Final Report: Vertebrate Fauna and Terrestrial Vegetation of Rainbow Forest Wilderness Area Petrified Forest National Park, Arizona

November 2007

Erika M. Nowak, Jessa F. Fisher, Jan V. Hart, and Trevor B. Persons

USGS Southwest Biological Science Center
Colorado Plateau Research Station
Box 5614 Northern Arizona University
Flagstaff, Arizona 86011

INTRODUCTION

In the past decade, several vertebrate and plant surveys have been conducted at Petrified Forest National Park. These included reptiles and amphibians (Drost et al. 2001, Persons 2001), birds (Banks and van Riper 2001, van Riper et al. 2006, van Riper and Lamow 2006), mammals (Bangert 1998, Ramotnik and Bogan 1998), and vascular plants (Thomas et al. 2003, Hansen and Thomas 2006). However, few of these surveys were conducted in wilderness areas in the park, and thus gaps existed in the knowledge of the park's resource base. These gaps became especially apparent as the park began planning for wilderness management. Additional plant, animal, and paleontological surveys were needed in the wilderness areas of the park to complete the planning process. An area of particular concern is the Rainbow Forest Wilderness Area, due to its proximity to areas of heavy visitor use.

To assist with completion of resource knowledge in the Rainbow Forest Wilderness Area, we conducted surveys in the Rainbow Forest for herpetofauna, birds, and mammals in 2003-2005, and for terrestrial plants in 2005. Our objectives were:

1) Conduct low-impact surveys of the vascular plants, herpetofauna, birds, and mammals of the Rainbow Forest Wilderness Area.
2) Record the location coordinates for species of special concern, amphibian breeding areas, and trapping areas.
3) Produce a final report at the end of the surveys, listing species present, describing temporal and spatial distribution and relative abundance of each species, noting the presence of rare or sensitive species, and discussing management implications.

METHODS

For all taxa, areas searched, trap locations, and survey routes were recorded with GPS point locations, as were locations of sensitive species and habitats. GPS data were obtained with a handheld Garmin GPS unit, and all UTM coordinates were collected in NAD27 Datum. Maps of survey and trap locations may be found in Persons et al. (2003), and Nowak et al. (2005).

Mammals. We surveyed for mammals during sampling sessions between April and September each year. For capture of small mammals, we used Sherman live traps (Jones et al. 1996). During each sampling session we established transects of 59-100 traps each (with traps spaced 10-15 m apart). Traps were baited with rolled oats and opened on two consecutive nights. Traps were checked in early morning, to prevent exposure of captured animals to excessive heat, and remained closed during the day. Transects followed natural habitat corridors (e.g. washes, ridges, shrub lines, dunes) or cut through multiple microhabitats, in order to maximize the number of species detected. Transects generally changed direction every 10 or 20 traps, in order to keep within optimal habitats. During one session in 2003, a 3x20 grid was employed, with three transect lines 15 m apart, each line approximately 300 meters long, with 20 traps per line. Medium and large mammals were recorded opportunistically throughout the study period.

Birds. We surveyed for birds using purposive area searches (Ralph et al. 1993) for both breeding and non-breeding species. Low bird abundance in the areas we visited would have rendered time-consuming strip transect surveys (e.g. Ralph et al. 1993) unproductive, given the primary goal of producing wilderness area-specific species lists and recording details on any special concern species. Area searches were targeted to sample potential "hot spots" with rare species or those new to the Park. Our sampling sessions for birds were conducted near small mammal trap lines (see above), and carried out over two to three days.

Herpetofauna. We primarily used visual encounter surveys to detect herpetofauna. Visual encounter surveys are extremely effective at detecting active, conspicuous lizards as well as amphibians at breeding areas (Drost et al. 2001, Crump and Scott 1994). These surveys entail walking through a defined area and recording all animals observed, as well as their sex and age. Animals were occasionally captured (by hand or noosing) for photography and body measurements. Surveys for diurnal lizards were conducted between 0700 and 1200 hrs and for nocturnal amphibians and snakes between 1900 and 2100 hrs. These methods have been used successfully for detecting and assessing the relative abundance of common species, as well as for detecting rarer herpetofauna throughout the southern Colorado Plateau region by Drost et al. (2001), Drost and Nowak (1997), and Persons and Nowak (2006). Our sampling sessions for herpetofauna were either carried out in conjunction with small mammal trapping over 2-3 days trapping (see above), or in separate 2-3 day sessions.

During every session in July and August (after the onset of the summer monsoon), we conducted night driving on the park road running alongside the wilderness boundary (ca. 0.25-0.5 mile east of the road) between mile markers 17 and 26. This survey method consists of driving a vehicle along a road at speeds between 20-30 mph and recording all herpetofauna seen on or alongside the road. This technique has ecological relevance for our study; that is, most of the reptiles or amphibians seen on the road were capable of having activity ranges that potentially extended into the wilderness area. This supplemental survey type is especially important for hard-to-detect snake species (e.g. Persons and Nowak 2006).

In addition to these field surveys, we compiled species lists of amphibians and reptiles occurring in or near the Rainbow Forest Wilderness Area by reviewing data from a previous herpetofauna inventory at Petrified Forest (Drost et al. 1999; Drost et al. 2001).

Terrestrial Vascular Plants. We conducted targeted surveys for vascular plants in the Rainbow Forest wilderness in 2005. Although these surveys provided a general overview of plant communities in the wilderness area, they primarily consisted of targeted searches for rare plants. In addition, in the course of plant surveys we documented the presence of sensitive habitats (e.g. microbiotic soil crusts) that were of special management concern to the park.

For the pre-monsoon sampling, we divided up the Rainbow Forest Wilderness Area into manageable sections for each daily plant survey, heading roughly from north to south. We traversed the days' section, making note of every new species we came across. Most species were collected and pressed using full-sized herbarium-quality plant presses. GPS coordinates were taken for plant locations when specimens were collected (Appendix 3). Special land features, which might yield unique plant species, such as sand dunes, mesas, and washes, were thoroughly

investigated. The same protocols were followed for the monsoon season sampling. Because most plants had already been collected, for certain areas and plant communities we did not collect plants, but simply recorded which species were present in an area and took a GPS reading of that particular community. Information for all plant specimens collected, as well as community descriptions and UTM coordinates of survey locations separate from plant collection sites, can be found in an electronic Microsoft Office Access 2003© database entitled *PEFO Rainbow Forest Wilderness Plant Survey 2005_Fisher.mdb*. This database may be made available at the discretion of Petrified Forest National Park.

Sampling Locations and Survey Dates.

Mammals. In 2003, we made three sampling visits (Table 1). Visits on May 7-9 and July 23-25 were focused primarily on small mammal trapping and area searches for birds and reptiles. The May 7-9 trapping transect (Mammal Session #1) was located near Dry Wash east of Agate Bridge, with 60 traps (Appendix 1 and Persons et al. 2003). During the session on July 23-25 (Mammal Session #2), the transects were located in the "woodland" area ca. 0.25 mile east of the main park road at milepost 24, southwest of the Flattops (Appendix 1 and Persons et al. 2003). These transects were set in a 3x20 grid pattern (see above), with 59 traps operable.

In 2004, we made two sampling visits focused on mammals: June 9-11 and August 24-26 (Table 1). The mammal trapping transect on June 9-11 (Mammal Session #3) was located near Dry Wash southeast of Agate Bridge, (south of the Dry Wash sampling site in 2003), and on the first night consisted of 79 traps (Nowak et al. 2005). On the second night, this transect was extended by adding an additional 29 traps to the northern end, to target adjacent fine sand habitat. The trapping transect on August 24-25 (Mammal Session #4) was located along the Puerco Ridge area, about 1.2 km ESE of the start-point for the June transect (Nowak et al. 2005). The July transect consisted of 93 traps: we added three large traps on the second night at an outcrop 120 m east of the transect's northern terminus, where woodrat sign was present.

In 2005, we made two sampling visits focused primarily on small mammal trapping and area searches for birds and reptiles (Table 1). The first sampling visit (Mammal Session #5) was on April 22-24, in two locations in or near Cottonwood Wash east of Agate House Ruins. The second sampling visit (Mammal Session #6) on July 5-7, was located near the middle of the wilderness area, in its farthest east corner.

Birds. Birds seen or heard were recorded opportunistically in conjunction with other surveys during almost every sampling visit (Table 1).

Herpetofauna. In 2003, one visit (August 31-September 1) focused on reptile and amphibian surveys (Table 1 and Persons et al. 2003). This visit was located east of the Flattops and Crystal Forest. In 2004, visits focusing on reptiles and amphibians occurred on July 7, August 9-11 and August 28-30 (Table 1). These visits were located on the park road adjacent to the wilderness area, southeast of Crystal Forest, and in the southwest and northwest corners of the wilderness area (Nowak et al. 2005). In 2005, one visit from September 3-5 at the south end of the wilderness area focused primarily on reptiles and amphibians (Table 1).

Terrestrial Plants. The additional winter and spring moisture made 2005 an excellent year to review the Rainbow Forest Wilderness Area flora and determine if the environmental conditions produced any new plants that had not been previously collected in the park. Two visits were carried out in 2005, for a total of 23 days (Table 1). The first two weeks were in early summer (pre-monsoon), from May 18-June 1. The last two weeks of sampling covered the late summer monsoon season, from August 22-September 5. During these visits, four days were spent in the PEFO museum collections' herbarium. One day spent was spent in conjunction with the reptile and amphibian survey crew (Table 1). Specific dates and locations for surveys and plant collection sites are listed in Appendix 3.

Most of the plants we documented have been identified to species, and several to a distinct variety or subspecies. A few entries have only been identified to genus because flowering parts or other parts necessary for identification to species were not present. A specimen of almost every plant was collected and the collection location was marked with a GPS point (Appendix 3). This information can be found in the Microsoft Office Access 2003© database *PEFO Rainbow Forest Wilderness Plant Survey 2005_Fisher.mdb*, as well as other pertinent information such as common name, general location of the plant, soils, and notes accompanying the collection. Specimens are currently being stored un-mounted in the Petrified Forest Museum collections.

RESULTS AND DISCUSSION

Weather Conditions

Overall, our surveys were conducted during a long regional drought (Webb et al. 2004), likely depressing sightings of birds and amphibians, in particular. In 2003, the winter and spring months (December 2002-March 2003), and summer rain months (July-August) all had below average precipitation (Western Regional Climate Center 2007). Persistent drought conditions, and cold weather during spring surveys, resulted in very few observations of even normally abundant species in 2003. In 2004, the winter and spring months again had below average rainfall, but the summer months had above average rainfall. In the winter months of 2004, an El Nino weather pattern brought substantially above-normal rainfall, which continued into the spring of 2005 (Western Regional Climate Center 2007). These conditions resulted in lush early summer vegetative growth, but perhaps contributed to reduced sightings of small mammals in subsequent surveys, a pattern seen in the Verde Valley of Arizona as well, where rodent numbers went from hundreds per trapping grid in September 2004 to none in the same grids in May 2005 (Nowak et al. in preparation). Herpetofauna sightings as well as mammal captures were very low during the unusually cold and rainy April 2005 surveys. Rainfall during the summer of 2005 was again below normal, but plants appeared to be still reaping the benefits of the previous season's rain (Figure 1).

Mammals

The greatest richness of small mammal species in the Rainbow Forest Wilderness was trapped in woodland (juniper) habitats (e.g. during Session #2), while the greatest abundance of small mammals was detected in mixed rocky and wash habitats (Session #4; Table 2). The least richness and abundance of small mammals (two captures of two species) came in 2005 in sandy

dune and grassland habitat in the southeast corner of the wilderness area; however this result almost surely was complicated by unknown environmental factors depressing regional mammal populations. During the same period, Nowak (unpublished data) documented a sharp decline in mammal populations at Montezuma Castle National Monument in Yavapai County. Those declines were hypothesized to perhaps be due to an abnormally wet winter and spring causing lush growth of non-native grasses (e.g. *Bromus* spp.). A bloom of non-native grasses was not the case at Petrified Forest; instead the native bunchgrasses were as lush as we had seen them during this survey. Perhaps the apparent small mammal population crash in the wilderness area was due to abnormally cold and wet spring conditions, as noted during the April tapping session.

Based on our trapping results for each session (Table 2), we estimated occurrence for each small mammal species: common (C)= >50% of captures; frequent (F)= 25-50% of captures; occasional (O)= 6-25% of captures; and rare (R)= $\leq$ 5 % of captures). We estimate that overall in the Rainbow Forest Wilderness Area, western harvest mice are common, deer mice and Plains pocket mice are frequently seen, Ord's kangaroo rats and northern grasshopper mice are occasional, and white-tailed antelope ground squirrel and silky pocket mice are occasional to rare. Within juniper habitats only, pinyon mice are common, and woodrats are rare. However, these estimates are likely biased by the trappability of different species; for example, it is likely that woodrats are actually fairly common within rocky and treed habitats, and antelope ground squirrels are more likely in more open areas.

In addition to small mammals captured during trapping, we detected 12 other, generally larger, species during sampling sessions (Table 3). We recorded mammals and mammal sign at the trapping sites and other areas surveyed. Detection methods ranged from visual sightings to bone, track, burrow, and scat observations. It is not possible to make estimates of abundance for larger mammals comparable to those based on individual animal sightings, without repeated surveying of transects.

Woodrats and pinyon mice were strongly associated with treed areas and rock outcrops, and are unlikely to be found far from these structural features. Conversely, kangaroo rats and pocket mice were most likely to be associated with open sandy habitats; and pocket gophers in open habitats with some clay (e.g. floodplains of washes). Although we expected that porcupines would be strongly associated with junipers and/or rock outcrops, in fact one sighting of tracks was from in a dry sandy wash relatively far from those features.

Our trapping and visual survey results were similar in species composition to those conducted previously in other areas of the park (Bangert 1998, Ramotnik and Bogan 1998, Nowak unpublished data); that is, most of the mammal species expected in the Rainbow Forest Wilderness Area were trapped there during this survey. However, we failed to detect some species suspected or known from other areas of the park, including brush mouse (*P. boylei*), white-footed deer mouse (*P. leucopus*), active prarie dog colonies, and black bear (*Ursus Americana*; reported from the juniper area SW of the Flattops by park staff before our surveys). We also did not detect any bats. We did not find any unique mammal species in the wilderness area, but confirming the presence of relatively shy mesocarnivores like bobcats and grey fox is significant.

Birds

Much of Petrified Forest, including the Rainbow Forest Wilderness, consists of very open, sparse short grass habitats, and bird species diversity and abundance would be expected to be low in such habitats. However, we detected at least 35 species of birds during our suveys (Table 4). Bird detections during mammal trapping sessions in 2003 and 2004 were combined with observations in 2005 to give a relative index of abundance (occurrence) during the survey period (Table 4). Common (C)= seen during >50% of surveys; frequent (F)= seen during 25-50% of surveys, occasional (O)= seen during 6-25% of surveys; and rare (R)= seen during $\leq$ 5 % of surveys. Rare species are likely migrants, with the possible exception of canyon wren, while common and frequent species tend to be summer residents at the park. The most common resident birds in the wilderness area were horned lark, raven, rock wren, kestrel, and mourning dove. The majority of migrants appeared to be warblers and some sparrows. It is likely we have underestimated the occurrence of some apparently rarer species such as eastern meadowlark and spring and summer migrants. We detected canyon wren on one occasion, a species which van Riper and Lamow (2006) suspected had been extirpated from the park.

Although no owls were seen, several times we observed owl pellets and feces under large juniper trees or at the base of rock outcrops. Fom their size and the habitat we judged most of these to be from great-horned owls; however other owl species (e.g. long-eared and barn owl) are also possible. We did not find any evidence of burrowing owls, and this result may be closely related to not finding active prairie dog colonies in the wilderness area (Bangert 1998).

A number of less-common species were detected outside the wilderness close to Agate Bridge, including ash-throated flycatcher, “western” flycatcher (probably cordilleran), MacGillivray’s warbler, Wilson’s warbler, chipping sparrow, blue-gray gnatcatcher, and northern mockingbird. Given the vagility of birds, it is possible that these species also entered the wilderness area.

