Small Mammal Inventory at Great Sand Dunes National Park and Preserve and Florissant Fossil Beds National Monument, 2003-2004

FINAL REPORT

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INTRODUCTION

Great Sand Dunes National Park and Preserve, and Florissant Fossil Beds National Monument encompass unique geologic features in Colorado. Great Sand Dunes National Park and Preserve (GRSA) is known for its large dunes that were created by winds blowing sand into and across the San Luis Valley to the western base of the Sangre de Cristo Mountains. Stabilized by the mountain barrier and replenished with sand from seasonal winds and spring runoff, these dunes and the surrounding areas provide habitat for a variety of desert and montane organisms, some of which occur nowhere else in Colorado or the world. In fact, some habitats have been isolated long enough to lead to the evolution of distinct geographic forms, such as the Great Sand Dunes tiger beetle (*Cicindela theatina*) and silky pocket mouse (*Perognathus flavus sanluisi*).

Florissant Fossil Beds National Monument (FLFO) once supported a coniferous forest of giant redwood (*Sequoia*) trees and lush vegetation that surrounded a large and warm lake. The forest and lake were covered with volcanic debris from several local eruptions that killed most life forms. This debris stopped organic matter from decomposing rapidly and, over time, mineral deposits replaced the organic matter. After organic materials became petrified, they were exposed through land upheaval and erosion. This once tropical-like habitat is now replaced by montane meadows and scattered stands of coniferous forests.

In an effort to gather valuable biological information, the National Park Service (NPS) initiated a nationwide program to inventory vascular plants and vertebrates on NPS lands. The U.S. Geological Survey, Fort Collins Science Center, Arid Lands Field Station became cooperators in this effort during 2003 and began a two-year mammalian

inventory on two parks within the NPS Rocky Mountain Region: the then Great Sand Dunes National Monument, now Park and Preserve, and Florissant Fossil Beds National Monument. Existing baseline data on occurrences of mammals in these parks varied from very little at FLFO, to extensive at GRSA. However, in many cases, information was insufficient to assess the status of species of local concern.

Over the last decade the status of small mammals has gained more attention. The 2003 listing of endangered, threatened, and wildlife species of concern in Colorado (http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/), also emphasizes smaller species such as bats and rodents, mainly because of restricted ranges or lack of information on distribution and natural history. Overall, little is known about the status and trends of these species and whether conservation efforts are needed.

OBJECTIVES

The primary objective of NPS inventories is to document the occurrence of at least 90% of vertebrates and plants expected to occur within each park. At GRSA and FLFO it was agreed that the emphasis would be on small mammals (shrews, bats, lagomorphs, and rodents) but that data on larger mammals (carnivores and ungulates) would be gathered opportunistically during a two-year field effort and a review of existing information. Secondary objectives include the following: 1) describe the distribution and abundance of species of special concern (e.g., threatened and endangered species, exotics, and other species of special management interest), 2) provide baseline information necessary for the development of a monitoring strategy, and 3) assist in development of a data management effort to facilitate dissemination of biological

information to resource managers, scientists, and the public. Data from these projects will contribute to the development of a long-term monitoring curriculum for each park.

METHODS

Initially, I prepared a list of mammals ("master list") likely to occur in or near the counties in which each park is located (Tables 1 & 2). Primary references used to create this list were Warren (1910), Cary (1911), Lechleitner (1969), Armstrong (1972), Hall (1981), Armstrong et al. (1994), and Fitzgerald et al. (1994). Species on each list were designated as unconfirmed (i.e., unlikely to occur), possibly present (i.e., species likely to occur; range includes or is near the park), or present (i.e., documented in some fashion) for that park. These lists were updated based on data collected in 2003 and 2004. Taxonomy and common names of mammals identified follow Baker et al. (2003), except for the common name of Arizona myotis (= *Myotis occultus*), which is referred to as the occult myotis.

In 2003 and 2004, I used targeted searches for mammals. I inventoried for small terrestrial mammals by using lines of live traps, pitfall traps, and some snap traps. I inventoried for bats using mist nets. Other mammal groups (e.g., small carnivores) were documented opportunistically. Reference maps with study site designations keyed to tables and databases are provided in Appendices I-II.

Small mammals were captured alive, identified to species, assessed for age, sex, and reproductive condition, and released unharmed at the site of capture. A voucher specimen of at least one representative of a species that was undocumented for each park or that needed to be identified using cranial characters was collected. All trapping and observation locations were recorded using Global Positioning System (GPS; Garmin 12)

units set to the UTM coordinate system and NAD27 datum. Data were recorded onto datasheets and then entered into electronic spreadsheets.

Capture and handling of animals was performed in accordance with a written protocol approved by the USGS Fort Collins Science Center, Animal Care and Use Committee. Voucher specimens (skins and skeletal material) are housed in the USGS Biological Survey collection at the Museum of Southwestern Biology, University of New Mexico (UNM). Samples of heart, kidneys, and liver were preserved in liquid nitrogen and deposited in the Division of Genomic Resources at UNM.

Small terrestrial mammal inventories--I inventoried for rodents and other small terrestrial mammals using Sherman live traps arranged in traplines; I also used pitfall traps (Wilson et al. 1996). Traplines typically consisted of 40-80 traps placed at 3-4.5 m (10-15 ft) intervals. Traps were baited with dry oatmeal and left open overnight and often during diurnal hours. Unbaited pitfall traps, consisting of 1-gallon plastic buckets, were buried at ground level in attempts to capture insectivores and other small mammals. Traps were set in targeted (i.e., based on likelihood of animal presence) areas. Study sites were selected to include each major type of habitat within a given park. During 2003, most traplines were set in areas likely to have a successful yield for targeted species. Herein, I report efforts in terms of trap-nights, with a trap-night representing one trap set for one night.

Bat inventories--Bats were inventoried using mist nets. Mist nets were deployed across and around bodies of water to capture bats drinking or feeding in the area (Kunz and Kurta 1988). Size of nets ranged from 6-20 m (18-60 ft) and number of nets varied depending on water surface area and configuration. Mist nets were set up prior to sunset and tended for several hours until activity declined. Mistnetting is especially effective when sources of water in the landscape are limited, as bats concentrate at relatively few sites and are thus more susceptible to capture. Mistnetting efforts are discussed in terms of net-nights, with one net-night representing one net deployed for one night.

Opportunistic observations--If presence of a species that had not been documented by trapping but was done so by other means (e.g. observed, tracks, scat, and middens), the details were noted and specific locations were recorded. Opportunistic observations were the predominant means of documenting larger mammals, but some smaller species were also documented in this manner. In addition, I examined each park's observation records for mammals noted by park staff. In cases where a species was unlikely to be confused with others, the record was generally accepted, especially if there were multiple reports of occurrence.

RESULTS

At GRSA, trapping efforts for 2003 and 2004 included a total of 5420 trap nights and 29 net nights, resulting in the documentation of 854 individuals of 37 species. At FLFO, trapping efforts for 2003 and 2004 included a total of 2083 trap nights and 29 net nights that led to the documentation of 369 mammals of 20 species. Overall, 74% and 70% of the small mammals likely to occur at GRSA and FLFO, respectively, were documented and verified (Table 3, 4). One of the species (ermine) documented at GRSA

represents a new record for the park and Saguache County. Four of the 20 species documented at FLFO represent new records for the park. Overall, the deer mouse (*Peromyscus maniculatus*) was the most frequently encountered rodent at both parks during both years.

GREAT SAND DUNES NATIONAL PARK AND NATIONAL PRESERVE

In the summer of 2003, I amassed a total of 3069 trap nights and 15 net nights at GRSA. I documented a total of 346 individuals consisting of 29 species of mammals (Table 5). I trapped in lowland habitats that ranged from sand sheet grasslands, piñon-juniper forests, and riparian areas along Medano Creek, to montane conifer and aspen forests at the higher elevations (Appendix I). Efforts during 2003 were concentrated on the newly acquired land of the Great Sand Dunes National Preserve, although I occasionally worked on the monument. The localities on the preserve were easily accessible due to the road passing through the eastern portion of the preserve near the Medano Lake Trailhead and Medano Pass.

In 2003, the most frequently captured species was the deer mouse (*Peromyscus maniculatus*). One hundred and fifty-one of 346 individuals captured (44% of the mammals documented) were deer mice (Table 5). The second and third most frequently encountered species in 2003 were the long-legged myotis (*Myotis volans*; 52 individuals netted or 15% of mammals documented; Table 5) and the long-tailed vole (*Microtus longicaudus*; 44 individuals or 12.72%; Table 5). All other mammal species were represented by eighteen (5.20%) or fewer individuals; nine species were documented by the presence of only single individuals (Table 5).

Although many of the species were documented by captures and identified in hand, I documented other species through visual observations alone. In 2003, I documented the presence of the coyote (*Canis latrans*), American beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mountain cottontail (*Sylvilagus nuttallii*), red squirrel (*Tamiasciurus hudsonicus*), and long-tailed weasel (*Mustela frenata*; Table 5). I regard the long-tailed weasel as a noteworthy observation because this species is rarely observed in natural settings. A long-tailed weasel was observed within a span of two days at two different locations, 0.5 mi from each other. Both observations were along Medano Creek near the southeastern boundary of the preserve and it is likely that this may be the same individual.

Another noteworthy record of occurrence was the capture of a juvenile snowshoe hare (*Lepus americanus*). The snowshoe hare was trapped on a rocky ridge in arid habitat atypical of its usual boreal habitat association. Surrounding vegetation consisted of sparse grasses and trees. Armstrong (1972) noted that favorable habitat of the snowshoe hair is brush in open forests. In general, the species occurs in the central mountains of Colorado, extending southwest to the San Juan Mountains. However, in south-central Colorado, the San Luis Valley splits the distribution of the snowshoe hare, and it occurs on the Sangre de Cristo Mountains as well. The narrow strip of boreal habitat in the Sangre de Cristo Mountains is located on the eastern edge of GRSA and is somewhat isolated from populations located in the southwestern edges of the San Juan Mountains (Armstrong 1972, J. Malaney pers. comm.).

At GRSA, 7 species of bats were netted in 2003, accounting for 23.92% of all mammals recorded at the park (Table 5). As noted earlier, the long-legged myotis was

the second most abundant species at GRSA. Thirty-two of 52 long-legged myotis captured in 2003 were females, 16 of which were lactating or pregnant (Table 6). The long-eared myotis (*M. evotis*) was the second most abundant bat species documented in 2003, with 14 individuals netted or 4% of all mammals recorded for the park. The third most abundant bat species netted was the big brown bat (*Eptesicus fuscus*) with 8 individuals (2.3%, Table 5); two of these were reproductive females (Table 6).

In 2003, a male and female western small-footed myotis (*Myotis ciliolabrum*) and a male Townsend's big-eared bat (*Corynorhinus townsendii*) were netted at Denton Spring. None showed signs of reproductive condition. The occult myotis (*M. occultus*) and a single hoary bat (*Lasiurus cinereus*) were netted along the riparian corridor of Medano Creek, neither species showed signs of reproduction (Table 6).

In 2004, trapping efforts included 1351 trap nights and 14 net nights. I documented a total of 508 individuals of 29 species, some of which were different than the species noted for 2003 (Table 7). Similar to 2003, I concentrated efforts on the preserve, especially the northern boundary of the park near Upper and Lower Sand Creek Lakes. However, I also surveyed transitional habitat between the monument and preserve, as well as areas around the sand sheet. Surrounding habitat near Upper and Lower Sand Creek Lakes varied from spruce, fir, and mixed coniferous forests to open meadows, low growing alpine shrubs, tundra, talus slopes, and montane streams. Elevations surveyed at Upper and Lower Sand Creek Lakes ranged between 10,000 ft (3048 m) and 12,000 ft (3658 m); other areas surveyed were lower than 10,000 ft (3048).

