

**San Francisco Peaks ragwort
(*Packera franciscana*)**

**5-Year Review:
Summary and Evaluation**



Photo by Carolyn Hull-Sieg, U.S. Forest Service, Rocky Mountain Research Station

**U.S. Fish and Wildlife Service
Arizona Ecological Services Field Office
Phoenix, Arizona**

5-YEAR REVIEW
San Francisco Peaks ragwort (*Packera franciscana*)

1.0 GENERAL INFORMATION

1.1 Reviewers:

Lead Regional Office: Region 2, Southwest Regional Office
Susan Jacobsen, Chief, Threatened and Endangered Species,
505-248-6641
Wendy Brown, Recovery Coordinator, 505-248-6664
Julie McIntyre, Recovery Biologist, 505-248-6507

Lead Field Office: Arizona Ecological Services Flagstaff Sub-Office
Shaula Hedwall, Senior Fish and Wildlife Biologist, 928-226-0614

1.2 Methodology used to complete the review:

The U.S. Fish and Wildlife Service (USFWS) conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act (Act) (16 U.S.C. 1531 et seq.). We provided notice of this status review via the Federal Register (72 FR 20134) requesting information on the status of the San Francisco Peaks ragwort (=groundsel) (*Packera franciscana* [= *Senecio franciscanus*]). No comments from the public were received. This 5-year review was completed by the USFWS lead biologist for the species using information from species survey and monitoring reports, the 1987 San Francisco Groundsel (*Senecio franciscanus*) Recovery Plan (Recovery Plan) (USFWS 1987), peer-reviewed presentations, and documents generated as part of section 7 consultations. We discussed potential recommendations to assist in recovery of the species with recognized *P. franciscana* experts, including scientists from the Rocky Mountain Research Station (RMRS), U.S. Forest Service (USFS), and Northern Arizona University (NAU). We are particularly grateful to James Fowler, (RMRS), for his contributions and efforts to establish a methodology for monitoring the elevational distribution of the plant, determine species abundance, and conduct seed viability experiments.

Experts contacted that provided information used in the status review:

Carolyn Hull-Sieg, Research Plant Ecologist, Rocky Mountain Research Station,
Flagstaff, AZ
James F. Fowler, Ecologist, Rocky Mountain Research Station, Flagstaff, AZ
Barbara Phillips, Zone Botanist, Southwestern Region Forest Service, Flagstaff, AZ
Tina Ayers, Curator, Deaver Herbarium, Northern Arizona University, Flagstaff, AZ

Since the plant was listed, the name has changed from San Francisco Peaks groundsel (*Senecio franciscanus*) to San Francisco Peaks ragwort (*Packera franciscana*). This document will use *P. franciscana* or San Francisco Peaks ragwort or ragwort to refer to the plant. However, when referring to older documents such as the Recovery Plan, the name the species was listed under may also be used in order to refer to the correct name of the document.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review: 72 FR 20134

1.3.2 Listing history:

Original Listing

FR notice: 48 FR 52743

Date listed: November 22, 1983

Entity listed: Species

Classification: Threatened, with critical habitat.

Areas designated as critical habitat are the summits of Agassiz and Humphreys Peaks and the surrounding slopes and alpine area, San Francisco Peaks, Coconino National Forest, Coconino County, Arizona (Township 22 North, Range 7 East, N½ of the NW¼ of Section 5; Township 23 North, Range 7 East, W½ Section 32 and W½ Section 29) (USFWS 1983).

1.3.3 Associated rulemakings: None.

1.3.4 Review History:

A 5-year review was initiated on November 6, 1991 (56 FR 56882) for all species listed before 1991, but no document was prepared for this species.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 8.

The *Packera franciscana* recovery priority number is 8, meaning that the degree of threat is moderate, the potential for recovery is high, and the listed entity is a species (48 FR 43098).

1.3.6 Recovery Plan or Outline:

Name of plan or outline: San Francisco Peaks groundsel (*Senecio franciscanus*)
Recovery Plan

Date issued: October 5, 1987

Dates of previous revisions, if applicable: Not applicable.

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate? No.

The species is a plant, therefore the DPS policy does not apply.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan? Yes.

2.2.1.1 Does the recovery plan contain objective, measurable criteria? Yes.

Some criteria are measurable, but long-term population stability is not quantitatively defined.

