

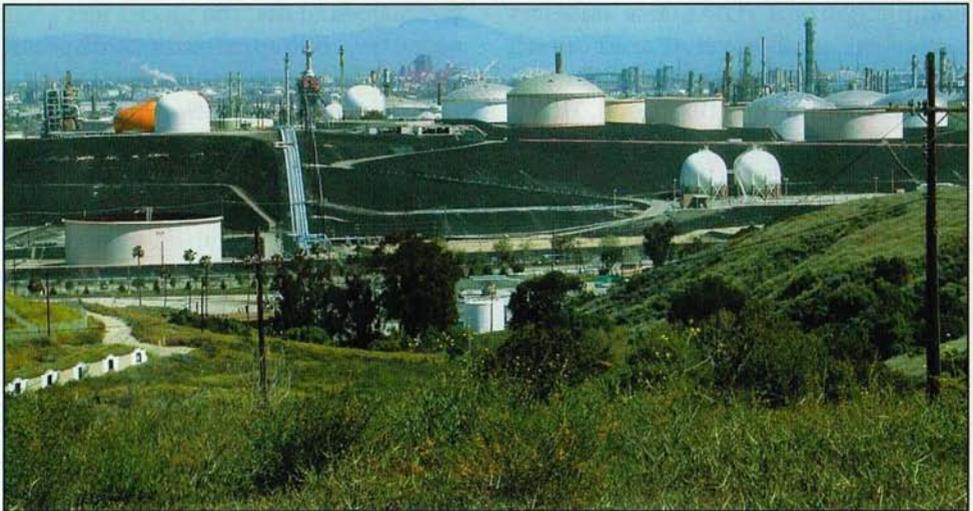
Invertebrate Conservation at the Gates of Hell

Travis Longcore and Catherine Rich

An endangered Palos Verdes blue butterfly (*Glaucopsyche lygdamus palosverdesensis*) sits motionless in the cool March morning air, wings spread and tattered as it rests on the stem of a deerweed plant. Behind it is the red glow of a fifty-foot-high gas flare, capping a mountain of asphalt covered by tanks and pipes—one of several oil refineries in southern Los Angeles County. The species itself is limited to a three-hundred-acre Navy fuel depot with underground tanks, but the view across the street reminds one of the gates of hell. This is the paradox of invertebrate conservation in cities. Noxious or extreme land uses have historically protected rare and endangered species by maintaining open spaces free

from development around them. These remnants are now a necessary focal point for urban conservation.

Conservationists sometimes overlook and undervalue urban fragments. This lack of attention may come from a tendency to think on a human scale and to emphasize larger species, usually mammals and birds. Yet research shows that even sites that might be otherwise derelict and degraded support significant invertebrate diversity. A survey of twenty-six brownfield sites in England—not necessarily as contaminated as American brownfields—found sixty-three carabid beetle species, including two that are nationally scarce. Because invertebrates have small body sizes, a



Fragments of habitat survive in even the most heavily industrialized areas. Small areas of relict habitat, such as this one on Los Angeles' Palos Verdes Peninsula, can support important invertebrate communities. Photograph by Travis Longcore.



The El Segundo blue (*Euphilotes bernardino allyni*) spends much of its life in intimate association with the flowerheads of seacliff buckwheat (*Eriogonum parvifolium*). Photograph by Travis Longcore.

great number can persist on small fragments, and because many invertebrates are habitat specialists, small fragments in cities may represent relict habitats.

Taking off from Los Angeles International Airport (LAX), few travelers notice the scrub-covered sand dunes, crisscrossed in part by the streets of a long-abandoned neighborhood. This is a three-hundred-acre remnant of the El Segundo dune system. Fed by sand from the Los Angeles River, it historically stretched eleven miles along the Santa Monica Bay. This remnant, where ear-plugs are a necessary defense against outgoing jets directly overhead, is home to at least ten rare or endemic invertebrates, including the El Segundo crab spider (*Ebo* new sp.), the El Segundo goat moth (*Comadia intrusa*), Ford's sand dune moth (*Psammobotys fordii*), the El Segundo scythrid moth (*Scythris* new sp. 1), the lesser dunes scythrid moth (*Scythris* new sp. 2), the El Se-

