

U.S. Fish & Wildlife Service

Post-Delisting Monitoring Plan

for

White-Haired Goldenrod
(*Solidago albopilosa*)



Photo courtesy of John MacGregor, KDFWR

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August 2016

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Acknowledgements: The Post-delisting Monitoring Plan for White-Haired Goldenrod was prepared by biologists of the U.S. Fish and Wildlife Service (Michael Floyd, Kentucky Ecological Services Field Office; Kelly Bibb, Southeast Regional Office). We wish to acknowledge assistance that we received in preparing this plan from Deborah White and Tara Littlefield of the Kentucky State Nature Preserves Commission and David Taylor and Sandra Kilpatrick of the U. S. Forest Service, Daniel Boone National Forest. Mr. John MacGregor, Kentucky Department of Fish and Wildlife Resources, kindly provided the cover photograph.

Recommended Citation

U.S. Fish and Wildlife Service. 2016. Post-delisting monitoring plan for White-Haired Goldenrod (*Solidago albopilosa*). U.S. Fish and Wildlife Service, Kentucky Ecological Services Field Office, Frankfort, Kentucky. 25 pp.

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I. Summary of Cooperator Roles in the Post-Delisting Monitoring Planning Effort

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*). Section 4(g)(1) requires the Service to:

“implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary.”

The purpose of this post-delisting monitoring is to verify that *Solidago albopilosa* (white-haired goldenrod) remains secure from the risk of extinction after it has been removed from the protections of the Act. The U.S. Fish and Wildlife Service (Service) prepared this post-delisting monitoring (PDM) plan (Plan), in coordination with the Kentucky State Nature Preserves Commission (KSNPC) and the U.S. Forest Service, Daniel Boone National Forest (DBNF), based largely on monitoring methods developed by KSNPC (KSNPC 2010, 24 pp.). This PDM Plan is designed to detect substantial declines in *S. albopilosa* occurrences with reasonable certainty and precision. It meets the minimum requirement set forth by the Act because it monitors the status of *S. albopilosa* using a minimum of five annual sampling events.

The majority (95%) of extant *S. albopilosa* occurrences are located on lands owned and cooperatively managed by the DBNF, which has partnered with KSNPC and the Service to manage occurrences of the species, undertake actions to reduce or eliminate threats to the species, and monitor occurrences of the species to document that recovery has occurred. KSNPC completed surveys of *S. albopilosa* occurrences in 1996, 1999, 2002, 2004-2005, 2008-2009, and 2013 (White and Droszda 2006, pp. 124-128; KSNPC 2010, p. 4; White pers. comm. 2014), and DBNF has completed annual surveys at selected locations since 2000. KSNPC (KSNPC 2010, pp. 4-8) completed the last range-wide survey during the 2008 and 2009 field seasons. Over this two-year period, KSNPC ranked each occurrence (i.e., A-D) based on population size and viability, habitat condition, and degree of threat (See Appendix C). KSNPC also evaluated the stability of each occurrence by comparing their 2008-2009 survey data with data collected in previous years. Occurrences were considered “stable” if no change was detected in their general rank/status over the course of monitoring and/or if fluctuations in stem numbers were attributed to natural climatic variation.

II. Summary of Species Status at Delisting

A. Demographic Parameters

Solidago albopilosa is restricted to outcroppings of Pottsville sandstone in a rugged, highly dissected area of eastern Kentucky known as the Red River Gorge (Figure 1)

(Service 1993, p. 2; White and Drozda 2006, p. 124). In this area, the species occurs in rock shelters (natural, shallow, cave-like formations) or on sandstone cliffs beneath overhanging ledges at elevations of between 243 and 396 m (800 and 1300 ft) (Service 1993, p. 5). The species flowers from September through November and sets fruit in mid-October through December. The flowers are visited by bees and syrphid flies, which are likely attracted by the fragrant, yellow flowers (Braun 1942, pp. 1-4; Service 1993, p. 6). Viability of the species' pollen is reported to be high (Andreason and Eshbaugh 1973, pp. 129-130). Seeds are most likely dispersed by wind, but germination rates and the extent of vegetative reproduction are unknown (Service 1993, p. 6).

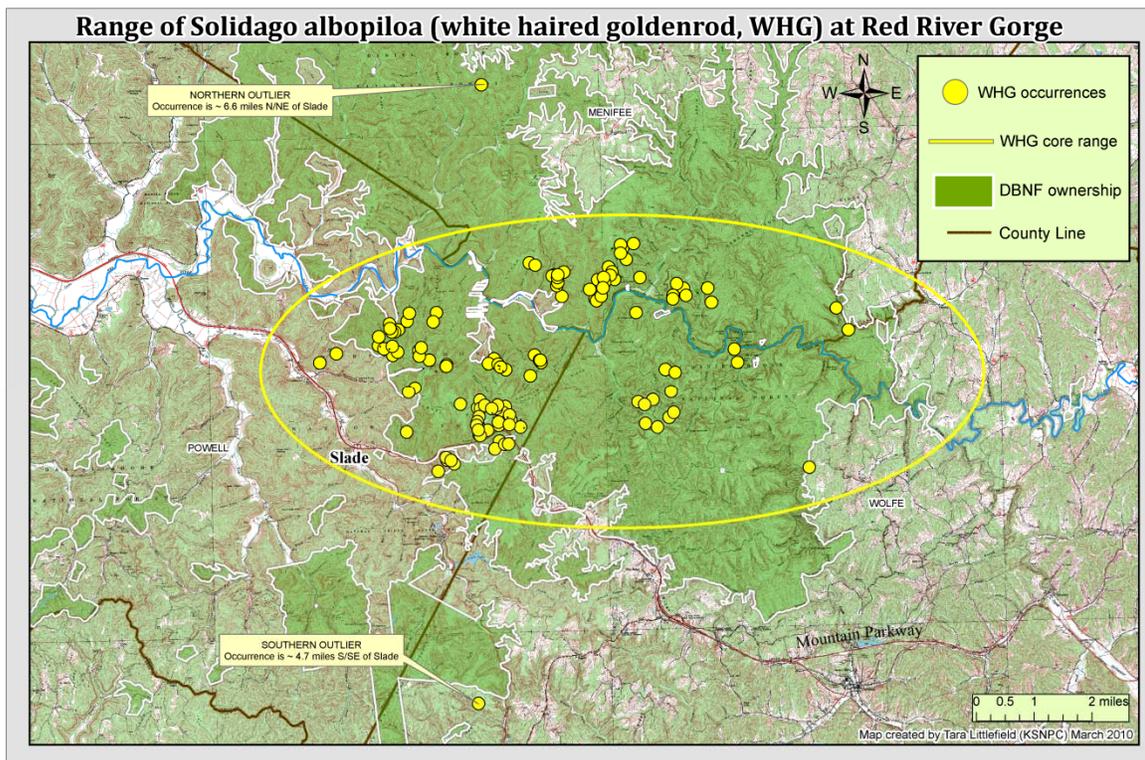


Figure 1. Current range of white-haired goldenrod, including locations of all known occurrences (map prepared by KSNPC).