2.2.2 Adequacy of recovery criteria

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat? No.

Information concerning the degree of cloning remains unknown, possibly leaving the plant susceptible to effects from limited genetic diversity, including the species' ability to respond to climate change.

2.2.2.2 Are all of the five listing factors that are relevant to the species addressed in the recovery criteria? No.

The recovery criteria do not reflect threats of tree encroachment (due to fire suppression or climate change) or the threat of climate change itself.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

The recovery plan for *P. franciscana* lists four actions identified as necessary for managing the essential habitat of the plant so that healthy populations may be sustained (USFWS 1987). These actions would not meet the USFWS's current standard for recovery criteria, but they are measurable and the USFS has implemented management activities intended to meet the intent of the first three actions. The actions identified in the recovery plan to be evaluated for meeting conditions of delisting are:

- 1) Demonstrated long-term stability in population levels and habitat size and quality at current levels or greater through monitoring studies;
- 2) Actions identified in the Alpine Tundra Management Plan are implemented;
- 3) Extend the improved trail system to the top of Humphrey's Peak and provide an alternate exit from the alpine zone; and,
- 4) Develop a cooperative agreement between the USFS and the USFWS on monitoring and enforcement of closure.

The final rule to list *P. franciscana* stated that the most severe threats to the species were the potential expansion of the Arizona Snowbowl Ski Area and trampling of plants and habitat by summer hikers due to inadequate regulation of off-trail hiking. These threats were described under Factor A (the present or threatened destruction, modification, or curtailment of its habitat or range) and all four actions were designed to address this

listing factor in the final rule. Factor D, the inadequacy of existing regulatory mechanisms, also is addressed by the first three conditions above, either in terms of enforcing existing regulations or in managing for protection. Uplisting criteria are not discussed in the Recovery Plan.

The following is a summary of what has been completed under each of these actions.

1) *Demonstrated long-term stability in population levels and habitat size and quality at current levels or greater through monitoring studies:*

Based upon information at this time, we are unable to demonstrate whether the population is decreasing, stable, or increasing. As described below, plant populations were originally mapped and described in 1978 and 1980. Surveys conducted in 1979 found 100 to 1,000 individual plants in a population; within population densities varied from 50 to 370 plants per 100 square meter (m²) (1,076 square feet [ft²]) (Philips and Peterson 1980). Based upon this information, USFS (1984) and USFWS (1987) estimated there were at least 100,000 clones of *P. franciscana* on the San Francisco Peaks. Coconino National Forest Service staff has periodically monitored discrete habitats where the plant occurs since that time. Unfortunately, very little of this data is comparable and it not possible to detect any population trend from these various estimates. In 1985, the distribution of *P. franciscana* on the San Francisco Peaks was mapped (Dexter 2007), but until 2008-2009 (Fowler et al. 2009, Fowler 2009) we have had no information regarding species abundance. Though monitoring by RMRS is dependent upon continued funding, they are planning to collect five years of species' abundance data and have established a repeatable methodology that may be used to determine future population trends.

2) *Actions identified in the Alpine Tundra Management Plan are implemented:*

The main management actions identified to alleviate recreational effects to *P. franciscana* have been implemented. These are (a) instituting a trail system from the Arizona Snowbowl ski area lodge to the saddle north of Agassiz Peak and thence to the Weatherford Road and Humphrey's Peak and (b) closing the alpine to non-permit off-trail use. In addition, implementation of an enforcement and monitoring program, and interpretive signage along the trail was accomplished as part of the Arizona Snowbowl Ski Area Facilities Improvement Project to minimize the potential for impacts to alpine tundra and *P. franciscana*.

3) *Extend the improved trail system to the top of Humphrey's Peak and provide an alternate exit from the alpine zone:*

This action is completed.

4) *Develop a cooperative agreement between the USFS and the USFWS on monitoring and enforcement of closure:*

We have met with the Coconino National Forest on several occasions to discuss monitoring and enforcement of the closure. However, development of a formal agreement seems unnecessary as most conservation actions the USFS has taken to protect *P. franciscana* are documented in the Alpine Tundra Management Plan and in our July 8, 2004, concurrence letter for the Arizona Snowbowl Ski Area Facilities Improvement

Project (see USFWS consultation file 22410-2002-I-0523) and meet the objectives of what would be included in a cooperative agreement.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

Packera franciscana is a dwarf alpine plant in the sunflower family that is found only on the talus slopes in the alpine zone on the San Francisco Peaks, north of Flagstaff, in Coconino County, Arizona. A detailed account of the taxonomy, biology, and reproductive characteristics of *P. franciscana* is found in the Final Rule listing the ragwort as a threatened species (USDI 1983) and in the Recovery Plan (USDI 1987). The information provided in those documents is included herein by reference.