gundo Jerusalem cricket (*Stenopelmatus* new sp.), Dorothy's El Segundo dune weevil (*Trigonoscuta dorothea dorothea*), Lange's El Segundo dune weevil (*Onychobaris langei*), a weevil with no common name (*Cylindrocopturus* new sp.), and, of course, the El Segundo blue butterfly (*Euphilotes bernardino allyni*). Although restoration of habitat in the early 1990s resulted in a dramatic increase in El Segundo blue numbers, a lack of management at the LAX dunes since 2001 has allowed the habitat to be degraded by invasive plants and the butterfly population there is declining.

Community-based restoration projects are creating new habitat for the El Segundo blue at other urban sites. Two remnant dune fragments tucked between the beach and the street in the cities of Redondo Beach and Torrance have been restored and were colonized in 2007 by El Segundo blue butterflies from a backyard population more than a thousand feet away. Previous research had suggested that the species was quite sedentary, but apparently its dispersal powers had been underestimated. Although these restoration projects are aiding the butterfly, our previous research shows that ground-dwelling arthropods do not respond quickly to restoration, so conservation of flightless species will probably rely on human-aided introduction to restored habitats or on the reinitiation of habitat management on the LAX dunes.

To the public, relict urban open spaces often appear to be wastelands to be ignored, developed, or dumped on. In the absence of a charismatic species such as a butterfly, conservation of urban parcels can be a daunting challenge. A scrubby dune system fifty miles in-

land from Los Angeles is home to the only federally listed fly in the continental United States. The endangered Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) persists in a series of fragments ranging from a few acres to a few hundred. Although the habitat is spectacular with showy flowers after winter rains, its arid appearance in the summer, when temperatures regularly exceed one hundred degrees Fahrenheit (thirty-eight degrees Celsius), wins few fans outside naturalists and dedicated conservationists. The fly's larvae burrow in the sand and adults emerge from the ground to mate, visit flowers, and lay eggs for the next generation. After years of contentious discussion over the species, the City of Colton has proposed setting aside the largest habitat in exchange for rights to develop other smaller fragments. This core habitat is located next to the cement plant at Slover Mountain, a mountain that over the last fifty years has been slowly scraped to the ground and transformed into Colton cement.

Farther north, about forty miles in-

land from San Francisco, Lange's metalmark butterfly (*Apodemia mormo langei*) contends with a different industrial use: a gypsum factory, which routinely blankets portions of the butterfly's habitat with a fine dust. Lange's metalmark uses naked buckwheat (*Eriogonum nudum* var. *auriculatum*) as a foodplant and is limited to a dune system along the San Joaquin River. The remaining habitat is split in two by the gypsum factory. Restoration efforts in the early 1990s led to substantial growth in the population, but the trend in the last five years has been one of rapid decline from a maximum daily count of 2,342 butterflies in 1999 to 45 in 2006. Reasons for this collapse are not fully identified, but the shifting sands needed by naked buckwheat and other native plants have been covered by a rapid expansion of exotic plant species, including a particularly troublesome species of vetch. Emergency habitat restoration is ongoing, as is a captive breeding program.

Back at the Navy fuel depot in San Pedro, the number of Palos Verdes blue butterflies each year has been volatile,



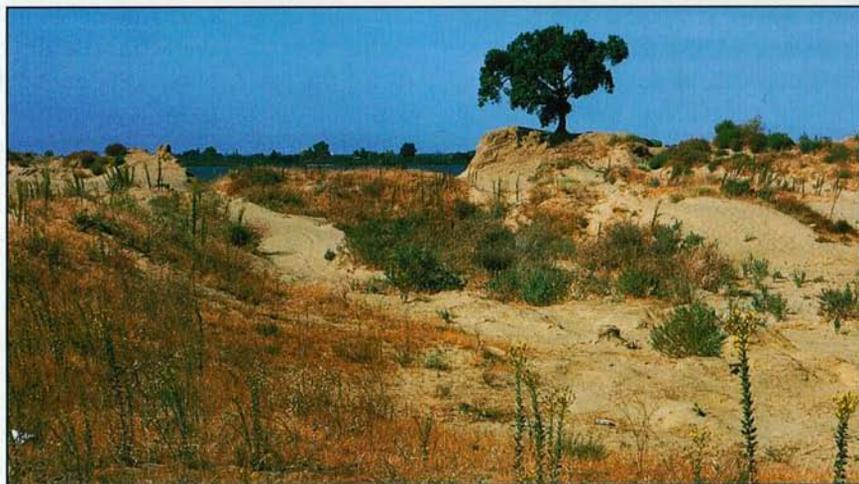
The Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) is restricted to a few patches of sandy habitat. Photograph by Guy Bruyca.