Habitat associations can be estimated for species with multiple sightings. While some bird species did not seem to favor particular habitats, others appeared more limited in their distribution. Species associated with rock outcrops included rock wrens, and owls. Sage sparrows appeared to be limited to shrub habitats along the eastern border. As a group, warblers and other likely migrants appeared to be limited to larger washes.

While all bird species we observed in the wilderness area have been documented in other areas of the park, two species are of management interest. On September 1 2003, we observed a flock of 20-25 scaled quail during a survey east of Crystal Forest. This observation is significant, as to our knowledge the species is only known at Petrified Forest from the northern part of the park, in the headquarters area. The second notable sighting was the likely pair of peregrine falcons from the southeast corner of the park in 2005. This species was formerly listed on the federal endangered species list and is considered a species of special concern in Arizona (Arizona Game and Fish Department 1998).

Reptiles and Amphibians

We detected a total of 14 species of reptiles and amphibians in or immediately adjacent to the wilderness area, including six lizard species, four snake species, and two or more amphibians (Table 5). We surveyed a total of 162 miles (261 km) of road adjacent to the wilderness area over eight nights. We found three species of snakes and three amphibians using this method (Table 5); all of these species likely enter the wilderness area.

Most species of reptiles and amphibians that were detected multiple times did not have strong habitat associations (Table 5), with three exceptions. Side-blotched lizards appeared to be patchily distributed near rocky areas, similar to those animals found by Drost et al. (2001), and eastern fence lizards were most common in habitats with vertical structure (rocks or trees). Amphibians were only found in washes or on the park road during the summer rains.
While lesser earless lizards are distributed throughout the park, we noticed that animals from the population living in the sand dunes on the eastern boundary of the park appeared to be larger, have less dorsal pattern and overall were more orange than animals seen from other parts of the park. The significance of these differences is not known; it may reflect local adaptation to the dune environement, or simply reflect founder effects caused by chance mutation.

We did not find any particularly sensitive species of reptiles or amphibians during our surveys of the wilderness area. We found a number of spadefoot toad tadpoles of unknown species in Dry Wash and Cottonwood Wash. GPS coordinates (in NAD 27 Datum) for these important amphibian breeding areas are: 606180E, 3852447N (2004; Cottonwood Wash), and 606582E, 3852390N (2005; Dry Wash).

Previous Herpetofauna Inventory. By reviewing data from a previous herpetofauna inventory at Petrified Forest (Drost et al. 1999; Drost et al. 2001), we were able to construct a more complete species list of amphibians and reptiles occurring in the Rainbow Forest Wilderness Area. During that inventory (1997-1998), we conducted only limited surveys in the wilderness area, including the areas northeast of Cottonwood Wash (Section 7), the “woodland” just east of milepost 24 and SW of the Flattops (where one of our 2003 small mammal trap lines was located), the Agate Bridge area, and the “shrub” area near the eastern boundary (Sections 26 and 27). During these surveys, we observed short-horned lizard, eastern fence lizard, sagebrush lizard, and plateau striped whiptail.

More significant, however, was data gleaned from the road driving portion of that inventory. By including data from the 8.9 mile section of the main park road (from milepost 16.6 to 25.5) that runs adjacent to the wilderness area boundary (ca. 0.25-0.5 mile east of the road), we were able to document many additional amphibian and snake species that likely enter the wilderness area. Amphibians included Couch’s spadefoot (*Scaphiopus couchii)*, New Mexico spadefoot, plains spadefoot (*Spea bombifrons)*, Great Plains toad, and WoodHouse’s toad. The WoodHouse’s toad was rare, found only once at milepost 25.5, and in fact during the entire inventory the species was only found in the vicinity of the two park visitor centers and near the Puerco River. Of the known amphibian fauna, only red-spotted toad (*Bufo punctatus*) and tiger salamander (*Ambystoma tigrinum*) were not found in the section of road adjacent to the wilderness area. Tiger salamanders undoubtedly occur somewhere in the wilderness area, but red-spotted toads have a very patchy distribution at Petrified Forest, and may be absent from the wilderness area.

Snakes observed along the section of road adjacent to the wildnerness area included the gopher snake (*Pituophis catenifer*), glossy snake, common kingsnake (*Lampropeltis getulus*), night snake, and western rattlesnake. Only the striped whipsnake (*Masticophis taeniatus*) and the milk snake (*Lampropeltis triangulum*) were not found adjacent to the wilderness area. The whipsnake occurs park-wide, and almost certainly occurs in the wilderness area. Although almost all records of milk snake are from north of the Puerco River, we find it hard to believe that populations do not occur somewhere within the wilderness area, particularily away from the road near the eastern park boundary. In this area the grassland and shrubland is better developed on deeper sandy loam soils, characteristic of the species' habitat north of the Puerco River.

Plants

Spring of 2005 was particularly wet in comparison to recent spring seasons in northern Arizona and Petrified Forest received higher amounts of rainfall than in recent years. This produced an abundance of spring annuals, carpeting the Painted Desert in a kaleidoscope of brilliant color. We noted a total of 226 distinct plants during the two vegetation sampling sessions (Table 6). This compares to 447 plants found in the whole park during the last comprehensive survey (Hansen and Thomas 2006).

Table 6 records how frequently the plant was found to occur in the general location where it was collected. Common plants are noted with a (C), occurring all over the Rainbow Forest Wilderness Area. Frequently seen plants (F) were also seen all over, but might not be considered common because their abundance was lower, or they were only found in specialized habitats (yet always found when that habitat existed). Some plants were only seen occasionally (O). These plants either were seen daily yet with very low abundance, or perhaps only seen rarely yet when they were present there was a fair sized patch of them. The last category is the rare plants (R). These plants were only found one or two times, with low numbers of individuals present.

Rare and Newly Documented Plants. Table 7 shows the plants that were deemed to be rare. It includes the scientific name, common name, occurrence, general location, specific UTM location, and the management concern for the plant. In some cases there was more than one record for an individual species; if so, only one location is listed in this table, but alternate locations can be found in Appendix 3. Also included Table 7 are plants that might not be rare (although often are) but were newly documented species for Petrified Forest National Park; i.e., plants not found in the most recent comprehensive survey (Hansen and Thomas 2006).

Five plants were found to be new records for the park:

<u>Asteraceae</u>
1. *Chrysothamnus baileyi*. Bailey's rabbitbrush. This plant was previously recorded as *C. pulchellus*, or *C. pulchellus* var. *baileyi*, but has since become its own recognized species. It is a mostly glabrous shrub with comparatively large flower heads.

2. *Machaeranthera canescens* var. *aristata*. Hoary tansyaster. This plant differs from other varieties of the species by the fact that the phyllaries and upper stem section is very glandular, and the tips of the phyllaries are green, and rhombic shaped opposed to triangular (McDougall

1973). It was found on the bank of a dry wash in the central wilderness area. It is found in Arizona only in Apache, Navajo, and Coconino counties. It is possible this was misidentified and could be *Symphotricum falcatum.* After exhausting local herbaria resources, we leave confirmation to the next generation of plant reseachers at Petrified Forest.

Cupressaceae

1. *Juniperus osteosperma*. Utah juniper. It was previously thought that all of the junipers in PEFO were the one-seed juniper, *J. monosperma*. However, there are patches of Utah juniper growing just inside the Rainbow Forest Wilderness Area boundary east of the park road, south of Agate Bridge to just south of the Flattops. Utah juniper has a more tree-like form than one-seed juniper, has larger, two-seeded berries, and contains both male and female reproductive units on the same individual.

Ephedraceae

1. Ephedra cutleri. Cutler's jointfir. This species of ephedra is very similar to *E. viridis*, and might not have been considered a separate species when the last flora of the park was done. It is best distinguished from *E. viridis* by its lower-growing form and its viscous stems which often have sand grains stuck to them. It was found growing on sand dunes in the central wilderness area.

Euphorbiaceae

1. *Chamaesyce nutans*. Spotted sandmat. This is a questionable identification due to poor condition of the plant material, and could possibly be instead *C. parryi* or *C. revoluta*. The species is not found in Arizona according to McDougall (1973) or the Deaver Herbarium at Northern Arizona University. It is identified by its spotted leaves. It was found in fine brown sand east of Agate Bridge. After exhausting local herbaria resources, we leave confirmation to the next generation of plant reseachers at Petrified Forest. If it is verified as *C. nutans*, it would be considered non-native to this state. This would also be a new park record.

Non-native Plants. Out of the 226 plants that we documented, there were twelve non-natives and one native which is a regulated noxious weed, *Portulaca oleracea*, or purslane (Table 8). Most of these non-natives do not seem to pose a problem to the park. There were either small numbers of individuals, there is nothing hazardous about their nature, or environmental conditions in the park are not conducive to their expanse. Four plants in particular, though, were found everywhere and should be a serious concern to park management. These are *Salsola tragus* (prickly Russian thistle), *Bromus tectorum* (cheatgrass), *Bromus rubens* (red brome) and *Tamarix chinensis* (saltcedar).

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

The Rainbow Forest Wilderness Area is a spectacular place, not just in terms of geology and archeology, but in terms of its plant and animal diversity as well. The area outside of the park boundary has been altered through water drawdown and livestock grazing (Abruzzi 1995) and thus the wilderness area, specifically set apart from motorized human use and trail development, provides a refuge of diversity in the Painted Desert ecoregion (e.g. Orodho et al. 1990, Leach and

Givnish 1996). Thus, the park may wish to focus on further inventory and monitoring in this area of the park.

Mammals. Prairie dogs are a keystone species in grassland ecosyems; that is, they exert a biotic influence on multiple trophic levels out of proportion to their abundance (Bangert 1998). In northern Arizona, they are also subject to outbreaks of plague, causing colonies to go extinct from one year to the next (Bangert 1998). Recolonization can take at least a few years (Nowak personal observation). We encourage continued surveys, on at least a bi-annual basis, for prairie dog colonies in suitable habitats (e.g. grasslands with short scattered shrubs) and in historic locations in the wilderness area. Any colonies detected should be examined thoroughly to determine if they are active, through indicators such as fresh scat and digging.

Park staff, especially during horse patrols of the boundary, could aid in completion of the mammal species list by recording species or sign they see. Recording opportunisitic sightings in the wilderness will be especially important for large carnivores such as bear and mountain lion, which probably at least pass through the wilderness area on a regular basis. Given the wide-ranging dispersal patterns of reintroduced Mexican wolves (*Canis lupus baileyi*) and Canada lynx (*Lynx rufus*), both of which have been documented in northern Arizona (G. Merrill, Colorado Division of Wildlife, personal communication 2005), attention should be paid to these hypothetical species as well.

Birds. Future monitoring efforts could focus on special concern species such as breeding raptors and burrowing owls (recorded elsewhere in the park). Raptor species of concern include ferruginous hawk, Swainson's hawk, and peregrine falcon. Due to the overall low density of birds in the area, future surveys in spring and fall could also focus on relative "hot spots," such as well-vegetated small washes, that may concentrate both breeding and migrating birds.

Herpetofauna. In addition to protecting and monitoring breeding habitats for amphibians, there are three species of herpetofauna that warrant additional surveys, or at least documentation of opportunisitic sightings. Isolated populations of little striped whiptail (*Cnemidophorus inornatus*), milk snake, and prairie rattlesnake may occur in the wilderness area. The little striped whiptail is known from only two small areas of the park, neither in the wilderness. It appears to be associated with prairie dog colonies and certain grassland and shrubland areas, and is difficult to distinguish from the plateau striped whiptail (Drost et al. 2001). Similarly, the milk snake has not been recorded from the wilderness area (and only once or twice documented south of the Puerco River); however park staff have apparently seen the species at Agate Bridge. Efforts to locate that species could focus on placement of small-gauge wire funnel traps in likely locations of deep sandy loam soil or in burrows.

Lastly, Petrified Forest law enforcement ranger C. Dorn has seen large ($\geq$ 60 cm total length) rattlesnakes while conducting horse patrols near the eastern park boundary (personal communication). Previous surveys have only documented the widespread, small "Hopi" rattlesnake form (formerly *Crotalus viridis nuntius*) from the park (e.g., Drost et al. 2001). Although the larger "prairie" form (*C. v. viridis*) has only been recorded in extreme eastern Arizona (Brennan and Holycross 2006), there is a slight possibility that intergrade populations exist somewhere at or near Petrified Forest. If present, genetic analysis of snakes from such a

population could be valuable to ongoing studies of the evolution and systematics of the *Crotalus viridis* species complex on the Colorado Plateau (e.g. Douglas et al. 2002).

Plants. With frequent monitoring of the Rainbow Forest Wilderness Area, this area could remain a thriving example of the native vegetation communities of the Painted Desert. Rare plants should be monitored at least every five years or when particularly rainy years occur, using the exact GPS locations where our points were taken to check on the status of these rare plants. Grasses with flowering parts should be better collected in future surveys. We encourage the park to mount, label and preserve the herbarium specimens we collected, especially the newly documented plants, for which our identifications should be verified by other experts.

We encourage development of a park-wide program of non-native and invasive plant removal, especially for saltcedar in the wilderness area. This species is present in most washes, but is not yet so abundant that it could not be removed from the wilderness area. It is dubious whether there can be anything done about the two species of *Bromus* or the prickly Russian thistle. This last plant is a concern, particularly on sand dunes where it replaces dune-adapted native vegetation. We recommend vigilantly watching the western wilderness border closest to the road, and also the southern border closest to the south entrance of the park. Several non-natives, including camelthorn, were noticed in the area of the Rainbow Forest visitor center in 2005, and could spread to the wilderness area.

ACKNOWLEDGEMENTS

Leslie Gilmore, Bryan Hamilton, Jason Pilarski, Justin and Tansy Pullins, AJ Monatesti, and Bob Parker assisted with fieldwork for this project. Thoughtful comments provided by Charles Drost, Mark Sogge, J. Judson Wynne, Pat Thompson, and William Parker improved the original reports. We would like to give many thanks to Karen Beppler-Dorn, Pat Thompson, and all the helpful staff at PEFO for their hospitality. Lastly, the beauty of the spring annual bloom and the summer bunchgrasses of 2005 is something we will never forget.

LITERATURE CITED

Abruzzi, W.S. 1995. The social and ecological consequences of early cattle ranching in the Little Colorado River Basin. Human Ecology: An Interdisciplinary Journal 23(1): 75-119.

Arizona Game and Fish Department. 1998. *Falco peregrinus anatum*, American Peregrine Falcon. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 5 pp.

Bangert, R. 1998. The ecology of the Gunnison's prairie dog landscape at Petrified Forest National Park, Arizona. Unpublished Master of Science thesis, Northern Arizona University, Flagstaff, Arizona.

Banks, A., C. van Riper III, and S.S. Rosenstock. 2003. Status of breeding and wintering birds in Petrified Forest National Park. U.S. Geological Survey/Southwest Biological Scienter Center Technical Report Series USGSSBSC/COPL/2003/22.

Brennan, T.C., and A.T. Holycross. 2006. A field guide to amphibians and reptiles in Arizona. Arizona Game and Fish Department, Phoenix, Arizona.

Crump, M.L., and N.J. Scott. 1994. Visual encounter surveys. Pages 84-92 *In* R.W. Heyer et al., editors. Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Smithsonian Institution Press, Washington, D.C.

Douglas, M.E., M.R. Douglas, G. Schuett, L. Porras, and A. Holycross. 2002. Phylogeography of the western rattlesnake (*Crotalus viridis*) complex, with emphasis on the Colorado Plateau. Pages 11-50 *In* G.W Schuett, M. Hoggren, M.E. Douglas, and H.W. Greene, editors. Biology of the Vipers. Eagle Mountain Publishing, Eagle Mountain, Utah.

Drost, C. A., and E. M. Nowak. 1997. Inventory and Assessment of Amphibian and Reptile Communities at Montezuma Castle National Monument. National Biological Service, Colorado Plateau Research Station, Flagstaff, AZ.

