

Puerto Rico applecactus (*Harrisia portoricensis*) surveys on Desecheo Island: February-April 2012

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Primary Survey Objectives:

- Measure, characterize, and photograph all previously identified *Harrisia portoricensis* individuals.
- Identify, mark, and fully document new *Harrisia portoricensis* individuals.

SUMMARY

The 2012 surveys of the endangered *Harrisia portoricensis* discovered new individuals and documented continued growth and maturation of known individuals, specifically:

- First observed fruiting of *Harrisia portoricensis* on Desecheo Island since 1994 (Breckon & Kolter 1994).
- 20 new individuals were discovered from February-April 2012 for a total of 54 known individuals currently growing on Desecheo (a total of 57 confirmed individuals have been identified during island-wide field surveys since 2009 but two have since died and one was never re-located). Prior to this effort, Fish and Wildlife staff had observed only 9 individuals on the island in 2003.
- Growth rates of the 23 individuals measured both in June 2010 and April 2012 ranged from 0.46 to 4.85 cm/month with a mean rate of 3.2 cm/month \pm 1.2 SD.
- Total height increases of 23 marked *H. portoricensis* ranged from 25% to 491% with a mean increase of 126% \pm 92% between June 2010 and April 2012.

PLANNING & ORGANIZATION

Personnel

- **Cielo Figuerola**, Monitoring Technician, Island Conservation
- **Tommy Hall**, Island Restoration Specialist, Island Conservation
- **Jose Luis Herrera**, Island Restoration Specialist, Island Conservation
- **Lourdes Lastra**, Monitoring Technician, Island Conservation
- **Erik Oberg**, Island Restoration Specialist, Island Conservation
- **Madeleine Pott**, Island Restoration Specialist, Island Conservation
- **Kirsty Swinnerton**, Program Manager, Island Conservation

Schedule & Logistics

Personnel were deployed on-island as part of the rodent eradication which took place in March 2012. No additional resources or expenses were incurred as part of the *Harrisia portoricensis* surveys.

Surveys were conducted as personnel schedules allowed, between 19 February 2012 and 8 April 2012.

METHODS

We revisited the 36 previously identified *Harrisia portoricensis* individuals. We took measurements (height of the stalks from base to tip and diameter of stalks at base), described key characteristics (number of stalks, flowers, fruits, disease or browsing, number of branches), recorded GPS coordinates, and took photos of all accessible *H. portoricensis* that we encountered in the field (as per Desecheo Conservation Measures Survey Protocols). We took two standardized, north-facing photos of each *H. portoricensis* at 1 m and 2 m away from the cactus as well as close-up photos of scars and markings. For those individuals growing in inaccessible locations, we recorded the GPS coordinates at the closest accessible point. We also photographed these individuals and noted key characteristics (i.e. number of branches and stalks, fruits, flowers, etc).

In addition to revisiting previously identified *Harrisia portoricensis* individuals, we also conducted opportunistic surveys for *H. portoricensis* while conducting monitoring work as part of the rodent eradication. New cactus individuals discovered in this way were labeled (permanent markers were unavailable so instead, fluorescent flagging was attached to nearby vegetation with the date and the initials of the observer), photographed, and measured as above.

RESULTS

During our 2012 field season, we confirmed a total of 54 *Harrisia portoricensis* currently growing on Desecheo (Figure 1).

Prior to the 2012 survey, there were 36 confirmed *H. portoricensis* cacti with known locations on Desecheo. Visits to known *H. portoricensis* revealed that 34 individuals were still alive in April 2012. We were unable to locate and measure two individuals (HarPor 13 & 23), which are suspected of having died. We thoroughly searched the areas surrounding the suspected dead individuals but did not find any regeneration. Due to time constraints, we did not search for two unconfirmed *H. portoricensis* (HarPor 17 & 18) and an *H. portoricensis* with an unknown location (HarPor A).

During the course of the 2012 rodent eradication, we identified and documented a total of 20 new *H. portoricensis* individuals. Of these 20, we were able to access 12 individuals and measure and fully characterize 11 individuals.

