

15 Year Follow-up Survey to Assess the Progress of a Cypress-Pond Apple, Maple Tree Planting Project in the ARM-Loxahatchee National Wildlife Refuge, Boynton Beach, FL USA

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PRIMARY OBJECTIVE

To monitor growth (height) and survival of 6600 trees planted in 2001 by the largest volunteer force (over 400) to that date helping to restore a mixed cypress-pond apple-maple swamp: *Taxodium ascendens* (pond cypress), *Annona glabra* (pond apple), and *Acer rubrum* (maple),

Environmental Science Class Spring 2016. Joel VanArman (guest researcher), Peggy VanArman, Kyle Holly, Trinity Livingston, Austin Peightel, Catherine Wiersma, David Periard.

ABSTRACT

Cypress swamps formed large forested parts of the historic Everglades ecosystem, providing habitat and shelter for wildlife, until the 1900's, when most of cypress was cut to furnish wood for buildings and commercial interests. A pilot project was undertaken in 2001 to restore a cypress community on a 6.5 acre tract (impoundment B-3) within the Arthur R. Marshall Loxahatchee National Wildlife Refuge (ARM-LOX), Boynton Beach, FL. The project was initiated by the Arthur R. Marshall Foundation, consistent with the goals of the Foundation (Marshall, 1972), to restore a native swamp community in an area that was previously managed as an open marsh, primarily to provide food for migratory birds. More than 400 volunteers planted approximately 6600 cypress, maple, and pond apples trees. After the planting, the site was not specifically managed to promote cypress growth, experienced atypically high water levels during subsequent years, and was significantly damaged by Hurricane Wilma in 2005. The site was initially monitored by LNWR staff approximately one year after the planting. A more extensive follow-up survey was conducted to determine growth and survival of trees in June 2007. This second follow-up study was conducted in March 2016 to document changes in vegetation over time. Due to flooded conditions over the years, no maple trees survived, very few pond apples were found, and the remaining trees were cypress. Statistical analyses of the data indicate that there was significant growth (measured by height relative to 2001) and that survival exceeded 70% in much of the study area.