B. Discussion of Populations

Rather than try to determine what constituted a population, the recovery plan used “occurrence” as the recovery unit (Service 1993, p. 1), defining it as a “discrete group of plants beneath a single rock shelter or on a single rock ledge.” In making this definition, the Service (1993, p. 6) explained that pollinators (bees and syrphid flies) likely carried pollen between rock shelters and may even move between adjacent ravines, but without additional research, it was impossible to determine the species’ actual population boundaries.

When the species' recovery plan was completed in 1993, 90 extant occurrences were known (Service 1993, p. 2), containing an estimated 45,000 stems (Service 1993, p. 2). All of these locations were situated within the proclamation boundary of the DBNF, and 69 occurrences (approximately 76 percent) were in federal ownership. The remaining occurrences (21) were located on private property. In subsequent years, KSNPC completed surveys in 1996, 1999, 2002, 2004-2005, and 2008-2009 (White and Droszda 2006, pp. 124-128; KSNPC 2010, p. 4), and these surveys raised the number of *S. albopilosa* occurrences from 90 to 141 (Table 1, Appendix A). Surveys in other areas of Kentucky and adjacent states with suitable habitat (e.g., sandstone rock shelters) did not produce additional occurrences of the species (Campbell et al. 1989, pp. 29-43; Palmer-Ball et al. 1988, pp. 19-25; Walck et al. 1996, pp. 326-333; Norris and Harmon 2000, pp. 2-3).

The most recent range-wide survey in the Red River Gorge was completed during the field seasons of 2008 and 2009 (KSNPC 2010, pp. 4-8), and KSNPC and the Service completed follow-up surveys at 30 extant occurrences in 2013. During these efforts, KSNPC and the Service documented a total of 117 extant occurrences (including 1 new occurrence, EO 59c), producing ranks with the following categorical results: A-rank (11 occurrences), B (26), C (25); and D (54) (see Appendix C for rank descriptions). The remaining 25 occurrences were considered to be historic, extirpated, or they could not be relocated (failed to find). Of the 117 extant occurrences, only 6 (5 percent) were located on private land, with the remainder located on the DBNF. For all extant occurrences, 81 (69 percent) were considered to be stable, including ranks of A (11 occurrences), B (21), C (18), and D (31). Occurrences were considered "stable" if no change was detected in their general rank/status over the course of monitoring and/or if fluctuations in stem numbers were attributed to natural climatic variation. The average monitoring period for these occurrences was 11.4 years, and each occurrence was visited an average of 3.7 times over the entire monitoring period.

The recovery plan states that *S. albopilosa* will be considered recovered when there are 40 geographically distinct, self-sustaining occurrences that are adequately protected and have been maintained for 10 years. We consider all stable A-, B-, and C-ranked occurrences occurring on the DBNF to meet these criteria (total of 46 occurrences), so there are now a sufficient number of stable, secure occurrences for the species to be delisted.

C. Residual Threats

Site protection and habitat management efforts by DBNF, working cooperatively with KSNPC and the Service, have reduced habitat loss from recreational activities so that it is no longer a high magnitude threat. We expect this trend to continue as the lands containing the 46 secure and self-sustaining occurrences will remain permanently protected in federal ownership and will be managed to maintain current habitat conditions.

Recreational impacts may continue at some occurrences, but the magnitude of these threats across the species' range has decreased due to trail re-routing, placement of signs at rock shelters, protective fencing, and back country patrols by DBNF personnel. Therefore, we anticipate that the status of *S. albopilosa* will remain secure after delisting under the Act because recovery efforts have secured habitat for 46 occurrences that are secure, self-sustaining, and distributed across the species' range (Table 1, Appendix A).

D. Legal and/or Management Commitments for Post-delisting Conservation

There are now 117 extant occurrences of *S. albopilosa*. We consider 46 of these to be geographically distinct, self-sustaining occurrences that have adequate protection and have been maintained for a period of at least 10 years. These occurrences include ranks of A (9 occurrences), B (21), and C (16), with a total number of 131,000 stems (KSNPC 2010, p. 10). These occurrences have an average monitoring period of over 11.1 years and have been visited an average of 3.7 times. Field data from KSNPC indicate relatively high percent reproduction rates (stems with flowers) for these occurrences, averaging 75–90 percent in nearly all cases (KSNPC 2010, p. 10). With respect to protection, all of these occurrences occur on the DBNF and receive management and protection through DBNF's Land and Resource Management Plan (LRMP) (USFS 2004, p. 1.1–1.10). Given the high level of federal ownership throughout the range of *S. albopilosa* and DBNF's demonstrated commitment to management and protection of *S. albopilosa*, we are confident that these occurrences will continue to receive long-term protection and the management necessary to maintain their current status. We expect that the delisting of *S. albopilosa* will not reduce KSNPC's or DBNF's commitment to the conservation of the species.

