Mountain golden heather
(Hudsonia montana)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Asheville ES Field Office
Asheville, North Carolina

November 2012

5-YEAR REVIEW
Mountain golden heather /*Hudsonia montana*

I. GENERAL INFORMATION

A. Methodology used to complete the review:

Public notice of this 5-year review was given in the Federal Register on July 28, 2006 (71 FR 42871-42872) and a 60-day comment period was opened. During the comment period, we did not receive any additional information about *Hudsonia montana* in response to the FR notice. However, the Service did receive additional information about the species in response to requests for specific information that were made (by the Service) directly to biologists familiar with the species. Additional information used in this report was gathered from published and unpublished reports in the Service's Asheville ES Field Office (hereafter, AFO) files. Updated records for the species were provided by the North Carolina Natural Heritage Program (hereafter, NC NHP). Once all data was gathered/obtained, the review was completed by the Service's lead recovery biologists for the species in Asheville, North Carolina (Carolyn Wells and Mara Alexander).

A draft of this five-year review was circulated to 10 persons for review. These persons were selected because of their familiarity with the species, their employment within applicable or affected natural resource agencies, or both. Responses were received from two of these 10 reviewers. A summary of the peer review process and comments received is provided in Appendix A.

B. Reviewers

Lead Region: Southeast Region, Atlanta, GA-Nikki Lamp (404-679-7118)

Lead Field Office: Asheville ES Field Office-Mara Alexander (828) 258-3939 ext. 238

C. Background:

1. **FR Notice citation announcing initiation of this review:** 71 FR 42871-42872; July 28, 2006

2. **Species status:** Stable. The aerial extent/size classes of *H. montana* between 2003 and 2009 have remained stable. Monitoring data obtained by the USFS in late 2009 indicates an increase in individuals from 2003-2004, but the overwhelming majority of these new plants are seedlings which can have a high mortality rate. Therefore, we need to monitor these seedlings to determine mortality rate.

3. **Listing history**
   Original Listing
   FR notice: 45 FR 69360-69363
   Date listed: October 20, 1980
   Entity listed: Species
   Classification: Threatened

Revised Listing, if applicable: n/a

4. **Associated rulemakings**: Critical habitat was designated at listing, in the above-referenced FR notice (45 FR 69360-69363); October 20, 1980

5. **Review History:**
AFO files do not contain prior agency status reviews or prior five year reviews for the species. However, the AFO files do contain numerous other documents with relevant information on the species. Documents containing more comprehensive summaries of the species' status are briefly summarized here to illustrate the nature of available information. For brevity and to minimize redundancy, relevant findings or observations from these and other documents are incorporated as appropriate in Section II.C. ('Updated Information and Current Species Status').

Synopsis of relevant reviews/documents

Morse (1979a) provided the first characterization of the conservation status of *Hudsonia montana*. His work included qualitative characterizations of the species across four locations within Linville Gorge, North Carolina (the only area known to contain the species at that time), and he estimated the total range to include some 200 plants. Sanders (1980) followed with a more quantitative study which estimated the total range to include "thousands of plants" distributed across five sites (Sanders treated one of Morse's sites as two discrete locations).

Pharr (1982) conducted a complete census of all known plants within all known populations. Pharr counted a total of 2,901 clumps across five sites (which she referred to as "populations", and which she further split into 31 subpopulations). Pharr also conducted extensive searches for new populations, both east and west of the Linville River. She established permanent transects in each of the five sites, along which the locations of each *H. montana* plant were mapped. Pharr's work was conducted in collaboration with the NC PCP. Her system of transects was later largely abandoned in favor of other sampling methods on Shortoff Mountain (C. Frost, formerly with NC PCP, pers. comm., 2007). NC PCP continued to assume the principal role in monitoring efforts for the species until 2004, when this responsibility was turned over to the United States Forest Service (USFS) and the Service at a joint meeting of these agency partners. NC PCP was also the primary author of most documents describing recovery efforts from 1982 to 2004.

Following Pharr's work, the next major phase of recovery efforts consisted of a five-year (1985-1989) field experiment examining the relative effectiveness of different management techniques (clipping versus burning) in reducing competition and maintaining the long-term viability of *H. montana* through seedling recruitment (Frantz, 1985; Frantz and Sutter, 1987; Frost, 1988; Frost, 1989; Frost, 1990a). This management experiment was conducted exclusively on Shortoff Mountain (the largest of the Linville Gorge populations). The experiment involved three treatments: a single burn conducted in late March 1987 (burn plots), annual clipping of competing vegetation (clipped plots), and a control. The design consisted of 10 experimental blocks, within each of which there were three plots and a variable number of $1/4m^2$ subplots.[1] Each treatment was randomly

