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## The Checkerspot Mystery: An Ecological Whodunit

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SAN JOSE -- For one week a year the vibrantly colored bay checkerspot butterfly is in its element on Coyote Ridge, flitting from one wildflower to the next in search of sustenance. The hillside used to be covered with these creatures -- which warm themselves in the sun, mate and deposit hundreds of eggs to launch the next generation before dying off.

But on Coyote Ridge's northern edge, their numbers crashed in the early 1990s as Silicon Valley's high-tech boom spurred a wave of development. The species, with its brilliant orange-and-red-flecked wings, first crashed between Palo Alto and San Francisco in the 1980s, prompting federal officials to list it as threatened with extinction. Then in the early '90s its numbers dropped on the southern edge of San Jose, around the suburban subdivisions that abut Coyote Ridge.



Traffic-induced habitat changes are threatening the breeding grounds of the bay checkerspot  
Courtesy Jon Christensen

The cause was a mystery until conservation biologist Stuart Weiss figured out that the butterfly's woes stemmed from a combination of pollution from the freeway below and, surprisingly, a cutback in local cattle grazing.

The fate of the bay checkerspot -- despite its problems, the butterfly still hatches in mid-April -- highlights the complexity of ecological relationships. As development surged, the stress of vehicular and power plant pollution devastated a population cycle that had existed for centuries.

Over years of research, Weiss -- who has worked for utility and waste management companies as well as conservation groups and government agencies -- documented how the nitrogen oxide emissions from cars commuting to Silicon Valley enriched the nutrient-poor serpentine-rock soil that sustains the native grasslands on Coyote Ridge. This soil enrichment allowed invasive grasses -- which flourish in more nitrogen-rich soil -- to out-compete the native plants on which the checkerspot depends. When local ranchers stopped grazing their cows on one side of the ridge, it made things worse, because grazing helped keep invasive grasses in check.

"The grazed side is great butterfly habitat, the ungrazed side is lousy," Weiss said. "You end grazing in the areas and it's bye-bye butterflies."

While Weiss may appear an unlikely champion for ranchers -- the amiable Stanford-trained scientist brings along a thermos of green tea and Ghirardelli bittersweet chocolate on his field trips -- he says that, in this case, cows play a vital role in preventing what he calls a "drive-by extinction." Cattle seek out the most nutritious grasses, he explained, and so they consume the grasses that threaten the dwarf plantain (*P. lantago erecta*), critical to the checkerspot caterpillars.

There is no question that exhaust from cars cruising below Coyote Ridge is depositing nitrogen in the ridge's soil. About 110,000 vehicles a day traverse Highway 101 and, along with other urban sources, annually deposit 15 to 20 pounds of nitrogen per acre on the ridge, according to Weiss's monitoring equipment. Some of the nitrogen is

absorbed by living plants, while small particles of the pollutant stick to plants and the ground and are washed into the soil by rain. By contrast, pollution from power plants and vehicles each year deposits just four to five pounds of nitrogen per acre on Jasper Ridge, a Stanford University biological reserve half an hour away.

By the mid-1990s, the checkerspot's numbers on Coyote Ridge's northern end had dropped from about 50,000 to near extinction. But in areas that have been grazed and well maintained, the population hovers in the low hundreds of thousands.

"It fluctuates more than the Nasdaq," Weiss said, noting that the population can crash or rebound for various reasons. "We've been dumping nitrogen for so many years, these ecosystems are going over the edge."

Unlike some conservation sagas, however, in this case local businesses and elected officials listened to Weiss, and it has made a difference, not only on Coyote Ridge. When Calpine Corp. decided to build a 600-megawatt power plant that would emit 120 tons of nitrogen oxide a year, Weiss lobbied the firm to create a 131-acre butterfly and plant reserve on nearby Tulare Hill as mitigation.

Calpine assented, setting aside the habitat six years ago and providing a \$1.3 million endowment to manage the land. "It was increasingly clear there was some concern about sensitive hillside habitat, and this seemed to be the best means to address this," said Kent Robertson, Calpine's director of public relations. Local chapters of the Sierra Club and American Lung Association welcomed the move, he said.

That established a precedent, so when the Santa Clara Valley Transportation Authority moved to expand Highway 101 below Coyote Ridge from four lanes to eight, the U.S. Fish and Wildlife Service instructed the agency to preserve 548 acres of habitat as compensation. Fish and Wildlife determined that the pollution from the increased traffic posed a threat not only to the butterfly but to four federally listed endangered plants as well: the Santa Clara Valley dudleya, Metcalf Canyon jewelflower, coyote ceanothus and Tiberon paintbrush.

"Obviously, when you are expanding a highway or doing a major construction project, there are going to be environmental impacts," said transportation agency spokeswoman Jayme Kunz, adding that the June 2005 land purchase cost \$55.3 million. "We felt mitigation was a critical part of doing any kind of construction that would expand our highway."

Rep. Zoe Lofgren (D-Calif.), who has bay checkerspot habitat in her district, as do Reps. Richard W. Pombo (R) and Mike Honda (D), said Santa Clara residents recognize the importance of preserving open space for wildlife.

"You have to listen to the biologists," said Lofgren, who started working on the issue when she was a county official. "It's not like you can set aside a postage stamp and expect it to work."

Scientists in California and elsewhere have documented other ways that traffic emissions are transforming ecosystems and threatening vulnerable species. Edith Allen, an ecology professor at the University of California at Riverside, has spent 13 years studying how a plume of automobile pollution from Los Angeles enriched soil more than 100 miles away in Joshua Tree National Park, helping a range of invasive grasses and flowers to thrive.

Those invaders, including Mediterranean split grass and red brome, are out-competing native plants such as the aromatic coastal sage scrub, depriving sustenance from both the bay checkerspot and the desert tortoise, which is on a federal list of threatened species.

Weiss continues to spend his days traversing the ridge, observing butterflies, counting caterpillars and measuring the nitrogen accumulating in the rocky soil. He has worked here for 23 years, but he said he does not tire of it, mainly because the colors change constantly as the more than 100 native flowers and grasses bloom.

"This is like walking in a Monet painting that changes day to day and year to year," Weiss said on the ridge last month, pausing to point out a butterfly perched nearby. "It's a thing of beauty."