

ACCELERATED MORTALITY OF *OPUNTIA* ON ISLA PLAZA SUR: ANOTHER THREAT FROM AN INTRODUCED VERTEBRATE?

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In 1979 and 1980, as part of our research on the Land Iguanas of Plaza Sur, we made a complete vegetation map of the island. Since that time we have monitored the mortality and recruitment of the *Opuntia* there. The results are striking (Fig. 1). From 1980 to 1982 we saw little mortality. Then during the 1982-83 El Niño a tremendous number of individuals died (Snell and Snell 1988). The proximate cause of death was apparently a combination of loading the trunks

and pads with water absorbed from the ground and then toppling by wind. We initially thought that this was a natural situation caused by the extremely wet conditions of El Niño. We prepared a manuscript dealing with it as a natural selective event and proposed an alternative hypothesis for the low growing cacti of small islands (Snell and Snell 1988). However, the mortality has continued. It has continued to be greatest in wetter years (Fig. 1), although the per-

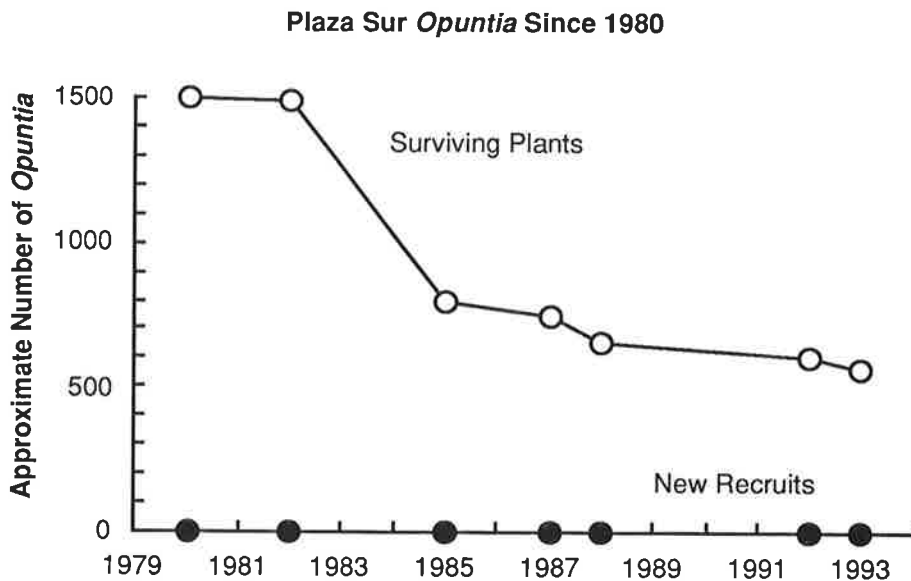


Figure 1. The status of *Opuntia* on Isla Plaza Sur since 1980. Population estimates come from the total counts and vegetation maps. Mortality has been monitored by counting dead individuals.

centage of the population dying in any year has increased. Several things have bothered us about this pattern for a number of years. First: if the wet years act as selective events, and the taller cacti are selected against, then in the next wet year shouldn't the percentage of the population that dies be less? In other words, if the selection in 1982-83 killed the tall cacti which were susceptible, then why were even relatively more killed in the next wet year? The cacti did not measurably grow, so if they weren't susceptible in 1982-83, what changed?

One thing that changed was the colonization of Plazas Sur and Norte by mice in the 1982-83 El Niño, probably from boats or by being swept into the sea from Santa Cruz. The mice reproduced extremely rapidly and were already numerous when Heidi discovered them in 1984. We've tried to hypothesize a mechanism for the mice to affect the *Opuntia* for several years without success. However, this year we made several observations that we feel are significant. First many *Opuntia* have small piles of disturbed soil from mouse burrows at their bases. The burrowing could weaken the hold of the roots on the soil, allowing the toppling mortality to occur. We also saw where mice had burrowed into the roots of *Opuntia*, hollowed out the central tissue, and left the root bark along the walls. That directly destroys the roots, and must weaken the cactus' hold on the ground. These could both be mechanisms by which the mice have played a role in the increased mortality.

An apparently logical test of this idea is provided by other islands with mice and *Opuntia*. If the effect is serious then why do *Opuntia* remain on other islands with mice? Possibly because most islands lack the final component of the situation, land iguanas. On most islands a fallen *Opuntia* isn't really a dead plant, it simply sprouts vegetatively from the fallen trunk or pads. However, on Plaza Sur the land iguanas quickly converge on fallen *Opuntia* and rapidly eat all of the pads and any fresh sprouts that appear. We've compared the success of vegetative regeneration of fallen *Opuntia* on Plazas Sur and Norte from 1982-83 to 1985 and 1987. On Plaza Norte 75% of cacti that fell in the 1982-83 El Niño had living sprouts in 1985. On Plaza Sur only 3% had sprouts in 1985!

By 1987 the situation was worse. Seventy percent were successfully sprouted on Plaza Norte and 0% on Plaza Sur! The iguanas are effective. This is also true with recruitment into the population. We've seen no successful recruitment of new individuals into the Plaza Sur population in 15 years (Fig. 1)!

The *Opuntia* population of Plaza Sur has decreased by roughly two thirds without recruitment since the arrival of mice onto the island in 1983. The connection is not definite, but suggestive enough to warrant further attention. We suggest two courses of action. First to try and strengthen the mouse/mortality hypothesis. This could be done by carefully surveying surviving *Opuntia* for the presence of mouse burrows. Then in 1994, do a chi-square analysis of the ratios of infested to non-infested *Opuntia* that died and that survived. If a significantly higher percentage of the cacti that died were mouse infected we'd have as strong a conclusion as we're going to get. Unfortunately, the cacti must be surveyed before they die. The soil around a fallen *Opuntia* is disturbed by the upheaval of roots, and the presence or absence of mouse burrows is impossible to determine.

At the same time we recommend trying to find all information possible about potentially applicable eradication techniques for mice. There is a tricky problem with poisoning on Plaza Sur. The land iguanas will eat anything presented. However, since the mice are small we're sure that some sort of a system of bait delivery via containers with small holes would be successful. The paired nature of Plazas Norte and Sur provides an opportunity to perfect techniques on Plaza Norte in the absence of iguanas and then move the effort to Plaza Sur.

LITERATURE CITED

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