[1] The total number of subplots is variously reported as 208, 210, and 212 in documents on file with the AFO. In reality, the design consisted of 210, $1/4m^2$ subplots within which individual plants were followed by repeat

assigned to one of three plots within a block. Within plots, 1/4m^2 subplots were centered on established *H. montana* plants (randomly selected from all those occurring within the plot). These subplots were photographed annually for the duration of the experiment (1985-1989), annually each year from 1990 to 1997, and then in years 1999, 2001 and 2003. During the five year study undertaken by NC PCP, the area occupied by *H. montana* within each 1/4m^2 subplot was digitized from the set of annual photographs, for purposes of examining the species' response to the different management treatments. Seedling cohorts emerging within these subplots in 1987, 1988 and 1989 were followed at monthly intervals during the growing season.

In 1990 NC PCP, USFS, and USFWS jointly agreed to shift the emphasis from research to active management, based primarily upon results from the five year management study. A ten-year work plan was produced, which provided annual objectives and agency responsibilities at each population from 1990 through 1999 (Frost, 1990b). This work plan also included estimates of equipment and labor costs, as well as estimates of time required to perform specific tasks. The first four years (1990 through 1994) of management and monitoring activities are detailed in a series of short annual reports by NC PCP (Frost, 1991; 1992; 1993a; 1993b; Frost et al., 1995 and summaries in annual reports to the Service for accomplishments using Section 6 funding for those years). These activities included implementation of prescribed burns supplemented with manual clearing of competing vegetation, augmentation of existing populations, continued efforts to redirect recreational user impacts away from occupied habitat, and continued monitoring of the species.

A second comprehensive inventory of all existing populations was conducted in 1993 (Frost et al., 1995), for purposes of comparison to Pharr's 1982 census. The 1993 census revealed a 36% decline across all Linville populations, from 2,901 (Pharr, 1982) to 1,854 clumps. Fourteen of the 31 subpopulations (45%) recognized by Pharr were apparently extirpated.

Gross et al. (1998) modeled the effectiveness of various management tactics upon population growth rates, based upon prior years of monitoring data collected by NC PCP. These modeling efforts predicted that a combined approach including both burning and reductions in trampling impacts would be required to reduce or eliminate ongoing declines in existing populations.

Michener (2004) and Donaldson (2004) conducted the 3rd global census for the species during the 2003 and 2004 field seasons. Michener's report (Michener, 2004) includes a compilation of local precipitation data and fire histories (prescribed burns and natural ignitions) for each *H. montana* site. Donaldson (2004) provides supplemental counts for sites that Michener either did not relocate or counted incompletely, as well as GPS coordinates for all known extant (and some presumably extirpated) *H. montana* locations.[2] After corrections and supplemental counts from Donaldson are taken into

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photographs over time. Two of these 210 subplots contained two (rather than one) plants that were each photographed over time, so these two 1/4m^2 subplots were each photographed twice (once for each plant). Therefore, the number of unique 1/4m^2 subplots is 210, but the number of photographs is 212 (Frost, pers. comm., 2007).

[2] Donaldson provided a master list of *corrected* GPS coordinates. This list includes corrections, with duplicate, erroneous or otherwise superfluous locations removed. It should be used in place of waypoints provided in Donaldson (2004).

account, the 2003-2004 census revealed the highest recorded estimates of plant numbers across the range of the species, with some 4,364 clumps estimated across all known sites.

On the whole, these increased numbers do not represent previously overlooked plants or changes in survey methods. As shown by annual survey and monitoring reports from NC PCP, these are increases in plant numbers possibly resulting from the experimental burns at Shortoff, Woods Mountain and Table Rock as well as hand clearing of competing vegetation in these sites and extensive recruitment of new plants at the Chimneys and Chimney Gap populations following the November 2000 wildfire there.

6. **Species' Recovery Priority Number at start of 5-year review:** 8 (species with a moderate degree of threat and high recovery potential)

7. **Recovery Plan or Outline**

Name of plan or outline: Mountain Golden Heather (*Hudsonia montana*) Recovery Plan
Date issued: September 14, 1983
Dates of previous revisions, if applicable: n/a

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy:

The DPS policy only applies to vertebrate species. Since mountain golden heather is a plant, the DPS policy does not apply.

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** No.

The species does have a final, approved recovery plan; however, the recovery criteria are only somewhat objective, and are not measurable. The limitations of the existing recovery criteria are addressed in Section 3, below.

2. **Adequacy of recovery criteria.**

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

b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?** Yes.

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 1983 Recovery Plan (USFWS 1983) for *H. montana* includes four recovery criteria. Each recovery criterion and the extent to which each has or has not been met is discussed below.