The plant grows on gravelly, sandy loams associated with talus in alpine fellfield above 3,322 meters (m) (10,900 feet [ft]) in elevation to 3,780 m (12,400 ft) (USDI 1983, 1987). The plant has a known global range of 85.59 hectares (ha) (211.49 acres [ac]) (Dexter 2007). The plant exists mainly on talus slopes as a primary successional species. Populations occur on Humphreys, Agassiz, Fremont, and Doyle peaks, and along the north rim that extends northeast from Humphreys Peak. The plant reproduces vegetatively via rhizomes, indicated by the high percentage of plants growing in dense clusters (Phillips and Peterson 1980). However, sexual reproduction also occurs, evidenced by numerous, scattered, individual plants and the observation of mature fruits with dense flowers (Phillips and Peterson 1980). Pollinators have been observed on the flowers, but we do not have any information regarding pollinator species. Flowering is from August to early September, fruits mature in mid-September, and the plant becomes winter-dormant in early October (USFWS 1983). The most recent surveys, described below, found a total of over 36,000 ramets¹ of the species along 2 transects (Fowler 2009).

2.3.1.1 New information on the species' biology and life history:

We have no data to indicate that there has been any new information published regarding the species' biology and life history.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Plant populations were originally mapped and described in 1978 and 1980. In the 1980s the USFS (1984) and USFWS (1987) estimated there were at least 100,000 clones of *P. franciscana* growing in patches of many plants and scattered as individuals on the San Francisco Peaks. Coconino National Forest Service staff has periodically monitored the plants since that time, and until recently, the

¹ A ramet is a member or modular unit of a clone, which may follow an independent existence if separated from the parent organism (Lincoln et al. 1983).

distribution of *P. franciscana* had been mapped (Dexter 2007), but there was no information on species abundance or population trends.

In September 2008, the USFS RMRS initiated a monitoring study to track the abundance of *P. franciscana*. The study objectives are to: (1) establish a statistically robust sampling protocol for long-term population density trends along recreation trails on the San Francisco Peaks; (2) determine the elevation of *P. franciscana* population centroids along these transects in order to detect altitudinal migration; (3) provide data that will aid the Coconino National Forest and USFWS in species management; and, (4) initiate seed viability studies (Fowler et al. 2009). Please see Fowler et al. (2009) for a description of the methodology used. To briefly summarize these methods, an elevational transect was established along the 2 established recreational trails with sample points established at 25 m (82 ft). At each sample point, researchers counted ramets within 12 individual 1 m² (11 ft²) frames, within 2 meters of the trail.

Study results estimated the trail side density of *P. franciscana* along the Humphrey's Trail to be approximately 3.19 ramets per m² (0.3 ramets per ft²), and the population centroid along the transect was located at 3,640 ± 5 m (11,042 ± 16 ft) and 3,641 ± 7 m (11,946 ± 23 ft) in elevation in 2008 and 2009, respectively (Fowler 2009). In September, 2009, the RMRS re-measured the Humphrey's Trail trailside transect and an additional trailside transect (Weatherford Trail) on the opposite slope aspect. The overall *P. franciscana* 2009 trailside density estimate was 4.36 ± 0.88 ramets per m² (0.4 ± 0.08 per ft²) within the plant's elevational range of occurrence (3,471 to 3,722 m [11,388 to 12,211 ft]) on these transects (Fowler 2009). The 2009 inner basin ramet density was higher than the estimate on the outer slopes and the overall *P. franciscana* population estimate along the two trails was over 36,000 ramets (Fowler 2009). The preliminary conclusion of the monitoring data is that *P. franciscana* is persisting and producing seed. The intent, pending funding, is for RMRS to conduct long-term monitoring of these transects in order to detect a trend. In addition, RMRS will collect seed and initiate seed viability studies. Re-measuring plots along the two transects and seed collections are planned for September 2010.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

We have no data regarding the genetics, genetic variation, or trends in genetic variation.