Drost, C.A., E.M. Nowak, and T.B. Persons. 1999. Inventory and monitoring methods for amphibians and reptiles at Petrified Forest National Park, Arizona. Unpublished report to National Park Service. USGS Colorado Plateau Field Station, Flagstaff, Arizona.

Drost, C.A., T.B. Persons, and E.M. Nowak. 2001. Herpetofauna survey of Petrified Forest National Park, Arizona. Pages 83-102 *In* C. van Riper, III, K.A. Thomas, and M.A. Stuart, editors. Proceedings of the Fifth Biennial Conference of Research on the Colorado Plateau. U.S. Geological Survey/FRESC Report Series USGSFRESC/COPL/2001/24.

Hansen, M.L. and K.A. Thomas. 2006. The flora of a unique badland and arid grassland environment: Petrified Forest National Park, Arizona. *In* W.G. Parker and P.A. Thompson, editors. A century of research at Petrified Forest National Park: Natural and Cultural History. Museum of Northern Arizona Bulletin 63. Flagstaff, Arizona.

Jones, C., W. McShea, M. Conroy, and T. Kunz. 1996. Capturing mammals. Chapter 8 *In* D.E. Wilson et al., editors. Measuring and monitoring biological diversity: Standard methods for mammals. Smithsonian Institution Press, Washington, D.C.

Leach, M.K., and T.J. Givnish. 1996. Ecological determinants of species loss in remnant prairies. Science 273(5281): 1555-1559.

McDougall, W.B. 1973. Seed Plants of Northern Arizona. Museum of Northern Arizona, Flagstaff, Arizona.

Nowak, E.M., J.V. Hart, and T.B. Persons. 2005. 2004 Surveys of the Vertebrate Fauna of Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona. Unpublished report to National Park Service. USGS Colorado Plateau Research Station, Flagstaff, Arizona.

Orodho, A.B., M.J. Trlica, and C.D. Bonham. 1990. Long-term heavy grazing effects on soil and vegetation in the Four Corners region. Southwestern Naturalist 35: 9-14.

Persons, T.B. 2001. Status of the New Mexico Whiptail Lizard at Petrified Forest National Park, Arizonas: 2000 survey results and a review. Report to National Park Service. USGS Colorado Plateau Field Station, Flagstaff, Arizona.

Persons, T.B., J.V. Hart, and E. M. Nowak. 2003. Preliminary Surveys of the Vertebrate Fauna of the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona. Unpublished report to National Park Service. USGS Colorado Plateau Field Station, Flagstaff, Arizona.

Persons, T.B., and E.M. Nowak. 2006. Inventory of amphibians and reptiles in southern Colorado Plateau national parks. U.S. Geological Survey, Southwest Biological Science Center, Colorado Plateau Research Station, Open File Report 2006-1132.

Pisani, G.R. 1973. A guide to preservation techniques for amphibians and reptiles. Society for the Study of Amphibians and Reptiles Herpetological Circular No. 1.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, and D. F. DeSante. 1993. Handbook of field methods for monitoring landbirds. General Technical Report PSW-GTR-144. US Forest Service, Pacific Southwest Research Station, Albany, California.

Thomas, K.A., M. Hansen, and C. Seger. 2003. Vegetation of Petrified Forest National Park, Arizona. USGS Biological Resources Division Technical Report to Petrified Forest National Park, Petrified Forest, Arizona.

Ramotnik, C.A. and M.A. Bogan. 1998. Baseline surveys for mammals at Petrified Forest National Park, Arizona. Final Report of 1996-1997 activities to National Park Service, Petrified Forest National Park, Arizona.

Rudran, R., T.H. Kunz, C. Southwell, P. Jarman, and A.P. Smith. 1996. Observational Techniques for nonvolant mammals. Chapter 6 *In* D.E. Wilson et al., editors. Measuring and monitoring biological diversity: Standard methods for mammals. Smithsonian Institution Press, Washington, D.C.

Van Riper III, C., and M. Lamow. 2006. A 2006 bird checklist for Petrified Forest National Park. pp. 19-27 *In* W.G. Parker and P.A. Thompson, editors. A century of research at Petrified Forest National Park: Natural and Cultural History. Museum of Northern Arizona Bulletin 63. Flagstaff, Arizona.

Van Riper III, C., A.J. Banks, and S.S. Rosenstock. 2006. Breeding and wintering birds of Petrifed Forest National Park, Arizona. pp. 4-18 *In* W.G. Parker and P.A. Thompson, editors. A century of research at Petrified Forest National Park: Natural and Cultural History. Museum of Northern Arizona Bulletin 63. Flagstaff, Arizona

Webb, R.H., G.J. McCabe, R. Hereford, and C. Wilkowske. 2004. Climatic fluctuations, drought, and flow in the Colorado River. USGS Fact Sheet 3062-04.

Welsh, S.L., N.D. Atwood, S. Goodrich, L.C. Higgins. 1973. A Utah Flora. Brigham Young University, Provo, Utah.

Western Regional Climate Center. 2007. Petrified Forest NP, Arizona. Monthly Total Precipitation (inches). Website: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?az6468

Figure 1. Jan Hart standing in native bunchgrasses (primarily *Stipa* spp.) at the eastern boundary of the Rainbow Forest Wilderness Area, Petrified Forest National Park, July 2005.

Table 1. Dates, locations, number of field-days, and primary focal taxa of sampling sessions for vertebrates and terrestrial vascular plants in the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, in 2003-2005. Number of traps refers to the number of Sherman live traps deployed. See text and Appendices 1-3 for additional details.

Date	Location	# Days in Field	Sampling Focus
May 7-9 2003 (Mammal Session #1)	Dry Wash E. Agate Bridge	3	mammals, birds, herpetofauna
July 23-25 2003 (Mammal Session #2)	Woodland SW of Flattops (E of Milepost 24)	3	mammals, birds, herpetofauna
August 31-September 1 2003	E of Flattops; E of Crystal Forest	2	herpetofauna, birds
June 9-11 2004 (Mammal Session #3)	Dry Wash SE of Agate Bridge	3	mammals, birds, herpetofauna
July 7 2004	park road (night)	1	herpetofauna
August 9-11 2004	SW corner- Cottonwood Wash and E; NW corner E of Agate Bridge; park road	3	herpetofauna, birds
August 24-26 2004 (Mammal Session #4)	Puerco Ridge; Dry Wash near Agate Bridge	3	mammals, birds, herpetofauna
August 28-30 2004	SE from Crystal Forest to boundary; SW corner- N toward Puerco Ridge; NW corner- Dry Wash	3	herpetofauna, birds
April 22-24 2005 (Mammal Session #5)	In and near Cottonwood Wash E of Agate House Ruins	2	mammals, birds, herpetofauna
May 18-June 1 2005	Various, see App. 3	11	plants
July 5-7 2005 (Mammal Session #6)	Farthest E corner in mid-wilderness	2	mammals, birds, herpetofauna
August 22-September 5 2005	Various, see App. 3	12	plants
September 3-5 2005	N of Long Logs; SW corner and N; park road (night)	2	herpetofauna, birds

Table 2. Number and species of small mammals trapped at sampling transects, including name of session and number of traps, in the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, 2003-2005. Number of traps refers to the number of Sherman live traps deployed. "Occurrence" refers to the relative frequency of trapping for each species out of the total trapped each session (C= >50% of captures; F= 25-50% of captures, O= 6-25% of captures; R= ≤ 5 % of captures).

Date	Species	Number/ Age	# Traps	Occurrence
May 7-9 2003 Mammal Session #1	Western Harvest Mouse (*Reithrodontomys megalotis*)	8 adult	60	C
Mammal Session #1	Deer Mouse (*Peromyscus maniculatus*)	3 adult 1 subadult	"	F
Mammal Session #1	Ord's Kangaroo Rat (*Dipodomys ordii*)	1 adult	"	R
July 23-24 2003 Mammal Session #2	Pinyon Mouse (*Peromyscus truei*)	7 adult 1 subadult	59	F
Mammal Session #2	Plains Pocket Mouse (*Perognathus flavescens*)	7 adult 2 unk.	"	F
Mammal Session #2	Silky Pocket Mouse (*Perognathus flavus*)	1 adult	"	R
Mammal Session #2	Northern Grasshopper Mouse (*Onychomys leucogaster*)	1 adult	"	R
Mammal Session #2	Deer Mouse	2 adult	"	O
Mammal Session #2	Western Harvest Mouse	2 adult	"	O
Mammal Session #2	Woodrat (prob. White-throated) (*Neotoma* cf. *albigula*)	1 adult	"	R
Mammal Session #2	Ord's Kangaroo Rat	1 adult	"	R
June 9-11 2004 Mammal Session #3	Deer Mouse	3 adult	108	F
Mammal Session #3	Northern Grasshopper Mouse	3 adult 1 subadult	"	O
Mammal Session #3	Western Harvest Mouse	2 adult	"	O
Mammal Session #3	Silky Pocket-mouse	2 adult	"	O
Mammal Session #3	Ord's Kangaroo Rat	7 adult	"	F
Mammal Session #3	White-tailed Antelope Squirrel (*Ammospermophilus leucurus*)	3 adult	"	O
August 24-26 2004 Mammal Session #4	Deer Mouse	4 adult 1 subadult	93	O
Mammal Session #4	Pinyon Mouse	34 adult 3 subadult	"	C
Mammal Session #4	Silky Pocket-mouse	1 adult	"	R

Table 2 continued. Number and species of small mammals trapped at sampling transects, including name of session and number of traps, in the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, 2005. Number of traps refers to the number of Sherman live traps deployed. "Occurrence" refers to the relative frequency of trapping for each species out of the total trapped each session (C= >50% of captures; F= 25-50% of captures, O= 6-25% of captures; R= ≤ 5 % of captures).

Date	Species	Number/ Age	# Traps	Occurrence
April 22-23 2005 Mammal Session #5	Deer Mouse	1 subadult	60	C
April 23-24 2005 Mammal Session #5	Western Harvest Mouse	1 adult	80	F
Mammal Session #5	Silky Pocket-mouse	1 adult	"	F
Mammal Session #5	Ord's Kangaroo Rat	2 adult	"	C
July 5-7 2005 Mammal Session #6	Northern Grasshopper Mouse	1 adult	102	F
Mammal Session #6	Silky Pocket-mouse	1 subadult	"	F

Table 3. Mammal species detected in addition to those trapped in the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, from 2003-2005. The area where each species was seen and its method of detection are also given.

Species	Area Detected	Detection Method
Gunnison's Prairie Dog (*Cynomys gunnisoni*)	south of Dry Wash and west of Puerco Ridge (no GPS coordinates)	burrows in colony sites-none appeared active
Deer Mouse (*Peromyscus maniculatus*)	on road adjacent to wilderness at night	visual
Woodrat (probably White-throated, *Neotoma albigula*)	in rock outcrops throughout; on road adjacent to wilderness at night	nests, visual
Botta's Pocket Gopher (*Thomomys bottae*)	Dry Wash east of Agate Bridge	mounds
Ord's Kangaroo Rat (*Dipodomys ordii*)	on road adjacent to wilderness at night	visual
White-tailed Antelope Squirrel (*Ammospermophilus leucurus*)	Near NE boundary, shrub/grassland	visual
Black-tailed jackrabbit (*Lepus californicus*)	edge of Dry Wash at the north end; on road adjacent to wilderness area	visual
Audubon's Cottontail (*Sylvilagus auduboni*)	throughout; skull from Puerco Ridge, on road adjacent to wilderness area	scat, skull from owl pellet, visual
Porcupine (*Erithizon dorsatum*)	woodland SW of Flattops; throughout	scat, tracks
Coyote (*Canis latrans*)	burrows near Puerco Ridge and in badlands; sign throughout	den burrows, tracks, scat
Grey Fox (*Urocyon cinereoargenteus*)	near Puerco Ridge	tracks
Badger (*Taxidea taxus*)	above Dry Wash	fresh burrows
Bobcat (*Lynx rufus*)	NW of Flattops	tracks
Mule Deer (*Odocoileus hemionus*)	on Puerco Ridge east of Agate Bridge; SW of Flattops	scat
American Pronghorn (*Antilocapra americana)*	Throughout	visual, tracks, scat
Domestic cattle (*Bos taurus*)	north of old Highway 180	tracks

Table 4. Bird species detected in the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, during surveys in 2003-2005. Detections are indicated by mammal trapping session number or date if outside a session, and general locations are given for rarer species. Detections are combined to determine relative "Occurrence" during the survey period: C= detected during >50% of surveys; F= 25-50% of surveys, O= 6-25% of surveys; R= ≤ 5 % of surveys.

Species (common name)	2003 session # or date	2004 session # or date	2005 session # or date	Occurrence
Turkey Vulture	1			R
Swainson's Hawk		4		R
Prairie Falcon		4		R
Peregrine Falcon (probable pair)			9/5, SE corner	R
American Kestrel	1,2, 8/31	3,4	9/3	C
Scaled Quail	9/1, east of Crystal Forest			R
Mourning Dove	1,2	3,4	9/3 (eggs)	C
Great-horned Owl	2	4	5	F
Broad-tailed Hummingbird		8/29		R
Common Nighthawk	2			R
Poorwill		8/10, on road near Dry Wash		R
Western Kingbird	2			R
Unknown *Empidonax* Flycatcher	2	8/10, Cottonwood Wash		O
Say's Phoebe	1		6 (nest?)	O
Horned Lark	1, 8/31-9/1	3,4, 8/10-11, 8/30	6, 9/5	C
Northern Rough-winged Swallow		4		R
Cliff Swallow			9/3	R
Common Raven	1,2	3,4	9/3-5	C
Rock Wren	1,2	3,4	9/3-5	C
Canyon Wren		8/11		R
Blue-gray Gnatcatcher		4	9/3	O
Mountain Bluebird		4		R
Townsend's Solitaire		4		R
Loggerhead Shrike	1	4, 8/11		F
Sage Thrasher		4		R
Yellow Warbler		3, Dry Wash		R

Table 4 con't. Bird species detected in the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, during surveys in 2003-2005. Detections are indicated by mammal trapping session number or date if outside a session, and general locations are given for rarer species. Detections are combined to determine relative "Occurrence" during the survey period.

Species (common name)	2003 session # or date	2004 session # or date	2005 session # or date	Occurrence
MacGillivray's Warbler		8/10, Cottonwood Wash		R
Black-headed Grosbeak		8/10, Cottonwood Wash		R
Black-throated Sparrow	2	8/11		O
Lark Sparrow		4		R
Brewer's Sparrow		4		R
Sage Sparrow			6, 9/5	O
White-crowned Sparrow		8/29		R
Western Meadowlark		3,4		O
Eastern Meadowlark			6	R

Table 5. Reptile and amphibian species detected in and near the Rainbow Forest Wilderness during surveys in 2003-2005. In each year, number of individuals observed are recorded. Species and number of individuals detected are grouped by taxa; all were found in wilderness unless otherwise noted by an asterisk (*).

Species	Habitat Type(s) Detected	# Detected 2003	# Detected 2004	# Detected 2005	Occurrence
Plateau Striped Whiptail (*Cnemidophorus velox*)	dry wash, rock outcrop, shrub/grassland, scattered juniper, sand dune	6	20	18	C
Lesser Earless Lizard (*Holbrookia maculata*)	dry wash, rock outcrop, shrub/grassland, sand dune, scattered juniper		25	9	F
Side-blotched Lizard (*Uta stansburiana*)	badlands, rock outcrops	1		4	R
Sagebrush Lizard (*Sceloporus graciosus*)	dry wash, rock outcrop, shrub/grassland	1	15	7	C
Eastern Fence Lizard (*Sceloporus undulatus*)= Plateau Lizard (*S. tristichus*)	rock outcrop, dry wash, scattered juniper	8	11	8	C
Greater Short-horned Lizard (*Phrynosoma hernandesi*)	shrub/grassland, sand dune		1	5 + lots scat	O
Collared Lizard (*Crotaphytus collaris*)	sand dune, rock outcrop		2	1	O
Unidentified lizards	dry wash, rock outcrop	1	4	19	C!
Glossy Snake (*Arizona elegans*)	Dry Wash; roadside (not in wilderness)*		1	1*	R
Hopi Rattlesnake (*Crotalus viridis viridis* var. *nuntius*)	roadside (not in wilderness)*, shrub/grassland		4*	2	F
Night Snake (*Hypsiglena torquata*)	roadside (not in wilderness)*		1*		R
Gopher Snake (*Pituophis catenifer*)	roadside (not in wilderness)*		1*		R
Southern Spadefoot Toad (*Spea multiplicata*)	roadside (not in wilderness)*, Cottonwood and Dry Wash		3 adults* ~750 tadpoles	13 adults* ~200 tadpoles	F
Great Plains Toad *Bufo cognatus*	roadside (not in wilderness)*			1*	R
WoodHouse Toad *Bufo woodhousei*	roadside (not in wilderness)*			1*	R

Table 6. Summary List of plants found in Rainbow Forest Wilderness Area, Petrified Forest National Park, during surveys in 2005. Occurrence categories (C, F, O, R) are detailed in the text.