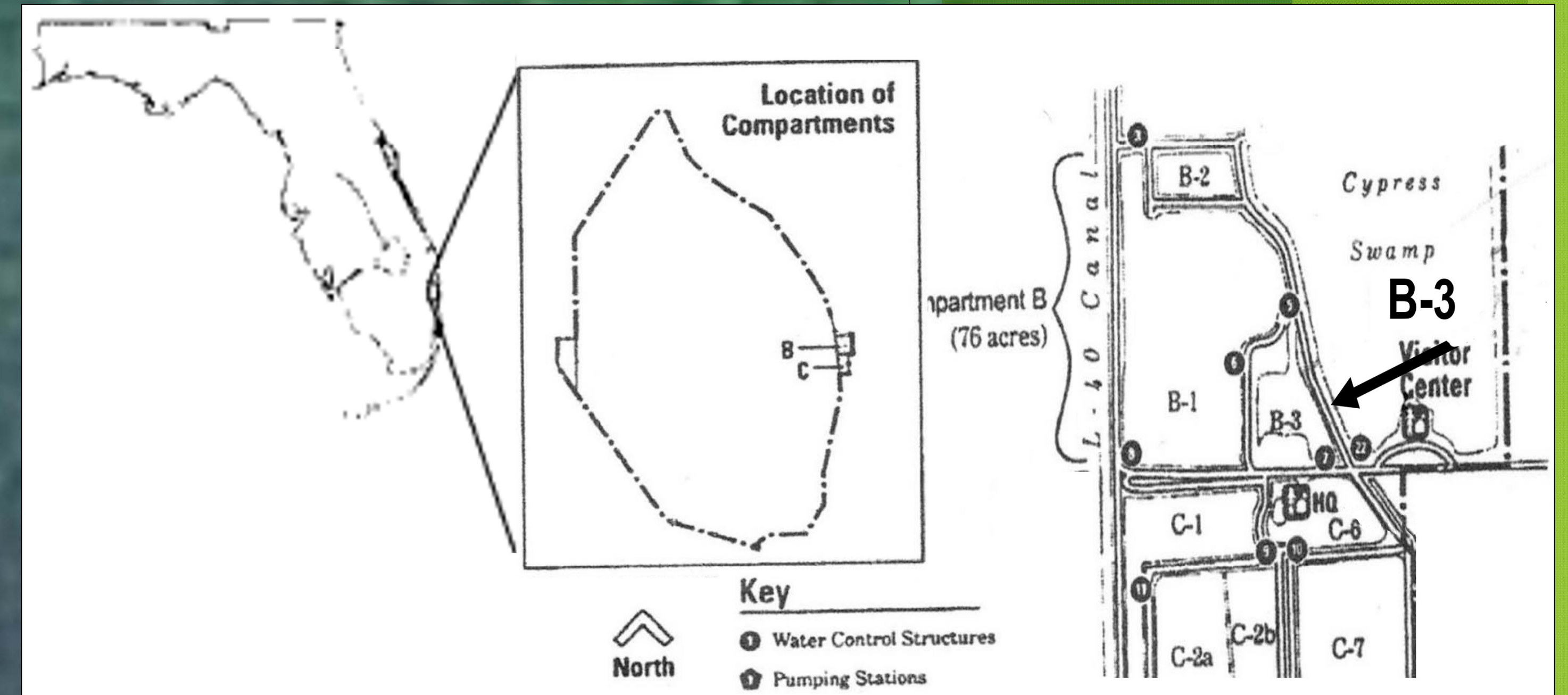


Figure 1. Map of LNWR showing the location of the B-3 impoundment.

INTRODUCTION

This project was initiated by the Arthur R. Marshall Foundation to restore a cypress swamp community on a disturbed wetland marsh site within the refuge.

Another major purpose was to elicit support from volunteers, to raise public awareness of wetland ecology and threats to refuge ecosystems. Public participation in community projects encourages, engages, and teaches stewardship to a diversity of citizens (Marshall Plan, 1972).

Restoration of swamp habitat by replanting trees in disturbed marsh enhances biodiversity and wildlife habitat.

Forest communities can reduce pollutants through long-term sequestering of nutrients in woody tissues.

SITE DESCRIPTION

This 6-acre B-3 tract (Fig. 1) was logged for cypress in the early 1900's. By 1948 the site was planted with barley, millet, buckwheat and chufa for waterfowl forage. Restoration to a mixed marsh was encouraged by water level manipulation and burning. In 2000, it was an open marshland consisting primarily of sawgrass and cattails.

The area is very flat, ranging in elevation from about 13.5 to 14.5 ft above sea level (Fig. 2). The land surface is slightly lower at the southwest end, and higher at the northeast end. The driest areas of the field were blocks 1 and 8 at the north end, and blocks 6 and 7 on the east (Martin 2001/2002).

METHODS

- Line transects were established from west to east within eight 40 x 80 meter blocks (plots) (Fig. 2). The area sampled within the eight blocks represents about 30% of the planted area in the impoundment
- Height, diameter at breast height (DBH), and survival data were collected from every tree within 4 meters of the line transect.
- Height and DBH were measured using a meter tape and meter stick.
- Data were initially analyzed using means and standard deviations, to compare results from June 2007 with those obtained in March 2016.

