

# Tree-climbing Foxes and Other Success Stories

**Thirty years of research and effort have restored a nearly extinct species.**

BY KATE RONEY FAULKNER

PHOTOGRAPHS BY CHUCK GRAHAM

larly vulnerable and experienced large declines. Vegetative cover was stripped from most areas accessible to sheep, horses, pigs, or cattle. Soil erosion increased dramatically.

After approximately one hundred years of sheep ranching, the number of bald eagles (*Haliaeetus leucocephalus*) was also declining. The Channel Islands, with their extensive coastlines and abundant fish, seabirds, and marine mammals, supported a robust and high density population of bald eagles. The birds were hunted by ranchers who considered them a threat to their sheep. Their eggs were coveted by collectors. It is estimated that the Channel Islands had a minimum of thirty-five nesting pairs of bald eagles in the early 1900s. By the mid-1900s, however, the proliferation of the organochlorine pesticide DDT, which biomagnifies as it moves up the food chain, led to thinning of eggshells for bald eagles. Thus, 1949 was the last known hatch

booming and the Channel Islands were an increasingly rare open space in a developing landscape. By the 1960s, people recognized that treasured wildlife, such as blue whales, elephant seals, bald eagles, and sea otters, had declined or disappeared from the region. There was greatly increased respect for the natural and cultural significance of the islands, and politicians were encouraged to protect these values into the future.

The U. S. Congress created Channel Islands National Park in 1980 to include the five northernmost Channel Islands, including Santa Cruz Island. The Nature Conservancy (TNC) recognized the significance of Santa Cruz Island and soon negotiated purchase of 90 percent of the island. Both the National Park Service (NPS) and TNC recognized that major projects were required to prevent further degradation of the island ecosystem. The initial focus was on the



**S**anta Cruz Island, at 62,000 acres (97 square miles), is the largest and most topographically diverse of the eight California Channel Islands. Since its geological formation, it has never been connected to the mainland just twenty miles away. Few terrestrial plants and animals were able to cross the ocean to colonize it. Those that did evolved into unique species and subspecies. The abundant marine life, surrounding the island, provided ample food for seabirds, pinnipeds, and for the native people who lived on the island for approximately 12,000 years.

In the early 1800s, native peoples were displaced by settlers of European origin. Sheep ranching began in the mid-19th century. At its peak, the island supported over 100,000 sheep—an unsustainable density on many lands. For Santa Cruz Island, with low rainfall and vegetative productivity, this overpopulation was particularly devastating. In addition to sheep, ranchers brought horses, pigs, cattle, non-native plants, and development. Many native plants, having evolved for thousands of years in isolation from grazing animals, had fewer chemical or structural defenses. Plant species that occurred only on the island were particu-

of a bald eagle chick on the Channel Islands, and 1960 was the last sighting of an adult bald eagle on Santa Cruz Island.

Perceptions of the Channel Islands began to change in the mid-1900s. Once seen purely as a source of economic gain through ranching or hunting, the rich scientific and recreational value of the islands became more broadly appreciated. The Santa Barbara oil spill of 1969 and the resulting pictures of oiled seals, sea lions, and pelicans on the beaches of the Channel Islands also generated increased appreciation and concern for the future of the islands and their wildlife. The population of southern California was

need to eliminate feral sheep and pigs from Santa Cruz Island. But the unexpected crash of the island fox population in the late 1990s, which occurred simultaneously on nearby Santa Rosa and San Miguel Islands, quickly increased the two organizations' sense of urgency and highlighted the web of ecological impacts resulting from the prior 150 years of land use.

The near extinction of the dwarf Santa Cruz Island fox (*Urocyon littoralis santacruzae*) is central to the complex tale of altered ecological connections and the restoration actions that were needed on Santa Cruz.





entific research. However, the island fox was not thought a likely candidate for an extinction crisis. Despite intensive land use and ecological impacts beginning in the mid-19th century, the island fox persisted and, at times, seemed to thrive.

This situation changed in the late 1990s when biologists noted high levels of fox mortality and population declines. It was not immediately apparent whether there was any strong reason for concern. Wildlife populations fluctuate naturally and mortality is both natural and necessary. After a time, however, when the population had declined by more than 90 percent, it was clear that a crisis was in the making.

