Monitoring Report

Sclerocactus mesae-verdae Transplant Project

Northern Navajo Fairgrounds
Shiprock, San Juan County, NM

2008

By
Daniela Roth, Botanist
Navajo Natural Heritage Program
Department of Fish & Wildlife
P.O. Box 1480
Window Rock, AZ 86515

INTRODUCTION

On March 27, 2001, Navajo Natural Heritage Program staff (Department of Fish & Wildlife) excavated 55 Mesa Verde Cacti (*Sclerocactus mesae-verdae*) from the south-central portion of the proposed Northern Navajo Fairgrounds site located south of Shiprock, New Mexico, east of US HWY 491, and north of Navajo Route 36.

The roots of the cacti were slightly trimmed to stimulate root growth and then dipped in a diluted Clorox solution in an effort to prevent bacterial infections. The cacti were then stored at the greenhouse of the Navajo Fish & Wildlife Department for two weeks to allow the roots to heal over. Only one cactus died during this period.

On April 9th, 2001, we delineated 5 monitoring plots within the designated non-development zone of the future fairgrounds. The monitoring plots were mapped and the boundaries were marked with rebar and wooden stakes. Monitoring plot location and size was determined by the presence of existing Mesa Verde Cacti. Naturally occurring cacti serve as a control and are monitored together with the transplanted cacti during annual monitoring efforts.

METHODS

On April 10, 2001, 54 cacti were planted within the established monitoring plots. Eleven cacti were planted into plot 1, which also contained 11 naturally occurring cacti. Eight cacti were planted into plot 2, containing 4 naturally occurring cacti. Plot 3 received 8 cacti, containing 9 naturally occurring cacti. Plot 4 was planted with 13 cacti. It contained 9 naturally occurring cacti. Plot 5 was planted with 14 cacti, and contained 16 naturally occurring cacti. All together there were 49 naturally occurring cacti and 54 transplanted cacti. All plants were mapped, numbered and tagged.

Monitoring takes place annually. Determined and recorded are plant vigor, reproductive status and diameter for each plant. Multi-stemmed cacti are counted as one plant but are measured individually for vigor, reproductive status and diameter. This baseline information is used to determine the success of the transplanting effort.

RESULTS

Annual monitoring in 2008 took place on April 30.

In 2008, 17 naturally occurring and 19 transplanted cacti were found alive in the 5 monitoring plots (Figure 1). No new cacti were recruited into the population since 2007 and two had died, both of which were naturally occurring cacti. Two naturally occurring cacti were not relocated in 2008. Recruitment of cacti from the seedbank into the population remains low. In 2002, 7 cacti were recruited into the population, 6 in 2003, 1 in 2004, 5 in 2005 and 2007 and none in 2006 and 2008. Five naturally occurring cacti have died between 2005 and 2008 and none of the transplanted cacti. Seventy-six percent of the naturally occurring cacti and sixty-five percent of the 54 transplanted cacti died between 2001 and 2004, the majority as a result of the drought of 2002.

In 2008, all natural cacti and 89% of the transplanted cacti were in excellent health (Figure 2.). One transplanted cactus was rated in good condition and one in fair health. In 2008 reproductive effort increased to its highest level since 2001. Fifty-three percent of naturally occurring cacti were reproductive in 2008 and 50% of the transplanted cacti (Figures 3 & 4, Table1). Since 2003 only three of the cacti have measured above 4 cm in diameter (transplanted), most others remain in the 1.00 to 3.99 category. The average diameter fro naturally occurring cacti is smaller since cacti are continually recruited into

the population from seedlings. None of the transplanted cacti were below 2.00cm in diameter by 2008(Figure 5, Table 2). Originally, transplanted cacti had a larger proportion of juvenile, small diameter plants (<1.99cm) and a lower proportion of large diameter, mature plants (> 5.00cm) than the naturally occurring cacti (Figure 6, Table 2). This trend continued into 2002, after which there was a shift in diameter size classes from larger diameters towards smaller size classes. By 2005, all naturally occurring cacti with a diameter above 3.00cm were gone and only 26% of the transplanted cacti were larger than 3 cm in diameter. The small diameter size classes (< 3.00cm) fared best among transplanted as well as naturally occurring cacti.