As noted for 2003, the most abundant species captured was the deer mouse (*P. maniculatus*), with a total of 262 individuals captured, or 51.57% of mammals

documented for the park (Table 7). This is an increase of 42% (111 more individuals captured) from 2003 (Table 7). The long-legged myotis was the second most abundant species encountered in the park, with 65 individuals netted (12.8% of the mammals documented for the park; Table 7). The third most abundant species was the Ord's kangaroo rat (*Dipodomys ordii montanus*), an endemic subspecies to the San Luis Valley (Armstrong 1972). Twenty-two of the 23 individuals were captured on the sand sheet on the same night.

In 2004, I observed six species, some of which included the same species as noted in 2003, such as the American beaver (*Castor canadensis*) and red squirrel (*Tamiasciurus hudsonicus*). The remainder of observations for 2004 included the yellow-bellied marmot (*Marmota flaviventris*), snowshoe hare (*Lepus americanus*), Abert's squirrel (*Sciurus aberti*), and common porcupine (*Erethizon dorsatum*, Table 7). With the exception of the American beaver, all observations were made in the area surrounding Sand Creek Lakes. Evidence of the American beaver was noted by the presence of a beaver lodge and dam located on Medano Creek, 1.8 mi northeast of the monument and preserve boundary. Although I documented the red squirrel from visual observations near the Sand Creek Lakes during 2004, a road kill near Medano Creek within the boundaries of the preserve was salvaged and prepared as a voucher.

A significant capture for 2004 was a male ermine (*Mustela erminea*), caught near Upper Sand Creek Lake. This ermine represents a new record for GRSA and Saguache County. The ermine is the smallest member of the weasel family (Mustelidae) that is known to occur in Colorado. It was captured with a Sherman live trap in habitat comprised of low-growing conifers, shrubs, and short grasses. A porcupine was observed

and two pikas were captured near this same locality. Pikas encountered in this area belong to the subspecies *Ochotona princeps incana* and are an isolated group found only in the Sangre de Cristo Mountains (Armstrong 1972).

In 2004, five species of bats were captured, accounting for 20.47% of all mammals documented (Table 7). The most frequently captured bat was the long-legged myotis (*Myotis volans*, 65 individuals, Table 7). Forty-one of 65 long-legged myotis captured were females (Table 8). Seventeen of the 41 displayed signs of being pregnant, lactating, or post-lactating (Table 8). There was a 33% increase in captures of the long-legged myotis from 2003, but only one additional record of a reproductive female for 2004.

The big brown bat (*Eptesicus fuscus*) was the second most abundant bat species at GRSA with a total of 16 captures or 3.15% of the mammals documented at the park (Table 7). Thirteen of these captures were females, 9 of which were reproductive (Table 8). The occult myotis (*Myotis occultus*) was the third most abundant species documented at GRSA with a total of 9 captured individuals or 1.77% of captures in 2004 (Table 7). Unlike the long-legged myotis and big brown bat, captures of the occult myotis, long-eared myotis, and hoary bat were comprised mostly of non-reproductive males (Table 8). The capture of mostly male individuals of the occult myotis, long-eared myotis, and hoary bat suggest that females are not using the area for feeding or do not occur in great numbers.

FLORISSANT FOSSIL BEDS NATIONAL MONUMENT

In 2003, I totaled 1363 trap nights and 16 net nights over an estimated 85-90% of the park (Appendix II). Habitat was comprised of ponderosa pine forest, open meadows, riparian areas along Grape Creek, and scattered water impoundments and ponds. A total of 132 individuals of 14 species were documented (Table 9). One-hundred and six, or 80%, of the 132 individuals documented were deer mice (*P. maniculatus*, Table 9). The second most abundant species captured was the meadow vole (*M. pennsylvanicus*, originally identified as *M. montanus*, Valdez 2003), comprising 5.30% of the mammals documented (Table 9). Most captures of the meadow vole were in the wet, mesic areas along Grape Creek and many of these animals were reproductive females. All other species were represented by the capture of 3 or fewer individuals (Table 9).

In 2003, eight of the 14 species documented on the park were recorded through visual observations (Table 9). These species included the mountain cottontail (*Sylvilagus nuttallii*), least chipmunk (*Neotamias minimus*), Richardson's ground squirrel (*Spermophilus richardsonii*), Gunnison's prairie dog (*Cynomys gunnisoni*), Abert's squirrel (*Sciurus aberti*), common muskrat (*Ondatra zibethicus*), North American porcupine (*Erethizon dorsatum*), and bobcat (*Lynx rufus*). Those species that were observed in a colony or social group of more than one individual at one location (i.e., Richardson's ground squirrel and Gunnison's prairie dog) were recorded as one observation.

In 2003, during 16 net nights of effort, three bats were captured. Two of these bats were female long-eared myotis (*M. evotis*) netted at the pond by Cusack Potato Barn. One of the female long-eared myotis was pregnant, whereas the other did not show any

signs of reproduction. Both bats were netted on the same night within 16 minutes of each other. The third bat documented at FLFO was a male silver-haired bat (*Lasionycteris noctivagans*). This bat was netted at a pond, northwest of the Hornbeck Homestead Barn and was not reproductive.

In 2004, I tallied a total of 720 trap nights and 13 net nights. Despite fewer trap and net nights for 2004, the total number of mammals documented was greater than in 2003 (Table 10). I documented a total of 237 individuals of 16 species (Table 10). In 2003, most areas of the monument were surveyed using Sherman live traps, however, a few unsampled areas existed and were targeted in 2004 (Appendix II). Most areas where bats were netted in 2003 were revisited in 2004.

Eighty-seven percent or 208 of the 237 mammals documented at FLFO during 2004 were deer mice (*Peromyscus maniculatus*); an increase of 7% or 102 more individuals captured over 2003 (Table 10). Again, the second most abundant species documented at FLFO was the meadow vole (*M. pennsylvanicus*), with 13 captures, or 5.48% of mammals documented (Table 10). I verified the identification of voles by examining the molars of individuals captured at FLFO in 2003 and 2004. The third most abundant species documented at FLFO was the hoary bat (*Lasiurus cinereus*) with two captures (Table 10). All other mammals documented in 2004 were represented by one individual or observation.

Sixty-five percent of the species reported at FLFO were identified in hand, whereas the remainders were observations. All observations in 2004 included the same species as those noted in 2003, with the exception of the coyote (*Canis latrans*). Although I heard coyotes in and around the park during 2003, I confirmed their presence

with a visual observation in 2004. Three to four individuals were observed near the Cusack Potato Barn. Observations of Gunnison's prairie dogs during 2003 and 2004 revealed that this colony moved from an area northeast of Hornbek Homestead in 2003 to an area southeast of Hornbek Homestead in 2004.

In 2004, 4 additional species occurring at FLFO, 3 of which were bats, were documented. New records of bat species for the park included the western small-footed myotis (*M. ciliolabrum*), long-legged myotis (*M. volans*), and hoary bat (*Lasiurus cinereus*). The silver-haired bat (*L. noctivagans*) and long-eared myotis (*M. evotis*) were netted during both years. All bat species documented in 2004 are represented by one capture except for the hoary bat with 2 individuals captured.

The fourth new species documented at FLFO during 2004 was a male thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*). This squirrel was found dead near the pond northwest of Hornbeck Homestead and amidst the small prairie dog colony reported in 2003. Most of the carcass had been eaten by carrion beetles but still possessed the diagnostic characters of stripes and spots on its dorsum. The skull of the thirteen-lined ground squirrel had been crushed and the carcass appeared to have been there for at least three or four days.

DISCUSSION

In 2003 and 2004, 74% of the small mammals occurring at GRSA and 70% of the small mammals thought to occur at FLFO were documented. Although the original master lists documented species of mammals that occur in counties where the parks were located, size or habitat of the parks likely precluded the occurrence of some species. Therefore, those mammals not likely to occur were removed from the list, providing a

revised master list. For example, the area encompassed by FLFO does not include habitat suitable for pikas, although they occur at higher elevations in Teller County.

Despite the elimination of some species from the original master list, overall number of species documented in this small mammal inventory was below 90% at each park. In part, sizes and habitats sampled in each park seem to be the limiting factors of why these values are lower than expected. For example, because there had been prior small mammal inventories on Great Sand Dunes National Park, and because little information was known from the newly acquired land (i.e., Great Sand Dunes National Preserve) that was comprised of montane and alpine habitat, it was agreed with GRSA to concentrate trapping efforts on the preserve. By doing so, it was unlikely that I would encounter four grassland species believed to occur at GRSA: the white-tailed jackrabbit (*Lepus townsendii*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), western harvest mouse (*Reithrodontomys megalotis*), and American badger (*Taxidea taxus*).

Another factor contributing to the low number of species documented at GRSA is that six species of small to medium-sized carnivores were elusive or difficult to detect. Many of these small to medium-sized carnivores have relatively large home ranges and it is more than likely that my presence did not overlap with theirs, at certain times (e.g, raccoons at night). Therefore, eliminating the four grassland species and six carnivores from the list, because the probability of detecting these species at GRSA is likely low, trapping success increases from 35 of 50 (74%) to 37 of 40 (93 %) mammals documented.

At FLFO, the low number of mammals documented at the park does not reflect level of effort. In fact, trapping efforts covered 80 to 90% of the park. In general, the park itself is too small to support a high diversity of small mammals. Like GRSA, some of the carnivores at FLFO have relatively large home ranges and are less likely to be detected or it is possible that the local coyote population is large enough to prevent other carnivores (e.g., red fox) from residing or occurring at the park. Also, other available water sources, outside of the park, prevent a concentration of bat activity, making it difficult to catch a large number of bats.

Overall, trapping success at both parks increased in 2004. In 2003 and 2004, the most frequently encountered mammal species at GRSA and FLFO was the deer mouse (*Peromyscus maniculatus*). However for both parks, the number of captures of the deer mouse was greater in 2004. At GRSA, the long-legged myotis (*M. volans*) represented the second most abundant species for 2003 and 2004. At FLFO, the meadow vole (*M. pennsylvanicus*) was consistently the second most abundant species documented for both years.

The increase in captures during 2004 may be influenced by several factors. One possibility is that drought conditions prior to 2003 were relieved by substantial snow and rainfall in the spring of 2003. When the survey was initiated, capture success of all small mammals was relatively low, especially at FLFO. Capture success later increased after the onset of new vegetation growth and a likely lag time in reproduction of many rodent populations. With an increase in vegetation in 2003, rodent species increased in 2004. This trend was most apparent in deer mice. At both parks, there was an increase of over 100 deer mice captured per park in 2004. Such annual fluctuations are not uncommon in

rodents, but may not be consistent or predictable over long periods of time or broad geographic areas (see Ernest et al. 2000).

GREAT SAND DUNES NATIONAL PARK AND PRESERVE

In 2003, I was successful in documenting the occurrence of several species from a variety of faunal elements. Some species associated with desert habitat (e.g., Kangaroo rats) were captured in and around the sand dunes of the monument. However, one exception, a silky pocket mouse (*Perognathus flavus*) was captured near the base of Mount Zwischen in a stand of aspen trees. This was an adult male and its capture represents an occurrence in atypical habitat.

Several mammals documented at GRSA also represent peripheral limits of their distribution. For example, four northern rock mice (*Peromyscus nasutus*) were captured in 2003 and 2004. This species often occurs in rocky habitat of canyons and cliffs along the Eastern Slope of Colorado (Fitzgerald et al. 1994). In Alamosa and Saguache counties, the distribution of the northern rock mouse does not extend west of the Sangre de Cristo Mountains (Fitzgerald et al. 1994, Armstrong 1972).

