

2009 ANNUAL HALEAKALA SILVERSWORD CENSUS

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To learn more about the Haleakala Silversword or hinahina (*Argyroxiphium sandwicense* subsp. *macrocephalum*), and to keep a pulse on this park icon, each year the flowering silverswords are counted, and 11 silversword plots are monitored. This year we were assisted by Paul Krushelnycky, Sam Aruch, Susan Aruch, Wendy Swee, and Marnie. Below are the results from 2009. In short, it was a low flowering year (158 blooms), and another year of decline (13%) with 17 less silverswords in the plots.

FLOWERING CENSUS

The Haleakala silversword flowers once and then dies. The silversword flowering census attempts to count all the flowering silverswords each year. The flowering silversword census was sporadically done from 1934 to 1962. Since 1969, the flowering silverswords census has been done almost every year.

- 2009 was a low flowering year, with 158 blooms. 2009 was the 32nd largest year out of 43 years on record. There were 1148 blooms last year (2008), the 10th largest year on record. The largest flowering year ever was 1991 with 6,632 blooms. The smallest was 1970 with 0 blooms.
- The bulk of silverswords that flowered this year were located at Sliding Sands, Puu o Pele, and Ka Moa o Pele.
- The silverswords continue to bloom right on cue every summer (June - October), but the annual variation in numbers of blooms is quite dramatic, with no clear indication what triggers mass blooming events in this self-incompatible species. Thoughts on silversword bloom triggers have included ultraviolet levels, changes in plant hormones such as gibberellins, and changes in precipitation. Of these, precipitation seems to be the most looked at, but to date no one has found a solid correlation, and what triggers silverswords to bloom still remains a mystery.

PLOTS

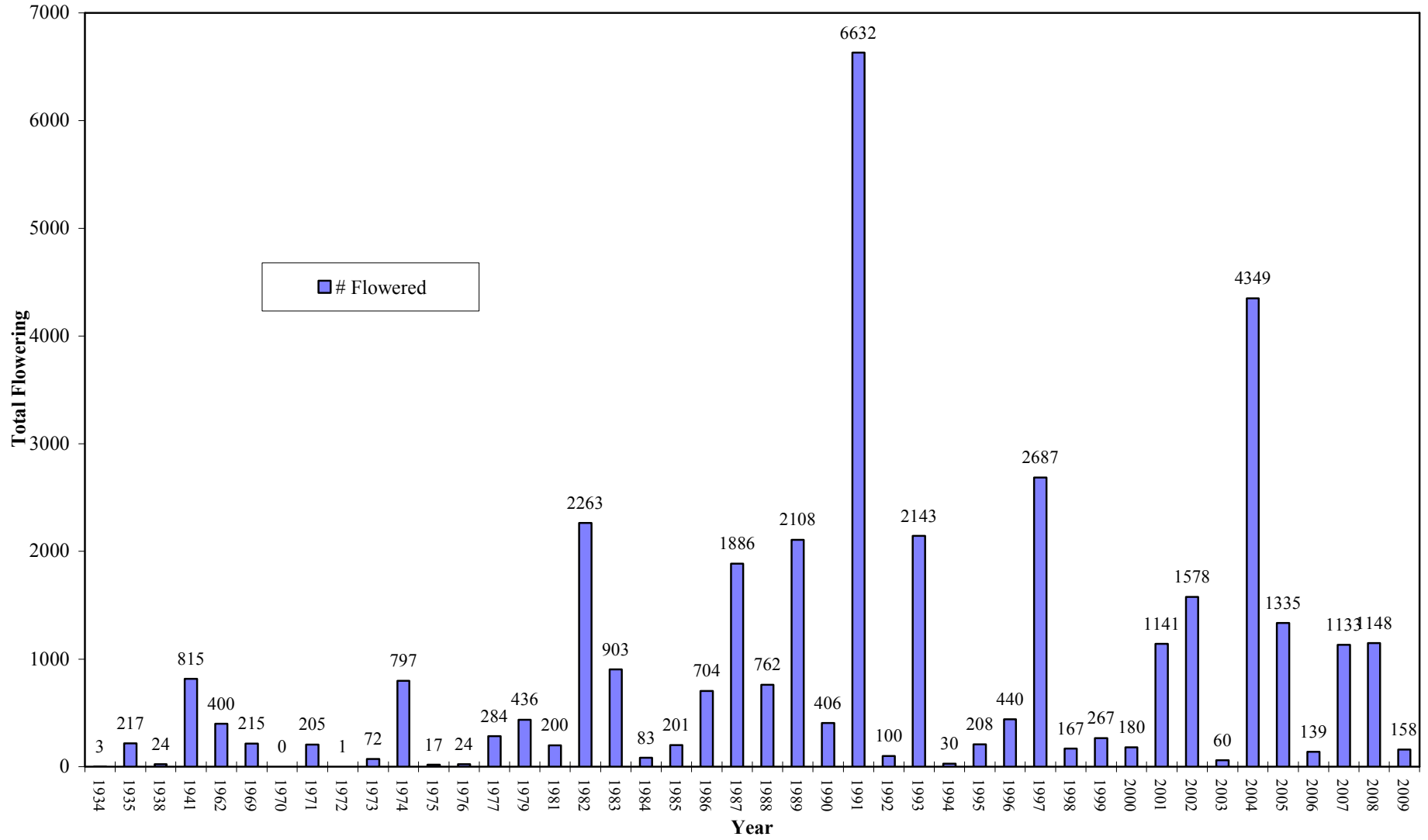
The 11 silversword plots attempt to monitor a representative sample of the silverswords by mapping individual silverswords, measuring live crown diameter of each silversword, and noting life history changes (seedlings, flowered, death). The silversword plots were established in 1982 and have been monitored almost every year since then.