Biologists initially thought that disease was the most likely explanation for the rapid population collapse across the three northern Channel Islands. Al-

The colonization of the islands by the fox has been the focus of considerable research. Current studies support the establishment of the progenitor of the island fox, likely the gray fox (*U. cinereoargenteus*), to the northern Channel Islands at no earlier than 9,000 years ago. Although gray foxes rarely climb trees, the tiny island foxes on Santa Cruz Island climb trees very well, going after figs and island cherries. Even though they don't have retractable claws, they are quite nimble maneuvering in the branches. It is not known if they were first brought to the island by native people, who occupied all the northern islands at the time, or by a rafting of individual foxes across the miles of ocean between the mainland and the nearest island. Clearly, native people moved the easily-tamed fox between islands and were the cause of their establishment in later years on the southern Channel Islands.

Island managers and researchers had been monitoring and studying island foxes since the 1960s as part of their basic responsibilities for stewardship and support of sci-



though disease and parasites in foxes are a natural part of the ecosystem, no new disease could be pointed to as the cause of the declines.

Researchers began looking to the sky for an explanation. A biologist studying foxes on Santa Cruz Island noticed that radio-collared foxes that were more active during the day were being predated at a higher rate than nocturnal foxes. He also determined that a high percentage of the fox carcasses he examined had been predated by a large rap-

tor. Other biologists were skeptical that predation could explain such a large fox population decline. However, it was the best hypothesis at the time and merited further study.

The largest established raptor on the islands, the red-tailed hawk (*Buteo jamaicensis*), was not thought to be capable of preying on adult island foxes. Sightings of golden eagles (*Aquila chrysaetos*) had increased since the late 1980s. Golden eagles were not considered to be established on the islands (1999 was the first confirmed golden eagle nest on Santa Cruz Island) and golden eagles were not being seen by personnel on San Miguel Island, even when its fox population was plummeting. However, a subsequent study of radio-collared foxes on San Miguel Island confirmed that golden eagle predation was the primary cause of population decline.

It was determined that the only hope for the island foxes was to protect the remaining individuals in captivity, to rear captive-bred young, and to release the offspring to the wild once the environment was conducive. On-island captive breeding facilities were built and biologists began capturing the remaining wild foxes. Fourteen were brought into captivity on San Miguel and fifteen on Santa Rosa Island. This meant that recovery of the subspecies depended on, and would represent the genetic diversity of, less than five percent of the typical population. At the same time, conservation organizations began the process of petitioning to have the island foxes listed as "Endangered" under the federal Endangered Species Act (ESA); the three park subspecies were finally listed in 2004.

A broad array of biologists, land managers, and organizations stepped forward to contribute their unique expertise and resources to the recovery of the island fox and the island environments on which they depended. It was clear that the management response had to be multi-pronged. Even if captive breeding of island foxes was successful, the progeny could not be released into the wild to face unsustainable levels of predation. To create the conditions necessary to sustain island foxes, it was necessary to address several factors: the presence of nesting golden eagles and of non-native animals, particularly feral pigs on Santa Cruz



Island, which provided a consistently available prey base for golden eagles; the absence of bald eagles, which would have hindered the establishment of golden eagles; and the loss of vegetation that provided cover for island foxes.

Much of the focus of the needed management actions was on Santa Cruz Island. The island was home to the feral pigs that supported most of the nesting golden eagles. Golden eagles are a native bird in California and can easily fly between the mainland and the islands. Yet, until recently they had never established on the islands, and island



species had evolved in an environment without an avian predator. Golden eagles are primarily terrestrial predators of small vertebrates such as ground squirrels. The islands, prior to the introduction of feral pigs, may not have had a sufficient prey base for golden eagles. Golden eagle populations on the mainland were driven down around the same time that potential prey, such as feral pigs, were introduced to the islands. The protection of golden eagles by the Bald and Golden Eagle Protection Act of 1940, and the resulting increase in their numbers on the mainland provided a source of golden eagles that began nesting on Santa Cruz Island by the latter half of the 1990s.

In 1999, biologists began both implementation of captive breeding and live capture and removal of golden eagles. The



golden eagles were extremely difficult to locate, much less capture. Despite the immense challenge, it was clear that unless the golden eagle population was substantially reduced, the prospects for island fox recovery were very slim. Many different techniques were tried; from setting baited, remotely triggered hoop traps on the ground to aerial net gunning from a helicopter. While no single technique consistently worked, biologists—with substantial effort over a period of seven years—were able to capture forty-four golden eagles and relocate them to suitable habitat on the California mainland.

Despite this success, it was clear that unless the sustaining food supply, feral pigs, was eliminated from Santa Cruz Island, the golden eagles would return and it would not be possible to recover island fox populations in the wild. TNC and NPS had long known that feral sheep and pigs needed to be eliminated from Santa Cruz Island. Both species were

known to eliminate vegetation, foul water quality, increase soil erosion, and destroy archeological sites. By the late 1990s, it was clear that the sheep and pigs were also contributing to the fox crisis.