As specified in the LRMP (USFS 2004, p. 1.1-1.10), *S. albopilosa* habitats receive protection and management consideration as part of the Cliffline Community Prescription (or management) Area (DBNF 2004, p. 3.5-3.8). The Cliffline Community is defined as the area between 100-foot slope-distance from the top of the cliff and 200-foot slope-distance from the dripline of the cliffline. A cliffline is defined as a naturally occurring, exposed, and nearly vertical rock structure at least 10 feet tall and 100 feet long. All known *S. albopilosa* occurrences occur within habitats fitting this description and, therefore, are included in this Prescription Area. For the Cliffline Community area, conservation goals in the LRMP include (1) maintenance of the unique physical and microclimatic conditions in these habitats, (2) the delisting of *S. albopilosa*, and (3) the protection of these habitats against anthropogenic disturbance (USFS 2004, p. 3.6). To

meet these goals, the following activities or resource uses are prohibited within the cliffline zone: mineral, oil, or gas exploration and development (Standard 1.C-MIN-1); road construction (1.C-ENG-1); recreational facilities (1.C-REC-1); recreational activities such as rock climbing and rappelling (C-REC-2); camping (1.C-REC-3); and campfires (1.C-REC-4). Other activities such as wildlife management (1.C-WLF) and vegetation management (1.C-VEG) are limited and strictly controlled. This Prescription Area is classified as Unsuitable for Timber Production but timber harvests may occur in areas adjacent to the clifflines where *S. albopilosa* occurs on an unscheduled basis to attain a desired future condition. Trees generally do not occur in the habitat occupied by *S. albopilosa*, and, if they do, they are not of a harvestable size and form. Therefore, harvest of wood products may occur only as a by-product of management efforts associated with pursuing other resource objectives (DBNF 2004, pp. 3.5-3.8). The DBNF monitors cliffline habitats and protects them as needed through law enforcement activities, construction of fences, trail diversion, and placement of signs. Therefore, the Service does not believe that *S. albopilosa* occurrences will be threatened or impacted by these activities.

Since the species was listed, the Service has worked closely with KSNPC and DBNF on the management and protection of *S. albopilosa*. Management activities have included trail diversion (i.e., away from *S. albopilosa* occurrences), installation of protective fencing around occurrences, and placement of informational signs in rock shelters, along trails, and at trailheads that advise recreational users of the area about the species and how to protect it. These activities and other management actions included in the DBNF's LRMP (USFS 2004, pp. 3.5-3.8) have assisted in recovery of the species, as reflected in the large number of stable occurrences (46 occurrences with ranks of A, B, or C) and the long period (> 11 years) during which this trend has been maintained. In addition, the Service completed a cooperative management agreement with DBNF and KSNPC in **Month XX, 2016** that provides for the long-term protection and management of the species. The cooperative management agreement is effective for a minimum of 10 years following the delisting of the species. The cooperative management agreement includes provisions for additional fencing at 4 occurrences, trail closings and diversions at up to 39 occurrences, placement of informative signs, annual monitoring, and public outreach.

III. Monitoring Methods and Locations

The PDM for *S. albopilosa* will be conducted annually in September through October from 2016 to 2021. PDM methods will be the same as those used by KSNPC during their recent two-year range-wide survey (KSNPC 2010, pp. 1-24). At each occurrence, stem count, height, size of patch, numbers of rosettes, and estimates of percent reproduction will be recorded along with various parameters characterizing the rock shelter (Appendix B - white haired goldenrod data sheet). Notes about recruitment of seedlings and other aspects of life history will also be recorded. Where plants are not accessible or occurrences are exceptionally large and concentrated (ledges, steep loose slopes, and very large groups of plants), an estimate of the total number of stems will be made based on extrapolation from a smaller sample area. In addition, photographs will be taken of all

visited occurrences and, when necessary, hand drawn maps will be created to help with location of individual patches within the occurrences. Recreational and disturbance impact ranks will be assigned to each occurrence following guidelines developed by KSNPC (Appendix C), and other potential threats such as the presence of invasive plants or changes in the composition of the surrounding forest will be recorded as may be appropriate.

The following practices will be followed in order to minimize variability that could be introduced by inconsistent sampling practices:

- KSNPC will be the primary entity conducting the PDM. It employs multiple staff members that have conducted recovery monitoring of *S. albopilosa* and are familiar with its locations and sampling procedures. DBNF personnel will assist with surveys and will coordinate all their survey efforts with KSNPC.
- KSNPC's *S. albopilosa* field data sheet (Appendix A) will be completed at each occurrence. This will ensure that all necessary data are recorded for each occurrence during each site visit.
- Recreational disturbance ranks will be assessed at each occurrence using KSNPC's guidelines (Appendix B). This will ensure that all necessary data are recorded for each occurrence during each site visit.
- Field surveys will be completed during the period, September 1–November 30.

The PDM period will be initiated during the first growing season following the publication of a final rule to delist *S. albopilosa* and will extend, at a minimum, through the fifth growing season following delisting. Surveys will be conducted at approximately 20 percent of the element occurrences (EOs) (20-25 occurrences) each year as displayed in Table 1 (Appendix A). In addition, a select number of EOs (10) that represent a range of population and recreational ranks will be visited annually as well (2016-2021) in order to get consecutive annual data on a subset of the population.

IV. Definition of Response Triggers for Potential Monitoring Outcomes

Effective PDM requires timely evaluation of data and responsiveness to observed trends. In order to assure timely response to observed trends, it is necessary to identify possible outcomes from monitoring that could be anticipated and general approaches for responding to these scenarios. In order to identify thresholds that would trigger alternative responses in the case of *S. albopilosa*, it will be necessary to analyze data from the pre-delisting monitoring period to identify the range of variability that has been observed with respect to each of the variables that will be monitored during the PDM period. From this analysis, it will be possible to categorize observations into one of the following three possible PDM outcomes.

A. Category I

Solidago albopilosa remains secure without protections of the Act. This would be true if:

- 1) The average numbers of adult plants, juveniles, and seedlings for natural and introduced colonies remain above the 50th percentile of average values observed since monitoring for this species began, and
- 2) No new or increasing threats to the species are observed.

In this case, PDM would be concluded at the end of the timeframe specified in this Plan.

B. Category II

Solidago albopilosa may be less demographically stable than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered. This would be true if:

- 1) The average number of adult plants, juveniles, or seedlings for natural and introduced colonies falls between the 25th and 50th percentiles of average values observed since monitoring for this species began, and
- 2) There are no new or increasing threats that are considered to be of a magnitude and imminence that may threaten the continued existence of *S. albopilosa* within the foreseeable future.

