with the DNER to collaborate and share responsibilities in the protection and management of natural resources in the GSF. Funds were used to remove invasive grass species in 3 of the 25 affected acres of forest land, plant 2,000 mature native tree and shrub species proved to be more tolerant to forest fires, and to provide maintenance of reforested areas to ensure survival success of native trees. All tasks were completed during a 24-month period.

2. INTRODUCTION

The Guánica Dry Forest (GDF), a United Nations World Biosphere Reserve, faces many challenges of concern due to anthropogenic activities and natural disturbances. The GDF receives over 600,000 visitors per year. Road 333 is the only access used by locals and tourists to the forest's coastal and preferred recreation areas. During the past 5 decades, more than 25 acres of protected mature forest have been lost to the fire cycle caused by invasive grasses along Road 333. It is estimated by the Department of Natural and Environmental Resources (DNER) that more than 2 acres of dry forest are lost every year due to this process. Furthermore, invasive grasses have grown to the edge of the forest ravines and canyons, threatening hundreds of acres of inland mature forest. These exotic species have a wide range of spreading capacity and this interferes with the regeneration of native species. The invasive grass species colonizing disturbed areas, serve as fuel to forest fires during the dry season, creating a fire cycle as the same areas easily ignite year after year.

Invasive plant species represent a significant threat to Puerto Rico's forest areas. These invasive species tend to colonize areas where the soil structure has been severely disturbed, resulting in a young forest with poor canopy coverage dominated by exotics (Perez-Martinez, 2007). Invasive species can lead to ecological and economic impacts as they can threaten biological diversity. Most invasive plants have been introduced intentionally for agricultural, silvicultural and other purposes, while others have been introduced accidentally. Plant invaders are of particular interest as they can alter fire regimes by altering plant fuel properties. This project has been identified as a high priority within GDF since forest fires have been a significant threat to the forest and associated endemic and endangered species.

The geographic extent of the affected area includes 25 acres of target forest patches across the southern-most GDF boundary along Road 333. Through this project, PDC completed the eradication of grasses and reforestation of 3 acres of the 25 acres currently being affected by fires. A closed canopy of native tree species will help prevent the recolonization of invasive grass species in its place.

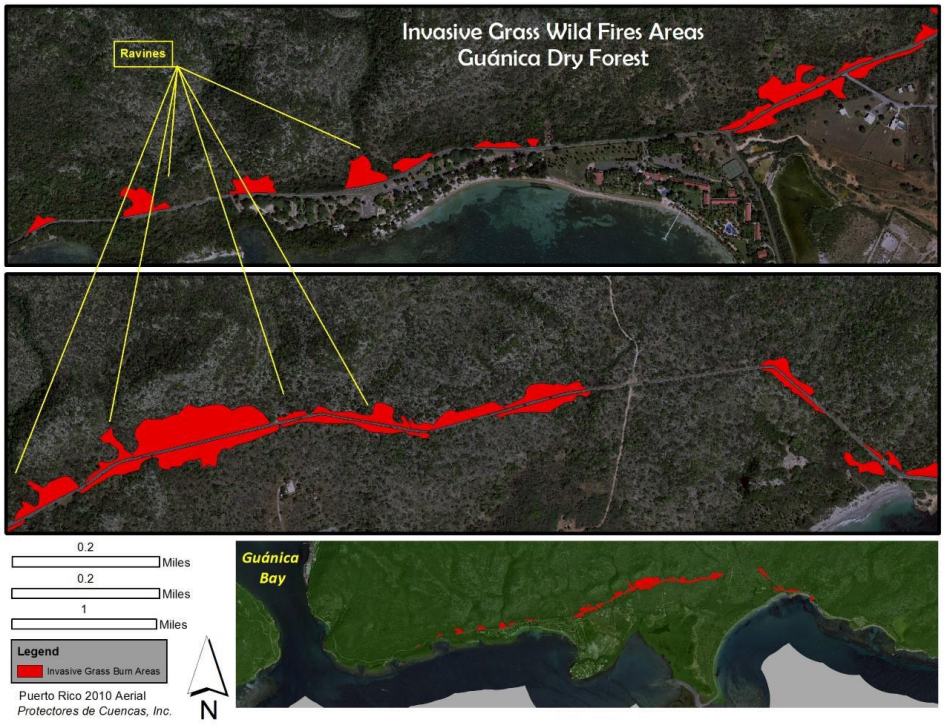

Figure 1. Map of extension of invasive grass wildfire areas. Common burn areas are highlighted in red.