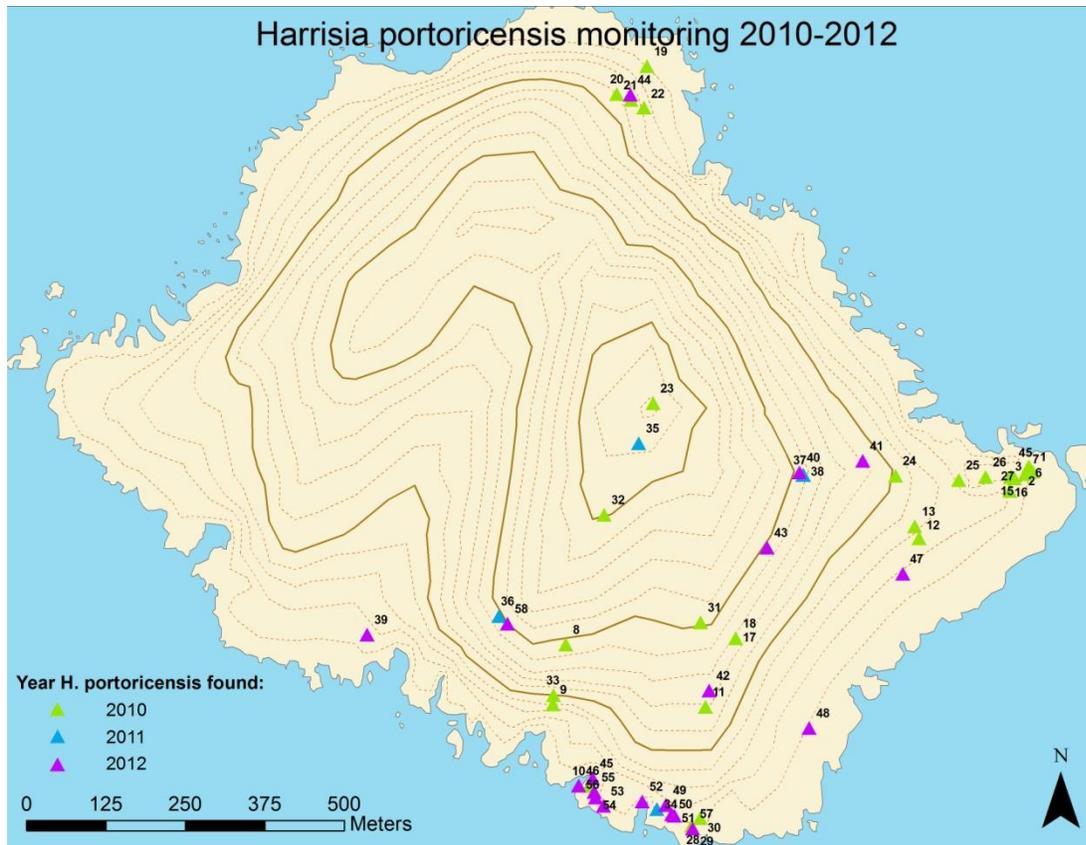


Figure 1. Map of known *Harrisia portoricensis* on Desecheo Island. Green and blue triangles signify cacti found before 2012. Purple triangles are new cacti found in 2012.

All 23 surviving, unbroken cacti originally measured in June 2010, demonstrated growth (*Appendix 2*) with the mean primary stalk length increasing annually (*Table 1*). The average percent increase in primary stalk height over the 22 month period was 126% ± 92% SD. The greatest percent increase occurred on the smallest individual from 2010, which grew from 17.6 cm to 104 cm, a 491% increase. Growth rates of the 23 individuals ranged from 0.46 to 4.85 cm/month with a mean rate of 3.2 cm/month ± 1.2 SD (*Appendix 2*).

Table 1. Total number of confirmed *Harrisia portoricensis* with known locations on island and summary of mean primary stalk height.

Year	# of individuals	Height (cm) ± SD	n	# at permanent survey points
2009	0	-	-	0
2010	31	64.7 ± 30.5	27	1
2011	36	93.9 ± 49.1	19	Survey not conducted
2012	54	119.8 ± 47.3	41	Survey not conducted

This survey was the first occasion in which *Harrisia portoricensis* was observed in fruit on Desecheo since 1994 (Breckon & Kolter 1994). We observed a total of three individuals (HarPor 6, 19, and 26) fruiting during the course of the survey period, producing a total of four fruits during that time (*Figure 2*). On 22 February, we first observed 2 fruits on “HarPor 26” (*Figure 3*). Between 26 February and 7 March, one

fruit disappeared and on 19 March, T. Hall collected the second fruit on behalf of the U.S. Fish & Wildlife Service for propagation purposes. At the time that the team left the island, two fruits remained undamaged, in situ, (on HarPor 6 & 19).

