

BY LAURA PRUGH

## KANGAROO RATS

# The Great Farmer-Engineers Of Our Deserts

It took all night, but all of the grains were transported from the haystack in the field to an underground silo. If this sounds like the work of a stealthy, paranoid farmer, you might be right about that. This is, in fact, a most extraordinary farmer. In addition to his nocturnal and subterranean tendencies, he will never drink a drop of water in his life. This industrious little fellow is a kangaroo rat.

Perhaps a farmer isn't the best analogy for a kangaroo rat. Sure, they churn and fertilize the soil, mow down vegetation, gather seeds into hay piles to dry, and then store them for future use. But farming is just the beginning—they are really more like engineers, ecosystem engineers. By excavating extensive burrow systems known as precincts, kangaroo rats provide refuges for squirrels, reptiles, and insects. Because of their industrious digging and foraging activities, and also because they are a favorite food for predators such as owls, foxes, snakes, badgers, and weasels, kangaroo rats are known as “keystone” species. That is, they create an environment that would change dramatically if they disappeared.

Unfortunately, disappearance is a real possibility for some kangaroo rat species. For example, the giant kangaroo rat, which (as you might have guessed) is the largest of the 21 kangaroo rat species, once ranged throughout the entire Central Valley of California but is now restricted to a few small populations. These rodent farmer-engineers were driven out by the human farmers and engineers who drastically transformed the Central Valley. More than one out of four kangaroo rat species are listed as endangered, and several others are considered vulnerable.

In the Carrizo National Monument of California, which harbors the largest remaining population of the giant kangaroo rat (GKR), my colleagues at UC Berkeley and I are studying how these amazing creatures affect the ecosystem and how we can best manage their habitat. Weighing in at a whopping 6 ounces, GKR are abundant in parts the Carrizo, with up to 250 individuals per acre. GKR are fiercely territorial, and I have seen them kickbox with one another and chase San Joaquin antelope squirrels out of their burrows. In spite of these confrontations, antelope squirrels and lizards are still more abundant on sites with more GKR precincts. For the wider-ranging lizards and squirrels, the ability to quickly duck down a burrow to escape a hawk or the scorching heat may trump



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the annoyance of being bullied. Using a series of GKR and cattle exclosures, we are learning how cattle impact GKR, and how both GKR and cattle affect plants and other species.

So now we know that kangaroo rats are keystone species in arid regions, but what are they exactly? We can rule out two things: kangaroo rats are neither kangaroos nor rats. Found exclusively in the arid grasslands and deserts of western North America, kangaroo rats are heteromyid

rodents, and they are actually more closely related to beavers than they are to common rats and house mice. Kangaroo rats emerged as a distinct group during the Miocene era 13-16 million years ago, a period that underwent spectacular geological transformations such as the uprising of the Sierra Nevada range and creation of Nevada's Great Basin. Having evolved alongside the creation of the great deserts of the west, it is no wonder that kangaroo rats are spectacularly adapted to life in these harsh environments.

Consider their ability to survive without consuming liquids. For people and other mammals, metabolic water (produced as a byproduct of metabolizing food) isn't enough to meet our needs, and we supplement by drinking liquids and eating moist foods. Kit foxes, for example, obtain liquid via the blood of the kangaroo rats they consume. Through modified kidneys and other adaptations, kangaroo rats get all the water they need from metabolizing dry seeds.

Another adaptation that allows kangaroo rats to live in wide open, sparsely-vegetated places is their exceptional hearing. Kangaroo rats have enlarged auditory bullae, allowing them to detect low-frequency sounds such as the wing beats of an owl or vibrations of a fox walking over their burrow. Silent to prey such as mice, approaching owls can be heard by kangaroo rats, giving them extra time to duck into a burrow. Because other small rodents lack this adaptation, they need the cover of shrubs or thick vegetation to help evade aerial predators. Kangaroo rats also use their acute hearing to communicate with each other: they beat their feet rapidly on the ground to create vibrations, a behavior known as foot-drumming. Out on the Carrizo Plain, this drumming can be heard all night long, as GKR post their audible versions of “Keep Out” and “No Trespassing” signs.