Genus	Species	Variety or Subspecies	Family	Occurrence
Abronia	elliptica		Nyctaginaceae	O
Abronia	fragrans		Nyctaginaceae	F
Achnatherum	hymenoides		Poaceae	O
Allium	macropetalum		Apiaceae	O
Amaranthus	acanthochiton		Amaranthaceae	F
Ambrosia	artemisifolia		Asteraceae	F
Andropogon	hallii		Poaceae	R
Arabis	perennens		Brassicaceae	F
Arenaria	eastwoodiae	var. adenophora	Carophyllaceae	C
Aristada	adscensionis		Poaceae	O
Aristida	purpurea		Poaceae	R
Artemisia	bigelovii		Asteraceae	F
Artemisia	dracunculus		Asteraceae	R
Artemisia	filifolia		Asteraceae	O
Artemisia	frigida		Asteraceae	O
Artemisia	ludovisciana	ssp. Albula	Asteraceae	F
Asclepias	involucrata		Asclepiadaceae	R
Astragalus	albulus		Fabaceae	O
Astragalus	amphioxys	var. amphioxys	Fabaceae	C
Astragalus	ceramicus		Fabaceae	R
Astragalus	flavus		Fabaceae	O
Astragalus	lentiginosus	var. diphysus	Fabaceae	R
Astragalus	mollissimus	var. thompsoniae	Fabaceae	O
Astragalus	praelongus		Fabaceae	O
Astragalus	sp.		Fabaceae	R
Astragalus	xiphoides		Fabaceae	R
Atriplex	argentea		Chenopodiaceae	F
Atriplex	canescens		Chenopodiaceae	F
Atriplex	confertifolia		Chenopodiaceae	C
Atriplex	obovata		Chenopodiaceae	F
Atriplex	powellii		Chenopodiaceae	C
Atriplex	saccaria		Chenopodiaceae	O
Baccharis	wrightii		Asteraceae	R
Bouteloua	barbata		Poaceae	R
Bouteloua	curtipendula		Poaceae	O
Bouteloua	eriopoda		Poaceae	O
Bouteloua	gracilis		Poaceae	C
Brickellia	californica		Asteraceae	O
Brickellia	oblongifolia	var. linifolia	Asteraceae	O
Bromus	japonicus		Poaceae	C
Bromus	rubens		Poaceae	F
Bromus	spp.		Poaceae	C
Bromus	tectorum		Poaceae	C
Caesalpinia	jamesii		Fabaceae	R
Calamovilfa	gigantea		Poaceae	F
Calochortus	aureus		Liliaceae	C
Calycoseris	wrightii		Asteraceae	R

Table 6 con't. Summary list of plants found in Rainbow Forest Wilderness Area, Petrified Forest National Park, during surveys in 2005. Occurrence categories (C, F, O, R) are detailed in the text.

Genus	Species	Variety or Subspecies	Family	Occurrence
Camissonia	scapoidea		Onagraceae	R
Castilleja	applegatei	ssp. martinii	Scrophulariaceae	O
Castilleja	integra		Scrophulariaceae	O
Castilleja	linariifolia		Scrophulariaceae	R
Castilleja	sp.		Scrophulariaceae	F
Chaenactis	macrantha		Asteraceae	R
Chaenactis	stevioides		Asteraceae	C
Chaetopappa	ericoides		Asteraceae	C
Chamaecye	nutans		Euphorbiaceae	O
Chamaecye	parryi		Euphorbiaceae	O
Chamaecye	revoluta		Euphorbiaceae	O
Chamaesyce	albomarginata		Euphorbiaceae	F
Chamaesyce	fendleri		Euphorbiaceae	C
Chamaesyce	revoluta		Euphorbia	O
Chenopodium	berlandieri	var. zschackii	Chenopodiaceae	C
Chenopodium	leptophyllum		Chenopodiaceae	F
Chenopodium	pratericola		Chenopodiaceae	O
Chrysothamnus	baileyi		Asteraceae	R
Chyrsothamnus	greenii		Asteraceae	C
Cirsium	vulgare		Asteraceae	R
Comandra	umbellata	ssp. pallida	Santalaceae	O
Conyza	canadensis		Asteraceae	F
Cordylanthus	wrightii		Scrophulariaceae	C
Coripsermum	nitidum		Chenopodiaceae	O
Croton	texensis		Euphorbiaceae	R
Cryptantha	crassisepala		Boraginaceae	C
Cryptantha	fulvocanescens	var. fulvocanescens	Boraginaceae	F
Cryptantha	pterocarya		Boraginaceae	R
Cymopteris	acaulis	var. fendleri	Apiaceae	F
Cymopteris	bulbosus		Apiaceae	C
Dalea	candida	var. oligophylla	Fabaceae	F
Dalea	lanata		Fabaceae	F
Dalea	lanata	var. terminalis	Fabaceae	R
Dalea	nana		Fabaceae	R
Delphinum	scaposum		Ranunculaceae	C
Descuriana	obtusa	ssp. obtusa	Brassicaceae	O
Descuriana	pinnata		Brassicaceae	C
Descuriana	sophia		Brassicaceae	O
Dimorphocarpa	wislizeni		Brassicaceae	F
Draba	cuneifolia		Brassicaceae	R
Echinocereus	fendleri		Cactaceae	R
Echinocereus	sp.		Cactaceae	R
Elaeagnus	angustifolia		Elaeagnaceae	R
Elymus	elymoides		Poaceae	F
Ephedra	cutleri		Ephedraceae	F
Ephedra	torreyana		Ephedraceae	O

Table 6 con't. Summary list of plants found in Rainbow Forest Wilderness Area, Petrified Forest National Park, during surveys in 2005. Occurrence categories (C, F, O, R) are detailed in the text.

Genus	Species	Variety or Subspecies	Family	Occurrence
Ephedra	viridis		Ephedraceae	F
Ericameria	nauseosa		Asteraceae	F
Ericameria	nauseosa	var. nauseosa	Asteraceae	C
Ericameria	parryi		Asteraceae	F
Erigeron	concinnus		Asteraceae	O
Erigeron	divergens		Asteraceae	O
Eriogonum	alatum	var. alatum	Polygonaceae	O
Eriogonum	cernuum		Polygonaceae	C
Eriogonum	corymbosum	var. aureum	Polygonaceae	O
Eriogonum	divaricatum		Polygonaceae	C
Eriogonum	leptocladon	var. ramossisimum	Polygonaceae	F
Eriogonum	leptophyllum		Polygonaceae	O
Eriogonum	subreniforme		Polygonaceae	R
Eriogonum	wrightii	var. wrightii	Polygonaceae	O
Erodium	cicutarium		Geranaceae	F
Erysimum	capitatum	var. purshii	Brassicaceae	O
Escobaria	sp.		Cactaceae	R
Escobaria	vivipara		Cactaceae	R
Evolvulus	nuttallianus		Convolvulaceae	R
Frasera	albomarginata		Gentianaceae	R
Gaillardia	pinnatifida		Asteraceae	O
Gaura	mollis		Onagraceae	R
Gilia	rigidula	ssp. acerosa	Polemoniaceae	R
Gilia	sinuata		Polemoniaceae	O
Gilia	triodon		Polemoniaceae	O
Gutierrezia	microcephala		Asteraceae	C
Gutierrezia	sarothrae		Asteraceae	F
Helianthus	annuus		Asteraceae	F
Helianthus	petiolaris		Asteraceae	O
Heliomeris	multiflora	var. multiflora	Asteraceae	R
Heliomeris	multiflora	var. nevadensis	Asteraceae	F
Hesperostipa	comata	ssp. comata	Poacaea	C
Heterotheca	subaxillaris		Asteraceae	O
Heterotheca	villosa		Asteraceae	O
Hilaria	jamesii		Poaceae	C
Hordeum	pusillum		Poaceae	C
Houstonia	rubra		Rubiaceae	R
Hymenopappus	filifolius	var. pauciflorus	Asteraceae	O
Hymenopappus	flavescens	var. canotomenstosus	Asteraceae	O
Hymenoxys	ivesiana		Asteraceae	O
Ipomopsis	longiflora		Polemoniaceae	C
Ipomopsis	multiflora		Polemoniaceae	O
Ipomopsis	polycladon		Polemoniaceae	O
Ipomopsis	pumila		Polemoniaceae	O
Isocoma	drummondii		Asteraceae	C
Juniperus	monosperma		Cupressaceae	O
Juniperus	osteosperma		Cupressaceae	R

Table 6 con't. Summary list of plants found in Rainbow Forest Wilderness Area, Petrified Forest National Park, during surveys in 2005. Occurrence categories (C, F, O, R) are detailed in the text.

Genus	Species	Variety or Subspecies	Family	Occurrence
Kallstroemia	californica		Zygophyllaceae	R
Kochia	americana		Chenopodiaceae	O
Krascheninnikovia	lanata		Chenopodiaceae	O
Lactuca	seriola		Asteraceae	O
Lappula	occidentalis	var. cupulata	Boraginaceae	C
Lesquerella	fendleri		Brassicaceae	F
Lesquerella	intermedia		Brassicaceae	O
Linum	aristatum		Linaceae	F
Linum	puberulum		Linaceae	O
Lupinus	pulsillus	var. intermontanus	Fabaceae	C
Lycium	pallidum		Solanaceae	R
Lygodesmia	arizonica		Asteraceae	O
Lygodesmia	grandiflora		Asteraceae	F
Machaeranthera	canescens	var. canescens	Asteraceae	C
Machaeranthera	canescens	var. aristada	Asteraceae	R
Machaeranthera	gracilis		Asteraceae	O
Machaeranthera	grindelioides		Asteraceae	O
Machaeranthera	pinnatifida	ssp. pinnatifida	Asteraceae	O
Machaeranthera	tanacetifolia		Asteraceae	O
Malacothrix	fendleri		Asteraceae	R
Menodora	scabra		Oleaceae	R
Mentzelia	albicaulis		Loasaceae	R
Mentzelia	multiflora		Loasaceae	F
Mentzelia	pumila		Loasaceae	O
Mirabilis	linearis	var. linearis	Nyctaginaceae	R
Monolepis	nuttalianis		Chenopodiaceae	C
Muhlenbergia	porteri		Poaceae	C
Muhlenbergia	pungens		Poaceae	C
Nama	hispidum		Hydrophyllaceae	O
Oenothera	albibaulis		Onagraceae	O
Oenothera	caespitosa	ssp. caespitosa	Onagraceae	O
Oenothera	caespitosa	ssp. crinata	Onagraceae	O
Oenothera	flava		Onagraceae	O
Oenothera	pallida	ssp. runcinata	Onagraceae	O
Opuntia	erinacea	var. erinacea	Cactaceae	C
Opuntia	erinacea	var. hystrix	Cactaceae	C
Opuntia	erinacea	var. utahensis	Cactaceae	C
Opuntia	polyacantha	var. rufispina	Cactaceae	C
Opuntia	whipplei		Cactaceae	O
Orobanche	ludoviciana	ssp. multiflora	Orobanchaceae	O
Parryella	filifolia		Fabaceae	C
Pectis	angustifolia		Asteraceae	F
Phacelia	cephalotes		Boraginaceae	C
Phacelia	crenulata	var. corrugata	Hydrophyllaceae	O
Phacelia	integrifolia		Hydrophyllaceae	R
Phacelia	ivesiana		Hydrophyllaceae	C
Plantago	patagonica		Plantaginaceae	F
Populus	deltoides	var. wislizenii	Salicaceae	R

Table 6 con't. Summary list of plants found in Rainbow Forest Wilderness Area, Petrified Forest National Park, during surveys in 2005. Occurrence categories (C, F, O, R) are detailed in the text.

Genus	Species	Variety or Subspecies	Family	Occurrence
Portulaca	oleraceae		Portulacaceae	O
Psilostrophe	tagetina		Asteraceae	R
Psoralidium	lanceolatum		Fabaceae	R
Quincula	lobata		Solanaceae	R
Rhus	trilobata		Anacardiaceae	O
Salsola	tragus		Chenopodiaceae	C
Sarcobatus	vermiculatus		Chenopodiaceae	O
Senecio	flaccidus	var. douglasii	Asteraceae	F
Senecio	flaccidus	var. flaccidus	Asteraceae	O
Senecio	spartioides	var. multicapitatus	Asteraceae	R
Solanum	elaeagnifolium		Solanaceae	R
Solanum	jamesii		Solanaceae	O
Sphaeralcea	ambigua		Malvaceae	O
Sphaeralcea	hastulata		Malvaceae	F
Sphaeralcea	incana	var. cuneata	Malvaceae	F
Sphaeralcea	parvifolia		Malvaceae	O
Sporobolus	airoides		Poaceae	C
Sporobolus	contractus		Poaceae	F
Sporobolus	cryptandrus		Poaceae	C
Sporobolus	flexuosus		Poaceae	R
Sporobolus	giganteus		Poaceae	O
Stanleya	pinnata		Brassicaceae	F
Stephanomeria	exigua		Asteraceae	F
Stephanomeria	exigua		Asteraceae	C
Stephanomeria	pauciflora		Asteraceae	R
Stipa	neomexicana		Poaceae	C
Streptanthella	longirostris		Brassicaceae	R
Tamarix	chinensis		Tamaricaceae	O
Thelesperma	megapotomicum		Asteraceae	O
Townsendia	annua		Asteraceae	C
Tragopogon	dubius		Asteraceae	O
Tragopogon	pratensis		Asteraceae	O
Tripterocalyx	carnea	var. wootonii	Nyctaginaceae	O
Verbesina	encelioides		Asteraceae	O
Vulpia	octaflora	var. hirtella	Poaceae	O
Wyethia	scabra	var. canescens	Asteraceae	R
Xanthium	strumarium		Asteraceae	R
Yucca	angustissima		Agavaceae	C
Zinnia	grandiflora		Asteraceae	R
Zuckia	brandegii	var. brandegii	Chenopodiaceae	C

Table 7. List of rare and newly documented native plants and their locations, Rainbow Forest Wilderness Area, Petrified Forest National Park, 2005. UTM coordinates are given in NAD 27 Datum.