2.3.1.4 Taxonomic classification or changes in nomenclature:

The scientific name and common name for the plant have changed since the species was listed. The scientific name has changed from "*Senecio franciscanus*" to "*Packera franciscana*" (Greene) W. A. Weber & Á. Löve. The common name

has changed from “San Francisco Peaks groundsel” to “San Francisco Peaks ragwort.”

The scientific and common name changes are widely accepted by professionals and are the accepted names at the Deaver Herbarium at Northern Arizona University (personal communication, Tina Ayers, Curator, August 26, 2007). The name changes are based upon Weber and Löve (1981). Weber and Löve (1981) are following the European botanist’s generic circumscription of *Senecio* and the segregates. *Packera* is the genus used for the (former) *Senecios* that have pendant heads (*Senecios* are upright), branched and nonfleshy roots, and few teeth on the leaves. This segregation is based on morphological and cytological evidence. As such, the correct common name is San Francisco Peaks ragwort (as groundsel is reserved for *Senecio* species). However, pending edits to species’ scientific names are not changed until there is a Federal Register document published that finalizes those scientific name changes. Though we cannot legally change the existing list of official names given in the Code of Federal Regulations (CFR) (50 CFR 17.11 or 17.12 tables) until a Federal Register document is published, we are using both names in order to facilitate communication, particularly with species experts. Currently, the USFWS is in the process of correcting the list of official species’ names in the CFR to update the revised taxonomic status of *P. franciscana*.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species’ within its historic range, etc.):

It is difficult to determine from existing information if there has been any trend in spatial distribution of *P. franciscana* or a change in its historical range. It is believed that the plant inhabits much of the same area it occupied when it was first described in 1884 (USDA 1987). It is reasonable to assume, based on the dynamic nature of alpine tundra habitat (e.g., avalanches), that small portions of the habitat have likely been disturbed to the point that local populations and densities of *P. franciscana* have changed and/or moved in recent history.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Packera franciscana occurs on the volcanic San Francisco Peaks which rise abruptly from 7,000 ft (2,134 m) to an elevation of 12,633 ft (3,851 m). The San Francisco Peaks are the highest point in the southwestern U.S. and are the home of the only true alpine zone in Arizona (Goodwin 1978). The plant grows in the alpine tundra where it is found mostly between 11,572 ft (3,527 m) and 11,824 ft (3,604 m) with a range size of 85.59 hectares (ha) (211.49 acres [ac]) (Dexter 2007). However, *P. franciscana* occurs both above and below those elevations (USFWS 1987, Fowler 2009).

Geographically isolated areas, such as the San Francisco Peaks, often support endemism as they serve as an "island" where species develop without connection to other suitable habitats. The closest alpine areas to the San Francisco Peaks are in southeastern Utah and southwestern Colorado. Therefore, *P. franciscana* and its insular southwestern habitat may provide a unique opportunity to study the effects of climate change in Arizona.

Currently, there is some speculation as to how much change has or has not occurred in vegetation on the San Francisco Peaks. Photographs have been used to show that vegetation (treeline) encroachment, either due to fire suppression or climate change, is occurring on the San Francisco Peaks (USFWS files). As *P. franciscana* inhabits only open, sunny areas, shading or habitat alteration from tree encroachment could reduce available habitat for the species. In addition, a change in vegetation could modify the soil and other biotic factors that the plant depends upon. Research funded by the USFS using geographic information system (GIS) layers and digitized air photos collected to monitor *P. franciscana* habitat has not been able to confirm any elevational changes in timberline on the San Francisco Peaks (Dexter 2007). Dexter (2007) used composite images of these data layers to visually analyze whether a change in treeline extent could be determined in the 49 years between 1949 and 1998. Vegetation change was evaluated primarily through identification of trees or visible vegetation. The study did detect increases in the vegetation density from 1967 through the 1998 image mosaic (Dexter 2007). In addition, vegetation clearly defined as tree growth increased outside the defined study area. Data indicate that treeline changes within the study boundary were typically characterized by decreases in open meadow areas. However, no elevational change was detected for the upper treeline (Dexter 2007).