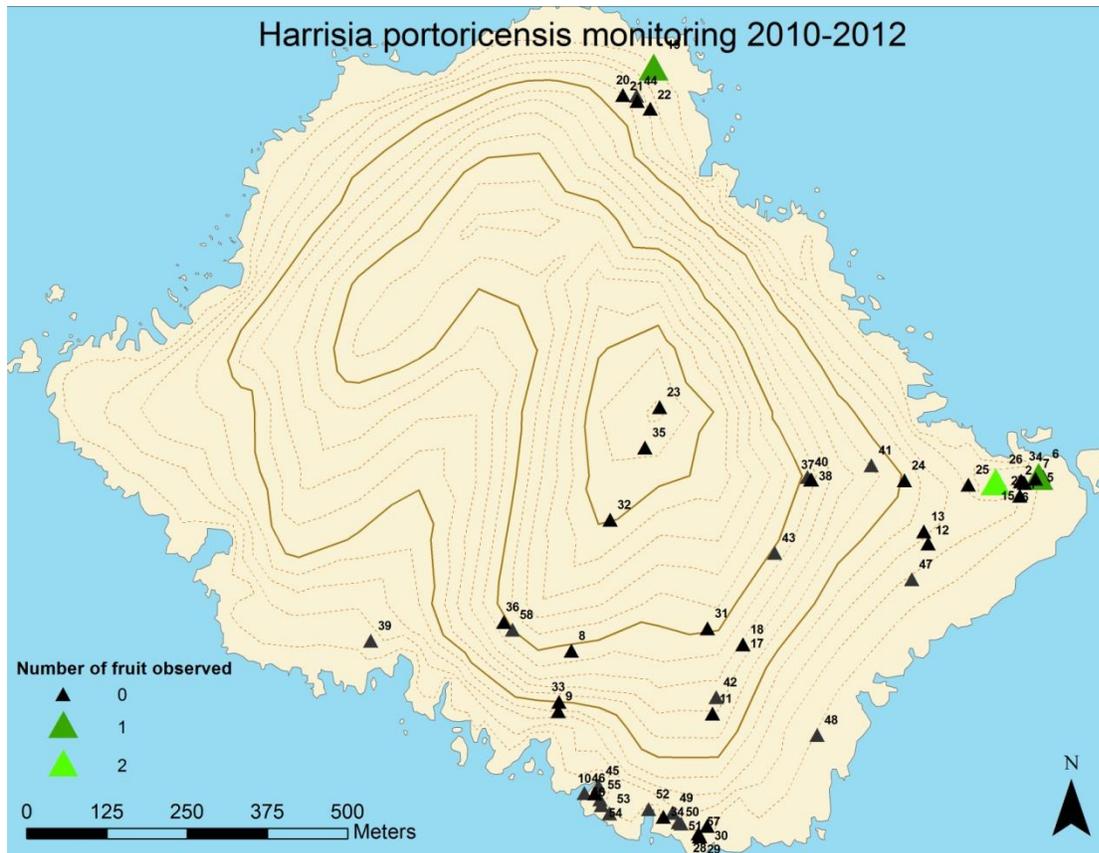


Figure 2. Map of known fruiting *Harrisia portoricensis* on Desecheo Island in 2012. Black triangles signify cacti with no fruit. Large dark green and light green triangles represent cacti with one and two fruits, respectively.



Figure 3. Photos of HarPor 26 (L-R) in Jun 2010 (height = 91.6 cm), March 2011 (118.0 cm), and April 2012 (155 cm) with 2 fruits.

We observed one inaccessible individual (HarPor 29) with what appeared to be 5 or more small white flower buds (*Figure 4*). Given its distance from the observer, however, it is difficult to confirm this observation.



Figure 4. Photo (L) of HarPor 29 on 8 April 2012. Photo (R) of what appears to be 5 or more white flower buds on HarPor29.

The number of branches per plant (an indicator of plant maturity) also increased between 2010 and 2012 (*Table 2*). The average number branches added per plant was 1.72 ± 2.12 SD ($n=29$), with one individual adding 7 new branches between March 2010 and April 2012.

Table 2. Average number of branches counted per plant.