TNC had eliminated sheep from 90 percent of Santa Cruz Island in the late 1980s, shortly after land acquisition. NPS did not fully acquire the eastern 10 percent of the island until 1997. NPS's first task was to live capture and remove the feral sheep. Over 9,200 sheep were removed from the 6,000-acre barren landscape!

In 2006 with the on-the-ground skills of Prohunt, a New Zealand company, NPS and TNC began a massive undertaking. In less than a year, all pigs were eliminated from Santa Cruz Island.

Southern California lagged other regions of the United States in the recovery of bald eagles even though it had been almost forty years since the banning of DDT. DDT had been manufactured in Los Angeles, and large amounts were in the marine food chain upon which the island's bald eagles depended. In 2002 a consortium of managers and biologists with the federal government, the State of California, and the Institute for Wildlife Studies began to restore nesting bald eagles to the northern Channel Islands. Two hawk towers were constructed on Santa Cruz Island. Over a period of six years, 61 bald eagle chicks were raised to fledging. Still, the question remained, whether the levels of DDT and its metabolites had declined sufficiently to allow bald eagles to successfully breed on the Channel Islands. The first hopeful answer came in 2006 when a chick hatched in a wild nest on Santa Cruz Island—the first in over fifty years. Since that time, the number of bald eagles, including successful nesting pairs, has continued to expand.

It is unlikely that reestablishment of bald eagles by itself would have turned around the fox crisis. In fact, bald eagles may even prey on island foxes on occasion. Bald eagles are nevertheless a historic and integral component of the island ecosystem. Their loss was emblematic of the extensive and deleterious changes that had occurred on the islands.

Finally, after ten years of intensive efforts to respond to the population decline of the island foxes, the conditions on Santa Cruz Island were supportive of recovery of its fox population. Island foxes had bred well in captivity and the process of releasing them to the wild had begun.

Santa Cruz Island is now a very different place than it was thirty years ago. The island is entirely in conservation ownership. Additionally, Santa Cruz Island accommodates visitors and researchers throughout the year. The NPS, following a generous land donation by TNC, now owns 24 percent



of the island. This portion is open to the public for day visitation, camping, hiking, and ocean-based recreation such as kayaking. Santa Cruz Island is the most visited island in Channel Islands National Park. The TNC property allows public use under permit and supports researchers and students to use the University of California Natural Reserve facilities on its property.

Island foxes are no longer in captivity; all foxes were released over several years and they are reproducing in the wild. In August 2016, the three island fox subspecies in the national park were removed from the Endangered Species list—the fastest recovery ever for any ESA-listed mammal in the United States.

Bald eagles continue to nest and raise chicks on the islands. Their population has now expanded to nesting on five of the eight Channel Islands and there are over twenty known nesting pairs.

The elimination of sheep and pigs has fostered an amazing increase in vegetation on Santa Cruz Island. Extensive acreage that was bare ground or non-native grasses is changing to coastal sage scrub, chaparral, or other native plant-dominated communities. Oak acorns are abundant once again. They are germinating and new seedlings are being established. The return of native plant communities provides the vegetative cover that will limit the population-level impacts of visiting golden eagles on island foxes.

In spite of all the progress on Santa Cruz Island, there are many remaining conservation challenges. The drought and heat of the past five years is killing many of the long-established forest trees. Invasive non-native plants persist, and even dominate, in many areas of the island. The soil lost over more than 150 years of ranching will require millennia to rebuild. The predicted warming and drying of

the climate will have unknown consequences for the endemic plants and animals that cannot, unassisted, move their range to a more favorable location. The surrounding ocean, a significant source of food for the island ecosystem, is stressed due to acidification, warming, harvest, and pollutants.

The good news is that Santa Cruz Island is now recognized as a conservation jewel. The public increasingly visits, enjoys, and treasures the natural, archeological, historical, and recreational values of the island. There is a body of organizations and individuals who are committed to the stewardship of Santa Cruz Island whatever changes and challenges the future brings.



**Kate Roney Faulkner**

recently retired as chief of natural resources management, Channel Islands National Park.

She was with the National Park Service for thirty-five years and led the growth of science-based management of park resources. **Chuck Graham** is a freelance writer and photographer based in Carpinteria, CA. He is a guide for Channel Islands Outfitters and leads kayak tours and backpacking trips at the Channel Islands National Park. He is the editor of *DEEP Surf Magazine*.