(1) *The five known populations are maintained at current levels or above and are self-sustaining.* The known populations have been relatively stable over time, though only through active land management.

(2) *Species biology and site dynamics are sufficiently understood to assure effective long-term management strategy.* Although we have learned a large amount of information about the species' biology and site dynamics so far, there are still many unknowns (e.g., water requirements and shade tolerance).

(3) *Protection and management policies of the U.S. Forest Service are proven effective.* More time and management work is required prior to deciding if the policies are effective.

(4) *The species and its habitat are protected from present and foreseeable human-related and natural threats that may interfere with the survival of any of the populations.* *Hudsonia montana* and its habitat are not protected from human-related and natural threats. The USFS is unable to perform controlled burns within the habitat that is home to the largest populations of the species due to housing development proximity. The destruction of habitat due to recreation has not been completely eliminated even when trails and camping sites are closed to the public. The possible effects of climate change on this species are currently unknown, so it is not clear if protection can be provided to *H. montana* if climate change were to become a threat in the future.

Adequacy of these criteria
These criteria are inadequate in that they are subjective and only somewhat measurable. Section IV ('Recommendations for Future Actions') includes a recommendation to revise these criteria to be more measurable and to include populations discovered since the recovery plan was published (see Section II.C., 'Updated Information and Current Species Status'). These criteria also do not reflect the critical role of fire in long-term habitat management, knowledge that has been gained since the recovery plan was finalized and which has been documented in a series of reports by NC PCP (Frost, 1991; 1992; 1993a; 1993b; Frost et al., 1995 and summaries in annual Section 6 accomplishment reports submitted to the Service during those years).

Recovery criteria and the five listing factors
Each of these four recovery criteria implicitly addresses one or more of the threats identified in the final listing rule. The final listing rule determined the following three listing factors to be significant for this species: the present or threatened destruction, modification or curtailment of habitat (factor A); the inadequacy of existing regulatory mechanisms (factor D); and other natural or manmade factors affecting the species' continued existence (factor E). With respect to listing factor A, the following specific threats were identified: trampling, soil compaction, camp fires, trail construction and associated soil erosion, and rock climbing. With respect to listing factor E, competition

for light from surrounding vegetation (presumably resulting from fire suppression) was also identified as a threat to the species. All of these threats continue to affect the species.

The final listing rule determined that listing factor B (overutilization for commercial, recreational, scientific, or educational purposes) and factor C (disease or predation) were not applicable to the species. However, the recovery plan identifies predation of seeds by an unidentified insect as a "serious threat", and further states that "this problem is common throughout the species' range". Subsequent investigation (Palmer, 1985) failed to substantiate this threat and it is no longer widely regarded as a significant threat to the species (see Section C.2. below).

C. Updated Information and Current Species Status

1. Biology and Habitat

a. 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:

Abundance and population trends (all sites)

Hudsonia montana was discovered by Thomas Nuttall on the summit of Table Rock, North Carolina in 1816 (Morse, 1979b). Nuttall described the species as "forming dense cespitose [growing in tufts or patches] patches; abundant on the romantic summit of Table Rock." The subsequent failure of several botanists to relocate the species at Table Rock or anywhere else within Linville Gorge throughout the 1960s and 1970s prompted many to presume the species extinct, until the species was rediscovered there in the late 1970s. In 1892, J.K. Small described the species from the southern end of Table Rock, an area where it no longer occurs (Frost, pers. comm., 2007).

Early estimates of population size varied widely, presumably due to differences in the intensity and spatial extent of any given survey effort. According to Smith (1978) and Pharr (1982), Morse initially estimated the total range to consist of some 200 plants distributed across four sites. Smith (1978) regarded Morse's estimates as far too low, but noted difficulties in obtaining comparable counts without a standardized monitoring program. Sanders (1980) counted significantly more plants (clumps) than observed by Morse (1979a, 1979b), estimating 1,500 plants from Shortoff Mountain alone, and speculating that across Linville Gorge the species was likely represented by "thousands of plants". No estimates of total population size (across all known sites) are provided in the 1980 final rule determining the species to be threatened under the Endangered Species Act (Act) (45 FR 69360-69363).

Pharr (1982) conducted the first comprehensive census of all known populations, counting 2,901 plants across five populations (and 31 subpopulations) in Linville Gorge. The five populations are: Table Rock, the Chimneys, Chimney Gap, Shortoff and the Amphitheatre/Carolina Wall.

