

determine the average net value of the 1000-head ranch in 1982 dollars.

A capitalization rate at 12% placed the ranch value at \$765,015, while a capitalization rate at 10% made the ranch worth \$918,020. Capitalization rates of 7 5/8% and 3% placed the ranch value at \$1.2 million and \$3 million.

"The federal government uses the 7 5/8% capitalization rates. We feel the 7 5/8% or the 3% rates are the most reasonable rates," Fowler said, "because these are primarily federal land ranches."

In addition to the budgets, the report contains trends of private and state land grazing fees per head per month and gross average livestock prices per hundredweight in New Mexico between 1940 and 1982.

This information and the formulas provided with each valuation technique will allow ranchers to figure their personal ranch value or set up a price scenario with their own sales records.

"Much of this report is support data that has been available, but not compiled in one source," Fowler said. "It is the practical information necessary to figure ranch values in terms of 1982 dollars."

Report 15, "Alternative Valuation Methods for Cattle Ranches on the White Sands Missile Range 1942-1982," is a cooperative project involving the Range Improvement Task Force, and NMSU Agricultural Experiment Station and Cooperative Extension Service. The report is available from NMSU Agricultural Information Bulletin Office, Box 3A1, NMSU, Las Cruces, NM 88003; telephone 505/646-3228. ●

Kangaroo Rats

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Kangaroo rats (*Dipodomys* spp.) are small, beautifully marked mammals found in the arid portions of western north America. They are distributed from southern portions of western Canada to central Mexico, as far west as California, and east to central Kansas and Oklahoma. Kangaroo rats occupy the sparsely vegetated areas of dry steppes and even the most barren of western rangelands. Recent studies of the seed and seedbed ecology of such important range forage and browse species as Indian ricegrass (*Oryzopsis hymenoides*) and bitterbrush (*Purshia tridentata*) have shown that seed collection and caching activities of rodents such as kangaroo rats are essential in the regeneration of these plants.

The kangaroo rats are strictly nocturnal. Because of this, a person can spend much time on the open range without ever actually seeing them. However, loose soil reveals paw prints and strange curved impressions made by long balancing tails, verifying the rat's nighttime activities. People camping on rangelands occasionally observe kangaroo rats in the evenings around the campfire. The animals approach timidly at first but become much bolder with each successive venture into the campsite, filching whatever may be found. Opportunistic and swift in their nocturnal activities, kangaroo rats reside during the day in burrows dug in soft soils.

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About the author: Sjoberg has been an undergraduate research assistant at the University of Nevada working with the USDA, Agricultural Research Service. Raised in Nevada, she grew up with long-established ranching families. She received a BS degree in Wildlife Management at the University of Nevada, Reno. While a research assistant she became very interested in range management and its importance to wildlife management. Her special research interest is bitterbrush and rodent interactions.

Taxonomy

Kangaroo rats belong to the order Rodentia (rats, mice, beavers, squirrels, marmots, etc.). This group is classified as such because of their upper persistently growing incisors. The family *Heteromyidae* includes kangaroo rats (*Dipodomys*), pocket mice (*Perognathus*), and kangaroo mice (*Microdipodops*).

Kangaroo rats are sometimes confused with pack rats (*Neotoma* spp.). The pack rats are widely distributed on western rangelands, especially in pinyon/juniper woodlands. The pack rats belong to the family *Cricetidae* so they are not closely related to the kangaroo rats.

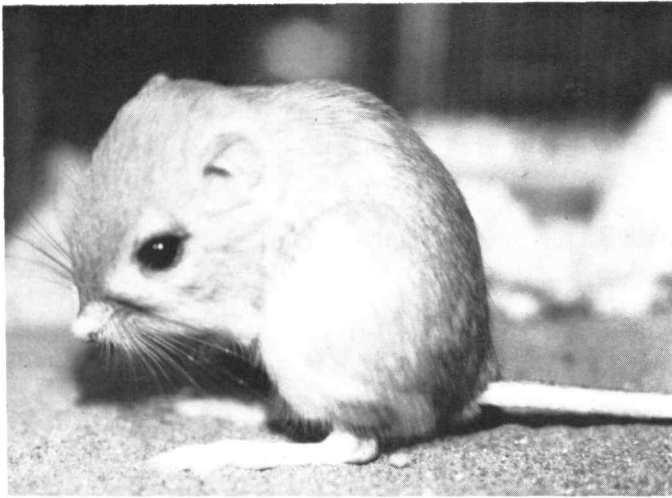
The family of heteromyids appeared in the Oligocene, but kangaroo rats are known from as recent as the Pliocene epoch when the vast deserts formed in western north America. Of 20 species identified in current taxonomic texts, only two species are currently threatened with extinction. Those are the big-eared kangaroo rat (*Dipodomys elephantinus*) and the Texas kangaroo rat (*D. elator*). It has been suggested that the kangaroo rat is closely aligned taxonomically with the family *Sciuridae* (squirrels and chipmunks). The most widely distributed of the 21 generally recognized species is Ord's kangaroo rat (*D. ordii*) which ranges from Alberta and

Saskatchewan throughout the western United States.