Relatively low population densities are often observed at the peripheries of a species' distribution and likely accounts for some of the low occurrences observed during this inventory. For example, during the 2-year inventory effort at GRSA, only one Abert's squirrel (*Sciurus aberti ferreus*) was observed. The squirrel was observed running along Medano Creek, near the southeastern boundary of the preserve. As noted by Armstrong (1972), this subspecies is limited to the central mountain ranges of Colorado and extends into the Sangre de Cristo Mountains. The locality where this

squirrel was observed on GRSA represents the southernmost edge of this subspecies' distribution.

Several subspecies are limited to the Sangre de Cristo Mountains and surrounding areas. For example, several subspecies are endemic to the Sangre de Cristo Mountains: the yellow-bellied marmot (*Marmota flaviventris obscura*), pika (*Ochotona princeps incana*), and red-backed vole (*Clethrionomys gapperi gauti*; Armstrong 1972). The pika and red-backed vole represent mammals associated with boreo-montane habitat and may be insular populations as a result from the receding glaciers in the late Pleistocene (Turner 1974). Although the subspecies of marmot found in the Sangre de Cristos is not considered an obligate of boreomontane habitats, Armstrong (1972) noted that it was an insular population, isolated by the same climatic events as the pika. Therefore, the portion of the Sangre de Cristo Mountains that occurs on GRSA may serve as an important area for future monitoring efforts.

The ermine or short-tailed weasel (*Mustela erminea*) is another species associated with the boreomontane faunal element (Turner 1974), and in 2004 this species was documented near Upper Sand Creek Lake. The ermine represents a new record for the park, as well as for Saguache County. Although the distribution of the ermine in Colorado is associated with the central mountain ranges and Western Slope (Fitzgerald et al. 1994, Hall 1981), the nearest record of occurrence is from Arbourville, Chaffee County; approximately 60 miles away (Armstrong 1972). The ermine represents the smallest carnivore known to occur in Colorado and is considered to be uncommon (Armstrong 1972, Fitzgerald et al. 1994).

Another new record for GRSA and a new record for Alamosa County was the capture of the western small-footed myotis (*M. ciliolabrum*) at Denton Spring in 2003. Two individuals, a male and female, were netted on the same night over the 3 ft (0.91m) x 2 ft (0.61m) pool. In both years of this survey, Denton Spring was not observed greater than the size mentioned. The size of this pool limits accessibility to those species capable of maneuvering in confined areas (e.g., small-footed myotis, long-eared myotis).

Other bats with relatively short, broad wings also are capable of this type of flight, such as Townsend's big-eared bat (*Corynorhinus townsendii*). The only record of this species was also at Denton Spring. However, there are reported records of Townsend's big-eared bat from nearby areas such as the Orient Mine, in the Sangre de Cristo Mountains north of the monument (Svoboda and Choate 1987). Townsend's big-eared bat is unique in that it is only one of two long-eared bats that occur in Colorado.

In 2003 and 2004, two relatively large species of bats, the hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were encountered. The hoary bat is a solitary species that uses tree branches as roosts (Shump and Shump 1982). Moreover, this bat is migratory (Cryan 2003), with a wing morphology adapted to rapid flight in open areas, thus limiting its ability to forage or drink in small and confined areas. For example, captures of the hoary bat occurred in open areas along Medano Creek, usually at creek crossings on the forest road.

The big brown bat is also widespread across Colorado (Armstrong et al. 1994). Unlike the hoary bat, females of this species often aggregate in large colonies where they give birth and raise their young. This species can be found in various types of habitats ranging from montane forests to urban areas. Many of the big brown bats netted along

Medano Creek on the preserve were pregnant, lactating, or post-lactating. The presence of these reproductive females suggests that there is a maternity colony nearby. However, this colony was not found.

At GRSA, the long-legged myotis (*Myotis volans*) consistently used the riparian corridor of Medano Creek for feeding and drinking. In this area, multiple females that were pregnant, lactating, or post-lactating were captured. Reproductive females outnumbered other bats of this species at some net sites along Medano Creek, suggesting that the riparian corridor of Medano Creek and neighboring habitats support a maternity colony. The long-legged myotis is known to use trees, buildings, rock crevices, mines, tunnels, and natural caves as day and/or night roosts (Armstrong 1972, Armstrong et al. 1994). In general, all of these roost types can be found in surrounding habitat of Medano Creek, within the preserve.

The occult myotis (*M. occultus*) was once considered a subspecies of the little brown bat (*M. lucifugus*), a widespread species in Colorado (Hall 1981). However, genetic analyses by Piaggio et al. (2002) indicated that *M. occultus* is a distinct species. The distribution of the occult myotis is relatively unknown, but captures of this bat in 2003 and 2004 represent the northernmost records of occurrence in Colorado. It is likely that the northward distribution of the occult myotis in south-central Colorado may be limited by the Sangre de Cristo Mountains.

Although there were no captures of any Brazilian free-tailed bats (*Tadarida brasiliensis*), there is a colony of over 100,000 individuals located at the nearby Orient Mine in the Sangre de Cristo Mountains (Svoboda and Choate 1987); approximately 50 miles from GRSA. It is likely that some of these bats could be flying over the park *en*

route to foraging areas or during migrations. This species is capable of relatively long-distance flight and, because of their less-maneuverable wing morphology it is likely they forage over open areas of the monument (e.g., Medano Lake).

The silver-haired bat is easily recognized by its distinct pelage of black fur with frosted white tips. Silver-haired bats are known to roost "behind the loose bark of old aspen trees" in Colorado (Armstrong et al. 1994, pg 29). In 2003 and 2004, areas along Medano Creek were surveyed but there were no captures of the silver-haired bat. This species is widespread across Colorado but also is believed to be migratory (Armstrong et al. 1994; Cryan 2003). Svoboda and Choate (1987) noted that at the Orient Mine, the silver-haired bat was present only in late August and October. The occurrence of this species on GRSA may be seasonal.

FLORISSANT FOSSIL BEDS NATIONAL MONUMENT

In 2003, my efforts covered over 80% of the park. In 2004, I surveyed additional unsampled areas for an estimated total 90% of the park sampled. There are relatively few habitat types at FLFO, as the park consists of ponderosa pine, wet meadows, grassland, rock outcrops, water impoundments or ponds, and small creeks. At FLFO, the deer mouse (*Peromyscus maniculatus*) was the most abundant species encountered for 2003 and 2004. The deer mouse is considered the most common rodent encountered in Colorado and is widespread across North America (Fitzgerald et al. 1994, Hall 1981, Armstrong 1972). Therefore, it is not surprising that the deer mouse was the only species encountered at most of the habitat types at FLFO.

Although the meadow vole (*Microtus pennsylvanicus*) was the second most frequently encountered species at FLFO, it was found only along riparian habitats of

Grape Creek and in areas where grasses were thick and lush. Armstrong (1972) noted that the meadow vole in Colorado is restricted to wetlands, but streamside herb communities are inhabited by other vole species (i.e., montane vole). After close examination of voucher specimens captured in 2003 and 2004, the identification of the meadow vole was confirmed. Although I did not document the montane vole on FLFO, it is likely to occur there. The nearest record of *M. montanus nanus* is from the town of Florissant (Armstrong 1972). However, this locality also represents the southeastern edge of its distribution and may provide an explanation for the limited number of encounters.

In 2004, a thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) was documented at FLFO. The thirteen-lined ground squirrel has been characterized as a grassland species and its occurrence is, in part, regulated by soil type (Armstrong 1972). Fitzgerald et al. (1994) noted that these squirrels are capable of using other disturbed habitats such as prairie dog colonies.

In 2003 and 2004, a total of 5 species of bats were netted at FLFO. The two species documented in 2003, were the long-eared myotis (*Myotis evotis*) and silver-haired bat (*Lasionycteris noctivagans*). As noted earlier, the silver-haired bat is easily recognized by its unique pelage of frosted tips on black fur. This bat is also considered one of the most common species across North America (Fitzgerald et al. 1994). Although it is a migratory species, Fitzgerald et al. (1994) noted that males are encountered at higher elevations of the Rocky Mountains during summer, whereas females occur farther north while raising their young. The capture of a male silver-haired bat at FLFO likely reflects this trend.

The report of the long-eared myotis at FLFO represents a new record for the park as well as for Teller County. The long-eared myotis occurs throughout most of western North America and in a variety of habitat types, but mostly in forested areas (Manning and Jones 1989). Most records of the long-eared myotis from Colorado have been noted at elevations of 6000 ft (1829m) to 8400 ft (2560m, Armstrong 1972). The coniferous forest habitat of FLFO is typical of the long-eared myotis in Colorado and the capture of a reproductive female suggests that there is a maternity colony nearby.

In 2004, I documented the small-footed myotis (*M. ciliolabrum*), long-legged myotis (*M. volans*), and hoary bat (*Lasiurus cinereus*). Like the long-eared myotis, the small-footed myotis represents a new record for Teller County. The small-footed myotis is one of the smallest bat species that is likely to be encountered at FLFO. The small-footed myotis, long-legged myotis, and hoary bat are all known to use trees as roosts, especially in montane habitat. However species of *Myotis* often use exfoliating bark or cracks and cavities of trees, whereas the hoary bat is known to roost in the foliage (Fitzgerald et al. 1994). Female small-footed and long-legged myotis also form maternity colonies, whereas female hoary bats typically roost alone or with young.

SPECIES OF CONCERN AND MANAGEMENT SUGGESTIONS

Townsend's big-eared bat (*Corynorhinus townsendii*) is the only Colorado species of concern encountered during the 2003-2004 small mammal inventories at GRSA. No Colorado species of concern were encountered at FLFO. In Colorado, *C. townsendii* occurs in western, central, and southeastern Colorado (Armstrong et al. 1994). As noted earlier, our only capture was a male netted at Denton Spring and because only one bat was netted, it is possible that this was a transient individual.

Because these bats often form large colonies during hibernation, one major concern regarding the protective status of this species is its vulnerability to human disturbance (Armstrong 1972). One suggestion for locating roosts of *C. townsendii* is to include radio-telemetry field studies with additional mistnetting efforts. Using radio-telemetry techniques allows the researcher to pinpoint the exact location where these bats are roosting during the daytime or in fall and winter months. Understanding what type of roosts these bats are using (i.e., caves, mines, tree snags, rock crevices, or buildings) and where they are located, allows the researcher to monitor a variety of factors such as frequency of use, size of colony, or if the roost is used as a hibernaculum; depending on when the bats are radio-tagged. In turn, this would allow for better management suggestions for the safety of the colony and the public, such as gating open mines or caves.

Although, *C. townsendii* is the only species I encountered that is listed as a species of concern in Colorado, little is known about the roosting ecology of many other species occurring at GRSA or FLFO. From this inventory, I documented the presence of reproductive females of other bat species (i.e., *M. evotis, M. volans,* and *E. fuscus*) and it is likely that each park supports one or more maternity colonies. Therefore, using the same radio-tracking efforts suggested for *C. townsendii* may prove advantageous to locating, monitoring, and managing for a variety of habitat types used by different species. Also, these efforts may provide insight on whether bats are using park lands as a resource for food and water, while using roosts in neighboring areas (e.g., Baca Land Grant), or using habitat in park lands for roosts and foraging elsewhere.

Although this small mammal inventory at GRSA and FLFO thoroughly targeted each of the habitat types occurring on the parks, a portion of Great Sand Dunes National Preserve remains to be surveyed. Therefore, additional small mammal inventories should be considered for this area, as well as for neighboring areas (e.g., Baca Land Grant). Not only do these baseline inventories determine what small mammals occur in these areas, but also serve as a guide for monitoring and management if these areas were to change drastically (i.e., large fires).