GENUS	SPECIES	Variety or Subspecies	Common Name	Occurrence	General Location	UTM N	UTM E	Management Concern
Andropogon	hallii		sand bluestem	R	E of Agate House	0604940	3851604	Rare
Aristida	purpurea		purple threeawn	R	E of m.m. 22 & 23	0609307	3854559	Rare
Asclepias	involucrata		dwarf milkweed	R	central wilderness area	0609372	3855967	Rare
Astragalus	ceramicus		painted milkvetch	R	grasslands at E park boundary	0610459	3857648	Rare
Astragalus	lentiginosus	var. diphysus	specklepod milkvetch	R	Flattops area	0607939	3853867	Rare
Astragalus	xiphoides		gladiator milkvetch	R	E of Flattops	0608192	3851983	Rare
Bouteloua	barbata		sixweeks grama	R	below Agate Mesa	0610476	3860849	Rare
Caesalpinia	jamesii		James' holdback	R	central wilderness area	0609847	3855529	Rare
Camissonia	scapoidea		barestem evening-primrose	R	S & SE Park Boundary	0608004	3850681	Rare
Castilleja	linariifolia		narrowleaf paintbrush	R	badlands 1 m. E of Long Logs	0606988	3852100	Rare
Chaenactis	macrantha		showy dustymaiden	R	N of Agate Bridge	0612369	3861976	Rare
Chamaesyce	nutans		spotted sandmat	O	E of Agate Bridge	0610826	3861360	New park documentation
Chrysothamnus	baileyi		Bailey's rabbitbrush	R	E of Martha's Butte	0612080	3855592	Rare
Croton	texensis		Texas croton	R	below Agate Mesa	0610323	3861021	Rare
Dalea	lanata	var. terminalis	wooly prarieclover	R	Flattops Area	0607684	3853982	Rare
Draba	cuneifolia		wedgeleaf draba	R	badlands 1 m. E of Long Logs	0606195	3851947	Rare
Echinocereus	fendleri		Fendlers' hedgehog cactus	R	grasslands at E park boundary	0612386	3856828	Rare
Eriogonum	subreniforme		kidneyshape buckwheat	R	N of Agate Bridge	0612469	3863306	Rare
Escobaria	vivipara		spinystar	R	1 m. Eof Agate Bridge	0612369	3861975	Rare
Evolvulus	nuttallianus		shaggy dwarf morning-glory	R	grasslands at E park boundary	0612325	3857656	Rare

Table 7 con't. List of rare of rare and newly documented native plants and their locations, Rainbow Forest Wilderness Area, Petrified Forest National Park, 2005. UTM coordinates are given in NAD 27 Datum.

GENUS	SPECIES	Variety or Subspecies	Common Name	Occur-rence	General Location	UTM N	UTM E	Management Concern
Frasera	albomarginata		white- margined swertia	R	top of mesa E of Crystal Forest	0611780	3859354	Rare
Gaura	mollis		willow gaura	R	E of Martha's Butte	0610193	3857497	Rare
Gilia	rigidula	ssp. acerosa	bluebowls	R	top of mesa E of Crystal Forest	0611780	3859354	Rare
Heliomeris	multiflora	var. multiflora	showy goldeneye	R	E of Martha's Butte	0610361	3856615	Rare
Houstonia	rubra		red bluet	R	badlands 1 m. E of Long Logs	0606569	3851910	Rare
Juniperus	osteosperma		Utah juniper	R	E of Agate Bridge	0606885	3853658	New park documentation
Lycium	pallidum		pale wolfberry	R	E of m.m. 22 & 23	0610079	3853828	Rare
Machaeranthera	canescens	var. aristata	hoary tansyaster	R	E of m.m. 22 & 23	0609316	3854879	New park documentation
Malacothrix	fendleri		sowthistle desert dandylion	R	S & SE Park Boundary	0608204	3850648	Rare
Menodora	scabra		rough menodora	R	badlands 1 m. E of Long Logs	0606569	3851910	Rare
Mentzelia	albicaulis		whitestem blazingstar	R	N of Agate Bridge	0612912	3862033	Rare
Phacelia	integrifolia		gypsum scorpion-weed	R	top of mesa E of Crystal Forest	0611510	3858890	Rare
Populus	deltoides	var. wislizenii	Freemont cottonwood	R	badlands 1 m. E of Long Logs	0605602	3852283	Rare
Psilostrophe	tagetina		wooly paperflower	R	S & SE Park Boundary	0605780	3850871	Rare
Psoralidium	lanceolatum		lemon scurfpea	R	N of Agate Bridge	0612469	3863306	Rare
Quincula	lobata		Chinese lantern	R	N of Agate Bridge	0612311	3863089	Rare
Senecio	spartioides	var. multicapitatus	broomlike ragwort	R	E of Agate House	0605687	3850741	Rare
Solanum	elaeagnifo-lium		silverleaf nightshade	R	E of m.m. 22 & 23	0609207	3854029	Rare
Sporobolus	flexuosus		mesa dropseed	R	E of m.m. 22 & 23	0609316	3854879	Rare
Stephanomeria	pauciflora		brownplume wireleaf lettuce	R	E of Martha's Butte	0610923	3855753	Rare

Table 7 con't. List of rare of rare and newly documented native plants and their locations, Rainbow Forest Wilderness Area, Petrified Forest National Park, 2005. UTM coordinates are given in NAD 27 Datum.

GENUS	SPECIES	Variety or Subspecies	Common Name	Occurrence	General Location	UTM N	UTM E	Management Concern
Streptanthella	longirostris		longbeak streptan-thella	R	N of Agate Bridge	0612469	3863306	Rare
Wyethia	scabra	var. canescens	badlands mulesears	R	on & around Flattops	0611634	3558887	Rare
Zinnia	graniflora		Rocky Mountain Zinnia	R	central wilderness area	0609526	3856104	Rare

Table 8. List of non-native plants and their locations, Rainbow Forest Wilderness Area, Petrified Forest National Park, 2005. UTM coordinates are given in NAD 27 Datum.

GENUS	SPECIES	Common Name	Occurrence	General Location	UTM N	UTM E	Management Concern
Bromus	japonicus	Japanese brome	C	N of Agate Bridge	0611046	3862407	Non-native
Bromus	rubens	red brome	F	top of mesa E of Crystal Forest; all over	didn't collect		Non-native, Invasive
Bromus	tectorum	cheatgrass	C	top of mesa E of Crystal Forest; all over	didn't collect		Non-native, Invasive
Cirsium	vulgare	bull thistle	R	E of m.m. 22 & 23	0609398	3853308	Rare, Non-native
Corispermum	nitidum	common bugseed	O	E of Agate Bridge	0612554	3860463	Non-native
Elaeagnus	angustifolia	Russian olive	R	grasslands at E park boundary	0612469	3863306	Rare, Non-native
Erodium	cicutarium	filaree	F	Crystal Forest	0612295	3860722	Non-native
Lactuca	serriola	prickly lettuce	O	N of Agate Bridge	0611046	3862407	Non-native
Portulaca	oleraceae	purslane	O	E of Agate Bridge	0612304	3859727	Native; Regulated noxious weed
Salsola	tragus	prickly Russian thistle	C	central wilderness area; all over	0608707	3853909	Non-native; Invasive
Tamarix	chinensis	saltcedar	C	grasslands at E park boundary; most washes	didn't collect		Non-native; Invasive
Tragopogon	dubius	yellow salsify	F	E of m.m. 22 & 23	0609398	3853308	Non-native
Tragopogon	pratensis	meadow salsify	O	top of mesa E of Crystal Forest	0611256	3859348	Non-native

Appendix 1. Key coordinates for locating mammal trapping transects from 2003-2005, at Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona. See text for descriptions of the physical location of each trapping area. Areas listed also include bird, reptile, and amphibian surveys, except those given in Appendix 2. UTM coordinates are given in NAD 27 Datum. "EPE" is the estimated GPS error of each location in meters.

Date	Location	Trap Number	UTM easting	UTM northing	EPE (m)
		2003			
5/7-9	Dry Wash E. Agate Bridge	1 (start)	611099	3861709	5
5/7-9	Dry Wash E. Agate Bridge	20	611184	3861381	4
5/7-9	Dry Wash E. Agate Bridge	30	611138	3861210	6
5/7-9	Dry Wash E. Agate Bridge	40	610992	3861115	6
5/7-9	Dry Wash E. Agate Bridge	50	610961	3861282	7
5/7-9	Dry Wash E. Agate Bridge	60 (end)	611081	38611425	7
7/23-24	Woodland SW of Flattops	1 (start #1)	606876	3853792	4
7/23-24	Woodland SW of Flattops	20 (end #1)	606898	3853498	5
7/23-24	Woodland SW of Flattops	21 (start #2)	606870	3853495	6
7/23-24	Woodland SW of Flattops	40 (end #2)	606854	3853771	4
7/23-24	Woodland SW of Flattops	41 (start #3)	606812	3853513	4
7/23-24	Woodland SW of Flattops	59 (end #3)	606820	3853774	5
		2004			
6/9-10	Dry Wash SE of Agate Bridge	Trap 1 (start)	610552	3860084	4
6/9-10	Dry Wash SE of Agate Bridge	Trap 21	610712	3860108	4
6/9-10	Dry Wash SE of Agate Bridge	Trap 41	610748	3860285	5
6/9-10	Dry Wash SE of Agate Bridge	Trap 61	610772	3860539	4
6/9-10	Dry Wash SE of Agate Bridge	Trap 79 (end)	610911	3860753	5
6/9-10	Dry Wash SE of Agate Bridge	Trap 80 (start)	610948	3860800	5
6/9-10	Dry Wash SE of Agate Bridge	Trap 91	610974	3860953	6
6/9-10	Dry Wash SE of Agate Bridge	Trap 101	611080	3861008	5
6/9-10	Dry Wash SE of Agate Bridge	Trap 108 (end)	611043	3861059	5
8/24-26	Puerco Ridge	Trap 1 (start)	611660	3859726	5
8/24-26	Puerco Ridge	Trap 11	611725	3859612	4
8/24-26	Puerco Ridge	Trap 21	611717	3859503	4
8/24-26	Puerco Ridge	Trap 31	611773	3859428	4
8/24-26	Puerco Ridge	Trap 41	611760	3859342	4
8/24-26	Puerco Ridge	Trap 45 (top of scarp)	611755	3859303	6
8/24-26	Puerco Ridge	Trap 46	611772	3859292	4
8/24-26	Puerco Ridge	Trap 51	611778	3859329	4
8/24-26	Puerco Ridge	Trap 61	611773	3859423	4
8/24-26	Puerco Ridge	Trap 71	611754	3859525	4
8/24-26	Puerco Ridge	Trap 81	611756	3859629	4
8/24-26	Puerco Ridge	Trap 90 (end)	611734	3859729	5
8/24-26	Puerco Ridge	Traps 91-93 (to east)	611849	3859738	5
		2005			
4/22-23	Agate House/Cottonwood Wash	Trap 1 (start)	605097	3851607	≤ 5m
4/22-23	Agate House/Cottonwood Wash	Trap 15	605312	3851757	≤ 5m
4/22-23	Agate House/Cottonwood Wash	Trap 30	605329	3851987	≤ 5m
4/22-23	Agate House/Cottonwood Wash	Trap 31	605352	3851965	≤ 5m

Appendix 1 continued. Key coordinates for locating mammal trapping transects from 2003-2005, at Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona. See text for descriptions of the physical location of each trapping area. Areas listed also include bird, reptile, and amphibian surveys, except those given in Appendix 2. UTM coordinates are given in NAD 27 Datum. "EPE" is the estimated GPS error of each location in meters.

Date	Location	Trap Number	UTM easting	UTM northing	EPE (m)
2005 continued					
4/22-23	Agate House/Cottonwood Wash	Trap 45	605335	3851744	≤ 5m
4/22-23	Agate House/Cottonwood Wash	Stream Gauge (end, Trap 60)	605076	3851593	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 1 (start)	605937	3852302	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 10	606036	3852325	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 20	606123	3852392	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 30	606199	3852409	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 40 (midpoint)	606276	3852482	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 50	606366	3852438	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 60	606428	3852351	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 70	606521	3852349	≤ 5m
4/23-24	Cottonwood Wash E Agate House	Trap 80 (end)	606630	3852408	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 1 (start)	612797	3855657	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 10	612680	3855737	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 20	612570	3855804	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 30	612443	3855756	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 40	612320	3855717	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 50	612216	3855781	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 60	612107	3855844	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 70	611995	3855789	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 80	611880	3855774	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 90	611765	3855806	≤ 5m
7/5-7	East boundary, middle wilderness	Trap 100 (end)	611667	3855776	≤ 5m

Appendix 2. Key coordinates for locating areas surveyed primarily for reptiles and amphibians during walking searches of the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, in 2004-2005. Other areas surveyed (with mammal trapping as the primary focus) are given in Appendix 1. Data is in NAD 27 Datum except as noted. "EPE" is the estimated GPS error of each location. Surveys were conducted during the day except as noted.

Date	Location	UTM easting	UTM northing	EPE (m)
2003				
8/31	E of Flattops	606591	3854112	3
8/31	E of Flattops	607572	3852837	7
9/1	E of Crystal Forest	610482	3858440	4
9/1	E of Crystal Forest	610844	3858882	3
9/1	E of Crystal Forest	611774	3859326	9
9/1	E of Crystal Forest	611859	3859326	4
2004				
6/10-11	E of Agate Bridge	610137	3860024	WGS 84 Datum
6/10-11	E of Agate Bridge	610287	3861415	
6/10-11	E of Agate Bridge	610137	3860032	
8/10	SW corner, Cottonwood Wash and E	606107	3851331	4
8/10	SW corner, Cottonwood Wash and E	606255	3851749	6
8/10	SW corner, Cottonwood Wash and E	606633	3852395	4
8/10	SW corner, Cottonwood Wash and E	606558	3852531	3
8/10	SW corner, Cottonwood Wash and E	606180	3852447	4
8/10	SW corner, Cottonwood Wash and E	605203	3851798	6
8/11	NW corner, E of Agate Bridge	610414	3861080	4
8/11	NW corner, E of Agate Bridge	610741	3860589	5
8/11	NW corner, E of Agate Bridge	611227	3860148	5
8/11	NW corner, E of Agate Bridge	611861	3859828	4
8/11	NW corner, E of Agate Bridge	611770	3859340	4
8/11	NW corner, E of Agate Bridge	611920	3860615	6
8/11	NW corner, E of Agate Bridge	610654	3861405	4
8/25	NW edge Puerco Ridge	611849	3859738	n/a
8/25	NW edge Puerco Ridge	612332	3860767	n/a
8/25	NW edge Puerco Ridge	610137	3860024	n/a
8/25 (night)	Dry Wash near Agate Bridge	610137	3860032	n/a
8/25 (night)	Dry Wash near Agate Bridge	611098	3862012	n/a
8/26	NW edge Puerco Ridge	609025	3855712	n/a
8/26	NW edge Puerco Ridge	609491	3854607	n/a
8/26	NW edge Puerco Ridge	609039	3854754	n/a
8/28	SE from Crystal Forest to boundary	611479	3858124	6
8/28	SE from Crystal Forest to boundary	611752	3858126	5
8/28	SE from Crystal Forest to boundary	612127	3858380	4
8/28	SE from Crystal Forest to boundary	611647	3857534	7
8/28	SE from Crystal Forest to boundary	611479	3858124	6
8/29	SW corner, N toward Puerco Ridge	605609	3850995	4
8/29	SW corner, N toward Puerco Ridge	606160	3851725	6
8/29	SW corner, N toward Puerco Ridge	606571	3851858	3
8/29	SW corner, N toward Puerco Ridge	607241	3851539	4
8/29	SW corner, N toward Puerco Ridge	606355	3851031	4
8/29	SW corner, N toward Puerco Ridge	605700	3851043	4
8/30	NW corner, Dry Wash area	611776	3863083	6
8/30	NW corner, Dry Wash area	611952	3862935	n/a

Appendix 2 continued. Key coordinates for locating areas surveyed primarily for reptiles and amphibians during walking searches of the Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, in 2004-2005. Other areas surveyed (with mammal trapping as the primary focus) are given in Appendix 1. Data is in NAD 27 Datum except as noted. "EPE" is the estimated GPS error of each location. Surveys were conducted during the day except as noted.