In this case, the PDM period should be extended for an additional five years, and if necessary, sampling intensity could be increased to provide greater precision in detecting trends. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

C. Category III

PDM yields substantial information indicating that threats are causing a decline in the status of *S. albopilosa* since the time of delisting, such that listing the species as threatened or endangered may be warranted. This would be true if:

- 1) The average number of adult plants, juveniles, or seedlings for natural and introduced colonies falls below the 25th percentile of average values observed since monitoring for this species began, or
- 2) There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of *S. albopilosa* within the foreseeable future.

If only the first of these conditions is true, then the Service will initiate a formal status review to assess changes in threats to the species and changes in its abundance, population structure, and distribution to determine whether a proposal for relisting is appropriate. Existing data will be analyzed to determine if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species. If both of these conditions are true, then the Service will promptly propose that *S. albopilosa* be relisted under the Act in accordance with procedures in section 4(b)(5).

V. Data Compilation and Reporting Procedures

Annual reports summarizing the PDM activities accomplished, data collected, and results will be submitted by KSNPC to the Service's Kentucky Ecological Services Field Office. These reports will be prepared in a timely manner to ensure that adequate data are being collected, to allow evaluation of the efficacy of the monitoring program, and to provide a periodic assessment of the status of *S. albopilosa*. Each annual report will synthesize all monitoring data and comment on observed trends and status of *S. albopilosa* with respect to the PDM outcome categories presented in Section IV of this Plan. After five years of data are available, the field collection data will be reviewed to determine overall population change and status with respect to threats to the species. The Service will compile the data contained in each annual report into a final monitoring report that will be made available to the public. The final monitoring report will summarize the data in the annual reports and will include a description of the geographic areas surveyed, the survey protocol, and updated population numbers for each occurrence surveyed.

If response triggers in Section IV are met or exceeded, the Service will consult with KSNPC, DBNF, and other partners to determine whether to conclude the PDM process or to pursue the management actions as described in Section IV. Our determination will also include, if necessary, an evaluation of the threats to *S. albopilosa* using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Species.

VI. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the Service; state, tribal, and foreign governments; other Federal agencies; and other non-governmental partners under the Act. Although the Act authorizes expenditures of both recovery funds and section 6 grants to the states to plan and implement PDM, Congress has not allocated nor earmarked any special funds for this purpose. To the extent feasible, the Service intends to provide funding for PDM efforts from annual Endangered Species general Recovery Program appropriations, if they are available. Nonetheless, nothing in this Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act (31 U.S.C. § 1341) or any other law or regulation.

The primary entity conducting the PDM and preparing reports will be KSNPC, who has accomplished the majority of the recovery monitoring for *S. albopilosa*. Based on KSNPC costs associated with recovery monitoring efforts, annual PDM expenditures for KSNPC should not exceed \$6,000. The Service will provide assistance as needed and as resources permit. Annual costs to the Service are not expected to exceed \$2,000 annually.

VII. PDM Implementation Schedule

The implementation schedule was developed in coordination with KSNPC and DBNF in order to ensure that it was feasible to accomplish PDM activities at all sites scheduled for a given year.

Table 1. Post delisting monitoring schedule for *S. albopilosa*, 2016 – 2020.

Population Cluster*	EO Numbers	2016	2017	2018	2019	2020
7	2, 10, 13, 34, 38-39, 47, 50, 53	X				
6	18, 23-27, 30-31, 33, 35-36		X			
2-5	1, 3-4, 5, 7, 19-21, 22, 29, 32, 36, 44, 52, 59			X		
8-9	8, 11-12, 14, 16, 40, 49, 57				X	
1, 10-12	9, 15, 45-46, 48					X

*Refer to Figure 2 for cluster locations.

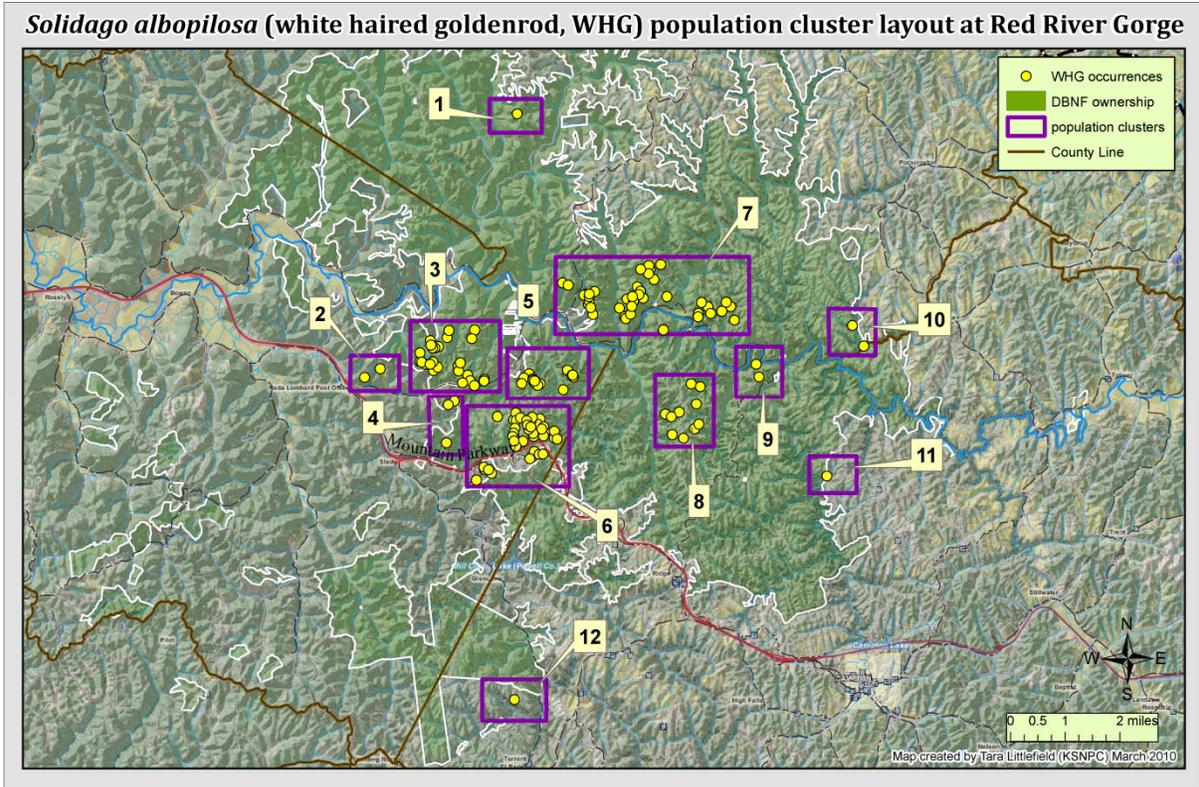


Figure 2. Current range map of white-haired goldenrod, showing population clusters summarized in Table 1 (map prepared by KSNPC).