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Table 1. Master list of 54 mammal species occurring or possibly occurring in Alamosa or Saguache County, and Great Sand Dunes National Park and Preserve (GRSA). See text for details.

Common name	Species	Status
Masked shrew	*Sorex cinereus*	Possibly present
Montane shrew	*Sorex monticolus*	Present
American water shrew	*Sorex palustris*	Present
Western small-footed myotis	*Myotis ciliolabrum*	Present
Long-eared myotis	*Myotis evotis*	Present
Arizona myotis	*Myotis occultus*	Present
Long-legged myotis	*Myotis volans*	Present
Hoary bat	*Lasiurus cinereus*	Present
Silver-haired bat	*Lasionycteris noctivagans*	Possibly present
Big brown bat	*Eptesicus fuscus*	Present
Townsend's big-eared bat	*Corynorhinus townsendii*	Present
Brazilian free-tailed bat	*Tadarida brasiliensis*	Possibly present
American pika	*Ochotona princeps*	Present
Desert cottontail	*Sylvilagus audubonii*	Present
Mountain cottontail	*Sylvilagus nuttallii*	Present
Snowshoe hare	*Lepus americanus*	Present
White-tailed jackrabbit	*Lepus townsendii*	Possibly present
Least chipmunk	*Neotamias minimus*	Present
Colorado chipmunk	*Neotamias quadrivittatus*	Present
Yellow-bellied marmot	*Marmota flaviventris*	Present
Golden-mantled ground squirrel	*Spermophilus lateralis*	Present
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	Possibly present
Rock squirrel	*Spermophilus variegatus*	Possibly present
Gunnison's prairie dog	*Cynomys gunnisoni*	Possibly present
Abert's squirrel	*Sciurus aberti*	Present
Red squirrel	*Tamiasciurus hudsonicus*	Present
Northern pocket gopher	*Thomomys talpoides*	Present
Silky pocket mouse	*Perognathus flavus*	Present
Ord's kangaroo rat	*Dipodomys ordii*	Present
American beaver	*Castor canadensis*	Present
Western harvest mouse	*Reithrodontomys megalotis*	Possibly present
Plains harvest mouse	*Reithrodontomys montanus*	Possibly present
Brush mouse	*Peromyscus boylii*	Possibly present
Deer mouse	*Peromyscus maniculatus*	Present
Northern rock mouse	*Peromyscus nasutus*	Present
Northern grasshopper mouse	*Onychomys leucogaster*	Present
Bushy-tailed woodrat	*Neotoma cinerea*	Present
Southern red-backed vole	*Clethrionomys gapperi*	Present
Long-tailed vole	*Microtus longicaudus*	Present
Montane vole	*Microtus montanus*	Present

Table 1 (cont.).

Common name	Species	Status
Meadow vole	*Microtus pennsylvanicus*	Present
Common muskrat	*Ondatra zibethicus*	Present
Western jumping mouse	*Zapus princeps*	Present
North American porcupine	*Erethizon dorsatum*	Present
Coyote	*Canis latrans*	Present
Red fox	*Vulpes vulpes*	Possibly present
Common gray fox	*Urocyon cinereoargenteus*	Possibly present
Northern raccoon	*Procyon lotor*	Possibly present
Ermine	*Mustela erminea*	Present
Long-tailed weasel	*Mustela frenata*	Present
American mink	*Mustela vison*	Possibly present
American badger	*Taxidea taxus*	Possibly present
Eastern spotted skunk	*Spilogale putorius*	Possibly present
Striped skunk	*Mephitis mephitis*	Possibly present
Bobcat	*Lynx rufus*	Possibly present

Table 2. Master list of 47 mammal species occurring or possibly occurring in Teller County and Florissant Fossil Beds National Monument. See text for details.

Common name	Species	Status
Masked shrew	*Sorex cinereus*	Possibly present
Merriam's shrew	*Sorex merriami*	Possibly present
Dwarf shrew	*Sorex nanus*	Possibly present
American water shrew	*Sorex palustris*	Possibly present
Western small-footed myotis	*Myotis ciliolabrum*	Present
Long-eared myotis	*Myotis evotis*	Present
Little brown myotis	*Myotis lucifugus*	Possibly present
Long-legged myotis	*Myotis volans*	Present
Hoary bat	*Lasiurus cinereus*	Present
Silver-haired bat	*Lasionycteris noctivagans*	Present
Big brown bat	*Eptesicus fuscus*	Possibly present
Townsend's big-eared bat	*Corynorhinus townsendii*	Possibly present
Brazilian free-tailed bat	*Tadarida brasiliensis*	Unlikely
American pika	*Ochotona princeps*	Unlikely
Mountain cottontail	*Sylvilagus nuttallii*	Present
Least chipmunk	*Neotamias minimus*	Present
Colorado chipmunk	*Neotamias quadrivittatus*	Possibly present
Yellow-bellied marmot	*Marmota flaviventris*	Unlikely
Golden-mantled ground squirrel	*Spermophilus lateralis*	Present
Richardson's ground squirrel	*Spermophilus richardsonii*	Present
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	Present
Rock squirrel	*Spermophilus variegatus*	Possibly present
Gunnison's prairie dog	*Cynomys gunnisoni*	Present
Abert's squirrel	*Sciurus aberti*	Present
Red squirrel	*Tamiasciurus hudsonicus*	Possibly present
Northern pocket gopher	*Thomomys talpoides*	Present
American beaver	*Castor canadensis*	Possibly present
Deer mouse	*Peromyscus maniculatus*	Present
Bushy-tailed woodrat	*Neotoma cinerea*	Present
Southern red-backed vole	*Clethrionomys gapperi*	Possibly present
Long-tailed vole	*Microtus longicaudus*	Possibly present
Montane vole	*Microtus montanus*	Possibly present
Meadow vole	*Microtus pennsylvanicus*	Present
Common muskrat	*Ondatra zibethicus*	Present
Western jumping mouse	*Zapus princeps*	Possibly present
North American porcupine	*Erethizon dorsatum*	Present
Coyote	*Canis latrans*	Present
Red fox	*Vulpes vulpes*	Possibly present
Common gray fox	*Urocyon cinereoargenteus*	Possibly present
Northern raccoon	*Procyon lotor*	Possibly present
Ermine	*Mustela erminea*	Possibly present
Long-tailed weasel	*Mustela frenata*	Possibly present

Table 2 (cont.).

Common name	Species	Mammals species noted at FLFO, based on results from 2003 and 2004 field seasons
American mink	*Mustel vison*	Possibly present
American badger	*Taxidea taxus*	Possibly present
Eastern spotted skunk	*Spilogale putorius*	Possibly present
Striped skunk	*Mephitis mephitis*	Possibly present
Bobcat	*Lynx rufus*	Present

Table 3. Revised master list of 50 mammal species occurring or possibly occurring at Great Sand Dunes National Park and Preserve (GRSA). Seventy-four percent of mammals were documented by 2003-2004 small mammal inventory and published records. Asterisks denote published records according to Armstrong (1972).

Common name	Species	Mammals species noted at GRSA, based on results from 2003 and 2004 field seasons
Montane shrew	*Sorex monticolus*	Present
American water shrew	*Sorex palustris*	Present
Western small-footed myotis	*Myotis ciliolabrum*	Present
Long-eared myotis	*Myotis evotis*	Present
Occult myotis	*Myotis occultus*	Present
Long-legged myotis	*Myotis volans*	Present
Hoary bat	*Lasiurus cinereus*	Present
Silver-haired bat	*Lasionycteris noctivagans*	Possibly present
Big brown bat	*Eptesicus fuscus*	Present
Townsend's big-eared bat	*Corynorhinus townsendii*	Present
Brazilian free-tailed bat	*Tadarida brasiliensis*	Possibly present
American pika	*Ochotona princeps*	Present
Desert cottontail	*Sylvilagus audubonii*	Present
Mountain cottontail	*Sylvilagus nuttallii*	Present
Snowshoe hare	*Lepus americanus*	Present
White-tailed jackrabbit	*Lepus townsendii*	Possibly present
Least chipmunk	*Neotamias minimus*	Present
Colorado chipmunk	*Neotamias quadrivittatus*	Present
Yellow-bellied marmot	*Marmota flaviventris*	Present
Golden-mantled ground squirrel	*Spermophilus lateralis*	Present
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	Possibly present
Rock squirrel	*Spermophilus variegatus*	Possibly present
Gunnison's prairie dog	*Cynomys gunnisoni*	Present*
Abert's squirrel	*Sciurus aberti*	Present
Red squirrel	*Tamiasciurus hudsonicus*	Present
Northern pocket gopher	*Thomomys talpoides*	Present
Silky pocket mouse	*Perognathus flavus*	Present
Ord's kangaroo rat	*Dipodomys ordii*	Present
American beaver	*Castor canadensis*	Present
Western harvest mouse	*Reithrodontomys megalotis*	Possibly present
Deer mouse	*Peromyscus maniculatus*	Present
Northern rock mouse	*Peromyscus nasutus*	Present
Northern grasshopper mouse	*Onychomys leucogaster*	Present
Bushy-tailed woodrat	*Neotoma cinerea*	Present
Southern red-backed vole	*Clethrionomys gapperi*	Present
Long-tailed vole	*Microtus longicaudus*	Present

Table 3 (cont.).

Common name	Species	Mammals species noted at GRSA, based on results from 2003 and 2004 field seasons
Meadow vole	*Microtus pennsylvanicus*	Present
Common muskrat	*Ondatra zibethicus*	Present
Western jumping mouse	*Zapus princeps*	Present
North American porcupine	*Erethizon dorsatum*	Present
Coyote	*Canis latrans*	Present
Red fox	*Vulpes vulpes*	Possibly present
Common gray fox	*Urocyon cinereoargenteus*	Possibly present
Northern raccoon	*Procyon lotor*	Possibly present
Ermine	*Mustela erminea*	Present
Long-tailed weasel	*Mustela frenata*	Present
American badger	*Taxidea taxus*	Possibly present
Eastern spotted skunk	*Spilogale putorius*	Possibly present
Striped skunk	*Mephitis mephitis*	Possibly present
Bobcat	*Lynx rufus*	Possibly present

Table 4. Revised master list of 29 mammal species occurring or possibly occurring at Florissant Fossil Beds National Monument (FLFO). Seventy percent of mammals were documented by 2003-2004 small mammal inventory.

Common name	Species	Mammals species noted at FLFO, based on results from 2003 and 2004 field seasons
Masked shrew	*Sorex cinereus*	Possibly present
Merriam's shrew	*Sorex merriami*	Possibly present
Western small-footed myotis	*Myotis ciliolabrum*	Present
Long-eared myotis	*Myotis evotis*	Present
Little brown myotis	*Myotis lucifugus*	Possibly present
Long-legged myotis	*Myotis volans*	Present
Hoary bat	*Lasiurus cinereus*	Present
Silver-haired bat	*Lasionycteris noctivagans*	Present
Big brown bat	*Eptesicus fuscus*	Possibly present
Townsend's big-eared bat	*Corynorhinus townsendii*	Possibly present
Mountain cottontail	*Sylvilagus nuttallii*	Present
Least chipmunk	*Neotamias minimus*	Present
Golden-mantled ground squirrel	*Spermophilus lateralis*	Present
Richardson's ground squirrel	*Spermophilus richardsonii*	Present
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	Present
Gunnison's prairie dog	*Cynomys gunnisoni*	Present
Abert's squirrel	*Sciurus aberti*	Present
Northern pocket gopher	*Thomomys talpoides*	Present
Deer mouse	*Peromyscus maniculatus*	Present
Bushy-tailed woodrat	*Neotoma cinerea*	Present
Meadow vole	*Microtus pennsylvanicus*	Present
Common muskrat	*Ondatra zibethicus*	Present
North American porcupine	*Erethizon dorsatum*	Present
Coyote	*Canis latrans*	Present
Red fox	*Vulpes vulpes*	Possibly present
Long-tailed weasel	*Mustela frenata*	Possibly present
American badger	*Taxidea taxus*	Possibly present
Striped skunk	*Mephitis mephitis*	Possibly present
Bobcat	*Lynx rufus*	Present

Table 5. Twenty-nine mammals documented at Great Sand Dunes National Park and Preserve (GRSA) in 2003. Asterisks denote species that were observed or signs of their presence were noted but were not trapped or captured. Values for percent capture are calculated by number of animals per species, divided by total number of animals documented, then multiplied by 100 and rounded to the nearest one-hundredth (e.g., *Peromyscus maniculatus* = 151 / 346 * 100 = 44%).