CONCLUSION

The drought of 2001/2002 combined with a subsequent insect attack had a severe impact on both naturally occurring Mesa Verde Cacti as well as transplanted cacti. This was apparent during the two monitoring seasons following the drought through unprecedented high mortality rates, very low reproductive effort, decreases in diameter and low vigor of surviving plants. Both transplanted and naturally occurring cacti were affected similarly, although large diameter plants had a higher mortality rate and therefore more naturally occurring cacti died. Large diameter plants were more susceptible to insect attacks than the smaller cacti. Mortality rates have dropped off since 2003 and new plants continue to be recruited into the population through 2007, although at a very low level. A very dry winter of 2005/2006 likely contributed to the lack of reproductive effort and recruitment in the spring of 2006 as well as the lower vigor among transplanted cacti. By 2007 and 2008 vigor increased and was rated excellent for all naturally occurring plants and most transplanted cacti. Reproductive effort increased substantially in 2008, likely due to increased rainfall and the maturation of juvenile plants.

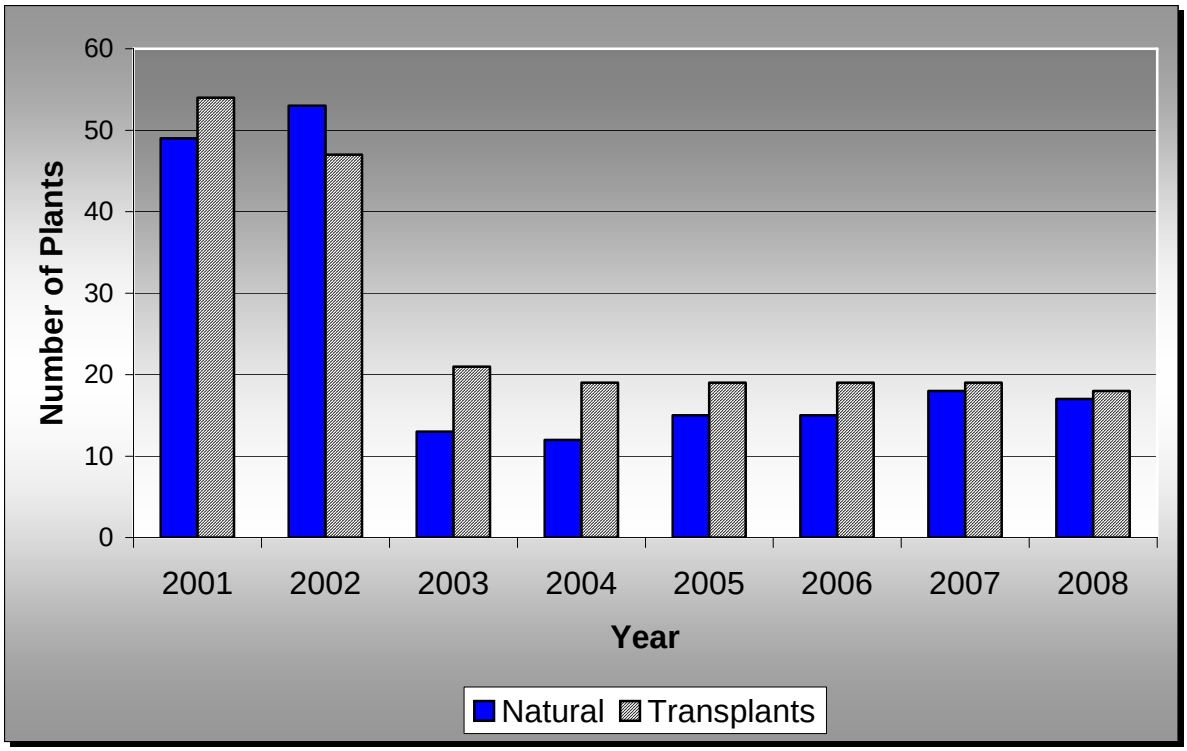

Figure 1. Total number of transplanted and naturally occurring *Sclerocactus mesae-verdae* plants from 2001 to 2008 in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