This project aimed to remove and eradicate invasive grasses, including buffel grass (*Cenchrus ciliaris)* and guinea grass (*Megathyrsus maximusthat*) in affected fire areas of the GDF. Eradication of invasive grass species was followed by a reforestation project on 3 of the 25 affected acres on target forest patches across the southern-most GDF boundary along Road 333 with mature native tree and shrub species that are proven to be more tolerant to forest fires.

3. IMPLEMENTATION

PDC implemented the following objectives, described in further detail below:

1) Eradication of invasive grasses along Road 333 of the GDF: Removal of invasive grass species in 3 acres of the 25 affected areas of forest land.
2) Reforestation of target forest patches along Road 333 of the GDF: Reforestation with approximately 2,000 mature native tree and shrub species that are proven to be more tolerant to forest fires.
3) Maintenance of reforested areas: PDC continues ensuring the survival success of planted native trees through long term maintenance of the reforested areas.

3.1. ERADICATION OF INVASIVE GRASSES ALONG ROAD 333 OF THE GDF

During the first months of the project, PDC personnel conducted several site visits to the targeted areas along Road 333 in order to establish a plan for all activities leading towards the eradication of invasive grasses. Personnel form US Fish & Wildlife Service trained Roberto Viqueira, Executive Director of PDC, on the identification of the endangered species Mitracarpus polycladus present in reforestation sites (Figure 2). This species can be easily suppressed by grasses therefore PDC staff was trained on the identification of the species and a photo of the species of concern was given to each brigade leader for reference in order to protect it when eradicating grasses. PDC staff marked the locations where the species was found. A buffer of 1 ft was set around each clump or individual to avoid affecting the species during grass removal.

Figure 2. Roberto Viqueira, PDC Executive Director, with personnel from USFWS identifying Mitracarpus polycladus along Road 333.

After designing the reforestation plan for the site, PDC staff proceeded with the eradication of invasive grasses (Figure 3). Through this project, PDC staff eradicated invasive grasses from 3 of the 25 affected acres. Existing natural drainages were kept open and free of trash and/or vegetation debris. All access roads in the surrounding areas were also being kept clear of trash and/or vegetation debris.

Figure 3. Eradication of invasive grasses along Road 333 in the GDF.

3.2. REFORESTATION OF FOREST PATCHES ALONG ROAD 333 OF THE GDF

3.2.1. Plant Material Maintenance

Plant material used for this project was provided from PDC's nursery facilities. The species used during this project were germinated from the seed bank or propagated (for species that can support this technique) in the nursery facilities. All trees and shrubs produced are native to Puerto Rico. All trees reached a height between 2 and 3 feet tall before planting began depending on the species and growth rates. A total of 2,000 trees and shrubs, from the species list in Table 1, were selected, planted and maintained in this effort.

Table 1. List of tree species propagated for reforestation efforts along Road 333.