Species at GRSA	Scientific name	No. of animals documented	% Captured or documented
Montane shrew	*Sorex monticolus*	3	0.87
American water shrew	*Sorex palustris*	2	0.58
Western small-footed myotis	*Myotis ciliolabrum*	2	0.58
Long-eared myotis	*Myotis evotis*	14	4.00
Arizona myotis	*Myotis occultus*	5	1.45
Long-legged myotis	*Myotis volans*	52	15.00
Hoary bat	*Lasiurus cinereus*	1	0.29
Big brown bat	*Eptesicus fuscus*	8	2.31
Townsend's big-eared bat	*Corynorhinus townsendii*	1	0.29
Mountain cottontail*	*Sylvilagus nuttallii*	1	0.29
Snowshoe hare	*Lepus americanus*	1	0.29
Least chipmunk	*Neotamias minimus*	18	5.20
Golden-mantled ground squirrel	*Spermophilus lateralis*	5	1.45
Red squirrel*	*Tamiasciurus hudsonicus*	3	0.87
Northern pocket gopher	*Thomomys talpoides*	2	0.58
Silky pocket mouse	*Perognathus flavus*	4	1.15
Ord's kangaroo rat	*Dipodomys ordii*	9	2.60
American beaver*	*Castor canadensis*	1	0.29
Deer mouse	*Peromyscus maniculatus*	151	44.00
Northern rock mouse	*Peromyscus nasutus*	2	0.58
Northern grasshopper mouse	*Onychomys leucogastor*	1	0.29
Bushy-tailed woodrat	*Neotoma cinerea*	4	1.15
Long-tailed vole	*Microtus longicaudus*	44	12.72
Montane vole	*Microtus montanus*	4	1.15
Meadow vole	*Microtus pennsylvanicus*	1	0.29
Common muskrat*	*Ondatra zibethicus*	1	0.29
Western jumping mouse	*Zapus princeps*	3	0.87
Long-tailed weasel*	*Mustela frenata*	2	0.58
Coyote*	*Canis latrans*	1	0.29
	TOTAL	**346**	

Table 6. Reproductive condition of bats netted in 2003 at GRSA. One non-reproductive male silver-haired bat and two (1 reproductive and 1 non-reproductive) long-eared myotis were netted at FLFO in 2003. Reproductive females were those that were pregnant, lactating, or post-lactating. Females with unknown reproductive condition were those captured during periods (e.g., spring) when reproductive signs are not apparent. Reproductive males were considered those with descended testes.

Species at GRSA	Reproductive Female	Non-Reproductive Female	Females with Unknown Reproductive Condition	Reproductive Male	Non-Reproductive Male	Grand Total
Long-eared myotis		8	1		5	14
Long-legged myotis	16	10	6		20	52
Occult myotis					5	5
Small-footed myotis		1			1	2
Hoary bat					1	1
Big brown bat	2	1		1	4	8
Townsend's big-eared bat					1	1
TOTAL	**18**	**20**	**7**	**1**	**37**	**83**

Table 7. Twenty-nine mammals documented at Great Sand Dunes National Park and Preserve (GRSA) in 2004. Asterisks denote species that were observed or signs of their presence were noted but were not trapped or captured. Values for percent capture are calculated by number of animals per species, divided by total number of animals documented, then multiplied by 100 and rounded to the nearest one-hundredth (e.g., *Peromyscus maniculatus* = 262 / 508 * 100 = 51.57%).

Species at GRSA	Scientific name	No. of animals documented	% Captured or documented
Montane shrew	*Sorex monticolus*	2	0.39
American water shrew	*Sorex palustris*	2	0.39
Long-eared myotis	*Myotis evotis*	6	1.18
Arizona myotis	*Myotis occultus*	9	1.77
Long-legged myotis	*Myotis volans*	65	12.80
Hoary bat	*Lasiurus cinereus*	8	1.57
Big brown bat	*Eptesicus fuscus*	16	3.15
American pika	*Ochotona princeps*	4	0.79
Desert cottontail	*Sylvilagus audubonii*	1	0.20
Snowshoe hare	*Lepus americanus*	4	0.79
Least chipmunk	*Neotamias minimus*	12	2.36
Colorado chipmunk	*Neotamias quadrivittatus*	13	2.56
Yellow-bellied marmot*	*Marmota flaviventris*	3	0.59
Golden-mantled ground squirrel	*Spermophilus lateralis*	3	0.59
Abert's squirrel*	*Sciurus aberti*	1	0.20
Red squirrel*	*Tamiasciurus hudsonicus*	6	1.18
Northern pocket gopher	*Thomomys talpoides*	3	0.59
Silky pocket mouse	*Perognathus flavus*	7	1.38
Ord's kangaroo rat	*Dipodomys ordii*	23	4.53
American beaver*	*Castor canadensis*	1	0.20
Deer mouse	*Peromyscus maniculatus*	262	51.57
Northern rock mouse	*Peromyscus nasutus*	2	0.39
Northern grasshopper mouse	*Onychomys leucogastor*	6	1.18
Southern red-backed vole	*Clethrionomys gapperi*	15	2.96
Long-tailed vole	*Microtus longicaudus*	9	1.77
Meadow vole	*Microtus pennsylvanicus*	14	2.76
Western jumping mouse	*Zapus princeps*	9	1.77
North American porcupine*	*Erethizon dorsatum*	1	0.20
Ermine	*Mustela erminea*	1	0.20
	TOTAL	**508**	

Table 8. Reproductive condition of bats netted in 2004 at GRSA. Reproductive females were those that were pregnant, lactating, or post-lactating. Reproductive males were considered those with descended testes. Individuals identified in the net but escaped before additional information was obtained, were recorded as unknown sex. Only males were netted at FLFO, none of which were reproductive.

Species at GRSA	Reproductive Female	Non-Reproductive Female	Reproductive Male	Non-Reproductive Male	Unknown sex	Grand Total
Long-eared myotis		1		4	1	6
Long-legged myotis	17	24		24		65
Occult myotis		2		7		9
Hoary bat				7	1	8
Big brown bat	9	4		3		16
TOTAL	**26**	**31**		**45**	**2**	**104**

Table 9. Fourteen mammals documented at Florissant Fossil Beds National Monument (FLFO) in 2003. Asterisks denote species that were observed or signs of their presence were noted but were not trapped or captured. Values for percent capture are calculated by number of animals per species, divided by total number of animals documented, then multiplied by 100 and rounded to the nearest one-hundredth (e.g., *Peromyscus maniculatus* = 106 / 132 * 100 = 80%).

Species at FLFO	Scientific name	No. of animals documented	% Captured or documented
Long-eared myotis	*Myotis evotis*	2	1.52
Silver-haired bat	*Lasionycteris noctivagans*	1	0.76
Mountain cottontail*	*Sylvilagus nuttallii*	2	1.52
Least chipmunk*	*Neotamias minimus*	3	2.27
Richardson's ground squirrel*	*Spermophilus richardsonii*	3	2.27
Gunnison's prairie dog*	*Cynomys gunnisoni*	1	0.76
Abert's squirrel*	*Sciurus aberti*	1	0.76
Northern pocket gopher	*Thomomys talpoides*	1	0.76
Deer Mouse	*Peromyscus maniculatus*	106	80.00
Bushy-tailed woodrat	*Neotoma cinerea*	2	1.52
Meadow vole	*Microtus pennsylvanicus*	7	5.30
Common muskrat*	*Ondatra zibethicus*	1	0.76
North American porcupine*	*Erethizon dorsatum*	1	0.76
Bobcat*	*Lynx rufus*	1	0.76
	TOTAL	**132**	

Table 10. Seventeen mammals documented at Florissant Fossil Beds National Monument (FLFO) in 2004. Asterisks denote species that were observed or signs of their presence were noted but were not trapped or captured. Values for percent capture are calculated by number of animals per species, divided by total number of animals documented, then multiplied by 100 and rounded to the nearest one-hundredth (e.g., *Peromyscus maniculatus* = 208/ 236 * 100 = 88.14%).

Species at FLFO	Scientific name	No. of animals documented	% Captured or documented
Western small-footed myotis	*Myotis ciliolabrum*	1	0.42
Long-eared myotis	*Myotis evotis*	1	0.42
Long-legged myotis	*Myotis volans*	1	0.42
Hoary bat	*Lasiurus cinereus*	2	0.85
Silver-haired bat	*Lasionycteris noctivagans*	1	0.42
Least chipmunk	*Neotamias minimus*	1	0.42
Golden-mantled ground squirrel	*Spermophilus lateralis*	1	0.42
Richardson's ground squirrel*	*Spermophilus richardsonii*	1	0.42
Gunnison's prairie dog*	*Cynomys gunnisoni*	1	0.42
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	1	0.42
Abert's squirrel*	*Sciurus aberti*	1	0.42
Northern pocket gopher	*Thomomys talpoides*	1	0..42
Deer mouse	*Peromyscus maniculatus*	208	87.76
Meadow vole	*Microtus pennsylvanicus*	13	5.48
Common muskrat*	*Ondatra zibethicus*	1	0.42
North American porcupine*	*Erethizon dorsatum*	1	0.42
Coyote*	*Canis latrans*	1	0.42
	TOTAL	**237**	

APPENDIX I

Topographic maps (A-I) of Great Sand Dunes National Park and Preserve with waypoints of trap sites or observation records noted as shaded circles. Corresponding waypoints and locality descriptions are listed below.

Waypoint	Locality description
GRSA1a	~1.2 mi SW of HQ, Sand Sheet
GRSA2a	~1.2 mi SW of HQ, Sand Sheet
GRSA3	~1.2 mi SW of HQ, Sand Sheet
GRSA4a	E. of Castle Creek
GRSA5	Castle Creek
GRSA6a	Denton Spring
GRSA6b	W and down slope of Denton Spring
GRSA7	Medano Creek near crossing #2
GRSA8a	S side of Medano Creek
GRSA9a	W side of Mt. Zwichen, E of Medano Creek
GRSA10	Medano Creek crossing #3, near campsite 0.9
GRSA11a-c	PJ woodland SE of amphitheater
GRSA12a	Rocky slope W of Medano Creek
GRSA13a	Grassy Meadow
GRSA14	Medano Creek crossing #4
GRSA15	On road by campsite 1. 6
GRSA16	By road near Medano Creek crossing #3
GRSA17a-b	Sandy pine ridge
GRSA18	Medano Creek crossing by cabin
GRSA19a-b	W side of Mt. Zwichen
GRSA20	.064 mi E of GRSA monument boundary from road
GRSA21	Medano Creek crossing # 2
GRSA22a	Riparian area of Medano Creek, S of VC
GRSA23a	ENE of Well house #4
GRSA24a-b	SE facing slope of Mt Herard, NW of Medano Creek
GRSA25a-b	SE facing slope of Mt Herard, NW of Medano Creek
GRSA26	Medano Creek by crossing #3
GRSA27a-b	Riparian area along Medano Creek, by campsite 1.6
GRSA28a-b	Forest W of campsite 1.6
GRSA29	Base of SE facing slope of Mt. Herard by Medano Creek crossing #4
GRSA30a-b	NNW of Campsite 3.5
GRSA31a-b	Beaver ponds along Medano Creek, N of campsite 3.5
GRSA32a-b	.32 mi NW junct of rd to Medano Pass and Medano Lake trailhead
GRSA33a-b	E. of campsite 3.2
GRSA34a-b	W of campsite 3.2
GRSA35a-b	E of campsite 3.8
GRSA36a-b	East of campsite 1.6
GRSA37a-b	Slope SE of campsite 1.6
GRSA38a-b	Grassy valley east of campsite 1.6
GRSA39	Pond at campsite 2.2
GRSA40	Medano Creek crossing # 5
GRSA41a-b	W of campsite 5.1
GRSA42a-b	W. of campsite 5.1 and over 10,000 ft ridge

APPENDIX I (cont.)