- 2009 was yet another year of decline. The total number of live silverswords in the plots declined 13% (17) in the last year from 127 to 110. Of the 17 that died this year, one flowered and then died and 16 died without flowering. Last year the plots declined 16% (24). The total number of live silverswords in the plots has dropped by 72% (288) since 1982, from 398 to 110. This steep decline has

occurred since an all time high of 508 silverswords in the plots in 1990, with 14 of the last 15 years showing decline.

- No new seedlings were recorded in the plots this year, nor the previous 2 years. Survival for the 3 seedlings from 2006 is now 0% (none alive), for the 25 seedlings from 2005 survival has been 15% (3 still alive), for the 127 seedlings from 2004 survival has been about 9% (11 still alive), for the 5 seedlings from 2001 survival has been about 20% (1 still alive), and for the 2 seedlings from 2000 survival has been about 50% (1 still alive).
- Of the seedlings still alive, most are still small in size (<5 cm), though one of the 2004 seedlings and one of the 2005 seedlings are now in the 5-20 cm size class, both of which occur in close proximity to each other in the same plot.
- One silversword flowered in the plots this year. The most flowering silverswords ever recorded in the plots was 22 in 2004. This year's bloomer was first recorded from the plots in 1982, and at the time was in the 5-20 cm size, making it at least 27 yrs. old, and perhaps much older, when it finally flowered this year.
- 39% (43 of 110) of the silverswords have been in the plots since 1982. In other words, 39% (43) of the silverswords in plots are at least 27 years old. The smallest of these old silverswords is a mere 4 cm in diameter, the largest is 32 cm in diameter. The largest silversword in the plot is currently from 1986 and measures 40 cm in diameter.
- No one knows what is causing the steep decline in silverswords, but what seems to be occurring is that silverswords begin shrinking (decrease in live crown diameter) and eventually shrink to zero (dead). The most obvious cause would seem to be lack of moisture. The past couple decades have held an inordinate number of dry years, including a string of driest years on record. However, local scale measurements of weather within silversword habitat at Haleakala during this period does not exist, and there have been silversword declines in wet years. Other factors that have been proposed for the marked silversword decline include increased temperature and a more stable inversion layer.
- Given the dire news the plots seem to report, folks have questioned whether the 11 non-randomly selected plots are representative of the entire crater population, last estimated at 50,000 in 2001. Anecdotally there appears to be a lot of death beyond the plots, a walk along the Silversword Loop is pretty gut wrenching if you know what to look for. That said, populations along Sliding Sands seem to be doing quite well. Con-current work by Paul Krushelnycky, Don Drake, and others will hopefully shed some light on trends beyond these long-term plots, through more detailed mapping of silverswords outside the plots, installation of local weather stations, and continued experimentation with remote sensing.

