



# Variation in Cactaceae Seeds in the Soil as a Function of an Invasive Exotic Grass in Mona Island Reserve

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## INTRODUCTION

Seed rain and seed bank dynamics are a critical component for the establishment, development and regeneration of native plant communities. On Mona Island, Puerto Rico, the invasive African grass, *Megathyrus maximus* (Figure 1) has invaded many areas. Grasses often become invasive and may have direct and indirect negative effects on native biodiversity and ecosystems (D'Antonio et al. 1998).

To better understand the ecological role of *M. maximus* on Mona Island, we are collecting and documenting information on the native seeds that reach the soil. With this information, our goal is to determine the effects of *M. maximus* on the distribution patterns and availability of Cactaceae seeds in the soil. We hypothesize that *M. maximus* interferes with seed rain deposition and we predict there will be a reduction in diversity and abundance of Cactaceae seeds in areas where the grass has invaded.



Figure 1 – *Megathyrus maximus* on Mona Island

## METHODS

Our research project is being conducted in the Mona Island Reserve, Puerto Rico (Figure 2). Samples were collected from four sites, three of which are dominated by *M. maximus*. Soil samples were collected with a 5 x 5 cm soil core sampler, stored in mesh bags and allowed to dry for laboratory analysis (Figure 3).



Figure 2- Mona Island Reserve, Puerto Rico



Figure 3– Soil sampling in Mona Island Reserve

## METHODS (CONTINUED)

We recover seeds from soil samples by sifting the soil under several sieve sizes followed by a modified flotation procedure by Buhler and Maxwell (1993). This work is in progress. Once soil samples are thoroughly dry, they are sifted through three USA Standard Certified Sieves (sizes 10, 35, & 60) to separate organic material from mineral matter. We collect and store the organic material captured on top of each sieve as well as the mineral material which is stored separately for verification purposes. We scan the organic material collected from sieve size 60 under a dissecting scope to extract large seeds. All seeds recovered are identified and photographed (Figure 4).



Figure 4 – Various seeds recovered from samples

Due to the large amount of species with small seeds in this community, we further process the remains from each sieve with the modified flotation method. First, we prepare a 0.5g/ml flotation solution of K<sub>2</sub>CO<sub>3</sub>. We divide each soil sample into four 50 ml centrifuge vials and fill each vial with the solution. We manually shake each vial until the mixture is homogenized and centrifuge samples at 5,000 RPM for 20 minutes. We collect the floating organic material from the top of the vials and vacuum filter it using #3 Whatman filter paper. Again, we retain the mineral debris in the centrifuge vials for future verification. We place the filter paper with the organic material in the oven at 60°C for about 3 hours. After the sample is completely dry, we proceed to identify, count and photograph seeds under the dissecting scope.

## RESULTS

As of this point, we have recovered seeds from over 27 species. Samples from the non-invaded site have different seed bank composition than invaded sites although some species occur in all sites. Seeds from three species including *M. maximus* are found in both invaded and non-invaded sites (Table 1). Invaded sites did not show lower seed diversity so far.

Invaded (n=4)	Non-invaded (n=3)
<i>M. maximus</i>	<i>M. maximus</i>
<i>M. intortus</i>	<i>E. ciliaris</i>
<i>S. peruvianus</i>	<i>S. peruvianus</i>
<i>R. reticulata</i>	<i>C. hirsutus</i>
<i>S. nodiflora</i>	<i>B. brillosa</i>
Unknown species (11)	<i>R. reticulata</i>
	Unknown species (8)

Table 1 – Species found in seed bank at invaded and non-invaded sites.

*M. maximus* sites are associated with an overall reduction in soil seed abundance. In total, fewer native seeds were recovered from invaded sites. We have recovered very few cacti seeds from any site up to this point (Table 2). Non-invaded sites are dominated by *C. hirsutus* and *S. peruvianus*.

	<i>M. Maximus</i>	Cacti Species	Native Species	Others
Invaded	26	2	2	21
Non-invaded	1	1	127	46

Table 2 – Number of seeds found in grass invaded and non-invaded sites

## CONCLUSIONS

Although several samples remain to be analyzed, preliminary results indicate that *M. maximus* can reduce considerably the abundance of native seeds in the soil. Too few cacti seeds have been recovered to draw significant conclusions about the effects of *M. maximus* on cacti species but ongoing research should clarify the effects.

## LITERATURE CITED

- Buhler, D., B. Maxwell. 1993. Seed separation and enumeration from soil using K<sub>2</sub>CO<sub>3</sub>-centrifugation and image analysis. *Weed Science*. 41(2) 298-302
- D'Antonio, C.R. Hughes, M. Mack, D. Hitchcock, P. Vitousek. 1998. The response of native species to removal of invasive exotic grasses in a seasonally dry Hawaiian woodland. *Journal of Vegetation Science* 9(5) 699-712.

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