Date	Location	UTM easting	UTM northing	EPE (m)
2004 continued				
8/30	NW corner, Dry Wash area	612137	3862428	6
8/30	NW corner, Dry Wash area	611909	3861207	8
8/30	NW corner, Dry Wash area	611231	3861925	4
2005				
4/23	Cottonwood Wash E of Agate House	605933	3852304	8
4/23	Cottonwood Wash E of Agate House	606275	3852482	5
4/23	Cottonwood Wash E of Agate House	606631	3852409	4
4/23	Cottonwood Wash E of Agate House	607220	3852623	3
4/23	Cottonwood Wash E of Agate House	607720	3853289	5
4/23	Cottonwood Wash E of Agate House	608009	3853238	5
4/23	Cottonwood Wash E of Agate House	607140	3853693	4
4/23	Cottonwood Wash E of Agate House	606916	3853691	5
4/23	Cottonwood Wash E of Agate House	606899	3853551	4
4/23	Cottonwood Wash E of Agate House	606725	3853375	4
4/23	Cottonwood Wash E of Agate House	606585	3852644	4
4/23	Cottonwood Wash E of Agate House	606408	3852436	4
7/5	SE corner of wilderness area, NW	612739	3855620	3.8
7/5	SE corner of wilderness area, NW	612014	3856260	4.2
7/5	SE corner of wilderness area, NW	611633	3856073	4.4
7/5	SE corner of wilderness area, NW	612093	3855671	5.1
7/6	SE corner of wilderness area, SW	610580	3855725	7
7/6	SE corner of wilderness area	610467	3855867	5
7/6	SE corner of wilderness area	610238	3855597	4
7/6	SE corner of wilderness area	609848	3855534	4
9/3	N of Long Logs	605178	3852903	3
9/3	N of Long Logs	605178	3852903	3
9/3	N of Long Logs	605644	3852270	4
9/3	N of Long Logs	606183	3851944	4
9/3	N of Long Logs	606884	3851749	5
9/3	N of Long Logs	606582	3852390	5
9/3	N of Long Logs	605559	3852932	5
9/5	SE corner of wilderness to NW	606875	3850939	4
9/5	SE corner of wilderness to NW	607499	3851257	4
9/5	SE corner of wilderness to NW	608195	3851433	4
9/5	SE corner of wilderness to NW	607031	3852400	5

Appendix 3. Collection locations, dates, UTM coordinates, and specimen numbers for plant specimens collected in Rainbow Forest Wilderness Area, Petrified Forest National Park, Arizona, in 2005. UTM coordinates are in NAD 27 Datum. In the column General Location, "N"= north, "E"= east, and "S"= south. UTMs are occasionally given for reference without an associated collection at that point. Error refers to the estimated precision of error in meters of the UTM coordinates.

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/19/05	about a mile due E of Agate Bridge	Lappula	occidentalis	var. cupulata	0612369	3861976	4	24
5/19/05	about a mile due E of Agate Bridge	Calochortus	aureus		0612369	3861976	4	2
5/19/05	about a mile due E of Agate Bridge	Malacothrix	fendleri		0612369	3861976	4	16
5/19/05	about a mile due E of Agate Bridge	Chaenactis	stevioides		0612369	3861976	4	1
5/19/05	about a mile due E of Agate Bridge	Sphaeralcea	parvifolia		0612369	3861976	4	19
5/19/05	about a mile due E of Agate Bridge	Sporobolus	giganteus		0612369	3861975	4	
5/19/05	about a mile due E of Agate Bridge	Erodium	cicutarium		0612369	3861976	6	
5/19/05	about a mile due E of Agate Bridge	Cymopteris	bulbosus		0612369	3861976	4	5
5/19/05	about a mile due E of Agate Bridge	Astragalus	amphioxys	var. amphioxys	0612369	3861976	4	10
5/19/05	about a mile due E of Agate Bridge	Escobaria	vivipara		0612369	3861975	4	
5/19/05	about a mile due E of Agate Bridge	Cryptantha	crassisepala		0612369	3861976	4	11
5/19/05	about a mile due E of Agate Bridge	Monolepis	nuttalianis		0612369	3861976	4	25
5/19/05	about a mile due E of Agate Bridge	Yucca	angustissima		0612369	3861976	4	21
5/19/05	about a mile due E of Agate Bridge	Delphinium	scaposum		0612369	3861976	4	15
5/19/05	about a mile due E of Agate Bridge	Lupinus	pulsillus	var. intermontanus	0612369	3861976	4	13
5/19/05	about a mile due E of Agate Bridge	Abronia	elliptica		0612369	3861976	4	22
5/19/05	about a mile due E of Agate Bridge	Townsendia	annua		0612369	3861976	4	3
5/19/05	about a mile due E of Agate Bridge	Vulpia	octoflora	var. hirtella	0612369	3861976	4	4
5/19/05	about a mile due E of Agate Bridge	Phacelia	ivesiana		0612369	3861976	4	23
5/19/05	about a mile due E of Agate Bridge	Plantago	patagonica		0612369	3861976	4	8
5/19/05	about a mile due E of Agate Bridge	Eriogonum	divaricatum		0612369	3861976	4	17
5/19/05	about a mile due E of Agate Bridge	Gilia	sinuata		0612369	3861976	4	6
5/19/05	about a mile due E of Agate Bridge	Oenothera	albicaulis		0612369	3861976	4	14
5/19/05	about a mile due E of Agate Bridge	Hordeum	pusillum		0612369	3861976	4	9
5/19/05	about a mile due E of Agate Bridge	Ipomopsis	longiflora		0612369	3861976	4	20
5/19/05	about a mile due E of Agate Bridge	Cymopteris	acaulis	var. fendleri	0612369	3861976	4	12

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/19/05	about a mile due E of Agate Bridge	Dimorphocarpa	wislizeni		0612369	3861976	4	18
5/19/05	about a mile due E of Agate Bridge	Gaillardia	pinnatifida		0612369	3861976	4	7
5/20/05	whole area N of Agate Bridge	Phacelia	crenulata	var. corrugate	0612470	3863306	9	63
5/20/05	whole area N of Agate Bridge	Helianthus	annuus		0612469	3863306	5	60
5/20/05	whole area N of Agate Bridge	Isocoma	drummondii		0611046	3862407	3	70
5/20/05	whole area N of Agate Bridge	Ephedra	torreyana		0612311	3863089	4	52
5/20/05	whole area N of Agate Bridge	Lygodesmia	arizonica		0612912	3862033	5	35
5/20/05	whole area N of Agate Bridge	Streptanthella	longirostris		0612469	3863306	5	62
5/20/05	whole area N of Agate Bridge	Sphaeralcea	incana	var. cuneata	0612469	3863306	5	57
5/20/05	whole area N of Agate Bridge	Cryptantha	fulvocanescens	var. fulvocanescens	0611046	3862407	3	66
5/20/05	whole area N of Agate Bridge	Stephanomeria	exigua		0612618	3861996	4	32
5/20/05	whole area N of Agate Bridge	Isocoma	drummondii		0612633	3862718	4	43
5/20/05	whole area N of Agate Bridge	Descuriana	sophia		0612469	3863306	5	54
5/20/05	whole area N of Agate Bridge	Comandra	umbellata	ssp. pallida	0611046	3862407	3	67
5/20/05	whole area N of Agate Bridge	Lactuca	serriola		0611046	3862407	3	68
5/20/05	whole area N of Agate Bridge	Phacelia	cephalotes		0612912	3862033	5	34
5/20/05	whole area N of Agate Bridge	Mentzelia	albicaulis		0612912	3862033	5	35
5/20/05	whole area N of Agate Bridge	Helianthus	petiolaris		0612469	3863306	5	58
5/20/05	whole area N of Agate Bridge	Lappula	occidentalis	var. cupulata	0612912	3862033	5	36
5/20/05	whole area N of Agate Bridge	Descuriana	obtusa	ssp. obtusa	0612633	3862718	4	42
5/20/05	whole area N of Agate Bridge	Descuriana	pinnata		0612532	3862863	4	47
5/20/05	whole area N of Agate Bridge	Elaeagnus	angustifolia		0612469	3863306	5	55
5/20/05	whole area N of Agate Bridge	Linum	aristatum		0612369	3861976	4	30
5/20/05	whole area N of Agate Bridge	Mentzelia	pumila		0611310	3862619	5	65
5/20/05	whole area N of Agate Bridge	Chenopodium	leptophyllum		0612363	3863000	4	51
5/20/05	whole area N of Agate Bridge	Chaenactis	macrantha		0612369	3861976	4	26
5/20/05	whole area N of Agate Bridge	Cryptantha	crassisepala		0612912	3862033	5	35
5/20/05	whole area N of Agate Bridge	Oenothera	flava		0612363	3863000	4	50
5/20/05	whole area N of Agate Bridge	Artemisia	filifolia		0612108	3861757	4	

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/20/05	whole area N of Agate Bridge	Zuckia	brandegii	var. brandegii	0612107	3861757	3	27
5/20/05	whole area N of Agate Bridge	Bromus	japonicus		0611046	3862407	3	72
5/20/05	whole area N of Agate Bridge	Atriplex	saccaria		0612107	3861757	3	29
5/20/05	whole area N of Agate Bridge	Atriplex	confertifolia		0612633	3862718	4	45
5/20/05	whole area N of Agate Bridge	Atriplex	powellii		0612912	3862033	5	39
5/20/05	whole area N of Agate Bridge	Atriplex	confertifolia		0612912	3862033	5	38
5/20/05	whole area N of Agate Bridge	Echinocereus	sp.		0611046	3862407	3	
5/20/05	whole area N of Agate Bridge	Eriogonum	subreniforme		0612469	3863306	5	61
5/20/05	whole area N of Agate Bridge	Atriplex	confertifolia		0612633	3862718	4	44
5/20/05	whole area N of Agate Bridge	Oenothera	pallida	ssp. runcinata	0612469	3863306	5	56
5/20/05	whole area N of Agate Bridge	Sphaeralcea	incana	var. cuneata	0612363	3863000	4	49
5/20/05	whole area N of Agate Bridge	Psoralidium	lanceolatum		0612469	3863306	5	59
5/20/05	whole area N of Agate Bridge	Castilleja	applegatei	ssp. martinii	0612618	3861996	4	31
5/20/05	whole area N of Agate Bridge	Ericameria	parryi		0611046	3862407	3	71
5/20/05	whole area N of Agate Bridge	Artemisia	ludovisciana	ssp. albula	0612633	3862718	4	41
5/20/05	whole area N of Agate Bridge	Ericameria	nauseosa	var. nauseosa	0612633	3862718	4	40
5/20/05	whole area N of Agate Bridge	Chamaesyce	albomarginata		0612912	3862033	5	37
5/20/05	whole area N of Agate Bridge	Gilia	triodon		0612363	3863000	4	48
5/20/05	whole area N of Agate Bridge	Ipomopsis	pumila		0612633	3862718	4	46
5/20/05	whole area N of Agate Bridge	Hesperostipa	comata	ssp. comata	0612618	3861996	4	33
5/20/05	whole area N of Agate Bridge	Ipomopsis	pumila		0612470	3863306	9	64
5/20/05	whole area N of Agate Bridge	Quincula	lobata		0612311	3863089	4	53
5/20/05	whole area N of Agate Bridge							69
5/20/05	whole area N of Agate Bridge	Atriplex	obovata		0612107	3861757	3	28
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Erigeron	concinnus		0611163	3859618	4	74
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Tetraneuris	ivesiana		0611607	3858657	5	80
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Hymenopappus	filifolius	var. pauciflorus	0611607	3858657	5	81
5/21/05	on & around central N-S mesa running	Machaeranthera	grindelioides		0611607	3858657	5	82

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
	bet. Agate Bridge and Crystal Forest							
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Erigeron	divergens		0611256	3859348	4	75
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Eriogonum	wrightii	var. wrightii	0611707	3860096	6	95
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Lesquerella	intermedia		0611510	3858890	4	76
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Astragalus	amphioxys	var. amphioxys	0611256	3859348	4	75
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Cryptantha	fulvocanescens	var. fulvocanescens	0611607	3858657	5	83
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Phacelia	integrifolia		0611510	3858890	4	76
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Castilleja	applegatei	ssp. martinii	0611780	3859354	4	91
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Gilia	rigidula	ssp. acerosa	0611780	3859354	4	94
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Kraschininnikovia	lanata		0611780	3859354	4	88
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Frasera	albomarginata		0611780	3859354	4	89
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Tragopogon	pratensis		0611256	3859348	4	75
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Eriogonum	alatum	var. alatum	0611780	3859354	4	90
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Chamaesyce	fendleri		0611780	3859354	4	93
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Astragalus	mollissimus	var. thompsoniae	0611732	3859193	4	87
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Erysimum	capitatum	var. purshii	0611695	3858807	6	85
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Echinocereus	sp.		0611504	3858885	4	

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Echinocereus	sp.		0611163	3859617	4	
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Opuntia	whipplei		0611193	3859698	6	
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Escobaria	vivipara		0611193	3859698	6	
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Echinocereus	sp.		0611724	3855553	5	
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Bromus	spp.		0611580	3858881	10	
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Gutierrezia	microcephala					
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Gutierrezia	sarothrae					
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Bromus	rubens					
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Bromus	tectorum					
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Arenaria	eastwoodiae	var. adenophora	0611607	3858657	5	79
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Ephedra	torreyana		0611707	3860096	6	96
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Zuckia	brandegii	var. brandegii	0611607	3858657	5	77
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Sarcobatus	vermiculatus		0611732	3859193	4	86
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Chaetopappa	ericoides		0611695	3858807	6	84
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Abronia	elliptica		0610751	3860182	4	73
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest							92
5/21/05	on & around central N-S mesa running							93

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
	bet. Agate Bridge and Crystal Forest							
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Ephedra	viridis		0611707	3860096	6	97
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Hymenopappus	flavescens	var. canotomenstosus	0611256	3859348	4	75
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Opuntia	erinacea	var. utahensis	0610572	3856168	12	121
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Zuckia	brandegii	var. brandegii	0611607	3858657	5	78
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Escobaria	vivipara		0611512	3858821	6	
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Hilaria	jamesii					
5/21/05	on & around central N-S mesa running bet. Agate Bridge and Crystal Forest	Erigeron	concinnus		0611607	3858657	5	83
5/22/05	just SE of Flattops, in Juniper area	Ipomopsis	polycladon		0611707	3860097	4	99
5/22/05	just SE of Flattops, in Juniper area	Salsola	tragus		0611707	3860097	4	
5/22/05	just SE of Flattops, in Juniper area	Orobanche	ludoviciana	ssp. multiflora	0611707	3860097	6	98
5/23/05	near road	Chamaesaracha	coronopus		0607864	3858063	4	100
5/24/05	in grasslands around E boundary of park	Lesquerella	intermedia		0611669	3858604	3	107
5/24/05	in grasslands around E boundary of park	Astragalus	mollissimus	var. thompsoniae	0612325	3857656	4	110
5/24/05	in grasslands around E boundary of park	Astragalus	flavus		0611359	3858604	3	102
5/24/05	in grasslands around E boundary of park	Astragalus	amphioxys	var. amphioxys	0612325	3857656	4	109
5/24/05	in grasslands around E boundary of park	Elymus	elymoides		0611968	3857946	3	
5/24/05	in grasslands around E boundary of park	Sphaeralcea	ambigua		0611669	3858040	3	108
5/24/05	in grasslands around E boundary of park	Descuriana	obtusa	ssp. obtusa	0612841	3856965	5	120
5/24/05	in grasslands around E boundary of park	Streptanthella	longirostris		0611359	3858604	3	103
5/24/05	in grasslands around E boundary of park	Astragalus	ceramicus		0610459	3857648	5	123
5/24/05	in grasslands around E boundary of park	Eriogonum	leptophyllum		0611359	3858604	3	105
5/24/05	in grasslands around E boundary of park	Plantago	patagonica		0612325	3857656	4	112
5/24/05	in grasslands around E boundary of park	Oenothera	pallida	ssp. runcinata	0611927	3857265	4	113