Unfortunately, no mosaic of any single photo set covered the entire study area and the area in the study images varied from year to year. Therefore, it is difficult to state with certainty at this time that the upper treeline on the San Francisco Peaks has remained static. In addition, extended drought has plagued Arizona since the mid-1990s and no analysis of photos post-1998 has been conducted.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

At the time of listing, the greatest threat to the species was thought to be the activity of summer hikers using a multitude of user-created trails and the lack of a designated trail to minimize effects to the San Francisco Peaks ragwort (USFWS 1983). Hikers were causing soil movement as well as rockslides along the steep slopes inhabited by *P. franciscana*, possibly causing fragmentation of the plant's rhizome system. In addition, the expansion of the Arizona Snowbowl, a local ski area located on Humphreys Peak, was predicted to have a serious detrimental

effect on *P. franciscana* (USFWS 1983).

The Arizona Snowbowl permit area consists of approximately 314 ha (777 ac) and is located on the southwestern slopes of the San Francisco Peaks, at an elevation ranging from 2,789 m (9,150 ft) to 3,670 m (12,040 ft) above mean sea level. Arizona Snowbowl Resort Limited Partnership, under a Special Use Permit from the Coconino National Forest, operates Arizona Snowbowl. The area consists predominately of subalpine, spruce-fir forest, but also includes mixed conifer forest, subalpine grassland, and alpine tundra habitats. Existing facilities at Arizona Snowbowl include 2 triple chair ski lifts (Agassiz and Sunset), 2 double chair lifts (Hart Prairie and Aspen), 55 ha (137 ac) of ski terrain, 2 (day) lodges, and maintenance and parking facilities. The Agassiz chair lift is also used in the summer for scenic rides, which gives hikers access to the tundra habitat.

In 2004, the Coconino National Forest proposed to implement the Arizona Snowbowl Ski Area Facilities Improvement Project. The expansion included the installation of a snowmaking system, construction of a new chairlift, replacement and realignment of three existing chairlifts, clearing of new ski terrain, installation of several beginner-level surface lifts, development of a lift-served snow tubing facility, expansion of the two day lodges, and construction of associated infrastructure and utilities, including a water delivery pipeline within existing right-of-ways (see USFWS consultation file 22410-2002-I-0523). This project is currently the subject of a legal challenge and as of September 2010, none of the expansion activities, including the infrastructure needed to make snow, have been implemented.

Within the Arizona Snowbowl permit area, alpine tundra habitat occurs at elevations from 3,429 to 3,536 m (11,250 to 11,600 ft), depending upon aspect and location. Tundra habitat occurs immediately above the top terminal elevation of the Agassiz chairlift. Other areas where re-contouring and rock/stump removal will take place (Spur Catwalk, upper portions of Flat Iron, Sundance, and Frontier ski trails) are within spruce-fir forest, outside of *P. franciscana* habitat. Five distinct populations of *P. franciscana* are growing within the permit area. Three of these occur in the immediate vicinity of Agassiz Peak and two are located downslope. The nearest location to the top terminal of the Agassiz chairlift is approximately 152 m (500 ft) upslope and consists of 10 plants. Designated critical habitat includes the eastern-most extent of the permit area (see USFWS consultation file 22410-2002-I-0523 for a detailed map).

Planned improvements to the ski area will not affect known populations or individual *P. franciscana* plants, but some activities will occur within designated critical habitat. The extension and smoothing/widening of five trails and the installation and operation of the snowmaking pipeline all fall within approximately 1 ha (2.4 ac) of designated critical habitat. However, this disturbance will occur in spruce-fir forest and will therefore not affect habitat for *P. franciscana*. There will be approximately 0.2 ha (0.5 ac) of disturbance on the talus slope immediately above the Agassiz chairlift top terminal. This area is

within alpine tundra habitat, but it is outside of designated critical habitat and surveys have not located any plants within this area. The population of 10 plants along the Upper Bowl Catwalk will not be impacted by proposed activities and there will be no snowmaking in any areas where there are known plant populations.