Common Name	Scientific Name
Palo de vaca/Spoon tree	*Bourreria succulenta*
Úcar/Black olive, Gregory wood	*Bucida buceras*
Almácigo/West Indian birch	*Bursera simaruba*
Péndula/Florida fiddlewood	*Citharexylum spinosum*
Cucubano, Uvilla	*Coccoloba diversifolia*
Jaboncillo, Abeyuelo	*Colubrina arborescens*
Mabí/Naked wood	*Colubrina elliptica*
Mangle botón/Button-Mangrove	*Conocarpus erectus*
Capá blanco/White manjack	*Cordia dentata*
Lija/Orange manjack	*Cordia rickseckeri*
Nia/Brisselet	*Erythroxylum brevipes*
Cocaina falsa, Indio/False coca	*Erythroxylum areolatum*
Guayacán/Lignumvitae	*Guaiacum officinale*
Ramón, Yaití/Crabwood	*Gymnanthes lucida*
Tachuelo/Fustic	*Pictetia aculeata*
Rolón/Cat's claw	*Pithecellobium unguis-cati*
Tintillo/Box brier	*Randia aculeata*
Cascarroya/Sloe	*Reynosia uncinata*
Roble nativo/White cedar	*Tabebuia heterophylla*
Emajagüilla/Cork tree	*Thespesia populnea*
Serrasuela/NA	*Thouinia portoricensis*

3.2.2. Site Preparation and Planting

Tree planting involved boring holes at the pre-determined intervals of 25 feet by 20 feet using an auger to drill the holes to a depth of approximately 18 inches with a diameter no wider than 12 inches (Figure 4). All holes were cleared of all soil and the soil was set aside for future use when planting the trees.

All trees measured between 2 and 3 feet tall before planting period began depending on the species and growth rates. Trees were housed at PDC facilities until they were ready for planting. During the planting process, PDC staff ensured that there was no damage to the root ball to avoid future damage to trees. A total of 2,000 trees were planted close together (at least 4 feet distance of each other) to create the closed canopy. PDC staff has been able to place new top soil and fertilizers, it has also been diligent in maintaining and irrigating the areas, avoiding the establishment of invasive grasses and monitoring the growth of natives that have been planted.

Figure 4. Drilled holes to a depth of 18 inches, cleared of soil and fertilizer added.

A granular polymer was added as a soil amendment to help reduce plant watering (Figure 5). The use of this polymer not only retains water but also helps reduce transplant shock and soil compaction. Fertilizer was added inside the holes and once the tree was planted, it was covered with the soil previously extracted from the hole leaving at least one (1) inch of space before reaching the ground level for water retention

Figure 5. Adding granular polymer to help reduce plant watering.

purposes. All trees were watered the same day they were planted. Finally, a piece of 4-5-inch PVC pipe was placed at the base of each planted tree to protect them during the maintenance period.

Figure 6. Reforestation site along Road 333

3.3. MAINTENANCE OF REFORESTED AREAS

After each planting site was completed, a periodic irrigation process began. At least one gallon of water was applied to each new tree. A water truck equipped with special irrigation components was used for the irrigation and maintenance component of the project. Any tree with unhealthy growth during the irrigation and maintenance period was replaced. Trees were irrigated for a period of 16 weeks using the following approach:

a. Five (5) times per week during the first two (2) weeks.

b. The following eight (8) weeks trees are irrigated three (3) times per week.

c. The following last six (6) weeks are irrigated trees once a week.

PDC staff has continued providing maintenance and irrigation for all reforested areas. Healthy growth of native trees planted has been observed in all of the reforested areas. Irrigation takes place on a weekly or biweekly basis, depending on the weather conditions and rain events. Maintenance includes the removal of invasive grass species, the trimming of the surrounding areas and removal of dry or dead portions. Maintenance visits are programmed to continue for several months to ensure the success of the reforested trees.

Figure 7. PDC staff trimming surrounding areas of planted trees.

This project builds on PDC's efforts to restore 25 acres of invasive grass burn areas along Road 333. To date, PDC has been able to restore a total of 14 acres with funds from this project and additional sources including the Natural Resources Conservation Service (NRCS) and Hispanic Federation.

