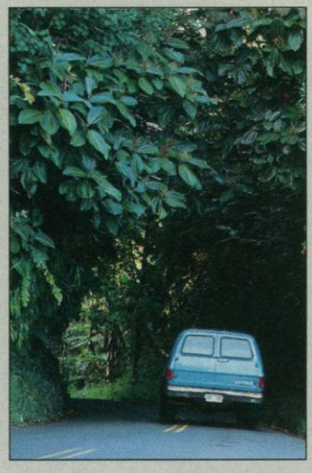
Keeping Paradise Safe For the Natives

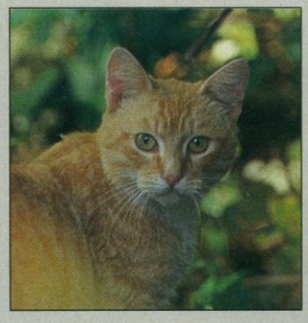
KULANI, HAWAII—When the Kulani Correctional Facility took in 400 fresh inmates in May, the hope was that the new prisoners, and their descendants, would be locked away for the rest of their lives. Not that these wards of the state were guilty of any crime: They were sent to Kulani because the 3000-hectare prison grounds and adjacent state and private reserves are part of an innovative program to protect native species from the ravages of invaders. The young inmates—seedlings marked by pink flags amid the surrounding grass—are endangered Mauna Loa silversword, a majestic plant with silvery, sharp leaves and a massive flowering stalk that blooms once and then dies. Sheltered inside a pig-proof fence, other native species are mounting comebacks too: Tree ferns, their starchy cores now off limits to pigs, are thriving. Native songbirds, driven from the lowlands by a triple whammy—habitat loss and avian malaria, plus invasive species that prey on their eggs—flit from branch to branch in the gnarled ohia forest.

The silverswords and songbirds are refugees from a war that has taken a heavy toll on Hawaii's native life-forms. Islands are particularly vulnerable to biological invaders, and Hawaii has suffered wave upon wave since the arrival of the first Polynesian settlers some 2000 years ago. Although it's hard to assign full blame to an invader for any particular extinction, statistics tell a sad tale: Of 140 known native bird species, 70 have gone extinct since human arrival, and 30 are on the endangered list. "Alien species are the biggest problem we're dealing with now," says Jim Jacobi, a botanist with the U.S. Geological Survey's Pacific Island Ecosystems Research Center in Hawaii. And as one of the hardest hit places on Earth, Hawaii has come up with an innovative way of protecting natives from invaders. Instead of trying to eliminate established exotic species—a nearly impossible task—Hawaii is creating well-defended reserves where native species can find refuge.

Hawaii's menagerie of imports includes plenty of unpleasant customers. Take the rosy wolf snail, *Euglandina rosea*. It was imported in 1958 to knock off another alien predator, the giant African snail, and is an ideal killing machine, tracking its victims by their slime trails. However, *Euglandina* swiftly developed a taste for the native snails too and went on a binge. "It's very difficult to prove that *Euglandina* is responsible for the extinction of native snails, but the weight of the evidence virtually forces this conclusion," says Robert Cowie, a biologist at the Bishop Museum in Honolulu.

Wiping out *Euglandina* is almost impossible—"everything you think of that can kill *Euglandina* would kill the native snails as well," says Stephen Miller, a population ecologist with the U.S. Fish and Wildlife Service in Honolulu. So scientists have for now forsaken the sword for the shield: snail "exclosures" designed to protect the natives from the exotic predators. A team led by zoologist Michael Hadfield of the University of Hawaii, Manoa, has built the largest of them, a 430-square-meter corrugated aluminum fortress, in the northern Waianae mountains on Oahu. Erected around a population of endangered *Achatinella mustelina* snails, the barrier is ringed by a salt trough, a substance as painful to snails as battery acid to people. "The minute *Euglandina* touch the salt, they just drop back," says Hadfield. The fence also has two electrified wires to deter rats, another snail predator, and rat motels inside the exclosure.





Besieged. Invaders such as feral cats (*left*), a Central American tree called *Miconia* (*above*), and feral pigs that dig up forests (*below*) have transformed Hawaii's natural areas.

Across the state, land managers are protecting other natives by throwing up fences and hunting down the exotics that remain inside. "Fencing of native preserves is considered state of the art," says Dave Bender, a restoration ecologist with the National Tropical Botanical Garden on Kauai. At Volcanoes National Park and on adjacent public and private lands on the northern slope of Hawaii's Mauna Loa volcano, managers have fenced off thousands of hectares of forest. Staff hunters have killed nearly all the feral pigs in the protected area. And from a population of 20,000 feral goats several years ago, the park is down to about a dozen "Judas" goats, allowed to stick around to attract any goats that sneak through the fence. Scientists keep tabs on the Judas goats, fitted with radio collars, and shoot any new faces. Next on the hit list, says Jacobi, are bird-eating feral cats—a controversial move among cat lovers—and nasty invasive plants like the yellow Himalayan raspberry, whose heart-shaped leaves belie its aggressive advance across the islands.

Of course, biologists would rather not have to build such reserves, so they are trying to prevent new threats from spinning out of control. After seeing the devastation that a Central American tree called *Miconia calvescens* has visited on Tahiti—where it covers 75% of the island and has earned the nickname "the green cancer"—Hawaiian biologists Betsy Gagne and Steve Montgomery mounted a 15-year-long campaign to get the tree on Hawaii's Noxious Weed list, which would prohibit its import. They finally succeeded in 1992. Since then, Maui and Hawaii have launched 10-year programs to eradicate *Miconia*, a laborious job that involves applying a thin line of herbicide at the base of each tree. It's working: So far, mature *Miconia* plants have been eliminated from 70% of Hawaii island, although all these areas must be treated again as the seed bank sends up shoots.

Hawaiian scientists have also lobbied to close the border to potential invasive species, but they have been opposed by horticultural interests. "I know the nursery industry would kill me if they heard me say this, but we need a broader list of plants that are prohibited," says Charles Lamoureux, director of the Lyon Arboretum in Honolulu. Others suggest a "white list" of permitted plants, such as exists in Hawaii for animals. "If we don't act now," says Jacobi, "we're going to have a much harder time dealing with the problem as time goes on."

—**RICHARD STONE**

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