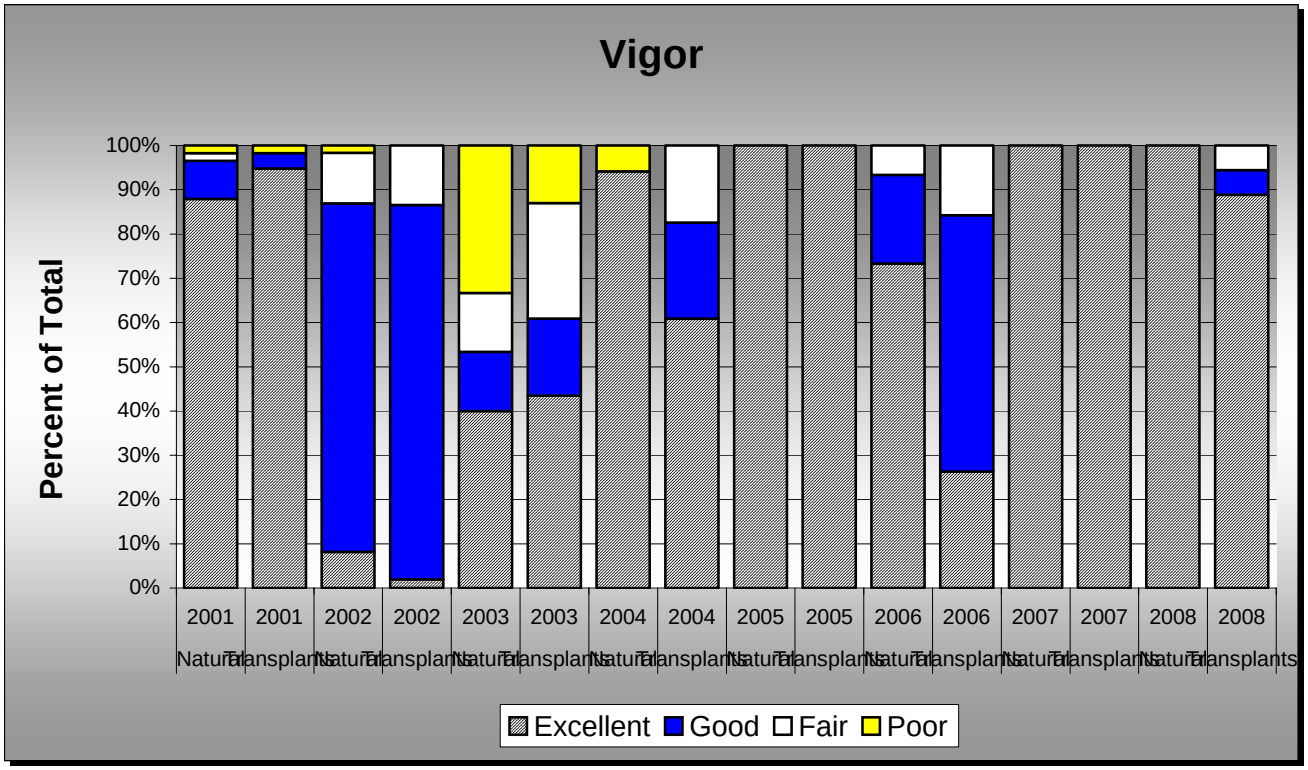

Figure 2. Percent of *Sclerocactus mesae-verdae* plants belonging to each of 4 vigor classes from 2001 to 2008 for transplanted and naturally occurring cacti in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