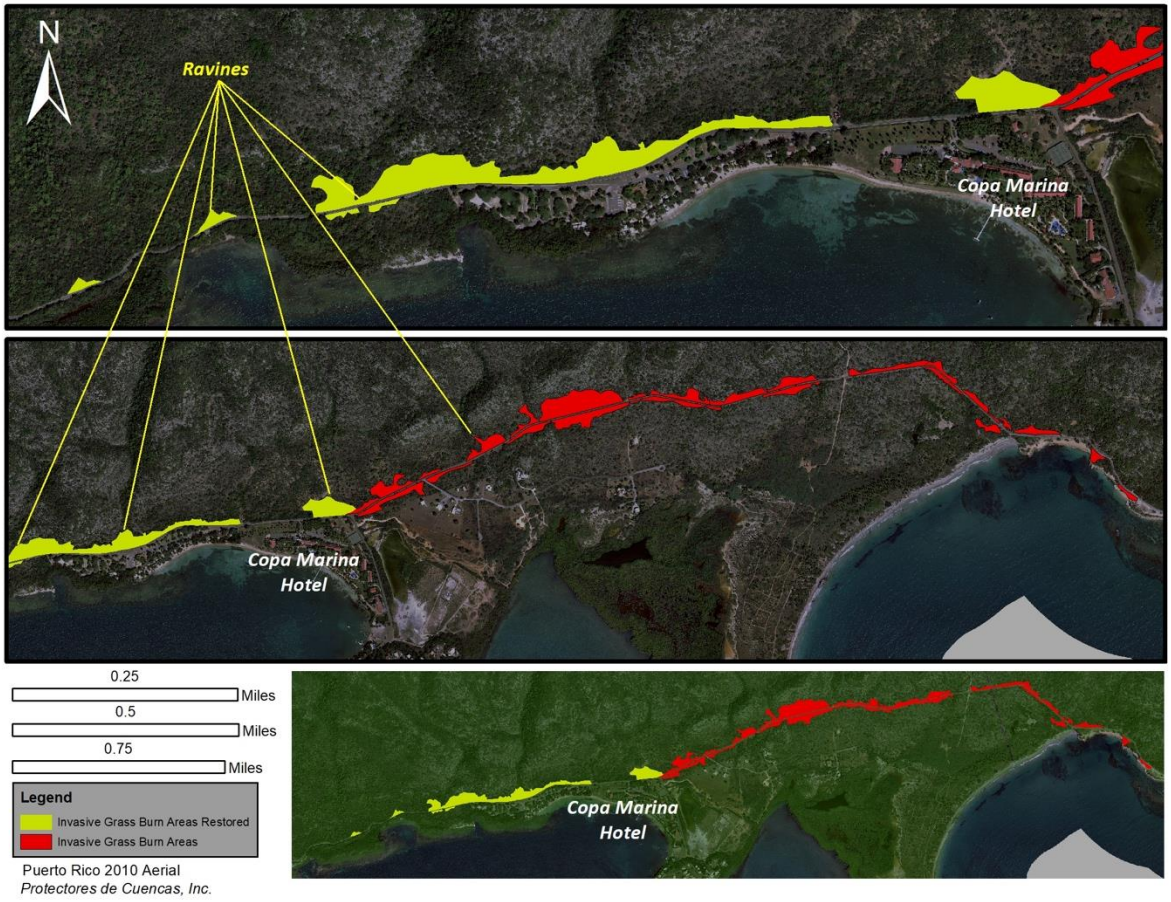

Figure 8. Acres restored (yellow) along Road 333.

4. PROJECT COSTS

The project was performed at a cost of fifty-five thousand dollars ($55,000) with an in-kind contribution of thirty-five thousand fifty-three dollars ($35,053) for a total of ninety thousand fifty-three dollars ($90,053) as itemized in Table 2.

Table 2. Project costs description

Category	Description	Federal	In-Kind
Personnel	Project management and general labor	$16,000.00	$4,428.00
Travel	Mileage for personnel and heavy equipment transportation	$2,775.00	$0
Supplies	Plant materials and soil enhancements	$15,600.00	$15,000.00
Other	Rental of heavy equipment	$15,625.00	$15,625.00
Indirect Costs	10% indirect cost rate	$5,000.00	$0
	Subtotal	**$55,000.00**	**$35,053.00**
	Total Fed + In Kind	**$90,053.00**	