Kangaroo rats and deserts have a symbiotic relationship: kangaroo rats need intact, natural arid lands to survive, and deserts need kangaroo rats to sustain the incredible diversity of plant and

Top: Nocturnal worker – a Giant Kangaroo Rat

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### Field forays

Desert tortoises spend key parts of their lives underground, making both sighting and photography a challenge. Four field trips this spring produced twenty tortoise sightings by the group. To date, the group has visited Joshua Tree National Park, Mojave National Preserve, the Desert Tortoise Natural Area, and Rainbow Basin National Natural Landmark. Each field trip was guided by a naturalist or wildlife biologist, and students were able to learn about the ecology of the Mojave Desert and about the tortoises and other wildlife that depend on this land for survival. Spring was very successful; wildlife and plant sightings have included desert iguanas, ground squirrel, horned lizards, roadrunner, red-tailed hawk, Gambel's quail, chuckwalla, and of course tortoises young and old. Despite the fact that all of the students live in relative proximity to world-famous national parks and monuments, the majority of them had never been to a national park before our trips. Save one, none of the students had ever seen a desert tortoise in the wild. When we found our first, several students literally squealed with delight. We have several more field trips planned for this fall when tortoises emerge once again to take advantage of monsoonal rains and the photographers can capture images.

### Increasing awareness

The program would be justifiable without an outreach component; however, we strive for the students to have an enduring experience where they understand the role they can play in conserving the Mojave and its inhabitants. Outreach efforts have resulted in public speaking opportunities, reaching over 600 people about our project and about the plight of the Mojave desert tortoise. To increase awareness, the photobook will be published and sold at local stores and events with proceeds going to tortoise conservation. Some books will be donated to non-profits, local school libraries, and environmental education centers to educate the community. The Desert Light Gallery at the Kelso Depot in Mojave National Preserve will feature the project's work in an upcoming exhibit, to showcase the work of the students and to reach a local, national, and international audience. We are continuing to reach out to media outlets for news coverage to raise awareness of this issue, to recognize the students' hard work, and to demonstrate that their efforts can affect change.

### How to get involved

We are still soliciting funding for publishing the book, and we would love to be able to print a second run in Spanish language. We are looking for additional media coverage, and for new venues to show our work, to discuss our project, and to encourage stewardship in the next generation. Supporters can join us in writing letters to stand up for the conservation of tortoise habitat. If you are interested in any of these opportunities contact me at [diamfrom@npca.org](mailto:diamfrom@npca.org) or 760-219-4916. ♦

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## Climate Change

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plant-eating, crawling, and hopping insects which are somewhat reminiscent of the common crickets we are all familiar with, but several times larger. Densities of greater than twenty insects per square foot have been seen in several areas this summer. In some places the roads are slippery with their crushed bodies. With warming winters, outbreaks of Mormon crickets and other insects may become much more common than they have been in the past.

Climate change models are just that, mathematical models based on past climate data and what we know about how earth's weather systems operate. A number of different models all point toward the same general conclusion: namely, that the deserts of the American Southwest will experience higher average temperatures, more intense and variable storm events, and less "effective precipitation," leading to a general drying trend. At least one model shows Winnemucca, in northern Nevada, having a climate similar to present day Las Vegas by the year 2090. At the same time Las Vegas might have a climate more like present day Tucson, only warmer and dryer. The annual flows in the Colorado River are predicted to decrease during the coming century, dramatically affecting water supplies for at least 25 million people, to say nothing of wildlife dependent on the river. Desert agriculture, dependent on cheap, abundant irrigation water is likely to be particularly hard hit. The Walker River Basin in western Nevada, fed by melting Sierra snows, is a probable example of unsustainable desert agriculture.

It is ironic that as the desert areas of California and Nevada are under pressure for massive renewable energy developments, these areas are also expected to undergo significant change in vegetation regimes due to climate change and invasive non-native plants. By the end of this century the deserts as we know them today may be just a memory. ♦

*John Hiatt, a desert activist living in Las Vegas, Nevada, is a member of the CNRCC Desert Committee and is a board member of Friends of Nevada Wilderness.*

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animal life found in these harsh regions. Next time you are in the desert, venture out at night to observe these little creatures hard at work. As you watch them hop around like miniature kangaroos, gathering seeds into their cheek pouches, foot-drumming, and putting the finishing touches on their latest tunnels, you may want to tip your hat in thanks, for a job well done. ♦

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