Development of a hiking trail from the Agassiz chairlift top terminal to the Agassiz mid-station will increase pedestrian activity on the lower slopes of Agassiz Peak. However, establishment of this hiking trail is not expected to increase the number of summer visitors using the chairlift (“Scenic Skyride”), but will affect use patterns. Currently, no summer access is allowed onto the mountainous slopes of the permit area. Limited access and a monitoring and interpretive program implemented at the top of the Agassiz chairlift have been effective in preventing hikers from accessing the sensitive alpine tundra. Once the trail is constructed, some visitors may attempt to reach the Humphrey’s trail by hiking off-trail. However, steep terrain and dense forest, implementation of an enforcement program, and interpretive signage along the trail minimize the potential for impacts to alpine tundra and the San Francisco Peaks ragwort.

Primary threats to *P. franciscana*, as described in the Recovery Plan (USFWS 1987), include trampling and habitat destruction by hikers. The Recovery Plan states that this threat would be exacerbated by increased summer visitor use that would result from the proposed Arizona Snowbowl expansion (as the action was described in the 1980s). However, in the final rule to list the plant we stated that the impact from the proposed expansion would be dependent upon the amount of care taken by the USFS and the permittee to minimize this threat (USFWS 1983).

In a letter dated July 8, 2004, the USFWS concurred with the USFS’s determination that the proposed project would not result in adverse effects to the threatened San Francisco Peaks ragwort or its designated critical habitat. We based our determination on the following: (1) no snowmaking using reclaimed water will occur where known plant populations exist; (2) no known plants or populations of plants occur in any area that will be impacted by proposed construction activities; (3) sensitive alpine tundra habitat, within and adjacent to designated critical habitat, will be protected through an enforcement and monitoring program, and interpretive signage along the trail (which is currently occurring and appears to be effective); and, (4) construction activities will not impact alpine tundra habitat within designated critical habitat. At present, the trail construction has routed summer hiker traffic away from plants and the enforcement, monitoring, and interpretive programs are ensuring that adverse effects do not occur. If monitoring indicates that a problem is developing, we expect the USFS to work with us to remove the threat to the plants and their habitat. To date, we have not received any monitoring reports from the Coconino National Forest indicating that impacts to plants are resulting in unanticipated or negative effects.

2.3.2.2. Overutilization for commercial, recreational, scientific, or

educational purposes:

Recreation impacts are discussed above. No other threats from overutilization are known to exist.

2.3.2.3 Disease or predation:

There is no evidence that either disease or predation is a contributing factor to the status of *P. franciscana*.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

At the time of listing, the final rule stated that there was little to regulate off-trail hiking except for a sign explaining the fragility of the tundra and requesting people to stay off the trails (USFWS 1983). Since that time, the Coconino National Forest has designated a single trail that takes hikers through *P. franciscana* habitat and has implemented the measures described under section 2.3.2.2 above. Due to a lack of monitoring data, we do not have quantitative information to indicate whether these measures have indeed improved habitat and reduced impacts to individual plants. However, it is likely that these measures are meeting their intended goal of alleviating soil disturbance as off-trail summer hiking has, for all practical purposes, been eliminated.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Global climate change may be the greatest threat to this alpine tundra-dependent species. Studies have shown that since 1950, the snowmelt season in some watersheds of the western U.S. has advanced by about 10 days (Dettinger and Cayan 1995, Dettinger and Diaz 2000, Stewart et al. 2004). Such changes in the timing and amount of snowmelt are thought to be signals of climate change in high elevations (Smith et al. 2000, Reiners et al. 2003). In alpine habitats, climate change intensifies natural drought cycles and the ensuing stress placed upon high elevation specialist species (IPCC 2007, Cook et al. 2004, Breshears et al. 2005, Mueller et al. 2005). The San Francisco Peaks ragwort may be threatened with extinction in the future if climate change results in the loss of tundra habitat on the San Francisco Peaks. Since the highest peak on the mountain is at 3,850 m (12,633 ft), there is little habitat available for the plant to migrate upward in a warming climate scenario, and we have speculated that the species may be vulnerable to extinction due to climate change. However, given that the effects of climate change may impact species across the Southwest, research that focuses on a small population with discrete boundaries, such as *P. franciscana*, may be a good starting point for measuring climate-related changes in vegetation that could be indicative of more widespread habitat changes occurring within montane systems and even throughout the Southwest.