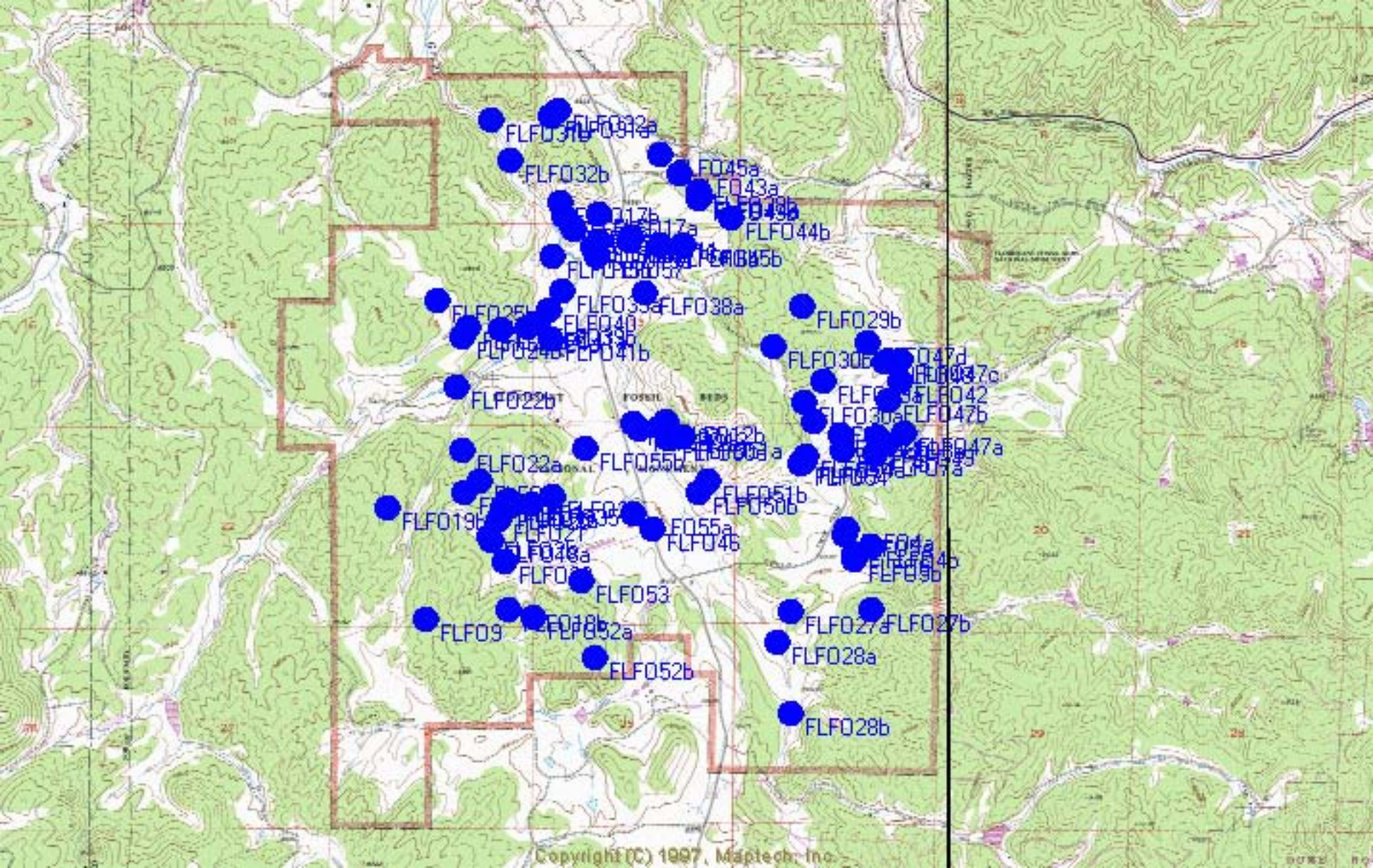
Topographic maps (A-I) of Great Sand Dunes National Park and Preserve with waypoints of trap sites or observation records noted as shaded circles. Corresponding waypoints and locality descriptions are listed below.

Waypoint	Locality description
GRSA43a-b	W. of campsite 5.1 and over 10,000 ft ridge
GRSA44a-b	E. facing slope, W of campsite 5.1 and over 10,000 ft ridge
GRSA45a-b	Forest W of rd towards Mosca Pass
GRSA46	Pond at campsite 2.2
GRSA47a-b	W. of campsite 2.2
GRSA48a-b	Aspen and conifer forest W of campsite 2.2 and north, parallel to road
GRSA49	Medano Creek crossing # 6
GRSA50	Road by grassy meadow
GRSA51	By parking lot of trailhead
GRSA52	Pinyon Flats Campground, loop 2

APPENDIX II

Topographic maps (A, B) of Florissant Fossil Beds National Monument with waypoints of trap sites or observation records noted as shaded circles. An estimated 85-90% coverage from work conducted in 2003. Corresponding waypoints and locality descriptions are listed below.