ranging from thirty to more than three hundred, but with no discernible trend. The base commander has supported restoration efforts and newly created habitats have been successfully “seeded” with butterflies in the past. However, the plants that support the species are early succession specialists and some other areas have lost the butterfly as larger scrub plants have elbowed out the pioneers. Long-term persistence will depend on managing specific areas for foodplants with some sort of disturbance (fire is out of the question for obvious reasons). Ironically, the normal operation of the fuel depot for forty years probably provided such a disturbance during the years when the butterfly’s presence at the site was unknown.

A successful captive breeding program is underway with Palos Verdes blue butterflies from the fuel depot. Releases in much more scenic sites on the Palos Verdes Peninsula are planned.

These steps toward recovery would never have been possible without the protective umbrella of the millions of gallons of jet fuel in underground tanks across the street from a refinery.

Cities, and especially industrial districts, are often neglected by conservationists. An “all-or-nothing” view of natural value has led both scientists and conservationists to concentrate instead on wilderness areas. But in an increasingly urban world, we will need to find opportunities for helping species persist in areas closer to our backyards than majestic national parks. Isolated urban habitats are the only hope for the Palos Verdes blue butterfly, Lange’s metalmark butterfly, the Delhi Sands flower-loving fly, and the endemic insects of the El Segundo dunes. Invertebrates have persisted in the forgotten fragments of our cities and, at times, nowhere else. We have learned that viability of these habitats for the long term



Lying on the south shore of California’s San Joaquin River, the Antioch Dunes were once more than a hundred feet high and topped with scattered coast live oaks. Most of the dunes were mined away during the twentieth century, and what remains is greatly disturbed. Photograph by Edward S. Ross.

will require management to overcome the consequences of urbanization. Natural disturbance regimes are interrupted and often must be replicated, either by accident or intent, to maintain native habitats. The consequences of pollution, such as the gypsum dust that wafts onto the leaves consumed by Lange's metalmark larvae or heavy metals deposited by departing aircraft on the El Segundo dunes, are not yet fully understood.

Climate change also threatens the urban survivors, which have no space for range shifts in response to altered precipitation or temperature. Managers will have to track these conditions and devise strategies to assist in colonization of new habitat areas. For the Palos Verdes blue butterfly, our preliminary analysis shows that annual abundance is positively correlated with rainfall during the early winter of the previous year. In addition, adults are stressed by above-average temperatures during their spring flight period. The species is well adapted to short-term drought; its pupae can exhibit multiple-year diapause, waiting for better weather conditions to emerge. But in the laboratory most pupae die after a couple of years, suggesting that long-term hotter, drier conditions would be catastrophic for the species. Managing against the risk of such changes means reintroducing the species to locations with slightly different topographic conditions within its historic range where microclimate will be cooler and wetter. Similar challenges face other rare species persisting on urban fragments.

To conserve invertebrate diversity, we should embrace and manage urban fragments. This often requires developing ways to coexist with the extreme



Lange's metalmark (*Apodemia mormo langei*) maintains a tenuous hold on survival at the Antioch Dunes. Photograph by Larry Orsak.

land uses that have protected these natural areas from the bulldozer. In the long term we must develop constituencies for sites that might never be considered a romantic spot for a picnic. We must prepare to fight to conserve them in a future when the extreme land uses themselves are phased out. Public support can be difficult to develop, but as such habitats become established, volunteer programs can offer an opportunity to fulfill the desire of so many urban residents to be active stewards of their communities. And therein lies preservation of little bits of wild.

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