Frantz and Sutter (1987) conducted a repeat census of all plants on Shortoff Mountain (the largest population) in 1985 and 1986. At Shortoff Mountain, the abundance of *H. montana* (measured as number of clumps) had decreased by 39%

(from 1,797 to 1,091 clumps) in those areas surveyed in 1982 and again in 1986. Frantz and Sutter (1987) interpreted this as a true decrease, one not likely attributable to surveyor error since Pharr accompanied Frantz in the field to standardize counting across the two survey periods. The reasons for the decline were not known, but drought was suspected to have played some role. These same authors reported the Table Rock population (the smallest known at that time) as having been extirpated (possibly due to recreation and camping) as of 1986. *H. montana* was extirpated from the top of Table Rock likely due to the elimination of fire which permitted woody expansion (trees and shrubs) to take over all former habitat for the species (Frost, pers. comm., 2007). In 1791, Andre Michaux described upper Table Rock as "very barren", in contrast with the dense growth of shrubs and trees found there today (Frost, pers. comm., 2007). Camping and trampling continued to impact the few plants surviving in the remaining open areas, which, paradoxically, were only kept open by camping, and when the plant was rediscovered there in the 1980s it was from fire-germinated seeds around a campfire site (Frost, pers. comm., 2007).

All known populations of the species remained in decline from 1985 through 1993 (Frost et al., 1995). In 1993, NC PCP conducted a repeat of Pharr's 1982 census of all known populations. The 1993 census revealed a 36% decline across the Linville populations, from 2,901 to 1,854 clumps. By the time of the 1993 census, one additional population had been located in adjacent McDowell County on Woods Mountain. In 1993, this population contained 120 clumps (roughly six percent of the total number of known plants across all populations).

The 2003-04 census of all known populations produced higher counts than any prior census (Donaldson, 2004; Michener, 2004). The total number of plants across all known populations was 5,053, compared with 1,967 in 1993 and 2,901 in 1982 (only the Linville Gorge populations were known at the time of the 1982 census). The number of plants counted within Linville Gorge in 2003-04 was 4,364, compared with 1,847 in 1993 and 2,901 in 1982. While some of these increases could be attributable to increased numbers of seedlings (either due to true increases in seedlings or more intensive searches for this stage class during the 2003-04 census), the magnitude and timing of these changes (e.g., occurring coincident with a period of active habitat management) suggest a legitimate increase in the number of known plants, well above the numbers known when the species was first federally listed. These changes are possibly attributable to the management actions implemented by NC PCP, USFS, and the Service, the results of which are described in the reports prepared by NC PCP (Frost, 1991; 1992; 1993a; 1993b; Frost et al., 1995).

A complete census of the subpopulations has been completed approximately every 10 years since 1982. An update to the census was completed in 2008 and early 2009 on Shortoff Mountain to document any changes as a result of the large stand replacement, duff-burning, lightning-set fire of 2007. The fire increased suitable habitat and more than doubled the previous high tally recorded for these 14 subpopulations. These increases are reflective of large increases in the smallest size class category recorded for the census. All of the remaining *H. montana* subpopulations were also censused in 2009. This includes the single subpopulation on Table Rock, and the two subpopulations at Woods Mountain. In contrast to the increasing population numbers recorded at Shortoff Mountain, there has been a 2-fold decline in *H. montana* clumps across the 19 subpopulations surrounding the Chimneys and Chimney Gap in Linville Gorge Wilderness. A four-fold decline in

abundance (from 191 clumps to 46 clumps) was recorded at Table Rock, while less of a decline (from 690 to 589 clumps) occurred at Woods Mountain during the last 5 years. Prior to this census, there had not been a prescribed burn within the surrounding plant communities for at least seven years.

In spring 2012, the USFS performed a prescribed burn surrounding both subpopulations on Woods Mountain in the Grandfather Ranger District of the Pisgah National Forest. In September 2012, a census of both subpopulations was completed. There was a decline in abundance in this population, decreasing from 589 clumps to 473. However, this census may have been too soon after the burn to see an increase in seedling growth, or the burn may not have been intense enough to positively affect *H. montana.*The USFS will continue to monitor effects of the burn in 2013.

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

The Service is not aware of any evaluations of genetics (including genetic variation within or among populations) conducted on this species.

c. Taxonomic classification or changes in nomenclature:

The Service is not aware of any such changes applicable to this species.

d. 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.):

Morse (1979a) described the known range as consisting of four locations: Table Rock, and three other sites (all within Linville Gorge) which he referred to as the "Campground Site" (discovered 1923), the "Lookout Site" (discovered 1975), and the "Flat Ledge Site" (presumably observed by Sargent in 1915, possibly the area seen by Nuttall in 1816). The version of Morse's report on file with the AFO does not contain maps or sketches of the four populations described, but Pharr (1982) includes a map which is titled "Distribution Map by Morse (1979)". This map depicts four general locations which are not labeled. It seems reasonable to assume that these locations correspond to the four locations described by Morse (1979a).