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/24/05	in grasslands around E boundary of park	Sporobolus	airoides		0611359	3858604	3	104
5/24/05	in grasslands around E boundary of park							114
5/24/05	in grasslands around E boundary of park	Oenothera	albicaulis		0612841	3856965	5	119
5/24/05	in grasslands around E boundary of park	Eriogonum	leptocladon	var. ramossisimum	0610459	3857648	5	122
5/24/05	in grasslands around E boundary of park	Eriogonum	cernuum		0611927	3857265	4	115
5/24/05	in grasslands around E boundary of park	Artemisia	bigelovii		0611927	3857265	4	116
5/24/05	in grasslands around E boundary of park	Tamarix	chinensis					
5/24/05	in grasslands around E boundary of park	Opuntia	polyacantha	var. rufispina	0612018	3856867	4	117
5/24/05	in grasslands around E boundary of park	Opuntia	whipplei		0612386	3856828	4	118
5/24/05	in grasslands around E boundary of park	Echinocereus	fendleri		0612386	3856828	4	118
5/24/05	in grasslands around E boundary of park	Evolvulus	nuttallianus		0612325	3857656	4	111
5/24/05	in grasslands around E boundary of park	Delphinum	scaposum		0612325	3857656	4	110
5/24/05	in grasslands around E boundary of park	Ipomopsis	multiflora		0611669	3858040	3	106
5/25/05	in central restricted wilderness area	Oenothera	pallida	ssp. runcinata	0609895	3854958	4	138
5/25/05	in central restricted wilderness area	Muhlenbergia	pungens		0609895	3854958	4	140
5/25/05	in central restricted wilderness area	Salsola	tragus		0608707	3853909	7	
5/25/05	in central restricted wilderness area	Artemisia	frigida		0609372	3855967	4	125
5/25/05	in central restricted wilderness area	Eriogonum	leptophyllum		0608523	3854386	5	145
5/25/05	in central restricted wilderness area	Streptanthella	longirostris		0609841	3855136	5	137
5/25/05	in central restricted wilderness area	Atriplex	confertifolia		0609809	3856290	6	133
5/25/05	in central restricted wilderness area	Allium	macropetalum		0609895	3854958	4	139
5/25/05	in central restricted wilderness area	Caesalpinia	jamesii		0609847	3855529	10	134
5/25/05	in central restricted wilderness area	Ephedra	viridis		0610044	3854482	5	142
5/25/05	in central restricted wilderness area	Stanleya	pinnata		0609809	3856290	6	132
5/25/05	in central restricted wilderness area	Chamaesyce	fendleri		0609526	3856104	4	128
5/25/05	in central restricted wilderness area	Conyza	canadensis		0609526	3856104	4	127
5/25/05	in central restricted wilderness area	Astragalus	flavus		0609179	3855686	4	124
5/25/05	in central restricted wilderness area							135
5/25/05	in central restricted wilderness area	Escobaria	sp.		0608528	3851239	5	
5/25/05	in central restricted wilderness area	Asclepias	involucrata		0609372	3855967	4	126

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/25/05	in central restricted wilderness area	Achnatherum	hymenoides		0609647	3853985	6	
5/25/05	in central restricted wilderness area	Bouteloua	gracilis		0610044	3854482	5	
5/25/05	in central restricted wilderness area	Echinocereus	sp.		0609254	3855656	4	
5/25/05	in central restricted wilderness area	Amaranthus	acanthochiton		0608707	3853909	7	144
5/25/05	in central restricted wilderness area	Baccharis	wrightii		0608983	3853888	5	143
5/25/05	in central restricted wilderness area	Ipomopsis	longiflora		0609526	3856104	4	130
5/25/05	in central restricted wilderness area	Yucca	angustissima		0609526	3856104	4	131
5/25/05	in central restricted wilderness area	Zinnia	grandiflora		0609526	3856104	4	129
5/25/05	in central restricted wilderness area	Helianthus	petiolaris		0609895	3854958	4	141
5/25/05	in central restricted wilderness area	Atriplex	saccaria		0609841	3855136	5	136
5/27/05	in badlands about a mile E Long Logs	Salsola	tragus		0605152	3852116	5	
5/27/05	in badlands about a mile E Long Logs	Mirabilis	linearis		0606988	3852100	5	167
5/27/05	in badlands about a mile E Long Logs	Helianthus	annuus		0606005	3850852	5	
5/27/05	in badlands about a mile E Long Logs	Populus	deltoides	var. wislizenii	0605602	3852283	4	
5/27/05	in badlands about a mile E Long Logs	Tetraneuris	ivesiana		0606733	3851886	5	165
5/27/05	in badlands about a mile E Long Logs	Menodora	scabra		0606569	3851910	7	156
5/27/05	in badlands about a mile E Long Logs	Houstonia	rubra		0606569	3851910	7	162
5/27/05	in badlands about a mile E Long Logs	Hymenopappus	filifolius	var. pauciflorus	0606934	3851656	4	166
5/27/05	in badlands about a mile E Long Logs	Cymopteris	acaulis	var. fendleri	0605152	3852116	5	147
5/27/05	in badlands about a mile E Long Logs	Linum	puberulum		0605152	3852116	5	148
5/27/05	in badlands about a mile E Long Logs	Lappula	occidentalis	var. cupulata	0605152	3852116	5	146
5/27/05	in badlands about a mile E Long Logs	Brickellia	oblongifolia	var. linifolia	0607751	3852779	8	173
5/27/05	in badlands about a mile E Long Logs	Tripterocalyx	carnea	var. wootonii	0606460	3852467	5	174
5/27/05	in badlands about a mile E Long Logs	Erigeron	concinnus		0605602	3852283	4	151
5/27/05	in badlands about a mile E Long Logs	Salsola	tragus		0605892	3850568	7	
5/27/05	in badlands about a mile E Long Logs	Machaeranthera	grindelioides		0606569	3851910	7	164
5/27/05	in badlands about a mile E Long Logs	Tragopogon	dubius		0605370	3852336	5	175
5/27/05	in badlands about a mile E Long Logs	Tripterocalyx	carnea	var. wootonii	0606460	3852467	5	174
5/27/05	in badlands about a mile E Long Logs	Artemisia	ludovisciana	ssp. albula	0605602	3852283	4	152
5/27/05	in badlands about a mile E Long Logs	Draba	cuneifolia		0606195	3851947	10	158

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/27/05	in badlands about a mile E Long Logs	Astragalus	flavus		0607738	3852495	9	170
5/27/05	in badlands about a mile E Long Logs	Astragalus	amphioxys	var. amphioxys	0606569	3851910	7	163
5/27/05	in badlands about a mile E Long Logs	Opuntia	erinacea	var. erinacea	0605301	3852219	5	149
5/27/05	in badlands about a mile E Long Logs	Brickellia	californica		0606195	3851947	10	160
5/27/05	in badlands about a mile E Long Logs	Ericameria	nauseosa	var. nauseosa	0605602	3852283	4	153
5/27/05	in badlands about a mile E Long Logs	Conyza	canadensis		0606988	3852100	5	169
5/27/05	in badlands about a mile E Long Logs	Escobaria	sp.		0605892	3850568	7	
5/27/05	in badlands about a mile E Long Logs	Phacelia	ivesiana		0606569	3851910	7	161
5/27/05	in badlands about a mile E of Long Logs	Oenothera	caespitosa	ssp. crinata	0607738	3852495	9	172
5/27/05	in badlands about a mile E Long Logs	Castilleja	linariifolia		0606988	3852100	5	168
5/27/05	in badlands about a mile E Long Logs	Ericameria	nauseosa	var. nauseosa	0605602	3852283	4	154
5/27/05	in badlands about a mile E Long Logs	Atriplex	obovata		0606569	3851910	7	157
5/27/05	in badlands about a mile E Long Logs	Atriplex	canescens		0606569	3851910	7	159
5/27/05	in badlands about a mile E Long Logs	Chenopodium	pratericola		0607738	3852495	9	171
5/27/05	in badlands about a mile E Long Logs	Oenothera	caespitosa	ssp. crinata	0605602	3852283	4	150
5/27/05	in badlands about a mile E Long Logs	Isocoma	drummondii		0605602	3852283	4	155
5/28/05	along S and SE boundary of park	Malacothrix	fendleri		0608204	3850648	5	187
5/28/05	along S and SE boundary of park	Sphaeralcea	incana	var. cuneata	0608004	3850687	8	182
5/28/05	along S and SE boundary of park	Camissonia	scapoidea		0608004	3850681	8	184
5/28/05	along S and SE boundary of park	Calycoseris	wrightii		0606818	3850741	4	181
5/28/05	along S and SE boundary of park	Oenothera	caespitosa	ssp. caespitosa	0606818	3850741	4	183
5/28/05	along S and SE boundary of park	Orobanche	ludoviciana	ssp. multiflora	0610120	3854739	5	
5/28/05	along S and SE boundary of park	Eriogonum	cernuum		0606570	3850794	3	179
5/28/05	along S and SE boundary of park	Lygodesmia	grandiflora		0605101	3851171	4	176
5/28/05	along S and SE boundary of park	Atriplex	powellii		0609982	3851058	3	186
5/28/05	along S and SE boundary of park	Escobaria	vivipara		0609911	3855324	4	
5/28/05	along S and SE boundary of park	Gilia	triodon		0606570	3850794	3	180
5/28/05	along S and SE boundary of park	Psilostrophe	tagetina		0605780	3850871	5	178
5/28/05	along S and SE boundary of park	Heliomeris	multiflora	var. multiflora	0605492	3851129	7	177
5/28/05	along S and SE boundary of park	Stephanomeria	exigua		0610238	3852321	4	185

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
5/29/05	around Flattops area and on Flattops	Rhus	trilobata		0607939	3853867	5	190
5/29/05	around Flattops area and on Flattops	Parryella	filifolia		0607307	3853357	5	195
5/29/05	around Flattops area and on Flattops	Cryptantha	pterocarya		0607939	3853867	5	192
5/29/05	around Flattops area and on Flattops	Astragalus	lentiginosus	var. diphysus	0607939	3853867	5	194
5/29/05	around Flattops area and on Flattops	Arabis	perennens		0607939	3853867	5	193
5/29/05	around Flattops area and on Flattops	Aristada	adscensionis		0607939	3853867	5	189
5/29/05	around Flattops area and on Flattops	Dalea	lanata	var. terminalis	0607684	3853982	13	188
5/29/05	around Flattops area and on Flattops	Wyethia	scabra	var. canescens	0611634	3558887	18	197
5/29/05	around Flattops area and on Flattops	Escobaria	sp.		0608000	3850615	6	
5/29/05	around Flattops area and on Flattops	Stipa	neomexicana		0607307	3853357	5	196
5/29/05	around Flattops area and on Flattops	Chamaesyce	fendleri		0607939	3853867	5	191
5/29/05	around Flattops area and on Flattops	Bromus	rubens		0607939	3853867	5	
5/30/05	around Crystal Forest	Castilleja	integra		0612295	3860722	5	199
5/30/05	around Crystal Forest	Sphaeralcea	incana	var. cuneata	0612295	3860722	5	198
5/30/05	around Crystal Forest	Astragalus	praelongus		0612602	3860194	3	201
5/30/05	around Crystal Forest	Cryptantha	crassisepala		0612750	3860369	4	200
5/30/05	around Crystal Forest	Erodium	cicutarium		0612295	3860722	5	
8/23/05	E of Long Logs trail	Sporobolus	airoides		0605522	3852388	4	213
8/23/05	E of Long Logs trail	Populus	deltoides	var. wislizenii	0605598	3852282	5	217
8/23/05	E of Long Logs trail	Eriogonum	cernuum		0605522	3852388	4	209
8/23/05	E of Long Logs trail	Senecio	spartioides	var. multicapitatus	0605598	3852282	5	220
8/23/05	E of Long Logs trail				0606322	3852172	3	
8/23/05	E of Long Logs trail				0605919	3851985	4	
8/23/05	E of Long Logs trail	Muhlenbergia	pungens		0605598	3852282	5	218
8/23/05	E of Long Logs trail	Astragalus	albulus		0605883	3852415	6	223
8/23/05	E of Long Logs trail	Linum	puberulum		0605522	3852388	4	211
8/23/05	E of Long Logs trail	Vulpia	octaflora	var. hirtella	0605522	3852388	4	214
8/23/05	E of Long Logs trail	Eriogonum	leptophyllum		0605746	3852326	4	221
8/23/05	E of Long Logs trail	Lesquerella	intermedia		0605522	3852388	4	212
8/23/05	E of Long Logs trail	Heterotheca	subaxillaris		0605522	3852388	4	210

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/23/05	E of Long Logs trail				0605110	3851626	5	
8/23/05	E of Long Logs trail				0604781	3851544	4	
8/23/05	E of Long Logs trail	Dalea	candida	var. oligophylla	0605598	3852282	5	219
8/23/05	E of Long Logs trail	Ipomopsis	multiflora		0605578	3852416	6	216
8/23/05	E of Long Logs trail				0605726	3851818	6	
8/23/05	E of Long Logs trail	Chyrsothamnus	greenii		0605103	3852441	4	204
8/23/05	E of Long Logs trail	Eriogonum	leptocladon	var. ramossisimum	0606136	3852550	5	224
8/23/05	E of Long Logs trail	Stephanomeria	exigua		0606136	3852550	5	225
8/23/05	E of Long Logs trail	Cordylanthus	wrightii		0605746	3852326	4	222
8/23/05	E of Long Logs trail				0606549	3852559	4	
8/23/05	E of Long Logs trail	Phacelia	crenulata	var. corrugata	0605334	3852520	3	205
8/23/05	E of Long Logs trail	Machaeranthera	canescens	var. canescens	0605334	3852520	3	206
8/23/05	E of Long Logs trail	Eriogonum	divaricatum		0605103	3852441	4	202
8/23/05	E of Long Logs trail	Gutierrezia	microcephala		0605103	3852441	4	203
8/23/05	E of Long Logs trail	Muhlenbergia	porteri		0605334	3852520	3	207
8/23/05	E of Long Logs trail	Isocoma	drummondii		0605578	3852416	6	215
8/23/05	E of Long Logs trail	Thelesperma	megapotomicum		0605334	3852520	3	208
8/24/05	E of Agate House				0605702	3851042	5	
8/24/05	E of Agate House				0605065	3851349	4	
8/24/05	E of Agate House	Senecio	spartioides	var. multicapitatus	0605687	3850741	5	238
8/24/05	E of Agate House	Krascheninnikovia	lanata		0604644	3851579	4	239
8/24/05	E of Agate House	Achnatherum	hymenoides		0604940	3851604	5	229
8/24/05	E of Agate House				0605862	3851025	5	
8/24/05	E of Agate House				0605187	3851215	5	
8/24/05	E of Agate House	Bouteloua	eriopoda		0605687	3850741	5	237
8/24/05	E of Agate House				0606360	3851034	5	
8/24/05	E of Agate House				0606033	3851048	5	
8/24/05	E of Agate House				0605222	3850821	5	
8/24/05	E of Agate House	Comandra	umbellata	ssp. pallida	0604940	3851604	5	227
8/24/05	E of Agate House	Castilleja	sp.		0604940	3851604	5	226

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/24/05	E of Agate House	Chamaesyce	parryi		0604940	3851604	5	228
8/24/05	E of Agate House	Stephanomeria	exigua		0605687	3850741	5	235
8/24/05	E of Agate House	Psilostrophe	tagetina		0606033	3851048	5	231
8/24/05	E of Agate House	Machaeranthera	pinnatifida	ssp. pinnatifida	0605786	3850793	7	232
8/24/05	E of Agate House				0605644	3851311	6	
8/24/05	E of Agate House	Machaeranthera	pinnatifida	ssp. pinnatifida	0605687	3850741	5	236
8/24/05	E of Agate House	Artemisia	filifolia		0605786	3850793	7	234
8/24/05	E of Agate House	Eriogonum	corymbosum	var. aureum	0607803	3853212	4	248
8/24/05	E of Agate House	Andropogon	hallii		0604940	3851604	5	230
8/24/05	E of Agate House				0605168	3851483	4	
8/24/05	E of Agate House				0605276	3851446	4	
8/24/05	E of Agate House	Heliomeris	multiflora	var. nevadensis	0605786	3850793	7	233
8/25/05	E of Flattops	Salsola	tragus		0606919	3852237	19	244
8/25/05	E of Flattops	Juniperus	monosperma		0607177	3852597	5	246
8/25/05	E of Flattops	Bouteloua	curtipendula		0607982	3853284	10	249
8/25/05	E of Flattops	Astragalus	amphioxys	var. amphioxys	0606652	3853124	5	242
8/25/05	E of Flattops	Machaeranthera	canescens	var. canescens	0607309	3854239	4	251
8/25/05	E of Flattops	Cryptantha	pterocarya		0607635	3852935	4	247
8/25/05	E of Flattops	Salsola	tragus		0606919	3852237	19	245
8/25/05	E of Flattops				0607671	3853857	5	
8/25/05	E of Flattops	Solanum	jamesii		0606821	3853474	5	240
8/25/05	E of Flattops	Ericameria	nauseosa		0606821	3853474	5	241
8/25/05	E of Flattops	Artemisia	dracunculus		0606919	3852237	19	243
8/25/05	E of Flattops				0607635	3852935	4	
8/25/05	E of Flattops	Machaeranthera	canescens	var. canescens	0607309	3854239	4	251
8/25/05	E of Flattops	Sporobolus	cryptandrus		0607982	3853284	10	250
8/25/05	E of Flattops				0606821	3853474	5	
8/25/05	E of Flattops				0606652	3853124	5	
8/25/05	E of Flattops				0606715	3852836	6	
8/25/05	E of Flattops				0606746	3852569	4	