VIII. Literature Cited

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Appendix A – Summary of White-haired Goldenrod Occurrences

Table 1. Summary of white-haired goldenrod occurrences.

EO	Sub EO	Survey site	Rank	S	D	U	X	Survey years	# Years	Monitoring Span	Rec. Impact	Fenced
1	b	Nada Tunnel	A	X				2008, 2009	2	2	5	X
	a	Nada Tunnel	A	X				2008, 2009	2	2	5	X
	c	Nada Tunnel	C		X			1985, 2008, 2009	3	24	5	X
2	a	Greasy Branch	A	X				2001, 2005, 2008, 2009, 2013	5	12	1	
	f	Greasy Branch	A	X				2008, 2013	2	5	1	
	b	Greasy Branch	X				X	1996, 2001, 2005, 2008, 2013	5	17	5	
	c	Greasy Branch	X				X	1996, 2001, 2005, 2008, 2013	5	17	5	
	d	Greasy Branch	X				X	1996, 2001, 2005, 2008, 2013	5	17	5	
	e	Greasy Branch	X				X	1996, 2001, 2005, 2008, 2013	5	17	5	
3	a	Rocky Branch	D	X				1987, 1996, 1997, 1999, 2000, 2001, 2005, 2008, 2009	9	22	3	X
	b	Rocky Branch	D		X			1987, 2008	2	21	1	
4	a	Tunnel Ridge Rd at Auxier Ridge	B	X				1996, 1997, 2005, 2008, 2009, 2013	6	17	4	X
	c	Tunnel Ridge Rd at Auxier Ridge	C	X				2008, 2009, 2013	3	5	2	
	b	Tunnel Ridge Rd at Auxier Ridge	D	X				1980, 1988, 1996, 2005, 2008, 2009, 2013	7	33	5	
	d	Tunnel Ridge Rd at Auxier Ridge	D	X				2005, 2009, 2013	3	8	5	
5	b	Gray's Branch NE	D	X				1980, 1997, 2001, 2003, 2005, 2006, 2008, 2009	8	29	1	
5	a	Gray's Branch NE	D	X				1997, 2001, 2003, 2006, 2008, 2009	6	12	1	
7	a	Moreland Branch	F			X		1983, 1999	2	16	NR	
8	a	Parched Corn Creek	X				X	1985, 1996, 2006, 2008	4	23	3	
9	a	Clifty Creek	F			X		1984, 1998	2	14	NR	
10	a	Rockhouse Arch	B		X			1996, 2003, 2006, 2008	4	22	1	
11	a	Trib of Parched Corn Creek	D		X			1996, 2001, 2006, 2008	4	12	5	
12	a	Laurel Branch	F			X		1986, 1999, 2009	3	23	5	
13	c	Sargent Branch	B	X				2006, 2008	2	2	5	proposed
	d	Sargent Branch	D	X				1987, 2008	2	21	5	
	b	Sargent Branch	D	X				2006, 2008	2	2	5	X
	a	Sargent Branch	X				X	1988, 1996, 2008	3	20	5	
14	a	Sky Bridge West	X				X	1980, 1999	2	19	NR	
15	a	Osborne Branch	H			X		1985	1	1	NR	

EO	Sub EO	Survey site	Rank	S	D	U	X	Survey years	# Years	Monitoring Span	Rec. Impact	Fencing
16	a	Chimney Top	C	X				1997, 2001, 2005, 2008	4	12	1	
	b	Chimney Top	X				X	1997, 2001, 2008	3	12	1	
18	A	Trib of Martins Fork	C	X				1996, 1999, 2005, 2008, 2009, 2013	6	17	4	X
19	a	Rush Ridge	D	X				1988, 1996, 1997, 2001, 2005, 2008, 2009	7	21	5	
20	c	Rush Ridge East	C	X				1988, 1996, 1997, 2001, 2005, 2008, 2009	7	21	4	
	a	Rush Ridge East	D		X			1988, 1996, 1997, 2001, 2005, 2008, 2009	7	21	5	
	b	Rush Ridge East	D		X			1988, 1996, 1997, 2001, 2005, 2008, 2009	7	21	5	
21	e	Gray's Arch	B	X				2000, 2003, 2005, 2008, 2009, 2013	6	13	4	
	d	Gray's Arch	B		X			2007, 2008, 2009, 2013	4	6	5	
	f	Gray's Arch	C	X				1986, 2009, 2013	3	27	1	X
	a	Gray's Arch	C	X				1980, 1996, 2009, 2013	4	33	3	X
	b	Gray's Arch	C	X				1996, 1997, 1999, 2007, 2008, 2009, 2013	7	27	5	
	c	Gray's Arch	D	X				1996, 1997, 2007, 2008, 2009, 2013	6	27	5	
	i	Gray's Arch	D	X				1996, 1997, 2007, 2008, 2009, 2013	6	27	5	
	j	Gray's Arch	D		X			2007, 2008, 2009, 2013	4	6	2	
	g	Gray's Arch	D		X			2007, 2008, 2009, 2013	4	6	5	
	h	Gray's Arch	D	X				2007, 2008, 2013	3	6	5	
22	f	Star Gap Arch	B	X				2005, 2008, 2009	3	4	3	
	c	Star Gap Arch	C		X			1998, 2008	2	10	3	
	b	Star Gap Arch	C	X				1998, 2006, 2008	3	10	1	X
	g	Star Gap Arch	C	X				2005, 2008, 2009	3	4	3	
	a	Star Gap Arch	D	X				1987, 1998, 2006, 2008	4	21	2	
	h	Star Gap Arch	D	X				2005, 2006, 2008	3	3	5	
	i	Star Gap Arch	D		X			2006, 2008	2	2	1	
	d	Star Gap Arch	D		X			1998, 2005, 2006, 2008	4	10	5	proposed

