PETITION TO LIST THE
Rocky Mountain Monkeyflower (*Mimulus gemmiparus*)
UNDER THE U.S. ENDANGERED SPECIES ACT

Photograph: Steve Olsen, U.S. Forest Service

Petition Submitted to the U.S. Secretary of Interior
Acting through the U.S. Fish and Wildlife Service

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INTRODUCTION

WildEarth Guardians hereby requests that the U.S. Fish and Wildlife Service (FWS) list the Rocky Mountain monkeyflower (*Mimulus gemmiparus*) as "threatened" or "endangered" throughout its entire range under the U.S. Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544).

The monkeyflower is endemic to Colorado and is known from only eight locations along the Front Range of the Rocky Mountains. NatureServe ranks *M. gemmiparus* as "G1" (critically imperiled globally and at very high risk of extinction) and the Colorado Natural Heritage Program ranks the species as "S1" (critically endangered throughout its range). The U.S. Forest Service, Rocky Mountain Region (Region 2) has designated the flower as a "sensitive species." The Smithsonian Institution petitioned to list this species in 1978, and the Secretary of the Interior responded by recognizing *M. gemmiparus* in 1980 as a category 2 candidate for listing under the Endangered Species Act. Although the Secretary has since discontinued the candidate 2 category and list, FWS regulations at the time defined category 2 candidates as "taxa for which information in the possession of the Service indicated that proposing to list as endangered or threatened was possibly appropriate, but for which sufficient data on biological vulnerability and threats were not currently available to support proposed rules." 61 Fed. Reg. 7596, 7597 (Feb. 28, 1996).

This petition presents substantial information indicating that the monkeyflower is biologically vulnerable to extinction and facing threats of sufficient magnitude to warrant listing under the ESA. WildEarth Guardians seeks to protect the Rocky Mountain monkeyflower under the ESA to preserve the species and its habitat. Over 99 percent of the species listed under the ESA persist today (Scott et al. 2006).[1] Listed species also benefit from the development of a federally funded recovery plan and designation of critical habitat. The ESA is the monkeyflower's best defense against extinction.

PETITIONER

WildEarth Guardians is a nonprofit environmental advocacy organization that works to protect wildlife, wild places and wild waters. The organization has more than 12,000 members and supporters and maintains offices in New Mexico, Colorado and Arizona. WildEarth Guardians maintains an active endangered species protection program. As part of this program, Guardians works to obtain ESA protection for a wide variety of imperiled wildlife and plants and the ecosystems on which they depend.

THE ENDANGERED SPECIES ACT AND IMPLEMENTING REGULATIONS

The Endangered Species Act of 1973 (ESA) protects plants and animals that are listed by the federal government as "endangered" or "threatened" (16 U.S.C. § 1531 et seq.). Any interested person may submit a written petition to the Secretary of the Interior requesting him to list a

[1]Compare the number of species currently listed under the ESA (1965) with the species that have been delisted due to extinction (9). *See* http://ecos.fws.gov/tess_public/pub/boxScore.jsp and http://ecos.fws.gov/tess_public/DelistingReport.do [Accessed February 2011].

species as "endangered" or "threatened" under the ESA (50 C.F.R. § 424.14(a)). An "endangered species" is "any species that is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. § 1532(6)). A "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C § 1532(20)). "Species" includes subspecies and distinct population segments of sensitive taxa (16 U.S.C § 1532(16)).

The ESA sets forth listing factors under which a species can qualify for protection (16 U.S.C. § 1533(a)(1)):

A. The present or threatened destruction, modification, or curtailment of habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; or
E. Other natural or manmade factors affecting its continued existence.

A taxon need only meet one of the listing criteria outlined in the ESA to qualify for federal listing.

If the Secretary determines that a species warrants a listing as "endangered" or "threatened" under the ESA, he is obligated to designate critical habitat for that species based on the best scientific data available (16 U.S.C. § 1533(b)(2)).

CLASSIFICATION AND NOMENCLATURE

Common name. Rocky Mountain monkeyflower; budding monkeyflower; Weber's monkeyflower.

Taxonomy. Ruth Ashton Nelson discovered *Mimulus gemmiparus* (Weber 1972) in 1950 before identification and description by William A. Weber in 1972 (Beatty et al. 2003) We refer to the species by its scientific name, "Rocky Mountain monkeyflower," or simply "monkeyflower" in this petition. The taxonomic classification for *Mimulus gemmiparus* is provided in Table 1.

Table 1. Taxonomic classification for *Mimulus gemmiparus*

Kingdom	Plantae
Phylum	Anthophyta
Class	Dicotyleddoneae
Order	Scrophulariales
Family	Scrophulariaceae
Genus	*Mimulus*
Species	*Gemmiparus*

SPECIES DESCRIPTION

Biologists characterize figworts (the Scrophulariaceae family) as often having colorful, zygomorphic (bilateral) flowers, taking the form of a sympetalous tube with petals that flare outward at the end. The *Mimulus* species has a two-lobed "lip" formed by the upper petals while the lower petals form a three-lobed, down-turned lip at times having a colorful, hairy, or ridged palate (GPFA 1986). *M. gemmiparus* is a small annual herb roughly 1 to 10 centimeters high with a hairless, typically unbranched, stem. Leaves are opposite, entire, oval in shape, hairless, and will grow to 10 millimeters long and 7 millimeters wide. Laterally compressed petioles are 2 to 3 millimeters long and bear a small pouch that contains a lens-shaped propagule used in asexual reproduction. As such, the plant as a whole is a repeating number of metamers, or identical segments lying in a longtitudinal series, where each portion of the plant's stem has a pair of opposite leaves with a petiolar sac growing a bulbil, used to reproduce (Beatty et al. 2003). Flowers are yellowish and formed singularly with two lips, typically 4 to 5 millimeters long and with an open throat. *M. gemmiparus* infrequently flowers naturally, making the plant inconspicuous to the eye (Beatty et al. 2003, Spackman et al. 1999). *Mimulus gemmiparus* appears to be a poor interspecies competitor (Beatty et al. 2003). Other vegetation is typically absent around the plant (Beardsley 1997; Beatty et al. 2003).