Waypoint	Locality description
FLFO1a	Ponderosa/Aspen woodland E of A-frame
FLFO2a-b	Grassy drainage N of A-frame
FLFO3	Pond by Cusack Potato Barn
FLFO4a-b	0.43 mi SE of Cusack Potato Barn
FLFO5a-b	0.43 mi SE of Cusack Potato Barn
FLFO6	Large pond E of Cusack Potato Barn
FLFO7a-b	Ponderosa woodland on hill N of Barksdale Picnic area
FLFO8a-b	Creek/Valley W of Barksdale picnic area
FLFO9	0.81 mi SW of A-frame
FLFO10	Base of hill E of Maytag Building
FLFO11	Pond N of Hornbek Homestead
FLFO12a-b	Base of hill E of Maytag Building
FLFO13	Pond N of Maytag Building
FLFO14a-b	Ridge NNE of pond at Cusack Potato Barn
FLFO15a-b	SE of Hornbek house
FLFO16a-b	Pond and hill N of Hornbek Homestead
FLFO17a-b	Ridge W of Hornbek Homestead
FLFO18a-b	SW of A-frame
FLFO19a-b	W of A-frame
FLFO20	Forest SW of A-frame
FLFO21	Pond W of A-frame
FLFO22a-b	0.5 mi NW of VC
FLFO23	0.73 mi SW of VC
FLFO24a-b	0.61 NNW of VC
FLFO25a-b	0.61 NNW of VC
FLFO26	Road to A-frame
FLFO27a-b	Ridge SE of Lower Twin Rocks Road and Teller 1 junction
FLFO28a-b	Drainage S of Lower Twin Rocks Rd, E of Teller 1
FLFO29a-b	E of VC, NE of Cusack Potato Barn
FLFO30a-b	1000 ft N of Cusack Potato Barn
FLFO31a-b	Grape Creek, ~1.5 mi NNW of VC
FLFO32a-b	Grape Creek, ~1.5 mi NNW of VC
FLFO32a-b	Grape Creek, ~1.5 mi NNW of VC
FLFO33	Pond 0.2 mi NW of Hornbek
FLFO34	Prairie Dog colony S of Hornbek Homestead
FLFO35	A-frame
FLFO36	Hornbek Homestead
FLFO37	Maytag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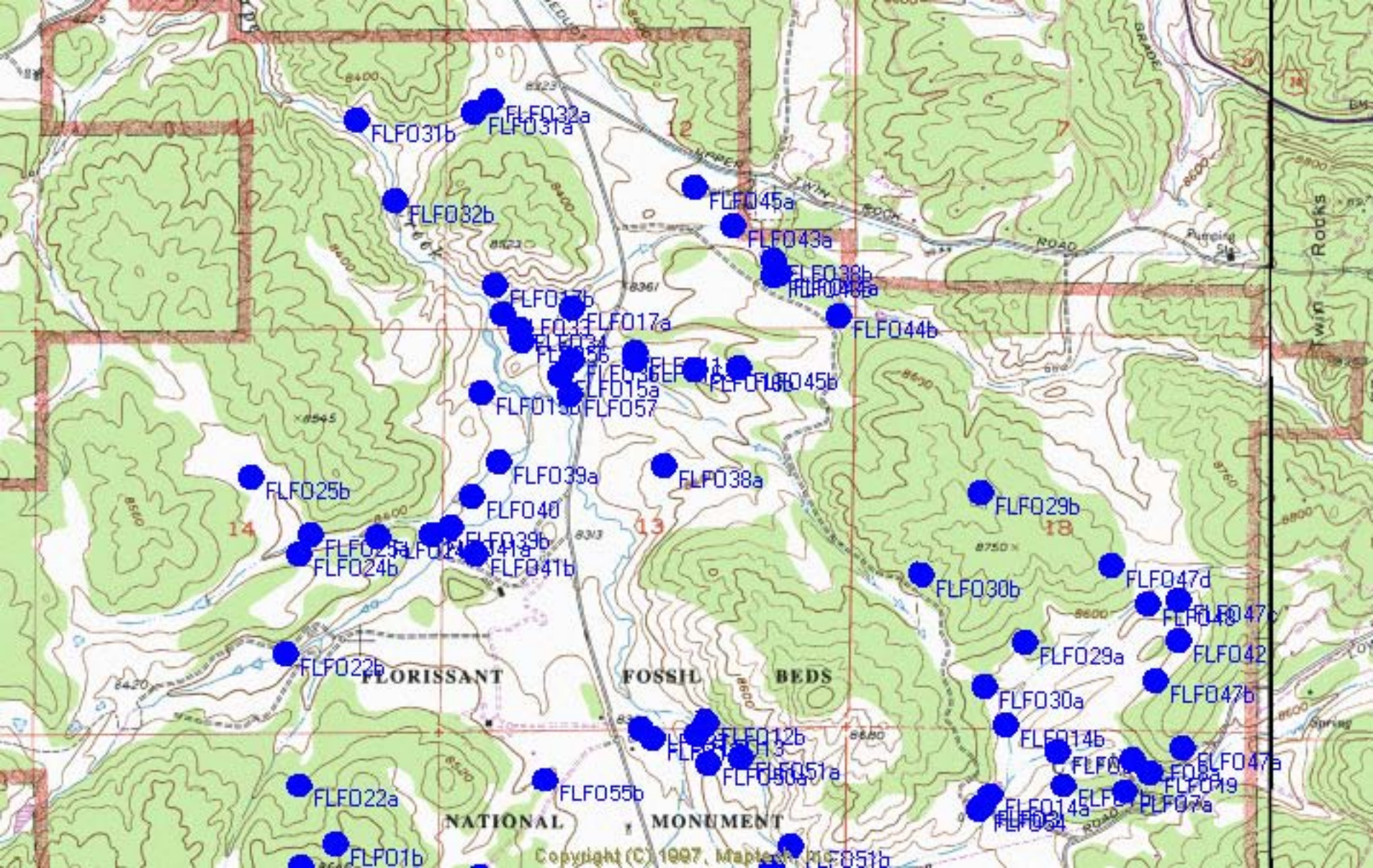
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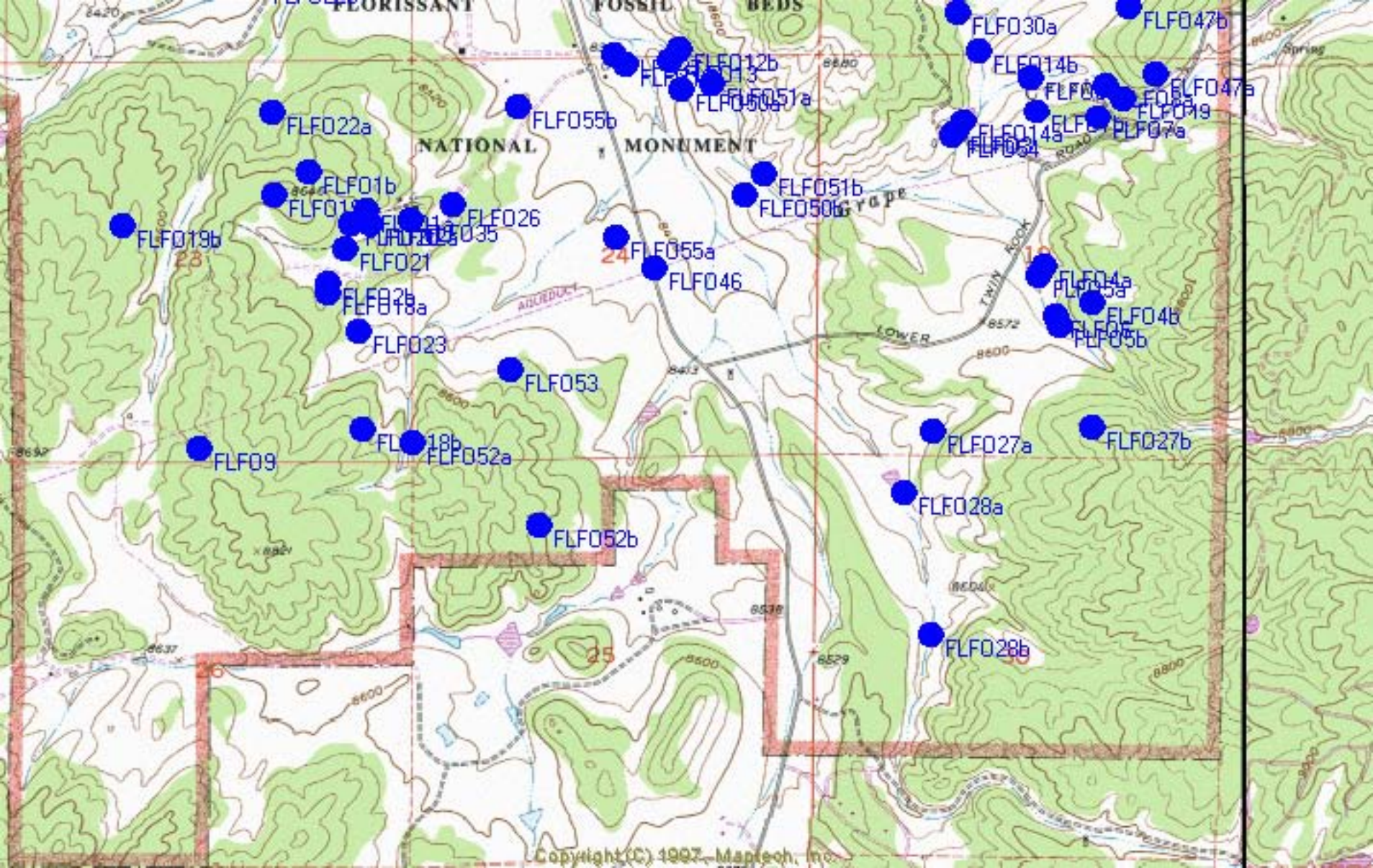
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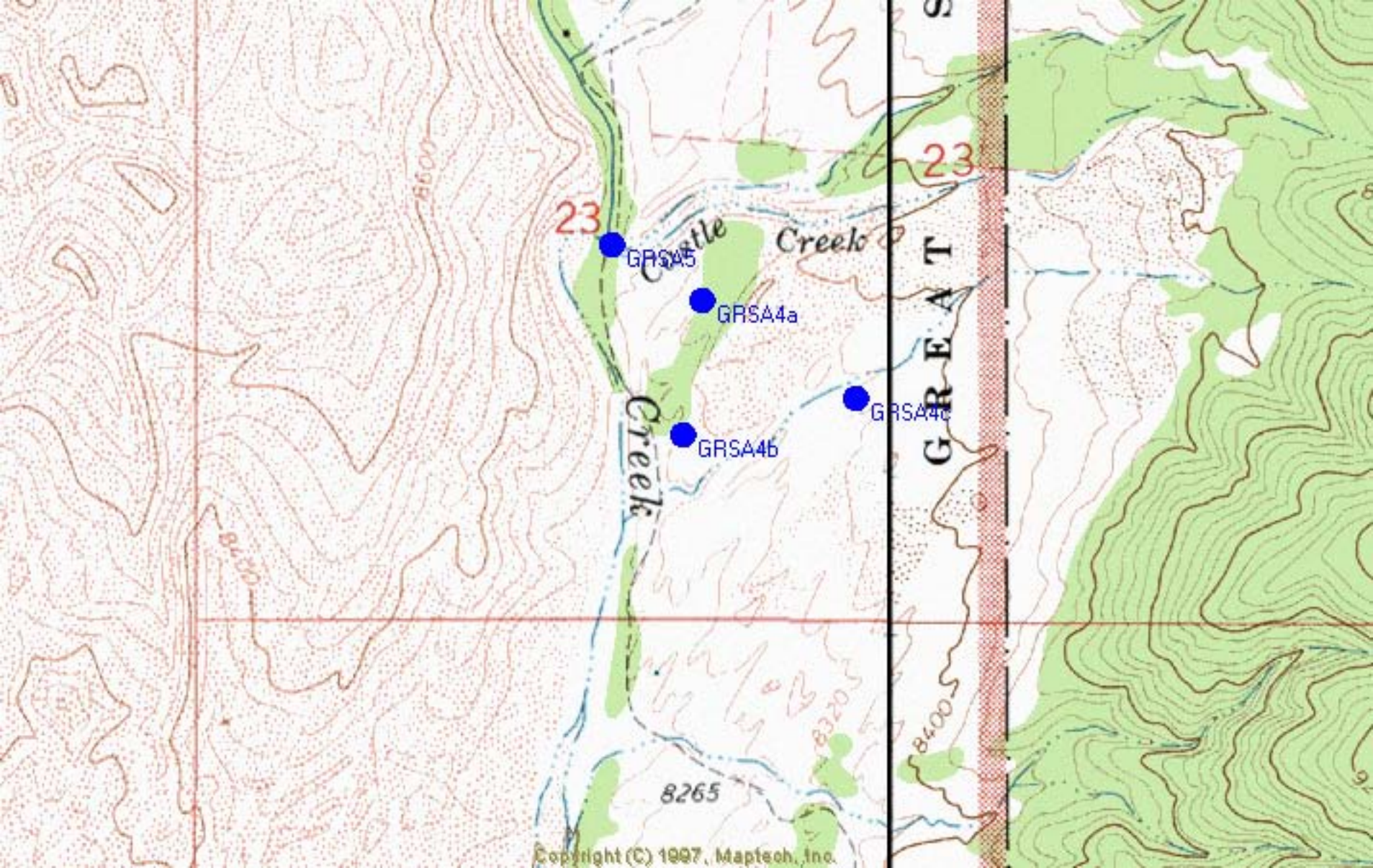