EO	Sub EO	Survey site	Rank	S	D	U	X	Survey years	# Years	Monitoring Span	Rec. Impact	Fenced?
23	g	Clear Branch	B	X				1996, 2006, 2008, 2009	4	13	1	
	b	Clear Branch	C	X				1986, 2000, 2005, 2008, 2009	5	23	5	
	e	Clear Branch	A	S				1986, 2000, 2005, 2006, 2008, 2009	6	23	2	
	c	Clear Branch	D		X			1986, 2000, 2006, 2008, 2009	5	23	1	
	f	Clear Branch	D		X			2005, 2006, 2008, 2009	4	4	1	
	a	Clear Branch	D		X			1986, 2000, 2005, 2006, 2008, 2009	6	23	5	
24	a	Clear Branch Headwaters	C	X				1997, 2001, 2005, 2008	4	11	1	
	d	Clear Branch Headwaters	D	X				2005, 2008	2	3	1	
	c	Clear Branch Headwaters	D	X				2001, 2005, 2008	3	7	1	
	b	Clear Branch Headwaters	D		X			1997, 2001, 2008	3	11	1	
	e	Clear Branch Headwaters	D	X				2005, 2008	2	3	1	
	f	Clear Branch Headwaters	D	X				2005, 2008	2	3	1	
	g	Clear Branch Headwaters	D	X				2005, 2008	2	3	2	
25	a	Clear Branch Headwaters 2	B		X			2005, 2008	2	3	1	
26	a	Clear Branch	A	X				2000, 2007, 2008	3	8	1	
	b	Clear Branch	B	X				1997, 2000, 2007, 2008	4	11	4	X
	c	Clear Branch	B	X				1996, 2000, 2007, 2008	4	12	3	X
	d	Clear Branch	D		X			2000, 2007, 2008	3	8	1	
	e	Clear Branch	D		X			1996, 2000, 2007, 2008	4	12	1	X
27	e	Daniel Boone Hut Trail	B	X				2005, 2009, 2013	3	8	2	X
	f	Daniel Boone Hut Trail	B	X				1997, 2009, 2013	3	16	4	X
	a	Daniel Boone Hut Trail	B	X				1996, 2005, 2009, 2013	4	17	4	
	c	Daniel Boone Hut Trail	C		X			2005, 2009, 2013	3	8	5	
	b	Daniel Boone Hut Trail	C	X				1996, 2005, 2009, 2013	4	17	2	
	d	Daniel Boone Hut Trail	D		X			1996, 2005, 2009, 2013	4	17	4	X
	g	Daniel Boone Hut Trail	D	X				1996, 2009, 2013	3	17	2	

EO	Sub EO	Survey site	Rank	S	D	U	X	Survey years	# Years	Monitoring Span	Rec. Impact	Fenced?
29	a	Rocky Branch	X				X	1996, 2003, 2005, 2006	4	10	1	
	b	Rocky Branch	X				X	1996, 1999, 2003, 2005, 2006	5	10	1	
	c	Rocky Branch	X				X	1996, 1999, 2003, 2005, 2006	5	10	1	
	d	Rocky Branch	X				X	1996, 1999, 2003, 2005, 2006	5	10	1	
	e	Rocky Branch	X				X	1999, 2003, 2005, 2006	4	7	1	
30	a	Clear Branch Headwaters	X				X	1980, 1996, 2009	3	29	3	
31	a	SR 15 West	B	X				1988, 2003, 2009	3	21	1	
	b	SR 15 West	D	X				2003, 2009	2	6	1	
32	a	Nada Arches	F			X		1999	1	1	NR	
33	a	Middle Clear Branch 2	B	X				1998, 2001, 2007, 2009	4	11	1	
	b	Middle Clear Branch 3	BC	X				1998, 2001, 2007, 2009	4	11	1	
	c	Middle Clear Branch 4	D	X				2007, 2009	2	2	1	
	d	Middle Clear Branch 5	D	X				2007, 2009	2	2	1	
34	c	Wolf Pen Creek	B	X				2001, 2005, 2008	3	7	2	
	d	Wolf Pen Creek	C	X				2005, 2009	2	3	1	
	a	Wolf Pen Creek	D		X			2005, 2008	2	3	1	
	b	Wolf Pen Creek	D	X				2001, 2005, 2008	3	7	1	
35	a	Middle Clear Branch 1	A	X				1998, 2001, 2007, 2009	4	10	2	
36	a	Court House Rock Trail	A	X				1998, 2003, 2005, 2008, 2009	5	11	4	proposed
	b	Court House Rock Trail	C	X				2003, 2005, 2008, 2009	4	6	2	
38	a	Dunkan Branch West	B		X			1996, 1999, 2003, 2005, 2008	5	12	2	
	e	Dunkan Branch West	C			X		1996	1	1	NR	
	f	Dunkan Branch West	D		X			1988, 1996, 1999, 2003, 2008	5	20	1	
	g	Dunkan Branch West	D		X			1999, 2003, 2005, 2008	4	9	1	
	c	Dunkan Branch West	D		X			1999, 2003, 2008	3	9	3	
	b	Dunkan Branch West	D		X			1999, 2003, 2005, 2008	4	9	5	
	d	Dunkan Branch West	D			X		2008	1	1	3	
39	b	Dunkan Branch East	B	X				1996, 2003, 2005, 2008	4	12	5	
	a	Dunkan Branch East	D			X		2008	1	1	1	
40	a	Laurel Branch	F			X		1986, 1996, 2009	3	11	1	
41	a	Parched Corn Creek	X				X	1986, 1996, 2006, 2008	4	22	5	
44	a	Clear Branch Trib	X				X	1986, 1996	2	10	1	