Weber made a full description of the Rocky Mountain monkeyflower (1972). Photographs and a biological illustration are available in the *Colorado Rare Plant Field Guide* (Spackman et al. 1999; *see also* Beardsley 1997).

Reproduction. The unique asexual form of reproduction in *M. gemmiparus* controls its life history. Its mode of reproduction is not known to occur in any other plant species (Beardsley 1997). Beardsley (1997) conducted extensive research and greenhouse experiments to document the plant's reproductive strategy. As the species is appears almost entirely dependent on asexual reproduction (through propagules) in the wild, survival of the species is critically dependent on overwintering and springtime germination success. As an annual, this species is dependent on the success of propagules from year to year. The longevity of the propagule in the soil is unknown (both longevity and germination are likely dependent on sufficient moisture). Therefore, for the survival of a population, it is important to maintain at least a few reproductive individuals at the location every year (Beatty et al. 2003). The apparent necessity of non-competing vegetation further limits satisfactory conditions.

M. gemmiparus forms propagules, consisting of a patiolar sac with a bulbil inside, on the petioles of all leaves (except the first pair, which spring from the previous year's plant). These embryo-like growths have the components necessary to form a new individual, including a shoot axis and rudimentary leaves and roots. As *M. gemmiparus* grows old and the end of the growing season in mountain and subalpine regions approaches, the leaf blades wither and the petiole shears off at the steam, releasing the propagule, which disperses. Germination follows in the spring with the bulbil growing into a new plant (Beardsley 1997).

The propagule is light and buoyant, which may allow for dispersal by floating downslope or by wind (Beardsley 1997). The species' unusual occurrence on the Horseshoe Park alluvial fan may

have resulted from water dispersion from an upstream location (Keigley 1993; *cited in* Beatty et al. 2003). "If natural dispersal vectors besides water exist for this species, they are unknown at this time" (CNHP 2011a). The propagules' adherent qualities may allow animals to propagate the species nearby (Beardsley 1997).

The plant rarely flowers in nature (Beatty et al. 2003; CNHP 2011b). Biologists often report only one flowering individual and observations in the wild have found seed capsules but without seeds (Beatty et al. 2003). Successful reproduction via seed has so far only been seen in the greenhouse (Beardsley 1997). In the wild, *M. gemmiparus* likely will either reproduce by its asexual vegetative process or fail to reproduce at all.

Ecologically, *M. gemmiparus* would seem to be an r-selected species as originally described by ecologists Robert MacArthur and E.O. Wilson in *The Theory of Island Biogeography* (1967). R-selected species can exploit low stress, high disturbance environments by minimizing vegetative growth but maximizing reproductive output (Beatty et al. 2003). Despite the absence of natural seed production, *M. gemmiparus*, as a short-lived, small herb, has the potential to maximize reproductive output by developing bulbils along with leaf development (Beatty et al. 2003). In an unstable or unpredictable environment, the monkeyflower should exhibit the ability of an r-selected species to reproduce quickly and colonize disturbed habitats (Beatty et al. 2003), while gradually giving way to K-selected species as the ecological environment stabilizes (this perhaps explains the early, unusual appearance of *M. gemmiparus* in the disturbed alluvial deposits at Horseshoe Park first described by Beardsley in 1997, but absent entirely for Steingraeber and Beardsley in 2005).

HABITAT REQUIREMENTS

M. gemmiparus is native and endemic to Colorado. It grows in spruce-fir-aspen communities (Beatty et al. 2003). It inhabits moist, seepy environments, frequently on ledges or beneath overhangs at the base of cliffs in montane to subalpine areas with observed populations ranging in elevation from 8,400-11,120 ft (2,560-3,390 m). The plant grows on a substrate of either biotite shist or granite, seeking moist conditions near seeps, waterfalls, and the alluvial deposits of floodplains. Most sites have a south- or west-facing aspect (Beatty et al. 2003; Steingraeber and Beardsley 2005). Habitat characteristics are summarized in Table 2.

Biologists found a notable population in Horsehoe Park's alluvial fan. This fan is an alluvial outwash left by a failed dam, suggesting that in at least rare catastrophic instances, the species can disperse widely (CNHP 2011a). This population of *M. gemmiparus* lived in an open area missing the standard cliff face or overhangs found in other populations but with a continual water source from stream rivulets (Beardsley 1997). The population was less dense than other sites and was interspersed among other plants such as grasses (Beardsley 1997). More recently, biologists observed no plants in this site (Steingraeber and Beardsley 2005).

Table 2. Summary of habitat information from all known populations of *Mimulus gemmiparus* in Colorado (Beatty et al. 2003).