Sanders (1980) recognized five locations by name, again all within Linville Gorge: Table Rock, Flat Ledge, Chimney Gap, Campground and Campground II. He states that four of these were known to Morse, and that the fifth (Campground II) may have been known to Morse. Yet despite similar or even identical place names, comparisons with Morse's map reveal inconsistencies in the locations depicted by these two investigators (as noted later by Pharr, 1982). Regardless, Morse (1979a, 1979b) and Sanders (1980) are generally in agreement with respect to the distribution of the species throughout Linville Gorge, with concentrations of plants at Table Rock, The Chimneys, in between The Chimneys and Chimney Gap, and at Shortoff Mountain.

Pharr (1982) recognized five populations and 31 subpopulations across Linville Gorge: Table Rock (with no subpopulations); The Chimneys (four subpopulations);

Carolina Wall-Amphitheater (13 subpopulations); Chimney Gap Ledge (no subpopulations); and Shortoff Mountain (14 subpopulations). Pharr conducted extensive searches for new populations throughout the Linville Gorge area, including but not limited to "all exposed quartzite openings or ledges on Jonas Ridge from Gingercake Mountain to the southern end of Shortoff". Pharr also searched the western rim of Linville Gorge, but did not find the species there.

In 1987, a previously undocumented population was discovered outside of Linville Gorge, on Woods Mountain in adjacent McDowell County by a hiker (this population consists of two subpopulations, Singecat Ridge and Woods Mountain proper). As of 2012, no additional populations have been discovered for the species.

Donaldson (2004) reported that five of the 33 sites originally recognized by Pharr (1982) were extirpated as of 2004.[3] Donaldson also notes that some of the subpopulations that Pharr treated as spatially discrete have since effectively merged, and are no longer discrete sites.[4] Of all 33 sites originally counted by Pharr (1982) and counted again by Michener and Donaldson in 2003-04, 10 had declined relative to the 1982 census, 17 had increased, and five had been extirpated .

Donaldson provides GPS coordinates for 31 of the 33 sites recognized by Pharr (1982); for all 10 of the blocks associated with NC PCP's management experiment on Shortoff Mountain (Frantz, 1985; Frantz and Sutter, 1987; Frost, 1988; Frost, 1990a); and for additional sites discovered in 1987 on Woods Mountain and Singecat Ridge. In 2007 the NC NHP used Donaldson's GPS coordinates to update their Element Occurrence (EO) records for the species and followed Donaldson's recommendations regarding merged subpopulations. As of 2007 the NC NHP EO data for the species are a complete and accurate representation of the known distribution of the species.

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

See discussion of threats to habitat, below.

2. **Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

a. **Present or threatened destruction, modification or curtailment of its habitat or range:**

Most available literature identifies fire suppression as the primary threat to the species, because it facilitates competition from other woody vegetation and suppresses seedling recruitment (e.g., Frost et al., 1995). The second source of endangerment is trampling from recreational users, who tend to camp and hike in the

[3] The five extirpated sites are as follows: Chimneys subpopulations Shelter Rock and Chimney Top, and Carolina Wall – Amphitheater subpopulations Mini Ledges, Border Ledge, and Narrow Ledge. Further inspection of data on file with the AFO reveal that these sites were likely extirpated as far back as the 1993 census, since plants were not counted at these locations during that survey effort either.

[4] Sites which Donaldson notes as having merged are as follows: Chimneys subpopulations Flat Ledge and Trail Side (both merged into one); Carolina Wall – Amphitheater subpopulations Upslope Ledge, Point Ledge, and Pocket Ledge (all three merged into one).

open areas in which the species occurs (Ibid). In general, campers are regarded as having greater impacts to the species and its habitat than day-hikers. In either case, continued fire suppression enables threats from competition, lack of seedling recruitment, and recreational user impacts. Paradoxically, recreational impacts (from campers) serve to slow further vegetation succession and occasionally expose mineral soils in these fire-suppressed habitats, thereby resulting in impacts to established plants while simultaneously facilitating seedling recruitment (Frost, pers. comm., 2007).

A five-year management experiment revealed that burning differentially benefitted *H. montana* by knocking back competing vegetation and encouraging recruitment of *H. montana* seedlings through exposure of mineral soils. Clipping was not an adequate substitute for fire, both because it failed to effectively reduce competition or stimulate seedling recruitment in *H. montana* (it was also labor intensive, requiring some 30 minutes of time per square meter in areas of dense shrub cover). NC PCP also compiled information on the frequency and severity of fires in the Linville Gorge prior to acquisition by the USFS. These data suggested a natural fire cycle of every 5 to 15 years. In nearly every report produced from 1987 through 2004, NC PCP recommended that this fire return interval be restored to the landscape, through adoption of a fire-use policy for wildfires, supplemented by prescribed fires.