Year	Maximum # of branches/plant	Average # of branches \pm SD	n
2009	0	-	-
2010	3	0.42 ± 0.76	31
2011	3	0.90 ± 1.07	20
2012	8	1.31 ± 2.00	54

DISCUSSION

Naturally occurring populations of *Harrisia portoricensis*, a Federally threatened species, only occur on four Puerto Rican islands – Mona, Monito, Caja de Muertos (Swinnerton pers. comm.), and Desecheo. Data cited in the U.S. Fish and Wildlife Service’s 5-year status review (USFWS 2010) on the species appear to show a decline in the *H. portoricensis* population on Desecheo from 1994 to 2003. In 1994, Breckon and Kolterman reported 550 individuals and estimated that these were distributed over approximately one third of the island (40 ha). By 2000, only five individuals were reported on the island by a master’s student from the University of Puerto Rico Mayaguez (Santiago-Vélez, cited in USFWS 2010). In 2003 Fish and Wildlife staff had observed only nine individuals on the island (Schwagerl pers. com.). Breckon (2000) attributed some declines to Hurricane Hortense (1996), and although he did not find any evidence of damage from goats, he did observe Rhesus Macaques eating young *H. portoricensis* stems in March 1996.

The increased number of individuals observed on Desecheo from 2009 – 2012 coincides with the removal of macaques and goats from the island. Our 2012 surveys found still more *H. portoricensis* (*Table 1*) and continuing growth of marked 2010 individuals (*Appendix 2*). This suggests that larger *Harrisia* are leading to increased detection rates, and/or that the species is increasing in abundance. In either case, it appears likely that the removal of introduced herbivores is having a beneficial effect on this federally threatened plant species. Most promisingly, the cacti are now beginning to reach sexual maturity and bear fruit. Prior to the 2012 survey, all marked *H. portoricensis* were less than 2 m in height and had little to no branching, characteristics that are typical of juvenile plants (cited in Rojas-Sandoval 2010). Although most of the 2012 *H. portoricensis* height measurements of are still less than two meters (*Appendix 2*), this survey indicates that at least three *H. portoricensis* have reached sexual maturity and are flowering and bearing fruit. In addition, our observations of increased plant height and number of branches per plant, indicate that other individuals are likely close to sexual maturity.

This is encouraging news for this Federally threatened species. It will be interesting to continue to track these trends in the number, size, maturity, and distribution of *H. portoricensis* on Desecheo in 2013.

APPENDIX

*Appendix 1. GPS Coordinates of *Harrisia portoricensis* found on Desecheo Island in 2010.*

<i>H. portoricensis</i> Number*	Latitude N	Longitude W	Visit June 2010	Visit March 2011	Visit April 2012
1	18.38320	-67.47358	X	X	X
2	18.38327	-67.47364	X	X	X
3	18.38327	-67.47364	X	X	X
4	18.38326	-67.47363	X	X	X
5	18.38326	-67.47363	X	X	X
6	18.38320	-67.47365	X	X	Fruit
7	18.38317	-67.47369	X	X	X
8	18.38080	-67.48055	X	X	X
9	18.37995	-67.48075	X		X
10	18.37879	-67.48022	X		X
11	18.37990	-67.47848	X		X
12	18.38227	-67.47528	X		X
13	18.38244	-67.47534	X		X (dead)
14	18.38314	-67.47390	X	X	X
15	18.38313	-67.47391	X	X	X
16	18.38311	-67.47385	X	X	X
17			Obs. Mar 2010; Not confirmed		
18	18.38087	-67.47802	Obs. Mar 2010; Not confirmed		
19	18.38901	-67.47927	X		Fruit
20	18.38862	-67.47972	X		X
21	18.38853	-67.47951	X		X
22	18.38842	-67.47932	X		X
23	18.38422	-67.47922	X	X (broken)	X (dead)
24	18.38316	-67.47562	X		X
25	18.38309	-67.47468	X	X	X
26	18.38313	-67.47428	X	X	Fruit
27	18.38293	-67.47392	X		X
28	18.37821	-67.47870	X		X
29	18.37817	-67.47868	X		Flower?
30	18.37832	-67.47857	X		X
31	18.38110	-67.47854	X		X
32	18.38264	-67.47996	X	X	X
33	18.38008	-67.48074	X		X
B – 34	18.37833	67.47912	-	Found Feb 2011	X
35	18.38365	-67.47944	-	X	X
36	18.38121	-67.48154	-	X	X
37	18.38318	-67.47700	-	X	X
38	18.38318	-67.47699	-	X	X
A	Unknown location		Photo taken Mar 2010		
39	18.380962	-67.483506	-	-	X

Appendix 1 cont.