County	Site Name	Elevation (ft)	General Habitat	Slope/Aspect	Substrate	Shading
Boulder	St. Vrain Canyon	10,121 to 10,259	Cliff ledges on glacially carved rock cliffs	Southwest aspect	Biotite shist	Partial shade from rock overhangs
Clear Creek	Guanella Pass	11,122	At lower slope of rock outcrop; near seeps with year-round moisture	West aspect, 90% slope	Granite	Partial shade to shaded
Grand	North Inlet Trail	8,999	Rock outcrop with bare soil next to trail; under a small overhang	Unavailable	Granite	Unavailable
Grand	East Inlet Trail	9,701	Rocky slope	Unavailable	Unavailable	Unavailable
Jefferson	Staunton State Park	10,000	Seep and waterfall overhang at base of 200 foot granite cliff; small overhang with hanging garden at base of large cliff; plants growing alone in packets of soil on granite adjacent to moss-covered seeps; in and among moss in moist seep; growing in cracks in moss; surrounding hillside is shrub/meadow community	Southwest aspect, steep slope, at base of cliff	Granite; dry granite gravel loam which is evidently wet during part of year	Shaded by cliff
Jefferson	Hankins Gulch	8,399	Under an overhand on granite outcrop; soil mostly bare under rock; directly next to creek and path; most, thin soil is well-shaded beneath *Pseudotsuga* spp. Canopy	Southfacing aspect level slope	Beryllium-bearing granite poryphry	Well-shaded beneath tree canopy
Larimer	Horseshoe Park	8,559	Alluvial deposits from a large floodplain as a result of a catastrophic event; wet rocky area with numerous small streamlets meandering through the flood area; atypical habitat that will probably succeed into unsuitable habitat; plants are on bare soil in and among roots bases of dead trees; essentially in a hole between roots with similar conditions to rock overhands (organic soil accumulation, constantly moist, shaded); on edge of rivulet	All aspects level slope	Deep, unsorted, damp coarse sand; sand, gravel, and boulders	Shaded
Larimer	Old Fall River Road	9,560 to 10,279	On seeping granite slopes; forming colonies in the protection of the overhanging rounded surfaces of erratic boulders	Gently sloping	Unavailable	Unavailable

GEOGRAPHIC DISTRIBUTION

M. gemmiparus is characterized by a disbursed, discontinuous scale regionally, but one that is locally clustered and dense. While it was first known to exist solely within the confines of Rocky Mountain National Park, researchers have since found the monkeyflower outside the park. The eight documented populations exist in an area roughly one hundred miles in length and thirty miles wide (Figure 1). A summary of the monkeyflower's historical range and distribution is provided in Table 3.

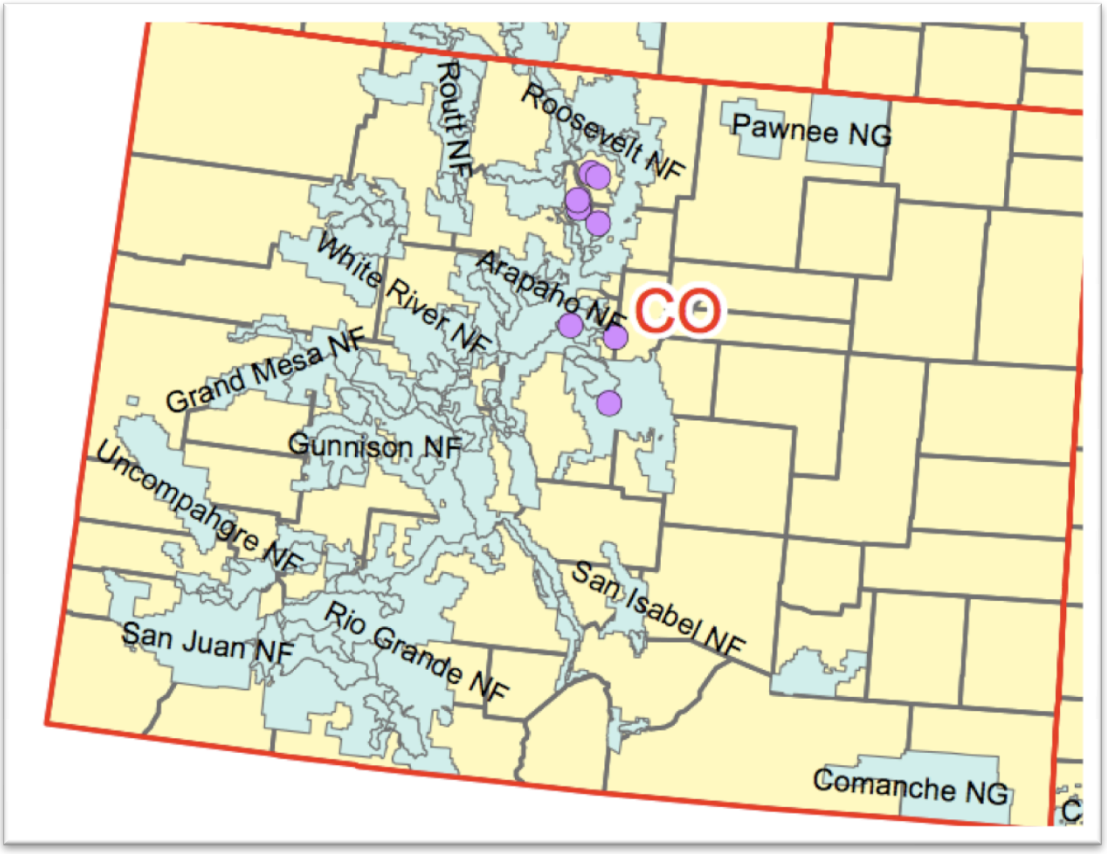

Figure 1. Distribution of eight *Mimulus gemmiparus* occurrences in Colorado. Each occurrence may include one to several populations (Beatty et al. 2003).