Physical Description

Depending on the species, kangaroo rats weigh between 1.2 to 6.3 oz. when fully grown. The Giant kangaroo rat (*D. ingens*) is the largest species at 4.5 to 6.3 oz (127 to 179 g); in contrast, Merriam's kangaroo rat (*D. merriami*) weighs a mere 1.2 to 1.75 oz. The most common kangaroo rat, Ord's, weighs 1.5 to 2.5 oz. These little mammals have a most unusual body structure. The head is very large and takes up to half of the body length. The expressive dark orbital eyes are placed high on the skull allowing the kangaroo rat to observe around him. The placement of these eyes have been likened to those of snakes. Despite the large eyes, researchers believe their eyesight is poor.

The forelegs of the kangaroo rats are short and not very



Merriam's kangaroo rat, a common rodent of western desert range-lands. (Author's Note: We could not find a photograph showing the kangaroo rat's beautiful tail. When photographers photograph the rat they either stand on the tail or attach a clip to make it stand still and therefore never frame the tail.)

strong, but are adapted for use in manipulating small food items. The hind legs and feet are long and powerful, quite similar to those of the Australian kangaroo for which the animals are named. The tail is used by the rats for balance in the same manner as kangaroos.

Kangaroo rats are considered to be among the most beautiful of rodents. Coloration varies with the species; upper coat color ranges from pale yellow to dark brown shades, and the underside is usually white. The very long tail is typically dark with white stripes on the sides and a terminal tuft of hair.

Life History

Most species are reproductively active from February to August. They are capable of producing multiple litters annually, with 2 to 3 young per litter, and an average gestation period of 29 to 33 days. The most common occurrence is a litter in early spring and another during late or early autumn, if fall germination of herbaceous plants occurs.

The young are born naked in nests constructed in the burrows. The nests usually consist of dried grasses, seed hulls, and root fibers. The coat of the young is complete at 10 to 14 days, and their eyes open when they are 10 to 18 days old. Functioning of the cheek pouches coincides with wean-

ing at approximately 17 to 22 days. By their 11th day of life the young can leap 3 to 4 inches vertically. When they are about 3 weeks old, they begin leaving the den with their mother. Life span is typically about 2 years under natural conditions.

Adaptations

Kangaroo rats are highly adapted structurally, physiologically, and behaviorally for the arid environment which they inhabit. Physiological adaptations in the kangaroo rat result in conservation of water. Highly specialized kidneys concentrate their urine up to five times that of man. Kangaroo rats also have decreased ventilation in their lungs which reduces water loss. Some species use their lower incisors to strip away the top layers of shrub leaves to get to the most succulent inner layers from which they obtain water. The rodents cope with the daytime desert heat by remaining underground where it is cool and moist in their burrows; above-ground foraging occurs in the cool of the night. In periods of extreme cold or low food intake, the little mammals will become torpid to reduce energy consumption.

The senses of hearing and smelling are highly developed in the kangaroo rats. They have a larger expanded portion of the tympanic bone, giving them the ability to hear extremely well. This keen hearing helps them in their escape from predators. Their excellent sense of smell is also an asset; it is important to them in relocating cached food stores, and because of their solitary nature, it is essential for finding reproductively active members of the population.

Behavior

Kangaroo rats bound along at top speed of 12 mph, and their hops have been measured at 28 inches. The home range for adult males averages about one-half acre in area. Within this area they excavate their burrow systems which generally have at least three separate burrows. These additional burrows, found at the base of shrubs, provide escape routes for the animals. Usually, kangaroo rats are solitary in their living habitats, and only during mating and litter raising do they share burrows. Up to 80% of their time is spent in these burrows.

Despite their small size, the ferocity of kangaroo rats is surprising. They jump on their opponents and puncture the flesh with the toes of their powerful hind legs. Biting is also part of the battle. Witnesses have attested that battles between kangaroo rats are noisy and often fatal. Researchers also warn of nasty bites received from frightened, captured subjects, although some species can become quite tame.

Natural Enemies

Kangaroo rats have many enemies. Among the birds that prey on kangaroo rats are great horned owls, barn owls, and red-tailed hawks. The mammalian predators that feast on these desert rodents include gray foxes, kit foxes, bobcats, and coyotes. Skunks occasionally prey on kangaroo rats, but with limited success. Reptiles such as rattlesnakes and gopher snakes also utilize the rodents in their diets. Many parasites plague the kangaroo rats. Fleas and ticks use them as hosts.

Habitat

Kangaroo rats are found in areas of low rainfall and humidity, high summer temperatures, and high evaporation rates. They usually inhabit areas of the upper and lower Sonoran life zones. Ord's kangaroo rats seem to prefer the disturbed

soil of road sites where tunneling is easier. These disturbed sites are often dominated by weeds which provide cover and a high annual seed production used for food. Other kangaroo rats also seem to prefer loose sandy or gravelly soils supporting widely spaced xerophytic shrubs. In most cases, loose earth is necessary for burrowing sites apparently because of the rats' weak forelegs.