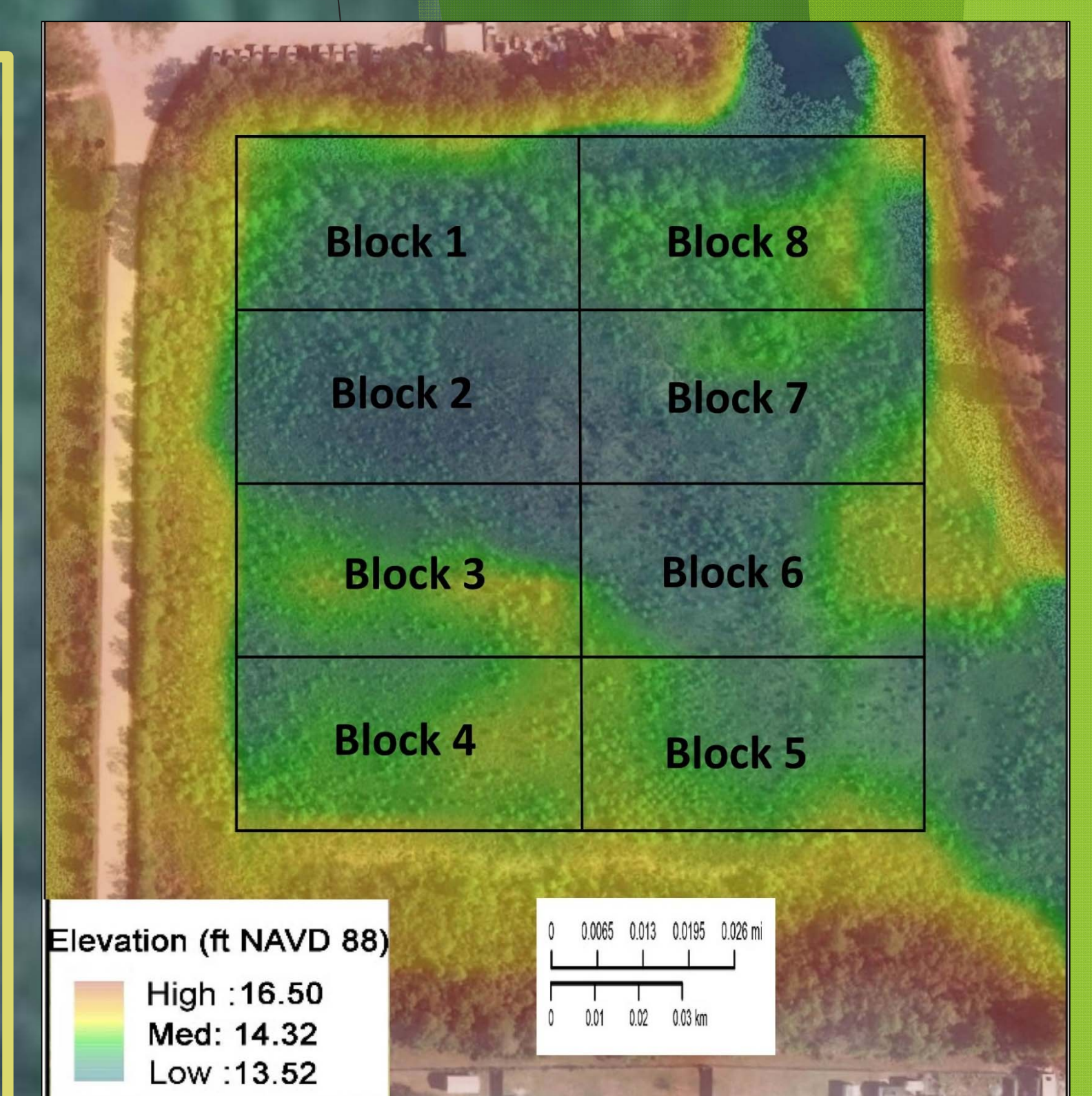


Figure 2. Topography of the B-3 impoundment, showing locations of sampling blocks

RESULTS

- Survival of cypress trees during the period from 2001 (Fig. 3) to 2016 (Fig. 5) ranged from 29-104% (Table 1 and Fig. 6). Increased survival in plots 1, 6, 7, and 8, in 2016 relative to 2007, indicates that recruitment likely occurred during this period.
- For the 2016 survey, no attempt was made to distinguish pond cypress from bald cypress. Results from both growth forms were combined for comparison with previous results.
- No remaining maple trees were observed in the planted area of impoundment in 2016; pond apple trees were rarely seen and only one was observed on the transects
- Mean height between cypress trees increased 56%, from 147 cm to 229 cm, between 2007 (Fig. 4) and 2016. The tallest trees occurred in the driest plots (1 and 8).

Table 1. Comparison of mean height between *Taxodium* (sp.) data collected in 2007 (VanArman, 2007) and 2016 to *Taxodium* (sp.) and data recorded 2001 (Martin 2001/2002).

Block	2001		2007			2016		
	N ₀	Ht ₀	N ₁	Ht ₁ (cm)±sd	%S ₁ vs S ₀	N ₂	Ht ₂ (cm)±sd	% S ₂ vs S ₀
1	150	(94)	88	183±62.3	58.7	156	254±105.4	104.0
2	150	(94)	71	125±47.0	47.3	43	185±72.4	28.7
3	150	(94)	93	135±38.6	62.0	88	192±65.2	58.7
4	150	(94)	26	n/a	17.3	n/a	n/a	n/a
5	150	(94)	88	n/a	58.7	n/a	n/a	n/a
6	150	(94)	79	141±29.6	52.7	144	248±95.6	96.0
7	150	(94)	67	143±39.5	44.7	116	178±75.4	77.3
8	150	(94)	47	171±54.6	31.3	100	274±104.0	66.7
Total	1200		559			647		
Mean		(94)	(447)*	147	46.58	(647)†	229	71.88†

◆ N₁ = (447) corresponds to blocks 1-3 and 6-8 where height measurements were taken in 2007
 ◆ N₂ = (647) corresponds to blocks 1-3 and 6-8 where height measurements were taken in 2016; For survival calculations N₂ is compared against an estimated initial N = 900 for blocks 1-3 and 6-8 combined



Figure 3. B-3 impoundment in 2001, during the initial planting



Figure 4. B-3 impoundment 2007, during the 2007 follow-up-survey.