Possible explanations for this disbursed regional representation may include highly specialized habitat needs, heretofore unseen long-range dispersal ability, incomplete location of all existent populations, historical habitat destruction whether natural or human-induced, and environmental fluctuations (Beatty et al. 2003). The monkeyflower requires a consistent source of water both for germination and adult growth, causing plants to cluster around water sources such as creeks, seeps, and under rock overhangs (Beardsley 1997; Beatty et al. 2003). "[V]ery few locations would make viable habitat for persistent populations of the species" (Beardsley 1997).

"Estimated range is 2,519 square kilometers (972 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences" (CNHP 2011b). Local distribution of *Mimulus gemmiparus* is characterized by highly clustered and dense populations. The area

covered at most sites is small, which increases the susceptibility of these populations to destruction from a single disturbance (Beatty et al. 2003). Of the 60 patches of occurrences documented by Steingraeber and Beatty (2005), 56 are under 10 square meters or less in size. Cumulatively, St. Vrain Canyon represents the largest population area at 68 square meters (as of 2005). The densest patch was 100,000 plants crowded into the 13 square meter area of Hankins Gulch. The smallest patch by population was 3 plants found on 0.2 square meters in Staunton State Park (Steingraeber and Beatty 2005). "There is no habitat connectivity between any of the known occurrences, and it is unlikely that occurrences of this species will be separated by apparently suitable habitat" (CNHP 2011a).

The critical elements of suitable habitat are not fully identified. Researchers have observed suitable habitat adjacent to existing populations, but without plants (Beatty et al. 2003). This pattern may evince habitat requirements unknown to biologists that would limit *M. gemmiparus* to a narrower potential range of conditions than is presently recognized. The disappearance of monkeyflowers from the Horseshoe Park alluvial fan may be indicative of the limited habitat available to sustain a long-term, stable population. The small *M. gemmiparus* population may result from the limited quantity of suitable habitat including a shortage of areas with adequate moisture and possibly the absence of competitive species (Beatty et al. 2003).

Table 3. Status of eight historic *Mimulus gemmiparus* occurrences: population sizes, site areas, and managing agency (Beatty et al. 2003; Steingraeber and Beatty 2005).

County	Site	Dates of Observation	Site area (m^2)	Population (2005/06)	Management
Boulder	St. Vrain Canyon	1998, 2005	68.1	14,660	USFS Arapahoe-Roosevelt NF (Indian Peaks Wilderness)
Clear Creek	Guanella Pass	1995, 2005	10.0	600	USFS Pike-San Isabel NF
Grand	North Inlet Trail	1950, 1992, 2005	25.0	4,400	Rocky Mountain NP
Grand	East Inlet Trail	1961, 1982, 2005	13.0	800	Rocky Mountain NP
Jefferson	Staunton State Park	1992, 1999, 2005, 2006	1.0	~150-200	Colorado Division of Parks and Recreation
Jefferson	Hankins Gulch	1979, 1992, 2005	13.0	102,000	USFS Pike-San Isabel NF (Lost Creek Wilderness)
Larimer	Horseshoe Park	2005	38.0	3,200	Rocky Mountain NP
	Alluvial fan sub-site	1987, 1992, 2005	-	0	
Larimer	Old Fall River Road	1970, 1980, 2005	-	0	Rocky Mountain NP

IDENTIFIED THREATS TO THE PETITIONED SPECIES: CRITERIA FOR LISTING

M. gemmiparus meets at least three criteria for listing under ESA Section 4 (16 U.S.C. § 1533(a)(1)) (bolded):

A. The present or threatened destruction, modification, or curtailment of habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; and
E. Other natural or manmade factors affecting its continued existence.

(Factor A) Present and Threatened Destruction, Modification, and Curtailment of Habitat and Range

Recreation, trails, and roads. Recreational activities are considered the primary threats to the species (CNHP 2011a). The species' limited numbers and concentration in only a handful of small sites makes localized extirpation possible from a single disturbance (Beardsley 1997). Multiple patches are so small in size and density that a single human being, purposefully or inadvertently, may destroy an entire site. The plant's locations make for good camping and shelter areas given their proximity to water and trails or protective overhangs. Some "populations are small enough to be feasibly wiped out by a single unfortunately placed campfire, or possibly trampled to death by one group of hikers under the same overhang which houses the rare plant" (Beardsley 1997).

Road improvement and construction activities at Guanella Pass could affect hydrologic patterns, affecting the monkeyflower (Beatty et al. 2003; CFLDH 2009). A hiking trail bisects one population in Rocky Mountain National Park (Beatty et al. 2003). The population in Hankins Gulch is about 6 feet from a trail, where observers saw clusters of *M. gemmiparus* trampled by human, dog, or horse footprints (Beardsley 1997). This trail is expected to be rerouted to avoid damage to the plant this year (http://www.fs.fed.us/sopa/components/reports/sopa-110212-2011-04.html). One of the locations in Rocky Mountain National Park is used as a latrine and rest stop by hikers (Beatty et al. 2003). The waterfall area where the monkeyflower occurs in Staunton State Park will likely be a popular destination for visitors when the park opens to the public (Beatty et al. 2003).