EO	Sub EO	Survey site	Rank	S	D	U	X	Survey years	# Years	Monitoring Span	Rec. Impact	Fenced?
45	a	Indian Creek	D		X			1996, 2001, 2004, 2005, 2008	5	12	1	X
46	a	Chester Creek	C					1992, 2008	2	16	1	
47	a	Bell Branch	A	X				1998, 2001, 2005, 2006, 2008, 2009	6	11	1	
	c	Bell Branch	B	X				1998, 2001, 2005, 2006, 2008, 2009	6	11	2	
	b	Bell Branch	D	X				1998, 2001, 2005, 2006, 2008, 2009	6	11	1	
	d	Bell Branch	D	X				2006, 2008, 2009	3	3	4	
48	a	Swift Camp Creek	F				X	1998	1	1	NR	
49	a	Sky Bridge	X				X	1998	1	1	5	
50	a	Sal Branch	A	X				2003, 2005, 2008	3	5	1	
	e	Sal Branch	B	X				2003, 2005, 2008	3	5	1	
	b	Sal Branch	B	X				2003, 2005, 2008	3	5	1	
	c	Sal Branch	B	X				2005, 2008	2	3	1	
	d	Sal Branch	X				X	1986, 1998, 2008	3	22	5	
51	a	Near mouth of Gladie Creek	C	X				1998, 2000, 2006, 2008, 2009	5	11	1	
52	a	King Branch	B	X				1997, 2005, 2008, 2009	4	12	1	
53	a	Dark Hollow	D	X				1999, 2003, 2005, 2006, 2008	5	9	1	
	b	Dark Hollow	B		X			1999, 2003, 2005, 2006, 2008	5	9	1	
54	a	Tunnel Ridge Rd East	B	X				1999, 2001, 2007, 2008, 2009	5	10	4	X
	b	Tunnel Ridge Rd East	C	X				2007, 2008, 2009	3	3	3	
55	b	Sheltowee Trace N	A	X				2001, 2008, 2009	3	8	5	proposed
	a	Sheltowee Trace N	B	X				2001, 2008, 2009	3	8	1	
	c	Sheltowee Trace N	D		X			2001, 2008, 2009	3	8	5	
	d	Sheltowee Trace N	D	X				2008, 2009	2	2	1	
56	a	End of Whittleton Branch trail	D	X				2005, 2006, 2009	3	4	5	
57	c	Rough Trail East	C	X				2006, 2009	2	2	1	
	a	Rough Trail East	D	X				2006, 2009	2	2	1	
	b	Rough Trail East	D		X			2006, 2009	2	2	1	
59	a	Moreland Branch Drainage	C	X				2007, 2013	2	6	1	
	b	Moreland Branch Drainage	C	X				2007, 2013	2	6	1	
	c	Moreland Branch Drainage	C	X				2013				

Appendix B - White-haired Goldenrod Field Data Sheet

White-haired Goldenrod Field Data Sheet

Kentucky State Nature Preserves Commission

Equipment check: 1x1 M square compass plt survey forms GPS count clicker digital camera
 EO # _____ Subpopulation _____ County _____ Site Name _____
 Lat/Long (GPS) _____ GPS waypt _____ Accuracy _____ Observer _____ Date/Time _____

HABITAT

Aspect <input type="checkbox"/> N <input type="checkbox"/> NE <input type="checkbox"/> E <input type="checkbox"/> NW <input type="checkbox"/> S <input type="checkbox"/> SE <input type="checkbox"/> W <input type="checkbox"/> SW <input type="checkbox"/> Flat or n/a	Rock Shelter Size Lgth (M) * Wdth (M) <input type="checkbox"/> 0-2 M (7 ft) <input type="checkbox"/> <input type="checkbox"/> 2-5 M (16 ft) <input type="checkbox"/> <input type="checkbox"/> 5-9 M (30ft) <input type="checkbox"/> <input type="checkbox"/> 9-15M (50 ft) <input type="checkbox"/> <input type="checkbox"/> 15-?M(50+ft) <input type="checkbox"/>	Light <input type="checkbox"/> Open (>4 hrs full sun) <input type="checkbox"/> Partial (>2hrs full sun but <4 <input type="checkbox"/> Filtered (<input type="checkbox"/> Shade	Topo position <input type="checkbox"/> Head of Ravine <input type="checkbox"/> Side of Ravine <input type="checkbox"/> Crest <input type="checkbox"/> Upper slope <input type="checkbox"/> Mid-slope <input type="checkbox"/> Lower-slope <input type="checkbox"/> Bottom	Moisture <input type="checkbox"/> Inundated <input type="checkbox"/> Saturated (wet-mesic) <input type="checkbox"/> Moist (mesic) <input type="checkbox"/> Dry-mesic <input type="checkbox"/> Dry (xeric)
---	---	---	---	---

Describe Rockshelter: _____

Associated plant species (overstory, midstory, understory):

BIOLOGY

Patch #1:

Population structure: _____ % Vegetative _____ % Reproductive _____ Height of Plants (in) Pop. area (using 1x1 M sq.) or patch size: _____ Lth (M) _____ Wdth (M) _____ Area (M)	Population Size: Stems: Actual # _____ Estimated # _____ Rosettes: <input type="checkbox"/> 1-10 <input type="checkbox"/> 10-20 <input type="checkbox"/> 20-40 <input type="checkbox"/> 40-60 <input type="checkbox"/> 60-80 <input type="checkbox"/> 80-100 <input type="checkbox"/> 100-150 <input type="checkbox"/> 150-200 <input type="checkbox"/> 200+	Population Density (based on Pop. area): <input type="checkbox"/> Sparse (0-10% cover) <input type="checkbox"/> Low Density (10-30%) <input type="checkbox"/> Moderate (30-60%) <input type="checkbox"/> Dense (60-80%) <input type="checkbox"/> High Density (80-100%) Is pop on inaccessible cliff faces? <input type="checkbox"/> yes <input type="checkbox"/> no If yes, estimated # _____	Vigor: Health of plt <input type="checkbox"/> Very feeble <input type="checkbox"/> Feeble <input type="checkbox"/> Normal <input type="checkbox"/> Vigorous <input type="checkbox"/> Exceptionally vigorous
--	--	---	---

Photograph taken? yes no Photograph # _____ Describe where photo was taken (direction, features, ect) _____

