Las Delicias Pima Pineapple Cactus Burn Experiment Results
Buenos Aires National Wildlife Refuge
2 February 2007

Four field surveys of PPC sites on the Las Delicias burn unit were completed on the following dates for the purpose of assessing impacts to PPC's from a prescribed fire:

Original Pre-burn survey 26 May 2005 (N = 97)
Pre-burn survey 21 April 2006 (34 days before ignition) (N = 91)
First post-burn 8 June 2006 (14 days after ignition) (N = 85)
Second post-burn 18 June 2006 (24 days after ignition) (N = 88)

For the purpose of this summary, only the 2006 surveys are assessed. The original pre-burn survey will be used only to assess non-fire related mortalities between 2005 and 2006. The prescribed fire was ignited on 25 May 2006.

The number of PPC's that died between the 2005 and 2006 and pre-burn surveys was 6 (= 6.2% of the original 2005 PPC population). These were non-fire related 'natural' deaths.

PPC and Habitat Distributions:
Three (3.3%) and 88 (97.6%) of the 91 viable PPC's surveyed during the pre-burn survey occur within the Buenos Aires NWR and Arizona State Lands portions of the Las Delicias Burn Unit respectively. The total number of acres within this burn unit is 1150.7, of which, 558.9 (48.6%) acres and 591.8 (51.4%) acres occur within State and Refuge lands respectively.

Fire induced Damage to PPC's:
By combining the first and second post burn survey results, damage to cacti were assessed as follows:
Twenty three (25.3% of the 91 pre-burn viable PPC's surveyed) from flames, 3 (3.3%) from fire heat, 2 (2.2%) from animals, 13 (14.3%) from other and 1 (1.1%) from an unknown cause. A total 26 cacti (28.6%) were damaged from combined fire effects (flames plus heat), and, 16 (17.6%) were damaged from non-fire related causes. Collectively, a total of 42 (46.2%) were damaged from one or more causes.

Fire induced Mortality to PPC's:
By combining the first and second post burn survey results, cacti mortalities were assessed as follows:
Two (2.2% of the 91 pre-burn viable PPC's surveyed) from flames, 2 (2.2%) from fire heat, 2 (2.2%) from animals, 3 (3.3%) from other, and 1 (1.1%) from an unknown cause. **A total of 4 (4.4%) of the cacti died due to fire (flames plus heat), and, 6 (6.6%) died from non-fire related causes.** Collectively, a total of 10 (11%) cacti died during the pre-burn to 2'nd post-burn time period.

In summary, 28.6% and 17.6% of the cacti were damaged from fire and non-fire causes respectively while 4.4% and 6.6% of the cacti actually died from fire and non-fire related causes respectively.

Fire Proximity to PPC's:
Fire distance information was recorded during the 1'st post-burn survey with the following results: Prescribed fire occurred 0 to 1 meters from 36 (42.4%) of the cacti, 1 to 5 meters from 19 (22.4%) of the cacti and greater than 5 meters from 30 (35.3%) of the cacti. These data represent fire proximity results for all PPC's sites irrespective of damage to the cacti.

Fire proximity results for the 'fire damaged' PPC's are as follows: 23 (92%) in the 0 to 1 meter distance category, 2 (8%) in the 1 to 5 meter distance category. None of the cacti were damaged by fire where burning occurred 5 or more meters away.

Vegetation Conditions:
Data from 9 vegetation parameters were recorded in these surveys. For the purpose of this report, the following 4 vegetation parameters were summarized as follows: percent canopy coverage of total live vegetation, Lehman's Lovegrass (Eragrostis lehmanniana), litter, and, total vegetation height. These were selected for the analysis because of an apparent strong correlation with fire effects.

Percent Boer's Lovegrass (Eragrostis curvula var. conferta), native grasses, forbs, presence/absence of shrubs, and, cross-section height measurements were not included in this summary due, in part, to limited sample sizes and an apparent poor correlation with the fire effects. A continuation of this analysis may take place in the future, which will more than likely include all of the vegetation parameters.

The following tables include the pre-burn site conditions within a 1 meter radius circle around the PPC's. These tables show the summary statistics for all of the PPC's that were damaged by fire and those that were not damaged by fire as assessed in the post burn surveys.

Percent Vegetation Canopy Coverage and Total Vegetation Height (cm) associated with PPC's Damaged By Fire:

	N = 25			
	Mean	S.D.	Min.	Max.
Litter	16.32	12.0	0	45.0
Total Veg.	42.4	21.22	10.0	85.0
Lehmann's	24.88	19.63	0	70.0
Total Height	36.84	14.47	5.0	65.0

Percent Vegetation Canopy Coverage and Total Vegetation Height (cm) associated with PPC's Not Damaged By Fire:

	N = 66			
	Mean	S.D.	Min.	Max.
Litter	11.33	12.04	1.0	75.0
Total Veg.	26.21	21.67	2.0	80.0

Lehmann's	16.08	16.93	0	75.0
Total Height	36.83	24.35	0	175.0

Single sample T tests were completed to assess statistically significant differences for each of these parameters. The following table includes the results of the T tests for the fire damaged vs. non-fire damaged PPC groups:

	P .
Litter	0.0477
Total Veg..	0.0008
Lehmann's	0.0345
Total Ht.	0.9973

Based on these results, it is apparent that total vegetation height was not a contributing factor to damage done to cacti from the fire. However, there was a statistically significant difference in percent canopy cover of total vegetation, Lehmann's lovegrass and litter in the fire damaged vs. non-fire damaged PPC sites ($P < 0.05$). As expected the probability of damage to PPC's was greater in areas with the greatest amount of vegetation.

In conclusion, we have demonstrated that prescribed fire did not significantly impact PPC viability in the Las Delicias Burn Unit area. Even though a large number of cacti were originally damaged from the prescribed fire, only a small percentage actually died from the fire. It is important to note, however, one reason why mortality was low could be due to the fact that a considerable rain had fallen in the study area between the first and second post burn surveys. It will be necessary, therefore, to supplement this study with subsequent surveys in the one and two year post burn time periods to quantify cacti mortality with a greater degree of precision.

Vegetation height was not a significant factor contributing to fire induced damage to cacti. However, the percent canopy coverage of three key vegetation parameters including Lehmann's Lovegrass, did significantly contribute to the damage where fire occurred.

It is also important to note that the State Lands portion of the burn unit is heavily grazed. This constitutes a considerably different land use practice as compared to the un-grazed portion of the burn that falls within the Buenos Aires NWR. Only 3 of the PPC's studied occurred within the Refuge. We, therefore conclude that the fire effects results presented in this report can not be extrapolated to predict potential impacts that may occur within the Refuge since habitat conditions differ considerably. It will be necessary to implement site specific fire effects studies within the Refuge in the future to accurately assess impacts to PPC's that occur there.

A complete set of the survey data will be made available upon request. Please contact Dan Cohan at (520) 823-4251 x107 or dan_cohan@fws.gov to request the data if needed.