The final listing rule (USFWS 1983) noted that winter avalanches, a natural disturbance, likely resulted in impacts to *P. franciscana*. The avalanches tend to

create disturbance areas that can impact existing vegetation. However, the plant seems to be adapted to some amount of disturbance, and it is not understood if this is a disturbance that results in negative, positive, or neutral impacts to the plant. Negative results may occur if plants are uprooted and destroyed. Personal observations indicate that the plant does occur in avalanche-disturbed areas and it is possible that these disturbances may allow for the plant to spread and/or take root in new areas. However, Phillips and Peterson (1980) noted that *P. franciscana* in protected areas (areas away from recreation) had higher reproductive success. Based upon this somewhat conflicting information, research is needed to better understand the role of natural and human disturbance in the life history of this plant.

2.4 Synthesis

In summary, *P. franciscana* is an endemic habitat specialist with a very limited distribution, making it highly vulnerable to extinction from localized stochastic events (though human impacts have been minimized to a great extent) and possibly, from global climate change due to its limited high-elevation habitat. Though the threats first anticipated to impact San Francisco Peaks ragwort have been mitigated by conservation measures and may be less severe than once thought (although more research is needed to determine this), we lack information on the genetic diversity and some aspects of the breeding biology of the plant, and have little data concerning the population trend of the species to make any recommendation other than to maintain its threatened status. The RMRS is currently conducting research that addresses some of these issues and will assist us in future status reviews of *P. franciscana*. The recent information we do have regarding the apparent persistence of the plant, the continued consistent occupancy of monitored areas, and implementation of many conservation measures to protect the plant and its habitat, would indicate that the plant is stable and no change in its status is required at this time. However, if data starts to show that the plant is moving up in elevation in response to a warming climate, this determination will likely need to be revisited.

3.0 RESULTS

3.1 Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- Extinction*
- Recovery*
- Original data for classification in error*
- No change is needed**

3.2 New Recovery Priority Number:

No change is recommended at this time; the Recovery Priority Number should remain at 8.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The following recommendations for future actions were the result of discussions on the status of the species and the species' needs with recognized experts from the USFS RMRS and Coconino National Forest. All of the actions below address the threats described in the Five-Factor Analysis and will provide important benefits for the recovery of the San Francisco Peaks ragwort.

- 1) We recommend that the USFWS, U.S. Forest Service Rocky Mountain Research Station, and Coconino National Forest establish a statistically robust, baseline population size estimate for the entire mountain and within the San Francisco Peaks Recreation Natural Area. This is necessary for us to better understand the true status and to accurately document responses and trends of the *P. franciscana* population.
- 2) We recommend that the USFWS initiate revision of the Recovery Plan (which is 23 years old) and develop specific delisting criteria for *P. franciscana*.
- 3) We recommend that the USFWS, U.S. Forest Service Rocky Mountain Research Station, and Coconino National Forest conduct long-term monitoring of the *P. franciscana* population centroid determined by Fowler et al. (2009) to allow detection of altitudinal migration.
- 4) We recommend that the USFWS, U.S. Forest Service Rocky Mountain Research Station, Coconino National Forest, and other partners conduct research on the reproductive biology of *P. franciscana* evaluating the genetic diversity within and between colonies, the breeding system involved with sexual reproduction, pollination, and fertilization.
- 5) We recommend that the USFWS, U.S. Forest Service Rocky Mountain Research Station, Coconino National Forest, and other partners conduct research on *P. franciscana* seed viability, seedling establishment, survivorship, and fecundity to better understand the life history characteristics of this species.
- 6) We recommend that the USFWS, U.S. Forest Service Rocky Mountain Research Station, Coconino National Forest, and other partners conduct research examining the effect of natural and manmade disturbance on *P. franciscana* persistence and distribution.