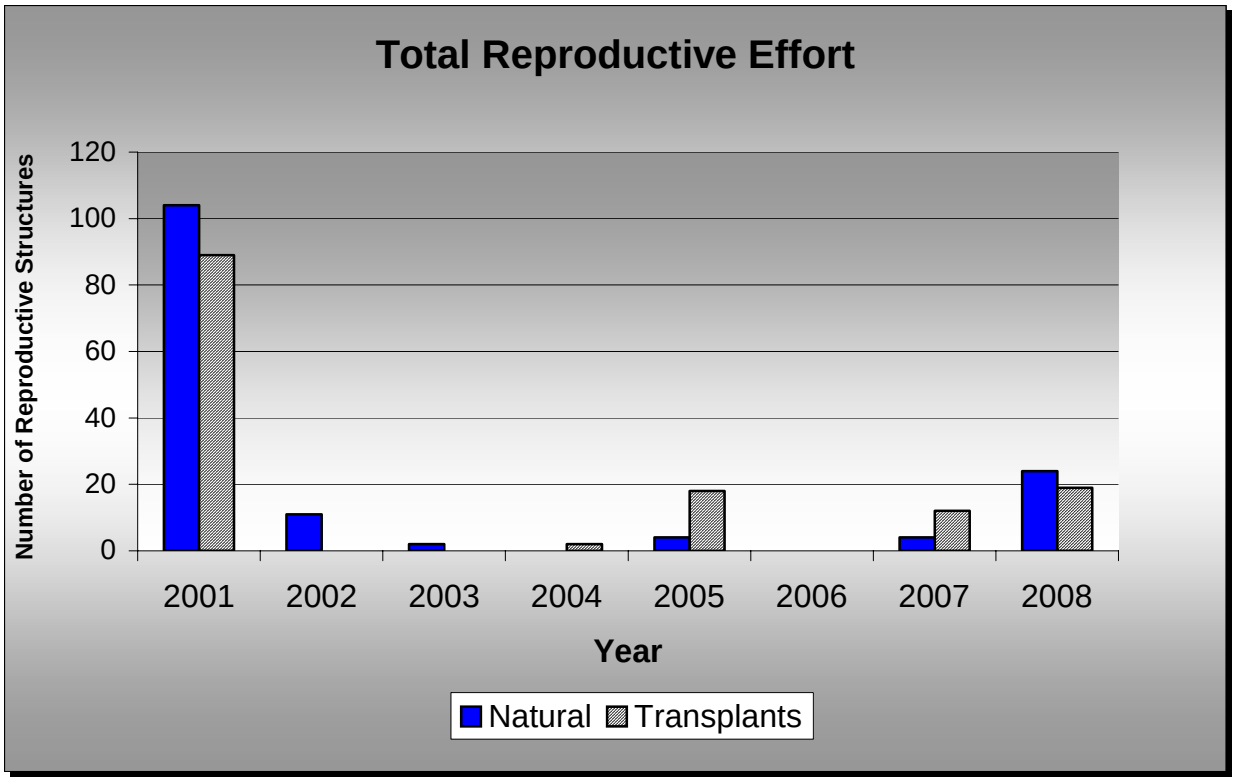

Figure 3. Number of reproductive structures found on transplanted and naturally occurring *Sclerocactus mesae-verdae* plants in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