In 1990, habitat restoration efforts shifted from an experimental to a management phase. At that time, the species and its habitat had been subject to decades of fire suppression, and all known populations were exhibiting pronounced declines (Frost et al., 1995). Although prescribed burns have been considerably more limited in frequency, scope, intensity, and severity than desired (by those familiar with the species), it appears that prescribed burning is having a beneficial effect. The species' population numbers were higher in 2003-04 than ever previously recorded and are suggestive of a legitimate reversal in the declines observed in prior years. However, it is difficult to assess the relative contribution of prescribed burning and efforts to curtail impacts from recreational users. The USFS has closed some sites entirely (Woods Mountain and Singecat Ridge), and continues to post "no camping" signs at others (Table Rock). The agency has also initiated an outreach program intended to inform the public of the species' presence within Linville Gorge and the need to stay on designated trails. Collectively, the prescribed burning program (although limited in scope) and these efforts to control recreational user impacts appear to be having a beneficial effect upon the species and its habitat.

The USFS initiated an Environmental Assessment (EA) scoping process to help continue prescribed burning in the Wilderness Area of Linville Gorge. The scoping letter was completed in May 2012. The goal is to expand potential habitat via large scale burning and exotic invasive species management.

In the summer of 2007, a wildfire burned virtually all of Shortoff Mountain (which supports the largest population of *H. montana* in Linville Gorge). The USFS monitored the effects of the 2007 wildfire upon the species, concluding the emergency consultation required after this fire. Habitat greatly improved (as described in section C.1). Following this wildfire, a Fire Use Policy was adopted by the Pisgah National Forest for the Linville Gorge Wilderness, which includes all of the *H. montana* populations with the exception of Woods Mountain. This policy was designed to inform decision makers on how to deal with future fires in terms of

suppression when working with fire dependent plant species including *H. Montana.* For example, the policy includes allowing lightning-caused fires to burn when beneficial to listed species and not a threat to other natural resources or public safety. The policy also includes using a USFS botanist to help fire crews avoid trampling the plants.

The USFS is continuing to coordinate with the USFWS on future controlled and prescribed burns that may affect *H. montana* habitat. The USFS completed a prescribed burn on Woods Mountain in spring 2012, which is expected to result in improved *H. montana* habitat. Monitoring of this population occurred in September 2012 (see earlier discussion under Section II.C.1) and will occur again in 2013 to examine the effects of the burn on the population. The USFS performs a complete census of all *H. montana* populations a minimum of every 5 years.

b. Overutilization for commercial, recreational, scientific, or educational purposes:

As described above, recreational user impacts (primarily camping) are regarded as perhaps the second-most severe threat to existing populations. The listing rule did not regard this factor as a significant threat to the species. The USFS closed some camping areas with populations of this species, but no designated camping areas have been created to further minimize disturbance to populations in Linville Gorge. The USFS also posted interpretative signs (about the species and its habitat, as well as the Wilderness Area designation and appropriate uses) along the main trail leading through Linville Gorge. However, periodic sign maintenance will be needed in the future to sustain user awareness, but these efforts appear to minimize the level of disturbance (Frost, 1991; 1992; 1993a; 1993b; Frost et al., 1995). Based on new information, it seems appropriate now to regard recreational use of the species habitat as a threat.

c. Disease or predation:

Not currently known to be a threat to this species.

d. Inadequacy of existing regulatory mechanisms:

The North Carolina Plant Conservation and Protection Act (NC State Code Article 19B, § 106-202.12) provides limited protection from unauthorized collection and trade of plants listed under that statute. However, this statute does not protect the species or its habitat from destruction in conjunction with development projects or otherwise legal activities. There are no other federal or state statutes that afford significant protections to *H. montana*. Therefore, inadequacy of existing regulatory mechanisms continues to threaten this species.

e. Other natural or manmade factors affecting its continued existence:

None known beyond those already addressed in Section II.B.3 (e.g., competition for light from surrounding vegetation).

D. Synthesis

Since *H. montana* was listed in 1980, the number of known sites has increased (to include one more population consisting of two subpopulations, Woods Mountain and Singecat Ridge). In addition, the number of known individuals has also increased from 2,901 clumps to 4,937 across the species' range. However, the overwhelming majority of the new plants observed between 2003 and 2009 are seedlings which can have a high mortality rate. Therefore, it will be important to monitor the fate of these seedlings in future census efforts. The increases in the number of known plants are largely (if not entirely) attributable to active efforts to manage habitat and control recreational user impacts. These efforts were largely spearheaded by the NC PCP until 2003, when the NC PCP turned over primary responsibility for management and monitoring to the USFS and the USFWS.