5.0 REFERENCES

- Breshears, D.D., N.S. Cobb, P.M. Rich, K.P. Price, C.D. Allen, R.G. Balice, W.H. Romme, J.H. Kastens, M.L. Floyd, J. Belnap, J.J. Anderson, O.B. Myers, and C.W. Meyer. 2005. Regional vegetation die-off in response to global-change-type drought. *Proceedings of the National Academy of Sciences* 102(42):15144-15148.
- Cook, E.R., C.A. Woodhouse, C.M. Eakin, D.M. Meko, and D.W. Stahle. 2004. Long-term aridity changes in the western United States. *Science* 306:1015-1018.
- Dettinger, M.D. and D.R. Cayan. 1995. Large scale atmospheric forcing of recent trends toward early snowmelt runoff in California. *Journal of Climate* 8:606-623.
- Dettinger, M.D. and H.F. Diaz. 2000. Global characteristics of streamflow seasonality and variability. *Journal of Hydrometeorology* 1:289-310.
- Dexter, L. R. 2007. Mapping impacts related to the *Senecio franciscanus* Greene Phase II. Report to the U S Forest Service, Coconino National Forest, FS Agreement #: 06-CR-11030414-777.
- Fowler, J.F., C. Hull Sieg, B.M. Casavant, and A. E. Hite. 2009. A Tale of Two Single Mountain Alpine Endemics: *Packera franciscana* and *Erigeron mancus*. *Proceedings of a conference; March 16-20, 2009. Salt Lake City, UT.*
- Fowler, J.F. 2009. Annual report for section 10(a)(1)(a) recovery permit. Electronic mail dated December 15, 2009 and attachments.
- Goodwin, G. 1978. An assessment of impacts created by past and present development on the alpine tundra zone of the San Francisco Peaks. Report prepared for U.S.D.A. Forest Service, Coconino National Forest.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Summary for policy makers. In: *Climate Change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Quin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at <http://www.ipcc.ch/>.
- Lincoln, R.J., G.A. Boxshall, and P.F. Clark. 1983. *A dictionary of ecology, evolution, and systematics.* Cambridge University Press, New York, NY, USA. 298pp.
- Mueller, R.C., C.M. Scudder, M.E. Porter, R.T. Trotter III, C.A. Gehring, and T.G. Whitham. 2005. Differential tree mortality in response to severe drought: evidence for long-term vegetation shifts. *Journal of Ecology* 93(6):1085-1093.
- Phillips, A.M. III and E.M. Peterson. 1980. Status report *Senecio franciscanus*. Unpublished status report for the USFWS, Albuquerque, New Mexico. 13 pp.

- Reiners, W.A., W.L. Baker, J.S. Baron, D.M. Debinski, S.A. Elias, D.B. Fagre, J.S. Findlay, L.O. Mearns, D.W. Roberts, T.R. Seastedt, T.J. Stohlgren, T.T. Veblen, and F.H. Wagner. 2003. Natural Ecosystems I: The Rocky Mountains (pp. 145-184). In Wagner, F.H. (Ed.), Preparing for Climate Change: Rocky Mountain/Great Basin Regional Assessment Team for the U.S. Global Change Research Program. Utah State University. 240 pp.
- Smith, S.J., T. Wigley, and J.A. Edmonds. 2000. "A new route toward limiting climate change?" *Science* 290(5494):1109-1110.
- Stewart, I.T., D.R. Cayan, and M.D. Dettinger. 2004. Changes in snowmelt runoff timing in western North America under a "business as usual" climate change scenario. *Climate Change* 62: 217-232.
- U.S. Fish and Wildlife Service (USFWS). 1983. Endangered and threatened wildlife and plants; final rule to determine *Senecio franciscanus* (San Francisco Peaks groundsel) to be a threatened species and determination of its critical habitat. *Federal Register* 48(226):52743-52747. November 22, 1983.
- U.S. Fish and Wildlife Service (USFWS). 1987. San Francisco groundsel (*Senecio franciscanus*) Recovery Plan. Albuquerque, NM. 39 pp.
- U.S. Forest Service (USFS). 1984. Alpine tundra interim management plan for *Senecio franciscanus* Greene. USDA Forest Service, Region 3. 12 pp.
- Weber, W.A. and Á. Löve. 1981. New combinations in the genus *Packera* (Asteraceae). *Phytologia* 49(1): 44 – 50.

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
San Francisco Peaks ragwort (*Packera franciscana*)**

Current Classification: Threatened

Recommendation Resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

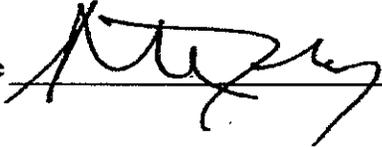
Appropriate Listing/Reclassification Priority Number, if applicable: Not applicable

Review Conducted By: Shaula Hedwall, Fish and Wildlife Biologist, Arizona Ecological Services Flagstaff Sub-office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve



Date

9/22/10

REGIONAL OFFICE APPROVAL:

Acting
**Lead Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service,
Region 2**

Approve



Date

10/22/10