<i>H. portoricensis</i> Number*	Latitude N	Longitude W	Visit June 2010	Visit March 2011	Visit April 2012
40	18.38322	-67.47705	-	-	X
41	18.383377	-67.476108	-	-	X
42	18.38013	-67.77842	-	-	X
43	18.38216	-67.47754	-	-	X
44	18.388607	-67.47952	-	-	X
45	18.378896	-67.480166	-	-	X
46	18.37879	-67.48038	-	-	X
47	18.38177	-67.47553	-	-	X
48	18.380727	-67.475573	-	-	X
49	18.37850	-67.47908	-	-	X
50	18.37837	-67.47899	-	-	X
51	18.37835	-67.47896	-	-	X
52	18.37856	-67.47943	-	-	X
53	18.37851	-67.48001	-	-	X
54	18.37862	-67.48012	-	-	X
55	18.37870	-67.48014	-	-	X
56	18.37879	-67.48038	-	-	X
57	18.37817	-67.47868	-	-	X
58	18.381101	-67.481413	-	-	X

*All accessible *H. portoricensis* monitored in June 2010 have metal tags identifying them, e.g. "Harpor 1"

Appendix 2. Summary of *Harrisia portoricensis* measurement monitoring for June 2010, March 2011, and April 2012. Calculations are for the 22 month period from June 2010 to April 2012.

Identification #	Stalk Height (cm)			% Height Increase [†]	Growth Rate [†] (cm/month)
	2010	2011	2012		
1	59.4	106.5	138	132	3.57
2*	77.4, 102.9	111, 136	141, 169	64	3.00
3	36.8	79	113	207	3.46
4*		Broken & regenerating,			
	55.2	14, 19	67, 51		
5	17.6	50	104	491	3.93
6	137.8	172.5	184 (F)	34	2.10
7	87.4	148	181	119	4.71
8	67.6	148	174.3	158	4.85
9	35.9	-	70.5	96	1.57
10	Missing data	-	125.5		
11	23.3	-	33.5	44	0.46
12	70.1	-	156	123	3.90
13	55.4	-	Dead		
14	85.5	144	176	106	4.11
15	103.6	157.5	173	67	3.15
16	58	98	125	116	3.05
17	-	-	-		
18	-	-	-		
19	87	-	166 (F)	91	3.59
20	64	-	146	128	3.73
21	115	-	143.5	25	1.30
22	65.6	-	172	162	4.84
23		Broken, dead?	Dead		
	33				
24	34	-	58	71	1.09
25*		112, 14	114.5, 12	122	2.86
	51.5, 12.6		(dead stalk)		
26	91.6	118	155 (F)	69	2.88
27*	63.4, 93.5	-	110.5, 176.5	89	3.77
28	~80	-	NE		
29*	~100, ~85	-	NE		
30	~50	-	NE		
31	29.2	-	62.5	114	1.51
32	32.5	47.1	78.5	142	2.09
33	53	-	159	200	4.82
B – 34	-	NE	NE		
35	-	31.5	63		
36	-	66	89.2		
37	-	41	84.5		

Appendix 2 cont.

<i>Identification #</i>		<i>Stalk Height (cm)</i>		<i>% Height Increase[†]</i>	<i>Growth Rate[†] (cm/month)</i>
38	-	72.5	71		
A	-	-	-		
39	-	-	208		
40	-	-	110.5		
41	-	-	113		
42*	-	-	40.5, 29.5		
43	-	-	141		
44	-	-	77		
45	-	-	113.5		
46	-	-	NE		
47	-	-	155		
48	-	-	~250		
49	-	-	NE		
50	-	-	NE		
51	-	-	NE		
52*	-	-	72, 95		
53	-	-	NE		
54	-	-	NE		
55	-	-	61		
56	-	-	58		
57	-	-	NE		
58	-	-	NE		
Average [†] ± SD	64.7 ± 30.5 cm	93.9 ± 49.1 cm	119.8 ± 47.3 cm	126% ± 92% SD	3.2 ± 1.2 cm/month

*Plant with two stalks; stalks were defined as a branch of the cactus that begins in the ground.

[†]For plants with two stalks, we calculated the growth rate and the % height increase of the longer of the two stalks; all averages were calculated for the longer of the two stalks

~Estimated measurements due to the plant's inaccessibility.

F = observed with fruit.

NE = height not estimated.

REFERENCES

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