Patch #2

Population structure: _____ % Vegetative _____ % Reproductive _____ Height of Plants (in) Pop. area (using 1x1 M sq.) or patch size: _____ Lth (M) _____ Wdth (M) _____ Area (M)	Population Size: Stems: Actual # _____ Estimated # _____ Rosettes: <input type="checkbox"/> 1-10 <input type="checkbox"/> 10-20 <input type="checkbox"/> 20-40 <input type="checkbox"/> 40-60 <input type="checkbox"/> 60-80 <input type="checkbox"/> 80-100 <input type="checkbox"/> 100-150 <input type="checkbox"/> 150-200 <input type="checkbox"/> 200+	Population Density (based on Pop. area): <input type="checkbox"/> Sparse (0-10% cover) <input type="checkbox"/> Low Density (10-30%) <input type="checkbox"/> Moderate (30-60%) <input type="checkbox"/> Dense (60-80%) <input type="checkbox"/> High Density (80-100%) Is pop on inaccessible cliff faces? <input type="checkbox"/> yes <input type="checkbox"/> no If yes, estimated # _____	Vigor: Health of plt <input type="checkbox"/> Very feeble <input type="checkbox"/> Feeble <input type="checkbox"/> Normal <input type="checkbox"/> Vigorous <input type="checkbox"/> Exceptionally vigorous
--	--	---	---

Photograph taken? yes no Photograph # _____ Describe where photo was taken (direction, features, ect) _____

Patch #3

Population structure:
 _____ % Vegetative
 _____ % Reproductive
 _____ Height of Plants (in)

Pop. area (using 1x1 M sq.) or patch size:
 _____ Lth (M) _____ Wdth (M)
 _____ Area (M)

Population Size:
Stems:
 Actual # _____
 Estimated # _____

Rosettes:
 1-10 10-20
 20-40 40-60
 60-80 80-100
 100-150 150-200
 200+

Population Density (based on Pop. area):
 Sparse (0-10% cover)
 Low Density (10-30%)
 Moderate (30-60%)
 Dense (60-80%)
 High Density (80-100%)

Is pop on inaccessible cliff faces?
 yes no
 If yes, estimated # _____

Vigor: Health of plt
 Very feeble
 Feeble
 Normal
 Vigorous
 Exceptionally vigorous

Photograph taken? yes no Photograph # _____ Describe where photo was taken (direction, features, ect) _____

Patch #4

Population structure:
 _____ % Vegetative
 _____ % Reproductive
 _____ Height of Plants (in)

Pop. area (using 1x1 M sq.) or patch size:
 _____ Lth (M) _____ Wdth (M)
 _____ Area (M)

Population Size:
Stems:
 Actual # _____
 Estimated # _____

Rosettes:
 1-10 10-20
 20-40 40-60
 60-80 80-100
 100-150 150-200
 200+

Population Density (based on Pop. area):
 Sparse (0-10% cover)
 Low Density (10-30%)
 Moderate (30-60%)
 Dense (60-80%)
 High Density (80-100%)

Is pop on inaccessible cliff faces?
 yes no
 If yes, estimated # _____

Vigor: Health of plt
 Very feeble
 Feeble
 Normal
 Vigorous
 Exceptionally vigorous

Photograph taken? yes no Photograph # _____ Describe where photo was taken (direction, features, ect) _____

Subpopulation Patches (describe if the plts occur in patches within the rockshelter, number them (1,2,3) and how they occur from direction (ex. From N to S) of rockshelter, each patch needs to have biology info recorded:

DISTURBANCE

Habitat/Shelter Disturbance check-off:

___ fire ___ logging ___ disease ___ insect damage ___ windthrow ___ invasives (non-native and native) ___ erosion (natural and anthropogenic) ___ browsing
 ___ rock karns ___ campfire ___ human trash/bedding ___ digging ___ trampling
 Comments _____

Check-off Total: _____

Natural Disturbance:

Evidence of deer browse high (>60%) med (>30% but <60%) low (<30%) none
 disease and gall formation high (>60%) med (>30% but <60%) low (<30%) none
 defoliation by insects high (>60%) med (>30% but <60%) low (<30%) none
 harvesting of plants by woodrats high (>60%) med (>30% but <60%) low (<30%) none
 Microstegium vimineum present yes no

Microstegium Density:
 Sparse (0-10% cover)
 Low Density (10-20%)
 Moderate (20-60%)
 Dense (60-80%)
 High Density

Appendix C – Recreational Impact and Population Rank Field Assessment Sheet

Recreational Impact and Population Rank Field Assessment Sheet

Habitat/Shelter Disturbance check-off:

fire logging disease insect damage windthrow invasives (non-native and native)
 erosion (natural and anthropogenic) browsing rock karns campfire human trash/bedding
 digging trampling
Check-off Total: _____

RECREATIONAL IMPACT RANKS (see description below)

5 High-Impacts due to recreation are persistent and/or severe. Greater than 50% of the habitat (primarily the rockhouse floor and associated cliff face habitat) is altered or damaged by recreation and there is evidence of direct and lasting damage to plants of white-haired goldenrod and habitat such as bare soil areas and disruption of vegetation resulting from camping or repeated trampling. Natural disturbance can also be high (trampling/browsing). Usually has a high check-off total (>10).

4 Medium-High-Similar habitat damage as that of the high category but less than 50% (but >30%) of the available habitat and plants of *S. albopilosa* are affected. Usually has a high check-off total (>7).

3 Medium -Available habitat for *S. albopilosa* has been disturbed by trampling or other recreational use but not greater than 30% of the available habitat and plants of *S. albopilosa*. Natural disturbance is usually evident. Usually has a moderate check-off total (>5).

2 Medium-Low-Available habitat for *S. albopilosa* has been disturbed by trampling or other recreational use but use has not resulted in compacted bare soil in vegetated areas or there is little/minor discernible reduction in the number of plants at the site. Natural disturbance may be evident. Usually has a moderate check-off total (>3).

1 Low Available habitat for *S. albopilosa* has very little or no disturbance. Shelter may have old signs of past disturbance. Trash or abandoned fire pits are not affecting population. Usually has a low check-off total (<3).

Population ranks were assigned to each occurrence following these criteria:

POPULATION RANK (see description below)

A (excellent estimated viability): 2,500 or more stems in habitat with a low degree of recreational impact or a minimum of 4,000 stems where the degree of recreational impact is medium or high.

B (good estimated viability): 1,000 to 2,499 stems and some areas of habitat with a low degree of recreational impact or higher numbers of stems (2,500-4,000) at sites where the degree of recreational impact is medium or high.

C (fair estimated viability): 300 to 1,000 stems where recreational impacts are low or higher numbers of stems (1-2,000) at sites affected by a medium or high degree of recreational impact; may also include sites with little opportunity for habitat recovery or population expansion.

D (poor estimated viability): 300 or fewer stems in any habitat.