Human population growth. *M. gemmiparus* exists only in a national park, two national forests, and a Colorado state park. Each of these locations lies within close proximity to large human populations that have grown significantly over the last several decades. The Front Range Urban Corridor, which fronts to the east all known *M. gemmiparus* populations, had a population of 4,333,742 at the 2010 United States Census, an increase of 17.50 percent since the 2000 United States Census (http://www.census.gov/). The Colorado Department of Local Affairs, State Demography Office, projects that between 2010 and 2025, the human population on the Front Range will increase by ~1,150,000 people (SDO 2011). This increased population may have significant impacts on *M. gemmiparus* locations from increased recreation. Nearly all sites are

near trails and roads, which are subject to impact from hikers, horses, dogs, off-road vehicles (except wilderness locations), or road and trail maintenance activity (Beatty et al. 2003).

Livestock and herbivore grazing. Native herbivores may trample or otherwise degrade *M. gemmiparus* habitat, as may domestic cattle in areas open to grazing (Beatty et al. 2003). Livestock grazing is not documented to be a direct threat to *M. gemmiparus*, but livestock presence in riparian areas could result in destruction by trampling. Also, livestock can spread exotic species to an area. *M. gemmiparus* seems to be a poor interspecies competitor (Beatty et al. 2003). There are no existing protections from grazing on the national forest sites, even in wilderness areas (NPLGC undated).

In Rocky Mountain National Park, excessive elk herds may create similar problems as cattle do in other areas. For example, willow is an important food source for elk. Willow is the dominant woody shrub on nearly all meadow or riparian areas in the park. This is the same habitat where the monkeyflower is found. Searching for willow, elk may trample or otherwise degrade the monkeyflower's habitat (even if elk do not eat the plant) (RMNP 2007b). The Park is currently experiencing ecological degradation due to a large elk population and lack of large predators, and as of 2009 had initiated a multi-decade plan to cull elk within the Park (Edward 2009; RMNP 2009). "Park officials have indicated that deteriorating ecological conditions within the Park are rooted in the absence of wolves… Rocky Mountain National Park needs wolves to keep the burgeoning elk population on the move – without them, the Park's aspen and willow trees will slide into local oblivion" (Edward 2009). The same may be true of the monkeyflower as of the aspen and willow.

Changes in natural regimes. Changes that affect hydrology, topography, soils, or shading also threaten *M. gemmiparus*. These could be any individual or combination of allogenic succession: fire, drought, rockfall, flash flood, global warming, erosion, blow down, or timber harvest (Beatty et al. 2003). Several locations have been affected by natural wildfires. For example, Steingraeber observed the Hankins Gulch location in 2003 and noted intensely burned areas within 30-40 feet of the *M. gemmiparus* population. While the riparian location of the monkeyflower protected it from this fire, the site's ecology was significantly altered in its hydrology and vegetation, and possibly soils, water runoff, erosion, and deposition of biotic mass as well (Beatty et al. 2003). The presence of nearby trails offers a direct threat to *M. gemmiparus* populations. Off-trail hiking, trail maintenance, and camping could cause trampling, and risk altering soil and water conditions as well as introducing exotic species. Wildfire fighting could also trample populations.

The loss of *M. gemmiparus* habitat has been documented in Rocky Mountain National Park (RMNP 2007b). There has been a 69 percent reduction in surface water as well as lowered water tables attributed to the loss of beaver, which has led to a significant decline in montane riparian willows (RMNP 2007b). The monkeyflower's riparian habitat indicates that, like willows, it is more dependent on groundwater from streams and snowmelt rather than rainfall. It is reasonable to conclude that the same factors responsible for declining willow populations may impact *M. gemmiparus*.

Climate change. The western United States will likely suffer a decrease in water resources due to climate change. "Warming in western mountains is projected to cause decreased snowpack, more winter flooding and reduced summer flows, exacerbating competition for over-allocated water resources" (IPCC 2007). Average temperatures in Colorado have increased 4.1° F, with annual precipitation down as much as 20 percent (EPA 1997). 2100 temperatures in Colorado could increase by 3-4°F in spring and fall (with a range of 1-8°F) and 5-6°F in summer and winter (with a range of 2-12°F) (EPA 1997). "With changes in climate, the extent of forested areas in Colorado could change little or decline by as much as 15-30 percent. The uncertainties depend on many factors, including whether soils become drier and, if so, how much drier. Hotter, drier weather could increase the frequency and intensity of wildfires, threatening both property and forests. Along the Front Range, drier conditions would reduce the range and health of ponderosa and lodgepole forests, and increase their susceptibility to fire" (EPA 1997).

Increased numbers or intensities of fires could have a damaging impact on the monkeyflower, easily destroying entire populations. Climate change may bring this about. "Large fire events are associated with extreme drought conditions, especially those caused by broad scale climate patterns… [R]egional changes in precipitation play a major role in large-scale fires in subalpine forests, which take place during extreme regional drought conditions. Large fires in the subalpine are not necessarily related to above average moisture conditions preceding fires, which increase fine fuels like grasses and are essential for fire occurrence in some lower-elevation forest types. These results indicate that large fires in [Rocky Mountain National Park] depend only on severe drought within the fire year" (RMNP 2008). It is expected that as a result of climate change, "more extreme fire behavior due to drying will pose greater threats to human life and structures in and adjacent to [Rocky Mountain National Park]" (RMNP 2007a).