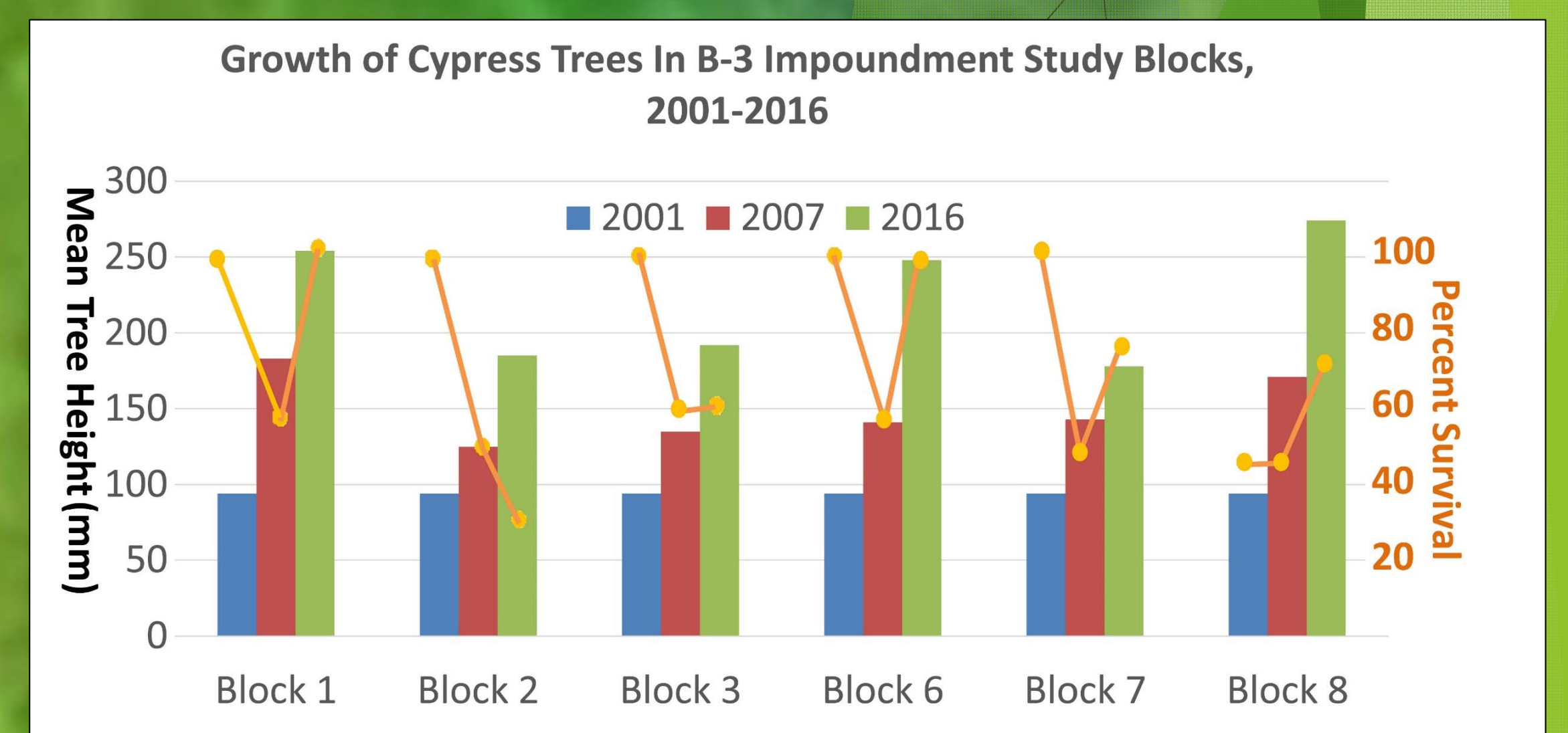


Figure 6. Summary of cypress tree growth and survival, 2001-2016

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Figure 5. Environmental Science class, Spring 2016 conducting the second follow-up survey