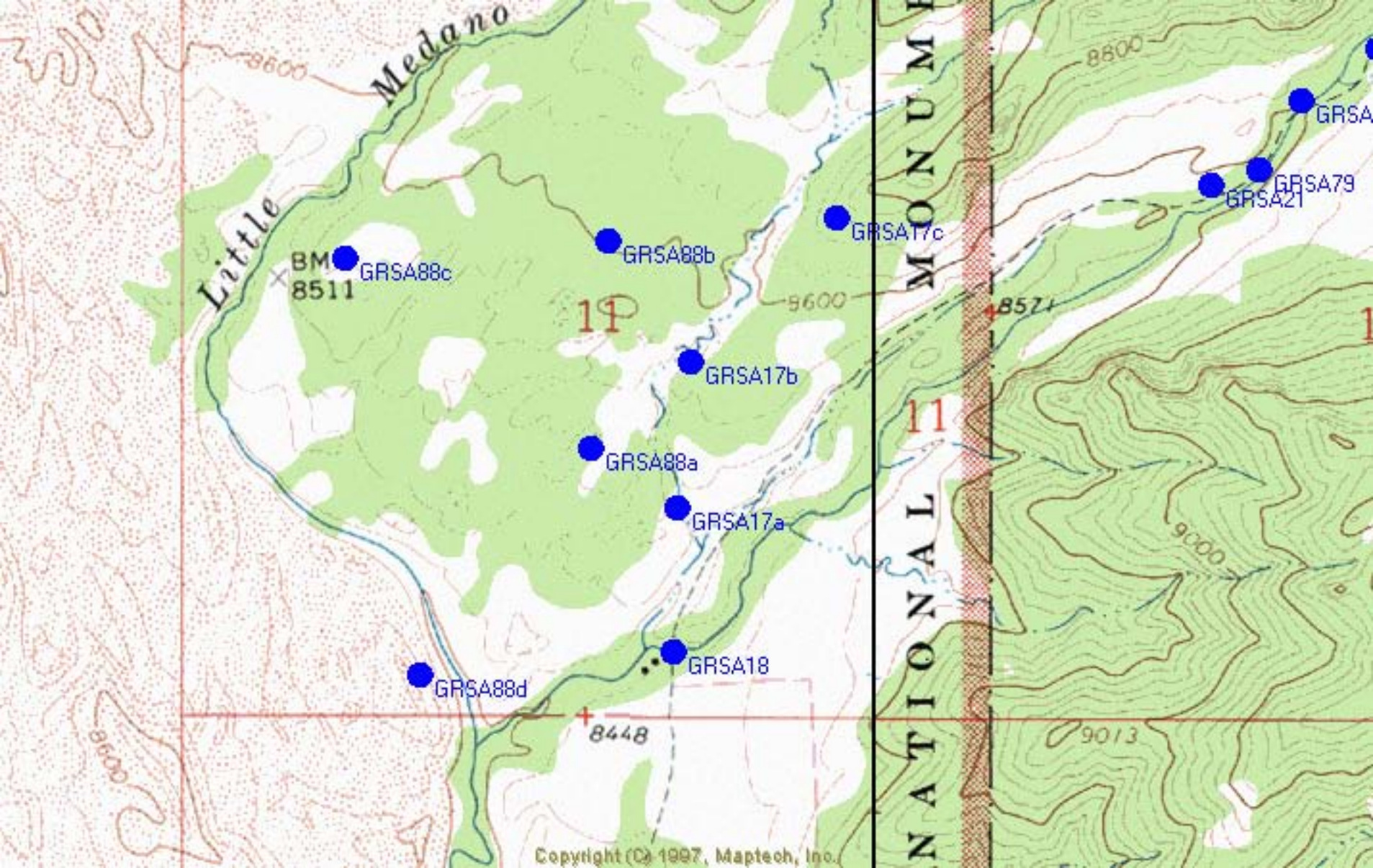
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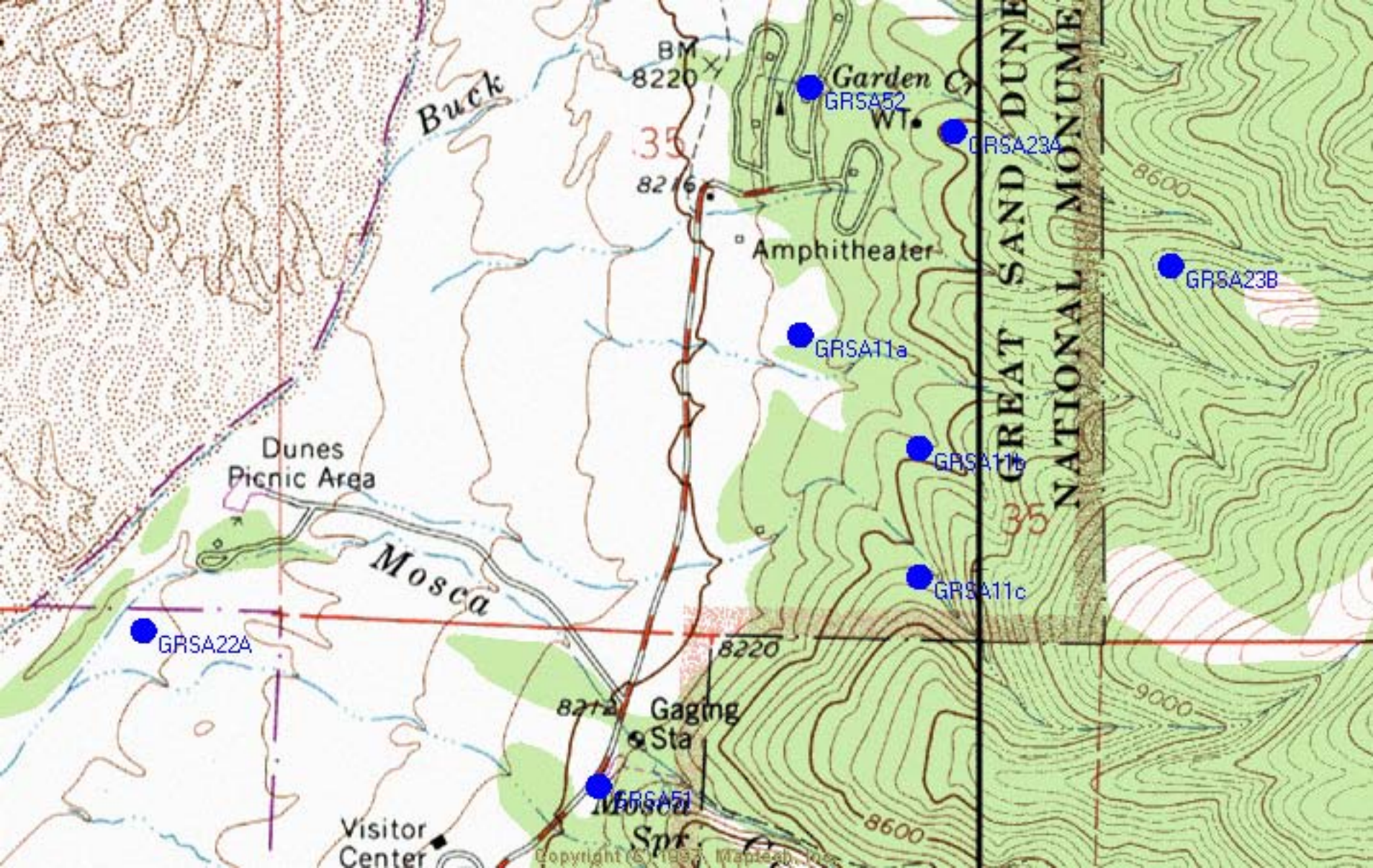
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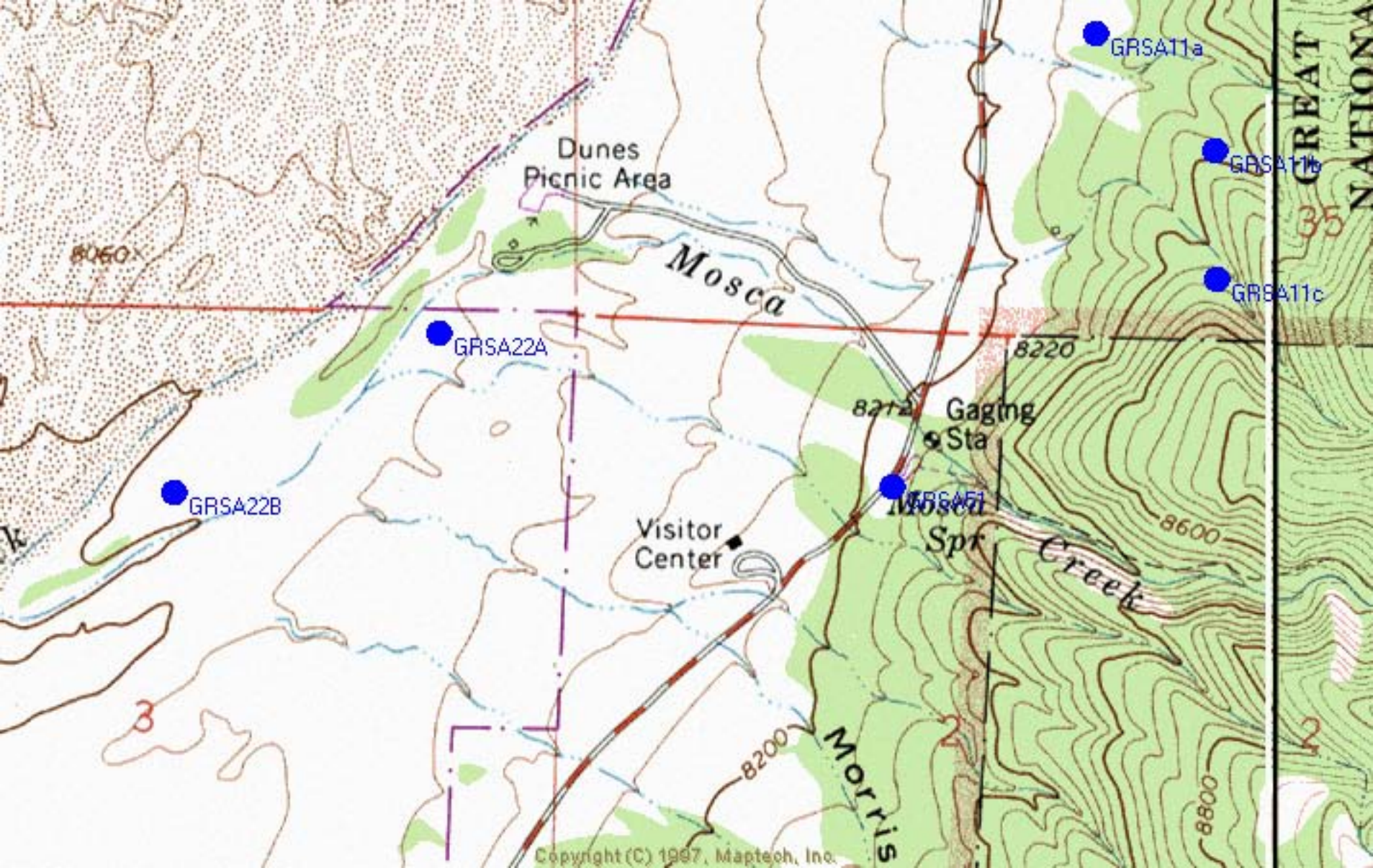
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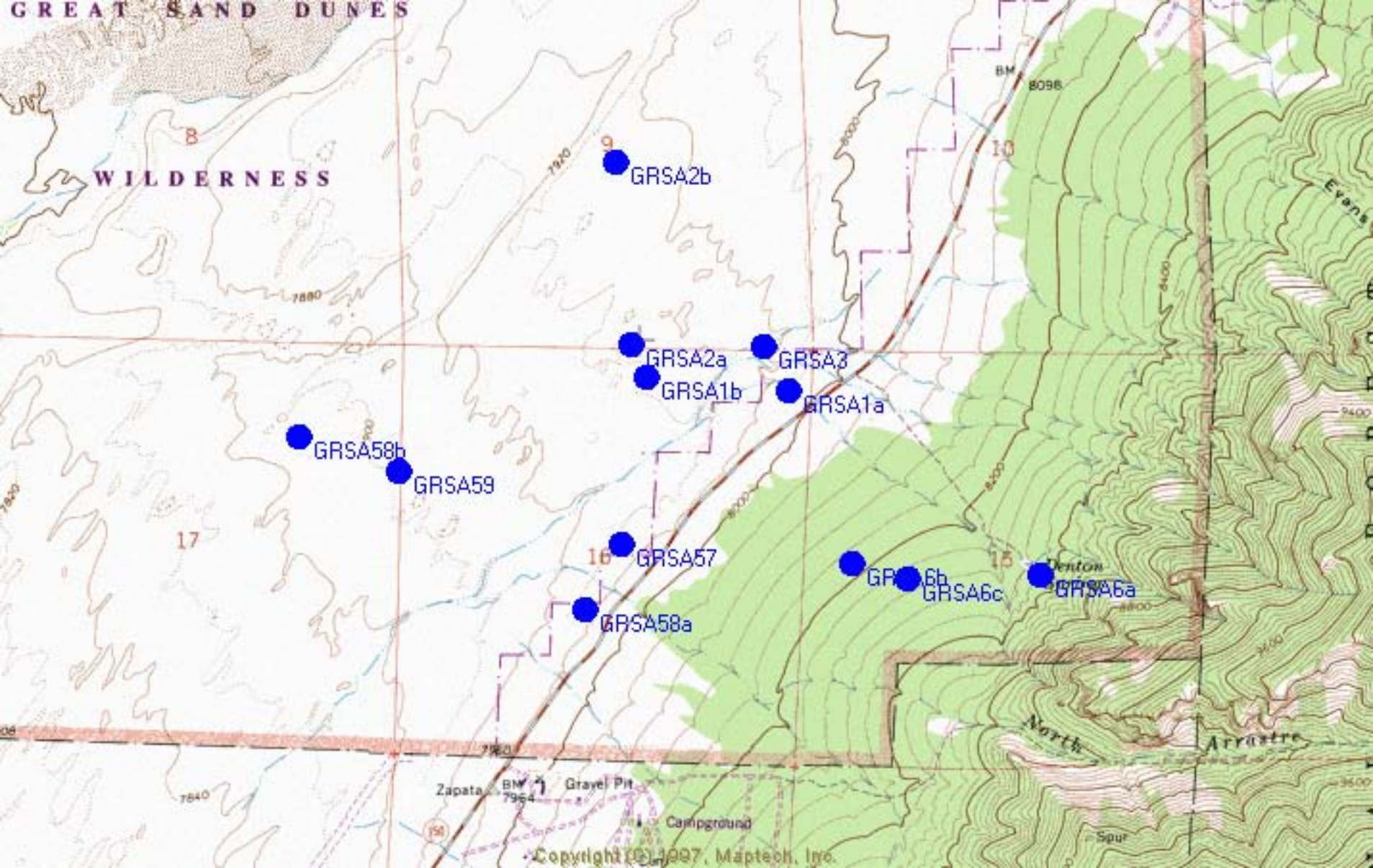
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Gravel Pit
Campground
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