A drier, hotter climate brought about by climate change would also directly threaten the monkeyflower's reproductive strategy, which is dependent on sufficient moisture. "Water resources in drier climates tend to be more sensitive to climate changes. Because evaporation is likely to increase with warmer climate, it could result in lower river flow and lower lake levels, particularly in the summer. If streamflow and lake levels drop, groundwater also could be reduced" (EPA 1997). "A warmer climate would lead to earlier spring snowmelt, resulting in higher streamflows in winter and spring and lower streamflows in summer and fall. Most of Colorado's reservoirs are small in relation to total runoff; therefore, earlier snowmelt could reduce the reliability of many water supply systems within the state by limiting the amount stored for use in summer" (EPA 1997). "More precipitation is expected to fall as rain instead of snow, significantly decreasing snowpack. Glaciers and perennial snowfields are believed to have recently shrunk back to around their 1940s extent. In the short term, melting permafrost may supplement stream flows during dry periods. Over time, this 'stored water' will diminish and streams will dry" (RMNP 2007a). Because of the monkeyflower's dependence on adequate moisture for survival, reproduction, and dispersal, reduction in stream flows could be catastrophic for this species.

Climate change will affect montane and subalpine ecosytems in Rocky Mountain National Park and across Colorado. "The subalpine ecosystem will change due both to dramatic disturbances such as fire and insects and from more gradual processes such as warming temperatures" (RMNP 2007a). In the subalpine system, it is expected that "[l]imber pine, lodgepole, and spruce-fir

forests may be especially susceptible to abrupt change from fire, insects, and disease. The subalpine ecosystem is expected to shift up in elevation and decrease in total acreage. Tree community composition will likely shift within the subalpine zone. For instance, north-facing hillsides may no longer be moist enough to support Douglas fir regeneration." In addition, "[w]arming could affect alpine areas, causing tree lines to rise by roughly 350 feet for every degree Fahrenheit of warming. Mountain ecosystems such as those found in Rocky Mountain National Park could shift upslope, reducing habitat for many subalpine species. Changes in rainfall and snowfall could alter streamflows and affect wetlands and wildlife, and possibly accelerate the invasion of non-native plants into streamside habitats" (EPA 1997). As a montane and subalpine plant that disperses generally by moving downstream, the monkeyflower will likely be adversely affected by decreases in acreage and upward shifts in its habitat.

(Factor D) Inadequacy of Existing Regulatory Mechanisms

Despite being ranked as "critically imperiled" (S1) by the Colorado Natural Heritage Program (2011a) and as "critically imperiled" (G1) by NatureServe (2010), current regulatory mechanisms are inadequate to protect the limited number of documented populations of *M. gemmiparus*. Listing the monkeyflower under the ESA and designating critical habitat would protect the species against destruction and extinction.

Six out of the eight known occurrences fall within a "protected area," defined as "public and private land with special designations or stipulations that limit use (for example, Research Natural Areas, Wilderness Areas, National Parks, Areas of Critical Environmental Concern, conservation easements, etc.). Some of the occurrences are on National Park Service land (Rocky Mountain National Park) and are protected, in general, under NPS guidelines" (CNHP 2011a). However, "[e]xisting laws and regulations seem inadequate to conserve *Mimulus gemmiparus* over the long term" (Beatty et al. 2003).

Three federal and state agencies manage monkeyflower populations—the National Park Service (NPS), the U.S. Forest Service (USFS), and the Colorado Department of Natural Resources. They seek to balance conflicting interests with conservation of the flower. Listing *M. gemmiparus* brings this species within the purview of the Endangered Species Act, the goal of which is "[providing] a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." 16 U.S.C. § 1531(b). Currently, little incentive exists to implement key recommendations that would either limit risks to *M. gemmiparus* or add to our knowledge of the species. A key recommendation is to take action to limit adverse human impacts at known sites. For example, trails adjacent to populations in Rocky Mountain National Park should be rerouted or at minimum carefully monitored for impacts on the monkeyflower (Steingraeber and Beatty 2005). ESA listing would provide incentive to take these actions.

Rocky Mountain National Park. The NPS prohibits the collection of any native plants without a permit (Beatty et al 2003). However, the NPS provides other recreational opportunities that affect the monkeyflower in Rocky Mountain National Park. A hiking trail bisects one population in Rocky Mountain National Park, and another location is used as a latrine and rest stop by hikers (Beatty et al. 2003).

USFS. "*Mimulus gemmiparus* is designated as a USFS Region 2 sensitive species. As a result, *M. gemmiparus* may obtain some protection under various conservation strategies designed to protect plants and animals within federal lands, such as those discussed in the following sentences. The National Environmental Policy Act requires an assessment to evaluate the impacts of any federal projects to the environment. [USFS] policies require a Biological Evaluation to assess project impacts to sensitive species. [USFS] management plans may protect rare species by restricting vehicle use to established roads only" (Beatty et al. 2003, internal citations omitted). However, road improvement activities at Guanella Pass could affect hydrologic patterns, impacting the monkeyflower (Beatty et al. 2003; CFLDH 2009). "The USFS prohibits the collection of sensitive plants without a permit" (Beatty et al. 2003). However, the USFS has a duty to harvest timber, graze cattle, facilitate recreation, and provide for other "multiple uses" that may endanger the monkeyflower. Balancing other interests with the species' survival threatens *M. gemmiparus*.

> *USFS wilderness areas.* Wilderness areas have restrictions on motorized travel (Beatty et al. 2003). There are no existing protections from grazing on national forest sites, even in wilderness areas (NPLGC undated). Populations in wilderness areas are still threatened by recreational activities; for example the population in Hankins Gulch is about 6 feet from a trail, where observers saw clusters of *M. gemmiparus* trampled by human, dog, or horse footprints (Beardsley 1997). This trail is expected to be rerouted to avoid damage to the plant this year (http://www.fs.fed.us/sopa/components/reports/sopa-110212-2011-04.html).