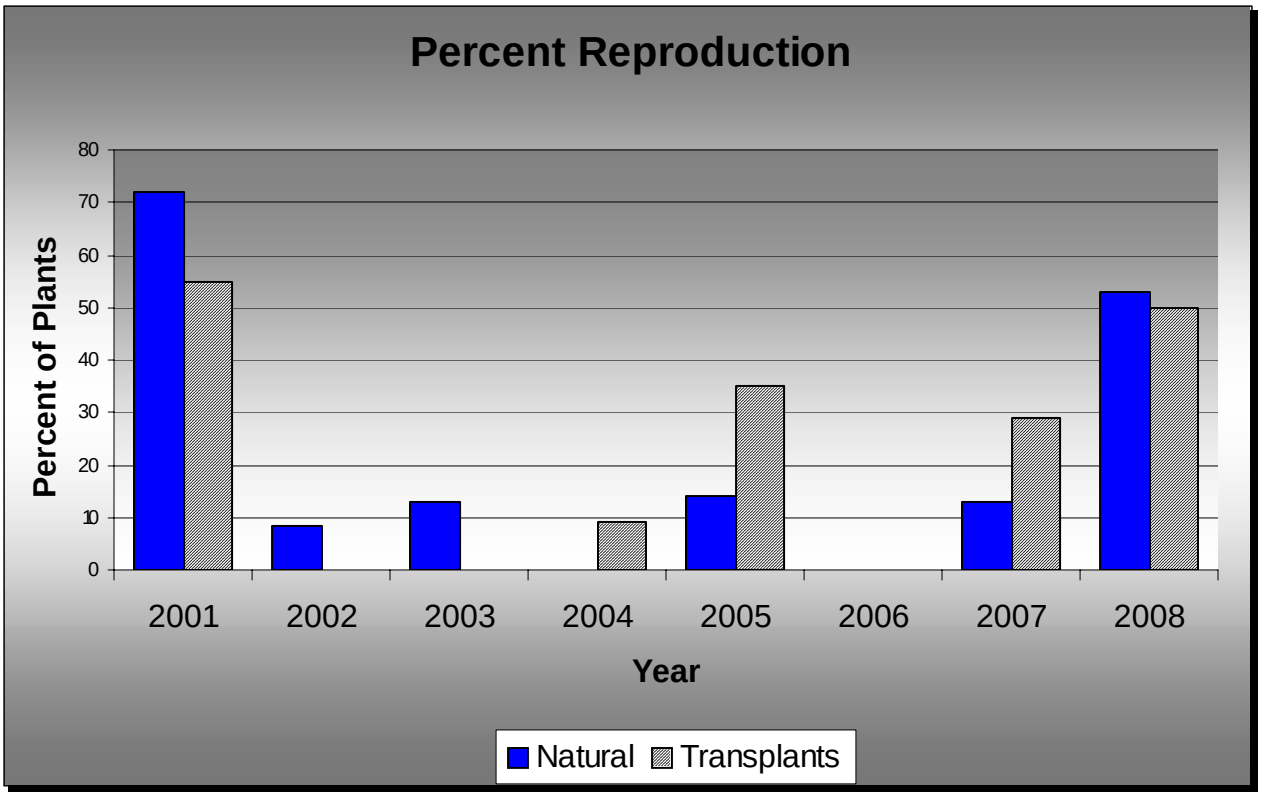

Figure 4. Percent of the total number of transplanted and naturally occurring S*clerocactus mesae-verdae* plants reproducing in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