ANNUAL HALEAKALA SILVERSWORD FLOWERING CENSUS 1934-2009



PLOT TOTALS 1982-2009

Size Class	1982	1983	1984	1985	1986	1987	1988	1989	1990	1992	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
X (<5 cm)	157	106	190	108	142	157	118	260	185	132	110	71	87	86	83	72	56	45	159	143	79	45	33	27
O (5-20 cm)	187	203	198	190	200	177	168	173	245	174	143	151	134	128	98	94	90	94	86	86	75	75	71	60
* (>20 cm)	54	71	66	65	62	68	70	55	78	56	52	61	61	48	56	57	57	50	34	35	41	30	23	23
Flowered	16	5	0	2	3	6	1	20	4	1	5	9	0	1	1	3	6	1	22	1	0	3	6	1
Total #	414	385	454	365	407	408	357	508	512	363	310	292	282	263	238	226	209	190	301	265	195	153	133	111
Total Live	398	380	454	363	404	402	356	488	508	362	305	283	282	262	237	223	203	189	279	264	195	150	127	110

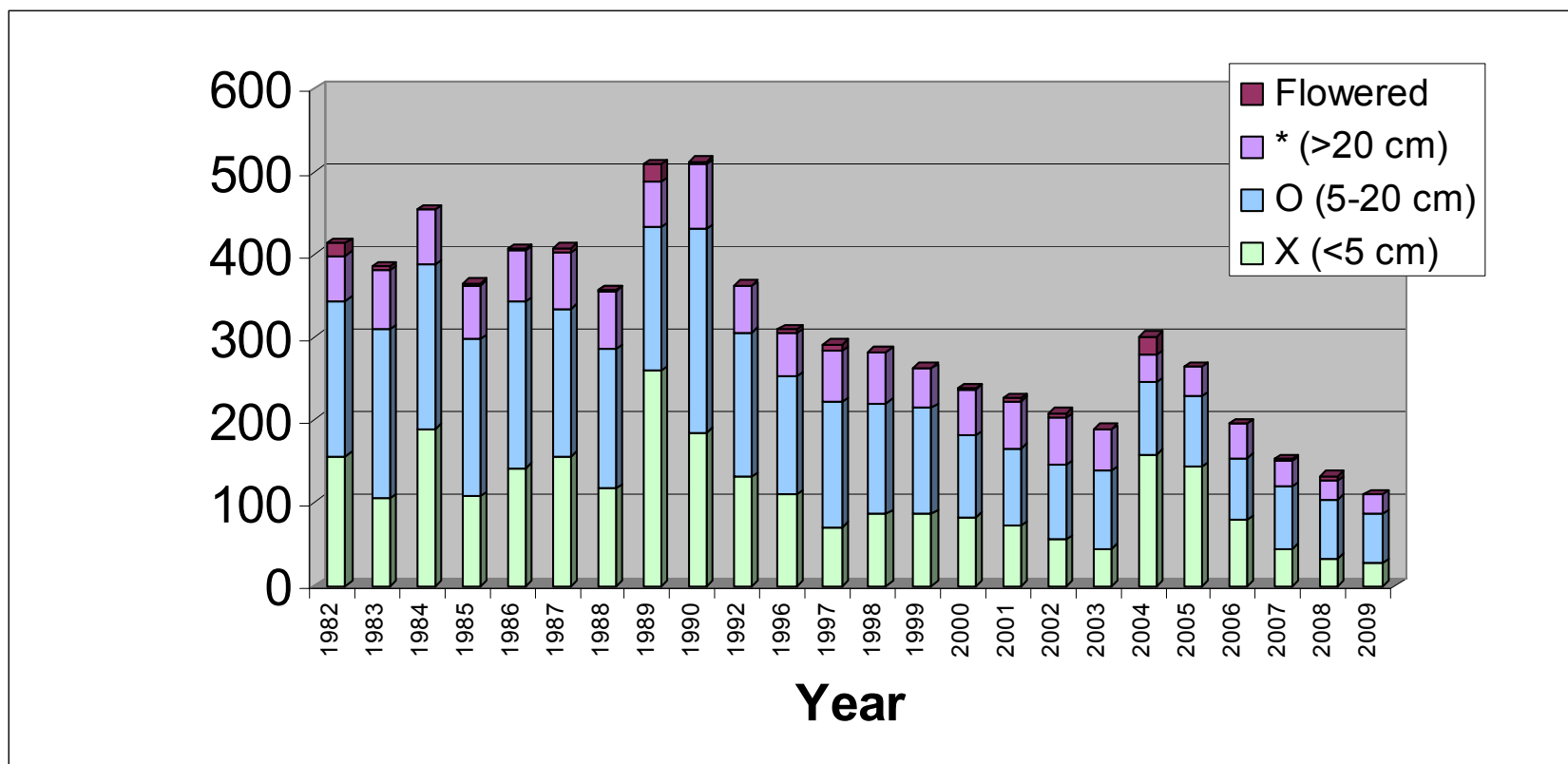


IMAGE FROM 2009

On top of Puu Nole was this unusual silversword bloom, with this year's bloom appearing to come from a dead silversword that flowered last year. We aren't sure exactly how this came to be, as Haleakala silverswords flower once and then die, but are leaning towards it being multiple plants that were growing really close together.