Colorado Department of Natural Resources. Staunton State Park is not currently open to the public, but will be once the planning process and park infrastructure is completed (http://www.parks.state.co.us/parks/staunton/Pages/Staunton.aspx). The waterfall area where the monkeyflower occurs in Staunton State Park will likely be a popular destination for visitors (Beatty et al. 2003). Park managers will consider the presence of *M. gemmiparus* when creating land use plans (Beatty et al. 2003).

Federal. "This species was formerly considered a USFWS Category 2 plant but this category no longer exists. Therefore this species is not currently listed under the ESA" (Beatty et al. 2003, internal citations omitted). ESA listing is important for this species because the monkeyflower needs protections beyond what the management in the National Park, State Park, and USFS land and wilderness can provide. Threats to the monkeyflower from climate change cannot be mitigated by any of the above agencies and require action at the federal level (*see* Climate Change above).

> <u>(Factor E) Other Natural or Manmade Factors</u>

Biological vulnerability. *M. gemmiparus* is especially vulnerable to extinction due to its unique asexual reproductive strategy. Plants produce a small propagation tool inside the stalk of each leaf, which separates at the end of each season and seems to die, but then regerminates from the ground in the spring.

Because of the limited reproductive ability of *M. gemmiparus* and an unknown ability to colonize new locations, the loss of any individuals could undermine survival of the species. Long-term management and protection offered by the ESA is vital to preserving the plant. Current management is insufficient to protect the species. Protections could and should include: removing or rerouting trails near known populations, preventing or destroying introduced exotic species, monitoring erosion following natural fire, and limiting livestock grazing in or near monkeyflower populations. Also possible are protection for upstream water and protection of habitat from fragmentation (Beatty et al. 2003).

Small population size. FWS has routinely recognized that small population size and restricted range increase the likelihood of species extinction.[2] Due to their small size and limited range, all populations of the monkeyflower are vulnerable to local extirpation from seemingly insignificant disturbances. Beardsley (1997) observed that the growth of a single tree could alter environmental conditions for an entire population.

Cumulative threats. Any of the above-mentioned threats working in tandem could lead to the extinction of the monkeyflower. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction. Ongoing habitat destruction and fragmentation are the primary drivers of contemporary extinctions, particularly in the tropical realm, but synergistic interactions with hunting, fire, invasive species and climate change are being revealed with increasing frequency (Brook et al. 2008).

FWS should consider whether the array of aforementioned threats intersect and act synergistically, therefore increasing the likelihood of endangerment or extinction of the monkeyflower in the foreseeable future. For example, habitat loss and degradation due to impacts from human recreation is exacerbated by the threats of increased temperatures and more extreme weather caused by climate change, which may impact the plant's reproductive success. The combined effects of threats to the monkeyflower could cause a greater reduction in the monkeyflower population than would be expected from simply the additive impacts of the threats. "[H]abitat loss can cause some extinctions directly by removing all individuals over a short period of time, but it can also be indirectly responsible for lagged extinctions by facilitating invasions, improving hunter access, eliminating prey, altering biophysical conditions and increasing inbreeding depression. Together, these interacting and self-reinforcing systematic and stochastic processes play a dominant role in driving the dynamics of population trajectories as extinction is approached" (Brook et al. 2008).

As mentioned above, the monkeyflower is already at risk due to its small population, and thus could easily be at risk from synergistic impacts of other threats. "Traits such as ecological specialization and low population density act synergistically to elevate extinction risk above that expected from their additive contributions, because rarity itself imparts higher risk and

[2] See, for examples, candidate assessment forms for *Porzana tabuensis* (spotless crake, April 2010), *Eumops floridanus* (Florida bonneted bat, March 2010), *Vagrans egistina* (Mariana wandering butterfly, April 2010), *Gallicolumba stairi* (friendly ground-dove, March 2010), *Eremophila alpestris strigata* (streaked horned lark, April 2010), and *Hyla wrightorum* (Arizona treefrog, April 2010) (Available at http://ecos.fws.gov/tess_public/pub/SpeciesReport.do?listingType=C&mapstatus=1).

specialization reduces the capacity of a species to adapt to habitat loss by shifting range or changing diet. Similarly, interactions between environmental factors and intrinsic characteristics make large-bodied, long-generation and low-fecundity species particularly predisposed to anthropogenic threats given their lower replacement rates" (Brook et al. 2008).

> [O]nly by treating extinction as a synergistic process will predictions of risk for most species approximate reality, and conservation efforts therefore be effective. However challenging it is, policy to mitigate biodiversity loss must accept the need to manage multiple threatening processes simultaneously over longer terms. Habitat preservation, restoring degraded landscapes, maintaining or creating connectivity, avoiding overharvest, reducing fire risk and cutting carbon emissions have to be planned in unison. Otherwise, conservation actions which only tackle individual threats risk becoming half-measures which end in failure, due to uncontrolled cascading effects.