Food Habits

Seeds are the primary food source for kangaroo rats, although other plant parts are also consumed. Insects are also important in the diets of Merriam's kangaroo rats, and possibly other species as well.

The favored food items of the kangaroo rats in a California study included brome grasses (*Bromus* spp.), filaree (*Erodium* spp.), and fescues (*Festuca* spp.). In the Southwest, kangaroo rat species prefer grama grasses (*Bouteloua* spp.), needlegrass (*Stipa* spp.), pigweed (*Amaranthus* spp.), fescues (*Festuca* spp.), and plaintain (*Plantago* spp.). A study in the Sonoran desert showed that availability of resources influenced the pattern of food utilization, but that the preferences of various heteromyid species determined the exact quantities used.

Kangaroo rats have various means of gathering and storing food. These methods are related to the necessity of staying underground for long periods and to the seasonality of food resources. Gathering and storing activities are further enhanced by the functional use of the cheek pouches for transporting food items. (As mentioned previously, kangaroo rats have an exceptional sense of smell which enables relocation of stored food.)

Caches are the most commonly known storage method utilized by kangaroo rats. The rodents gather seeds and put them in their pouches. Caching usually occurs around the immediate vicinity of the burrow opening or at the end of well-worn runways. Besides storage, another advantage of depositing seeds in the soils is the resulting enhanced water content of the seeds. Kangaroo rats indicate a preference for seeds stored in soil for a time over those not cached in soil. Seeds absorb moisture at nighttime temperatures when the humidity in the soil rises. Some seeds may contain up to 30% free water and in these arid areas the additional water becomes a critically important resource. Because the recovery of these seeds is by smell, the depth of burial is shallow. A study done on Merriam's kangaroo rat in Arizona indicated that at a soil depth of 0.25 inches, 83% of the seeds were recovered. The lowest recovery rate (56%) was a depth of 1.0 inch.

Although kangaroo rats are well known for their seed eating preferences, they need other items to balance their diets nutritionally. This balance is accomplished through the use of germinated seedlings. Seeds are very low in carotene, whereas seedlings, especially coleoptiles or cotyledons, are very rich in this precursor of vitamin A. Kangaroo rats may be deficient in vitamin A and their reproduction potential thereby impaired unless their diet includes germinating seedlings from their seed cache system.

Recent studies with seeds of Indian ricegrass carry this scenario a step further. Seeds of this grass are highly dor-

mant, partially because of the indurate lemma and palea which persist around the seed. Kangaroo rats are selective in the types of Indian ricegrass seeds they collect. They choose primarily the forms with the best chance for germination. Most importantly, before the rodents cache these seeds, they remove the lemma and palea, thus greatly enhancing germination. Although the kangaroo rats then prey on emerging seedlings, the key to natural regeneration of Indian ricegrass is this partial grazing which reduces intraspecific competition among the remaining seedlings in individual caches. A similar scheme may exist for other species such as bitterbrush.

Management Implications

Kangaroo rats attracted interest in the 1920's and 1930's when drought and improper grazing affected many desert ranges. Many believed that these small mammals were partially at fault for the deterioration of the range. Studies on these deteriorated sites were completed by the U.S. Biological Survey, now known as the U.S. Fish and Wildlife Service, and many other studies have been completed since. In the Southwest, it was especially apparent that the bannertail kangaroo rat (*D. spectabilis*) and its extensive mound system was causing a loss of forage availability due to the surface disturbance on the range. Various methods were devised to remove the offending rodent, including use of poison grain similar to methods used for prairie dog control. In the absence of these animals, range grasses tended to return but the economic implication was that it was not cost effective to improve degraded rangeland by this method when degradation could have been avoided in the beginning, with sound grazing practices and management.

With deteriorating range conditions, less desirable plant species are usually the last plant utilized by grazing cattle. Kangaroo rats can further increase the numbers of these undesirable plant species through their activities. Various studies have also indicated that large seeded perennials are detrimentally influenced by kangaroo rats during periods of low seed production. Because of the small numbers of seeds produced, the gathering activities of the rodents can have a detrimental impact on plant reproduction. Also, their gathering of seeds on broadcast seeded areas can be especially aggravating.

The results of most studies have shown that detrimental effects by kangaroo rats occur in cases where the range is already in a deteriorated condition. Problems caused by these rodents are considered only to be additive to the existing situation and not due entirely to their actions.

On the other hand, the kangaroo rat can be very helpful in its own way to the land that provides it a living. In good seed years, rodents favorably affect seed dispersal and germination of large seeded perennial grasses and tall, shrubby plants. Recovery of desired range vegetation might be enhanced by the differential feeding pressure of certain rodents. Soil quality too can be affected by kangaroo rats. Their burrowing and caching promotes water infiltration and retention, thus improving soil moisture. This favorably affects the survivability of seedlings in arid regions and could be important in the natural maintenance and improvements of our rangelands. ●