Fire suppression continues to be the primary threat to the species, one that exacerbates impacts from recreational use (primarily associated with camping rather than day-hiking), by facilitating woody vegetation encroachment and thereby limiting the amount of open habitat available. Although the USFS has continued efforts to manage woody vegetation (through slashing and burning) at the Woods Mountain/Singecat Ridge population, implementing prescribed burning regimes within the Linville Gorge (the majority of the species' known range) has been difficult. Trampling by recreational users (campers and day-hikers) continues to be a secondary threat to this species.

Although the number of known sites and individuals has increased since *H. montana* was listed as threatened, this species has an extremely narrow geographic range (two counties, six total populations) and continues to be threatened by fire suppression, impacts from recreational use, and the inadequacy of existing regulatory mechanisms. Therefore, *H. montana* continues to meet the definition of threatened under the ESA, and no change in the species' status is currently warranted.

III. RESULTS

A. Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change is needed

B. New Recovery Priority Number: n/a

C. Listing and Reclassification Priority Number: n/a

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Monitor effects from the 2012 prescribed burn on Woods Mountain. Lead agency: USFS.

   This was initiated in 2012, but should be repeated in 2013 during the complete census for all known populations.

2. Begin a physical removal of duff layer on Woods Mountain to restore *H. montana* habitat and propagate *H. montana* for future introduction into restored area. Lead agency: USFS

3. Prepare and finalize individual fire-use and prescribed burn plans for each of the individual populations of the species. Lead agencies: USFS and USFWS.

4. Resume prescribed burns in Linville Gorge, with emphasis upon those populations with the longest lapse in burning. Lead agency: USFS.

5. Repeat census of all known populations in 2013. Lead agencies: USFS, USFWS.

6. Perform research to examine *H. montana* water requirements and shade tolerance. Lead agencies: USFS, USFWS.

7. Establish a system of interagency cross-checks to ensure that necessary actions are completed each year until restoration efforts are complete and required management is reduced to routine maintenance. Lead agencies: USFS, USFWS.

8. Obtain low altitude, high resolution aerial (or satellite) imagery sufficient for delineation of currently occupied and restorable habitat. Use this imagery to set measurable goals for future habitat restoration efforts. Lead agency: USFS.

9. Digitize photos from long-term photo monitoring project, or a subset of these, with intent of examining changes in spatial extent (and seedling recruitment) under varying management regimes (e.g., burning) and threat abatement strategies (e.g., closures). Lead Agency: USFWS.

10. Revise recovery criteria and/or the species' recovery plan. Lead agency: USFWS.

    As stated in Section II.B.3., the first of the four recovery criteria addresses only those occurrences of the species known at the time (e.g., those occurring in Linville Gorge). An additional population of the species (at Woods Mountain) was identified after the recovery plan was written. The first recovery criterion should be revised to require that this additional population be subject to equal levels of protection and management prior to delisting the species.

    The species' dependence upon fire to maintain its open habitat was suspected but undocumented in 1980, but is now well understood, documented, and corroborated by the large increase in plants seen after the November 2000 wildfire at Chimneys and Chimney Gap (Frost, pers. comm., 2007). The critical role of fire in the recovery of this species should be emphasized in any revisions of recovery criteria or the recovery plan itself.

11. Attempt to reintroduce the species to the southern end of Table Rock using seeds collected from elsewhere within the Table Rock population, or other sites within Linville Gorge. Lead agencies: USFS, USFWS, NC PCP.

V. REFERENCES

Donaldson, J.T. 2004. 2003 Mountain golden heather (*Hudsonia montana*) photo monitoring and third global inventory. 26 pages.

Frantz, V. 1985. Interim report, *Hudsonia montana* research program. N.C. Department of Agriculture, Plant Conservation Program. Submitted October 20, 1985. 9 pages.

Frantz, V. and Sutter, R. 1987. *Hudsonia montana*: From discovery to recovery. N.C. Department of Agriculture, Plant Conservation Program. Plant Conservation Program Technical Report Number 2.

Frost, C.C. 1988. *Hudsonia montana* field report, Summer 1987. Interim, annual report submitted to NCDA Plant Conservation Program, June 8, 1988. 59 pages.

Frost, C.C. 1989. *Hudsonia montana* field report, Summer 1988. Interim, annual report submitted to NCDA Plant Conservation Program, March 1, 1989. 9 pages excluding appendices

Frost, C.C. 1990a. *Hudsonia montana* final report: Effects of fire, trampling and interspecies competition, 1985-1989. Parts I (Final Report) and II (Appendices). 93 pages.

Frost, C.C. 1990b. Ten-year plan for *Hudsonia montana*.