(Brook et al. 2008)

SUMMARY

Mimulus gemmiparus should be listed under the Endangered Species Act. Its small population size, specialized habitat needs, reliance on water and moist soils, discontinuous distribution, annual life history, unique asexual reproduction, and lack of interspecific competitive ability all limit its biological ability to thrive. The extent of suitable habitat is unknown, but given the small populations documented would appear to be limited. This underscores the danger of simple changes to soil, geology, or hydrology to any of the species existing populations. The isolated nature of its habitat limits if not prevents any ability to broaden genetic variation. As an annual, *M. gemmiparus* is highly reliant on successful asexual reproduction each year. Any disruption would severely imperil a population's survival. Listing under the ESA would provide incentive to protect the species from disturbance and destruction on a local level and to improve management of threats from climate change on the federal level.

REQUESTED DESIGNATION

Pursuant to Section 4(b) of the ESA, 16 U.S.C. § 1533(b), Section 553(3) of the Administrative Procedures Act, 5 U.S.C. § 553(e), and 50 C.F.R. § 424.14(a), we hereby petition the U. S. Fish and Wildlife Service to list the Rocky Mountain monkeyflower (*Mimulus gemmiparus*) as "threatened" or "endangered" under the Endangered Species Act. This listing action is warranted, given the rarity of this species, its biological vulnerability to extinction, and known threats to the existing populations including trampling, fire, and climate change. The monkeyflower is threatened by at least three of the five listing factors: present and threatened destruction, modification and curtailment of habitat and range; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. The petitioners also request that the Fish and Wildlife Service designate critical habitat in all occupied habitat and in suitable unoccupied habitat as appropriate for this species concurrent with final ESA listing.

REFERENCES

Beardsley, M. 1997. Colorado's rare endemic plant, *Mimulus gemmiparus*, and its unique mode of vegetative reproduction. M.S. thesis, Colorado State University, Fort Collins, CO.

Beatty, B., W. Jennings, and R. Rawlinson. 2003. *Mimulus gemmiparus* W.A. Weber (Rocky Mountain monkeyflower): A Technical Conservation Assessment. U.S. Forest Service, Rocky Mountain Region, Species Conservation Project, Denver, CO. Available at http://www.fs.fed.us/r2/projects/scp/assessments/mimulusgemmiparus.pdf.

Central Federal Lands Highway Division (CFLHD). 2009. Guanella Pass Reevaluation. Lakewood, CO.

Colorado Natural Heritage Program (CNHP). 2011a. Element Global Rank Report: *Mimulus gemmiparus.* Fort Collins, Colorado. Biodiversity Tracking and Conservation System.

Colorado Natural Heritage Program (CNHP). 2011b. Global Plant Characterization Abstract: *Mimulus gemmiparus.* Fort Collins, Colorado. Biodiversity Tracking and Conservation System.

Edward, R. 2009. A Vision for Wolves in the Southern Rocky Mountains. WildEarth Guardians Report: Santa Fe, NM.

Environmental Protection Agency (EPA). 1998. Climate Change and New Mexico. EPA 236-F-98-007p.

Environmental Protection Agency (EPA). 1997. Climate Change and Colorado. EPA 230-F-97-008f.

Great Plains Flora Association (GPFA). 1986. FLORA OF THE GREAT PLAINS. University Press of Kansas: Lawrence, KS.

Intergovernmental Panel on Climate Change (IPCC). 2001. Climate Change 2001 Synthesis Report: Summary for Policy Makers. Geneva, Switzerland.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007 Synthesis Report: Summary for Policy Makers. Geneva, Switzerland.

National Public Lands Grazing Campaign (NPLGC). Undated. Position paper: Livestock grazing and wilderness. Available at http://www.publiclandsranching.org/ [Accessed 9/29/11].

NatureServe. NatureServe Explorer: An online encyclopedia of life, Version 7.1 (online). NatureServe, Arlington, VA. (August 2010). Available at http://www.natureserve.org/explorer.

Rocky Mountain National Park (RMNP). 2007a. Climate Change in Rocky Mountain National Park: Preservation in the Face of Uncertainty. Available at http://www.nps.gov/romo/parkmgmt/research_publications.htm.

Rocky Mountain National Park (RMNP). 2007b. Final Environmental Impact Statement, Elk & Vegetation Management Plan. Available at http://www.nps.gov/romo/parkmgmt/upload/evmp_1chapt_dec_07.pdf.

Rocky Mountain National Park (RMNP). 2008. Effects of Elk Herbivory. Available at http://www.nps.gov/romo/parkmgmt/research_publications.htm.

Rocky Mountain National Park (RMNP). 2009. Subalpine Forest Fires and Climatic Variation. Available at http://www.nps.gov/romo/parkmgmt/research_publications.htm.

Scott, M. J., D. D. Goble, L. K. Svancara, and A. Pidgorna. 2006. By the Numbers. Chapter 2 *in* THE ENDANGERED SPECIES ACT AT THIRTY, vol. 1. Island Press: Washington, DC.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1999. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, U.S. Forest Service and U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program, Fort Collins, CO. Available at http://cnhp.colostate.edu/rareplants/cover.html [Accessed 7/4/11].

State Demography Office, Colorado (SDO). 2011. Preliminary Population Forecasts by Region, 2000-2040. Available at http://dola.colorado.gov/dlg/demog/2010censusdata.html [Accessed 9/29/11].

Steingraeber, D. A., and M. Beardsley. 2005. *Mimulus gemmiparus* Populations: Current Status and Extended Search. Prepared for USDA – Forest Service, Arapaho-Roosevelt National Forests and Pawnee National Grassland, Fort Collins, CO. Addendum added Sept. 2006.

Weber, W.A. 1972. *Mimulus gemmiparus* sp. Nov. from Colorado. Madrono 21(6): 423-425.