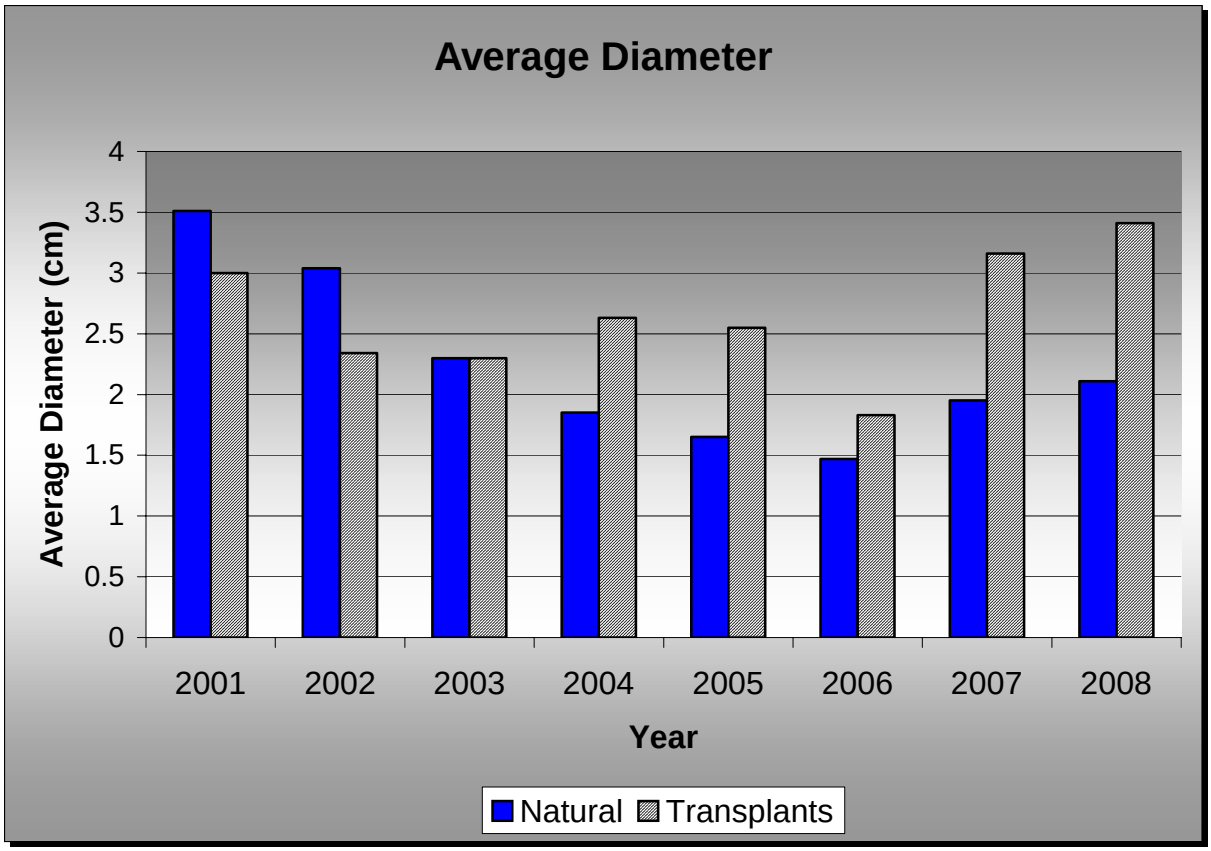

Figure 5. Average diameter of transplanted and naturally occurring *Sclerocactus mesae-verdae* plants in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

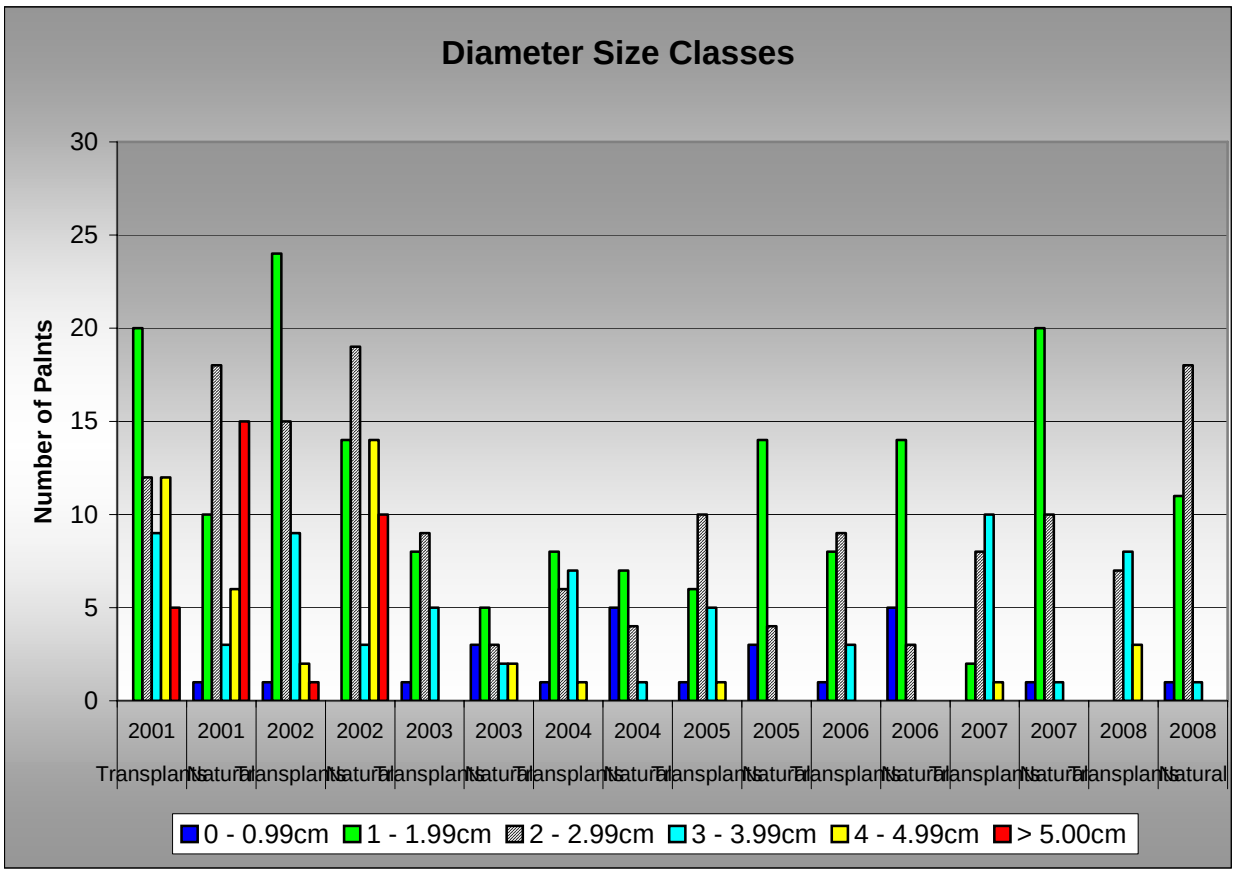

Figure 6. Diameter size classes for transplanted and naturally occurring *Sclerocactus mesae-verdae* plants in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