Frost, C.C. 1991. *Hudsonia montana* monitoring and management for 1990. Submitted to NCDA Plant Conservation Program, May 15, 1991. Funded by US Fish and Wildlife Service under Cooperative Agreement No. 14-16-0004-89-967 and by US Forest Service under Purchase Order 43-4550-1361. 27 pages.

Frost, C.C. 1992. *Hudsonia montana* monitoring and management for 1990. Report prepared by N.C. Department of Agriculture and submitted to USDA Forest Service and US Fish and Wildlife Service May, 1992.

Frost, C.C. 1993a. *Hudsonia montana* monitoring and management for 1991. Report prepared by N.C. Department of Agriculture and submitted to USDA Forest Service and US Fish and Wildlife Service July 13, 1993. 28 pages.

Frost, C.C. 1993b. *Hudsonia montana* monitoring and management for 1992. Report prepared by N.C. Department of Agriculture and submitted to the USDA Forest Service and US Fish and Wildlife Service, October 12, 1993. 34 pages.

Frost, C.C., Senter, J. and Harrington, D. 1995. *Hudsonia montana* recovery activities, 1993 and 1994, including: second global inventory of *Hudsonia*; seedling propagation and reintroduction projects; and first inventory of *Liatris helleri* and *Zigadenus leimanthoides*. Report prepared by N.C. Department of Agriculture and submitted to the USDA Forest Service and US Fish and Wildlife Service, October 30, 1995. 60 pages.

Gross, K., Lockwood III, J.R., Frost, C.C., and Morris, W. 1998. Modeling controlled burning and trampling reduction for conservation of *Hudsonia montana*. Conservation Biology, vol. 12 (6): 1291-1301.

Michener, R.L. 2004. Current global status of *Hudsonia montana* Nuttall (Mountain golden heather). Senior research thesis, Whitman College, May 2004. 57 pages.

Morse, L.E. 1979a. Report on the Conservation Status of *Hudsonia montana*, a candidate endangered species. N.Y. Botanical Garden. Unpublished report. 15 January 1979.

Morse, L.E. 1979b. Systematics and ecological biogeography of the genus *Hudsonia* (Cistaceae), the sand heathers. Ph.D. dissertation. Harvard University, Cambridge, Mass. August 1979.

Palmer, M. 1985. Report on *Hudsonia montana* for 1984 field season: demography, hypothesis testing, seed predation, and recommendations. Dated April 1985. 7 pages plus appendices.

Pharr, R.H. 1982. Population status and species biology of *Hudsonia montana* Nuttall. Prepared by Ruby H. Pharr, Western Piedmont Community College, with editing and monitoring plan (Appendix II) by Robert D. Sutter, botanist, N.C. Department of Agriculture. 338 pages including appendices.

Sanders, B.A. 1980. Population status study, *Hudsonia montana*. USDA, Forest Service. Prepared by Ben A. Sanders, Wildlife Biologist, U. S. Forest Service. Report date August 13, 1980.

Smith, L. 1978. Observations of the Short-off [sic] population of *Hudsonia montana*. Field notes taken by E. La Verne Smith, USFWS, Washington Office. Date: August 30, 1978.

U.S. Fish and Wildlife Service (USFWS). 1983. Mountain Golden Heather (*Hudsonia montana*) Recovery Plan. Initial version prepared by Levester Pendergrass, Regional Botanist, U.S. Department of Agriculture – Forest Service, Southeast Region. Final version with revisions by U.S. Department of Interior – Fish and Wildlife Service, Southeast Region. September 1983.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Hudsonia montana*

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X_ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:

Review Conducted By: Carolyn Wells and Mara Alexander, Asheville Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 10/16/12

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 1/14/13

APPENDIX A

Summary of Peer Review for the 5-Year Review of the Mountain golden heather *(Hudsonia montana)*

A. Peer Review Method: A draft 5-year review was sent to 10 reviewers, as an attachment to an email, requesting their review and any other changes or additions that should be included in the document. All reviewers have extensive knowledge of this and similar species. The following individuals responded to our peer review request:

1. David Danley, Botanist for the Pisgah National Forest, U.S. Forest Service, Asheville, North Carolina.

2. Gary Kauffman, North Carolina State Botanist, U.S. Forest Service, Asheville, North Carolina.

B. Peer Review Charge: Reviewers were charged with providing a review of the document, including any other appropriate comments and/or additions. Reviewers were not asked to comment on the legal status of the species.

C. Summary of Peer Review Comments/Report: Reviewers responded by email. Both reviewers agreed that the information in the document provided to them was accurate.

D. Response to Peer Review: Recommendations from the reviewers were incorporated into the document as appropriate. These consisted primarily of additional information concerning the status of certain populations, threats to the species, and recommendations for future actions.