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/25/05	E of Flattops				0606777	3852365	4	
8/25/05	E of Flattops				0607177	3852597	5	
8/25/05	E of Flattops				0607309	3854239	4	
8/25/05	E of Flattops				0608312	3853608	5	
8/25/05	E of Flattops				0607767	3853755	5	
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Senecio	flaccidus	var. douglasii	0609232	3853632	4	270
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Sporobolus	giganteus		0609316	3854879	5	263
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Menodora	scabra		0609316	3854879	5	260
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Sphaeralcea	ambigua		0609316	3854879	5	261
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Linum	aristatum		0609316	3854879	5	259
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Dalea	lanata	var. terminalis	0609316	3854879	5	258
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Machaeranthera	pinnatifida	ssp. pinnatifida	0609232	3853632	4	269
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Sphaeralcea	ambigua		0610241	3854031	4	281
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Machaeranthera	canescens	var. canescens	0609316	3854879	5	262
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Pectis	angustifolia		0609316	3854879	5	256
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Lycium	pallidum		0610079	3853828	4	280
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Sphaeralcea	hastulata		0610372	3854127	4	283
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Opuntia	whipplei		0610372	3854127	4	285
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Zinnia	grandiflora		0609232	3853632	4	268
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Solanum	elaeagnifolium		0609207	3854029	4	266
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Sporobolus	flexuosus		0609316	3854879	5	255
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Lesquerella	fendleri		0610372	3854127	4	286
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Machaeranthera	tanacetifolia		0609316	3854879	5	257
8/26/05	E of 1/2 way bet. mile marker 22 & 23				0609307	3854559	6	
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Mirabilis	linearis		0610372	3854127	4	284
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Astragalus	mollissimus	var. thompsoniae	0609232	3853632	4	267
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Abronia	fragrans		0610241	3854031	4	282
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Aristida	purpurea		0609307	3854559	6	264
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Ephedra	cutleri		0609207	3854029	4	265
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Amaranthus	acanthochiton		0609316	3854879	5	253

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Erigeron	divergens		0609398	3853308	4	275
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Ambrosia	artemisifolia		0609316	3854879	5	252
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Cirsium	vulgare		0609398	3853308	4	276
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Salsola	tragus		0609398	3853308	4	272
8/26/05	E of 1/2 way bet. mile marker 22 & 23				0610092	3855041	4	
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Machaeranthera	tanacetifolia		0609264	3853444	5	271
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Chenopodium	leptophyllum		0609398	3853308	4	274
8/26/05	E of 1/2 way bet. mile marker 22 & 23				0609715	3853559	6	
8/26/05	E of 1/2 way bet. mile marker 22 & 23				0610226	3854759	4	
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Atriplex	powellii		0609398	3853308	4	277
8/26/05	E of 1/2 way bet. mile marker 22 & 23				0610241	3854031	4	
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Atriplex	powellii		0609398	3853308	4	278
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Tragopogon	dubius		0609398	3853308	4	279
8/26/05	E of 1/2 way bet. mile marker 22 & 23	Atriplex	argentea		0609398	3853308	4	273
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Dalea	nana		0611211	3855631	6	294
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0611992	3857046	4	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0612492	3856717	5	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Heliomeris	multiflora	var. multiflora	0610361	3856615	5	287
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Townsendia	annua		0610683	3856456	7	289
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0611358	3855631	5	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Lactuca	serriola		0610885	3856255	4	291
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0611009	3855560	22	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0610820	3855692	6	

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0611175	3855686	4	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0611515	3857928	4	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0610922	3856165	5	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Opuntia	erinacea	var. hystrix	0610683	3856456	7	288
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0610783	3857762	6	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Sphaeralcea	incana	var. cuneata	0612369	3856785	5	303
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Chamaesyce	revoluta		0611348	3857934	4	304
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Ipomopsis	pumila		0610677	3857708	6	306
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Gaura	mollis		0610193	3857497	3	308
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Sporobolus	cryptandrus		0611642	3855603	4	295
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Muhlenbergia	pungens		0612845	3856404	7	300
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Calamovilfa	gigantea		0610677	3857708	6	305
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Bouteloua	eriopoda		0612578	3855714	4	298
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0611724	3857716	4	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0611116	3857868	5	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Helianthus	annuus		0610677	3857708	6	307
8/27/05	E of Martha's Butte (1/2 mile S of mile	Machaeranthera	gracilis		0610885	3856255	4	290

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
	marker 21)							
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Erigeron	divergens		0612704	3856554	8	302
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Chamaesyce	revoluta		0610885	3856255	4	292
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Stephanomeria	pauciflora		0610923	3855753	4	293
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)				0612838	3855993	4	
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Heterotheca	villosa		0612278	3855617	6	297
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Sporobolus	contractus		0612578	3855714	4	299
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Chrysothamnus	baileyi		0612080	3855592	8	296
8/27/05	E of Martha's Butte (1/2 mile S of mile marker 21)	Chrysothamnus	greenii		0612704	3856554	8	301
8/28/05	E of Flattops				0608517	3853844	7	
8/28/05	E of Flattops				0608331	3851069	4	
8/28/05	E of Flattops				0607880	3851204	4	
8/28/05	E of Flattops				0607766	3851633	3	
8/28/05	E of Flattops				0607928	3851950	4	
8/28/05	E of Flattops				0608228	3852308	4	
8/28/05	E of Flattops				0608511	3852338	4	
8/28/05	E of Flattops				0608774	3853456	4	
8/28/05	E of Flattops	Heliomeris	multiflora	var. multiflora	0607990	3851311	5	314
8/28/05	E of Flattops				0605550	3854160	6	
8/28/05	E of Flattops	Astragalus	flavus		0608385	3851303	5	317
8/28/05	E of Flattops	Sphaeralcea	hastulata		0606868	3851081	4	318
8/28/05	E of Flattops				0608632	3853100	5	
8/28/05	E of Flattops	Eriogonum	divaricatum		0606795	3850975	6	319
8/28/05	E of Flattops	Erigeron	divergens		0608192	3851983	4	311

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/28/05	E of Flattops	Astragalus	xiphoides		0608192	3851983	4	310
8/28/05	E of Flattops	Astragalus	amphioxys	var. amphioxys	0607990	3851311	5	315
8/28/05	E of Flattops	Tripterocalyx	carnea	var. wootonii	0608199	3851454	6	316
8/28/05	E of Flattops	Sporobolus	cryptandrus		0608707	3853100	5	309
8/28/05	E of Flattops				0607506	3851152	4	
8/28/05	E of Flattops	Bouteloua	eriopoda		0607732	3851510	4	312
8/28/05	E of Flattops				0608080	3851021	5	
8/28/05	E of Flattops	Conyza	canadensis		0605943	3850668	6	320
8/28/05	E of Flattops				0606589	3850823	4	
8/28/05	E of Flattops				0607020	3851196	5	
8/28/05	E of Flattops				0608319	3851491	7	
8/28/05	E of Flattops				0607192	3851177	4	
8/28/05	E of Flattops				0607780	3851032	6	
8/28/05	E of Flattops	Gaillardia	pinnatifida		0607732	3851510	4	313
8/29/05	E of Flattops toward SW park boundary				0607916	3850876	5	
8/29/05	E of Flattops toward SW park boundary				0610087	3851442	10	
8/29/05	E of Flattops toward SW park boundary				0609952	3851647	17	
8/29/05	E of Flattops toward SW park boundary				0609433	3851730	5	
8/29/05	E of Flattops toward SW park boundary				0609636	3851209	4	
8/29/05	E of Flattops toward SW park boundary				0609765	3850956	4	
8/29/05	E of Flattops toward SW park boundary				0609420	3850915	5	
8/29/05	E of Flattops toward SW park boundary				0609049	3850829	6	
8/29/05	E of Flattops toward SW park boundary				0608747	3850829	6	
8/29/05	E of Flattops toward SW park boundary				0610206	3851222	6	
8/29/05	E of Flattops toward SW park boundary				0607436	3850776	4	
8/29/05	E of Flattops toward SW park boundary				0609830	3853190	6	
8/29/05	E of Flattops toward SW park boundary				0606560	3850675	4	
8/29/05	E of Flattops toward SW park boundary				0608926	3853223	3	
8/29/05	E of Flattops toward SW park boundary				0609263	3852998	4	
8/29/05	E of Flattops toward SW park boundary				0609497	3853185	5	

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/29/05	E of Flattops toward SW park boundary				0610122	3852914	6	
8/29/05	E of Flattops toward SW park boundary				0610457	3852598	4	
8/29/05	E of Flattops toward SW park boundary				0610356	3852534	6	
8/29/05	E of Flattops toward SW park boundary				0610143	3852388	5	
8/29/05	E of Flattops toward SW park boundary				0609749	3852152	8	
8/29/05	E of Flattops toward SW park boundary				0608166	3850672	4	
8/29/05	E of Flattops toward SW park boundary				0610586	3852931	4	
8/29/05	E of Flattops toward SW park boundary	Muhlenbergia	pungens		0610299	3850985	19	321
8/29/05	E of Flattops toward SW park boundary				0610543	3850890	4	
8/29/05	E of Flattops toward SW park boundary				0610071	3851900	8	
8/29/05	E of Flattops toward SW park boundary				0610430	3851305	8	
8/29/05	E of Flattops toward SW park boundary				0610299	3850985	19	
8/31/05	E of Agate Bridge	Kallstroemia	californica		0612304	3859727	4	336
8/31/05	E of Agate Bridge	Stephanomeria	pauciflora		0612365	3860711	4	325
8/31/05	E of Agate Bridge	Portulaca	oleraceae		0612304	3859727	4	337
8/31/05	E of Agate Bridge	Artemisia	fridgida		0611909	3858661	4	342
8/31/05	E of Agate Bridge	Lycium	pallidum		0612466	3861044	5	323
8/31/05	E of Agate Bridge	Nama	hispidum		0611909	3858661	4	341
8/31/05	E of Agate Bridge				0612689	3858811	4	
8/31/05	E of Agate Bridge	Solanum	jamesii		0612550	3861336	4	322
8/31/05	E of Agate Bridge	Oenothera	pallida	ssp. runcinata	0612554	3860463	5	332
8/31/05	E of Agate Bridge	Stephanomeria	exigua		0612365	3860711	4	326
8/31/05	E of Agate Bridge				0612220	3859925	5	
8/31/05	E of Agate Bridge				0612328	3858656	5	
8/31/05	E of Agate Bridge	Machaeranthera	canescens	var. canescens	0612554	3860463	5	333
8/31/05	E of Agate Bridge	Astragalus	amphioxys	var. amphioxys	0612349	3859405	4	338
8/31/05	E of Agate Bridge	Thelesperma	megapotomicum		0612325	3860648	6	330
8/31/05	E of Agate Bridge	Dalea	candida	var. oligophylla	0612554	3860463	5	331
8/31/05	E of Agate Bridge	Eriogonum	alatum	var. alatum	0612325	3860648	6	327
8/31/05	E of Agate Bridge	Artemisia	bigelovii		0612325	3860648	6	328

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
8/31/05	E of Agate Bridge	Eriogonum	divaricatum		0612435	3859071	4	340
8/31/05	E of Agate Bridge	Juniperus	osteosperma		0606885	3853658	4	343
8/31/05	E of Agate Bridge	Coripsermum	nitidum		0612554	3860463	5	334
8/31/05	E of Agate Bridge	Senecio	flaccidus	var. flaccidus	0612377	3860796	4	324
8/31/05	E of Agate Bridge	Ambrosia	artemisifolia		0612435	3859071	4	339
8/31/05	E of Agate Bridge	Achnatherum	hymenoides		0612458	3860132	4	335
8/31/05	E of Agate Bridge	Astragalus	praelongus		0612325	3860648	6	329
8/31/05	E of Agate Bridge				0612661	3860272	4	
9/01/05	E of Agate Bridge				0611281	3861192	4	
9/01/05	E of Agate Bridge	Chenopodium	berlandieri	var. zschackii	0611762	3862724	4	355
9/01/05	E of Agate Bridge				0611013	3861316	5	
9/01/05	E of Agate Bridge				0611407	3860646	4	
9/01/05	E of Agate Bridge	Krascheninnikovia	lanata		0610799	3860839	4	347
9/01/05	E of Agate Bridge	Pectis	angustifolia		0606884	3853658	4	344
9/01/05	E of Agate Bridge	Machaeranthera	tanacetifolia		0611522	3862236	4	354
9/01/05	E of Agate Bridge				0610811	3861460	4	
9/01/05	E of Agate Bridge	Helianthus	petiolaris		0611727	3860808	4	348
9/01/05	E of Agate Bridge	Verbesina	encelioides		0610799	3860839	4	345
9/01/05	E of Agate Bridge	Mentzelia	multiflora		0611522	3862236	4	353
9/01/05	E of Agate Bridge	Kochia	americana		0612418	3861277	6	350
9/01/05	E of Agate Bridge				0611524	3861078	6	
9/01/05	E of Agate Bridge	Chamaesyce	nutans		0610826	3861360	6	349
9/01/05	E of Agate Bridge				0611108	3860719	6	
9/01/05	E of Agate Bridge	Parryella	filifolia		0611229	3861717	4	352
9/01/05	E of Agate Bridge	Chenopodium	leptophyllum		0610799	3860839	4	346
9/01/05	E of Agate Bridge	Ericameria	nauseosa		0612290	3861595	4	351
9/02/05	E of 1/2 way bet. mile marker 22 & 23	Dalea	nana		0611175	3855686	4	361
9/02/05	E of 1/2 way bet. mile marker 22 & 23	Mirabilis	linearis		0610372	3854127	4	357
9/02/05	E of Martha's Butte (1/2 mile S. of mile marker 21)	Conyza	canadensis		0610372	3854127	4	359

Date Collected	General Location	Genus	Species	var or ssp	UTM N	UTM E	Error (m)	Specimen Number
9/02/05	E of 1/2 way bet. mile marker 22 & 23	Amaranthus	acanthochiton		0609386	3854669	3	356
9/02/05	E of 1/2 way bet. mile marker 22 & 23	Machaeranthera	pinnatifida	ssp. pinnatifida	0611175	3855686	4	360
9/02/05	E of Martha's Butte (1/2 mile S. of mile marker 21)	Heterotheca	subaxillaris		0610372	3854127	4	358
9/03/05	just below Agate Mesa	Gutierrezia	sarothrae		0610323	3861021	5	363
9/03/05	just below Agate Mesa	Croton	texensis		0610323	3861021	5	364
9/03/05	just below Agate Mesa	Lesquerella	intermedia		0610323	3861021	5	371
9/03/05	just below Agate Mesa	Xanthium	strumarium		0610323	3861021	5	362
9/03/05	just below Agate Mesa	Bouteloua	barbata		0610476	3860849	5	365
9/04/05	E of 1/2 way bet. mile marker 22 & 23	Machaeranthera	canescens	var. aristata	0609316	3854879	5	367
9/05/05	SW corner of park	Astragalus	sp.		0607353	3851175	13	369
9/05/05	SW corner of park	Erigeron	concinnus		0607353	3851175	13	368
9/05/05	SW corner of park	Salsola	tragus		0607911	3851606	4	370