Table 1. Reproductive effort among transplanted and naturally occurring *Sclerocactus mesae-verdae* plants in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

Transplants	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Buds	85	0	0	0	0	0	1	0
Flowers	4	0	0	0	5	0	2	2
Immature Fruit	0	0	0	0	5	0	7	9
Mature Fruit	0	0	0	1	4	0	0	7
Aborted Flowers	0	0	0	1	4	0	2	1
Total	**89**	**0**	**0**	**2**	**18**	**0**	**12**	**19**

Natural	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Buds	104	11	0	0	0	0	0	0
Flowers	0	0	0	0	0	0	3	4
Immature Fruit	0	0	0	0	1	0	0	14
Mature Fruit	0	0	1	0	3	0	0	6
Aborted Flowers	0	0	1	0	0	0	1	0
Total	**104**	**11**	**2**	**0**	**4**	**0**	**4**	**24**

Table 2. Size class distribution of natural and transplanted *Sclerocactus mesae-verdae* plants in 5 monitoring plots at the future Northern Navajo Fairgrounds near Shiprock, NM.

Transplants	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
0 - 0.99cm	0	1	1	1	1	1	0	0
1 - 1.99cm	20	24	8	8	6	8	2	0
2 - 2.99cm	12	15	9	6	10	9	8	7
3 - 3.99cm	9	9	5	7	5	3	10	8
4 - 4.99cm	12	2	0	1	1	0	1	3
> 5.00cm	5	1	0	0	0	0	0	0
Total	**58**	**52**	**23**	**23**	**23**	**21**	**21**	**18**

Natural	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
0 - 0.99cm	1	0	3	5	3	5	1	1
1 - 1.99cm	10	14	5	7	14	14	20	11
2 - 2.99cm	18	19	3	4	4	3	10	18
3 - 3.99cm	3	3	2	1	0	0	1	1
4 - 4.99cm	6	14	2	0	0	0	0	0
> 5.00cm	15	10	0	0	0	0	0	0
Total	**53**	**60**	**15**	**17**	**21**	**22**	**32**	**31**

REFERENCES

Benson, L. 1982. The Cacti of the United States and Canada. Stanford University Press, Stanford, CA.

Heil, K., and J.M. Porter. 1994. *Sclerocactus* (Cactaceae): A Revision. Haseltonia No. 2: 20 - 46.

Ladyman, J. 2004. Status Assessment Report for *Sclerocactus mesae-verdae* (Mesa Verde Cactus). Prepared for: The Navajo Natural Heritage Program, Window Rock, AZ. http://nnhp.navajofishandwildlife.org/docs_reps.htm

New Mexico Rare Plant Technical Council. 1999. New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. http://nmrareplants.unm.edu (Latest update: 18 January 2006).

Roth, D. 2008. Species Account for Mesa Verde Cactus. In: Mikesic, D. & D. Roth. 2008. Navajo Nation Endangered Species List Species Accounts. Navajo Natural Heritage Program, Department of Fish & Wildlife, Window Rock, AZ. http://nnhp.navajofishandwildlife.org/

Roth, D. 2001 – 2007. Monitoring Report. *Sclerocactus mesae verdae* Transplant Project, Northern Navajo Fairgrounds, Shiprock, San Juan County, NM. Unpublished annual update prepared for the Navajo Natural Heritage Program, Window Rock, AZ.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish & Wildlife Service by the Colorado Natural Heritage Program. http://www.cnhp.colostate.edu/rareplants/cover.html

USDI Bureau of Land Management. 1995. The Farmington District Endangered, Threatened, and Sensitive Plant Field Guide. Prepared by Ecosphere Environmental Services, Inc., Farmington, NM.

U.S. Fish & Wildlife Service. 1984. Mesa Verde Cactus (*Sclerocactus mesae-verdae*) recovery plan. U.S. Fish & Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, NM.