White-haired goldenrod
(Solidago albopilosa)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
Frankfort Ecological Services Field Office
Frankfort, Kentucky

5-YEAR REVIEW

White-haired goldenrod (*Solidago albopilosa*) E. L. Braun 1942

I. GENERAL INFORMATION

A. Methodology used to complete this 5-year review: Public notice was provided in the Federal Register on July 26, 2005 (70 FR 43171), and a 60-day comment period was opened. During this comment period, we obtained information on the status of this species from several experts, and obtained additional data from the recovery plan, peer-reviewed scientific literature, and our state partners. Once all of the known literature and information was collected for this species, Dr. Michael A. Floyd, lead Recovery Biologist with the Kentucky Ecological Services Field Office (KFO) completed the review. The draft document was peer-reviewed by Deborah White, Kentucky State Nature Preserves Commission (KSNPC), Frankfort, Kentucky; David Taylor, U.S. Forest Service, Daniel Boone National Forest (DBNF), Winchester, Kentucky; and Dr. Ronald Jones, Eastern Kentucky University, Department of Biological Sciences, Richmond, Kentucky (see Appendix A). Comments received were evaluated and incorporated where appropriate.

B. Reviewers

Lead Region – Southeast Region: Kelly Bibb, 404-679-7132

Lead Field Office – Frankfort, KY, Ecological Services: Michael Floyd, 502-695-0468

C. Background

1. FR Notice citation announcing initiation of this review: 70 FR 43171, July 26, 2005.

2. Species status: Stable (2008 Recovery Data Call). The last representative or significant survey was completed by KSNPC in 2005. From 2005 to 2008, KSNPC and DBNF began a 3-year sampling cycle, where approximately one-third of known *S. albopilosa* sites were visited each year. Management actions were evaluated on a yearly basis. Funds ($32,000) were obtained by KFO in 2007 and used by KSNPC to fund range-wide surveys in the fall of 2008 and 2009. The 2008 survey was completed in January 2009, but results of the survey have not been finalized. There has been no change in threats to the species, and no new threats are known. A total of 119 occurrences have been documented within the Red River Gorge area; at present, 51 of these occurrences (43 percent) appear to be stable or increasing (number of stems have remained constant or increased, with flowering at all occurrences). This total exceeds the number required for delisting (40), but insufficient monitoring data is available to show that these populations have been stable and protected for a period of 10 years (as required in the recovery plan). Current monitoring data is available for an average time period of 6.4 years. Only 11 occurrences (9%) have shown declines, and 17 occurrences have been extirpated.

3. Recovery achieved: 3 (51-75% species recovery objectives achieved). A sufficient amount of recovery progress has been made to increase the "recovery achieved" number from 2 to 3. This increase is based on the fact that (1) it appears that there are now a sufficient number of stable/increasing occurrences (51) as compared to the Recovery Plan goal of 40; (2) current monitoring data is available over an average time period of 6.4 years per occurrence, more than half way toward the recovery goal of 10 years; and (3) protective fencing has been placed around 21 occurrences, over half of the protected occurrences (40) required by the Recovery Plan.

4. Listing history

Original listing:
FR notice: 53 FR 11612
Date listed: April 7, 1988
Entity listed: Species
Classification: Threatened

5. Associated rulemakings: None

6. Review History:

The Service conducted a five-year review for the goldenrod in 1991 (56 FR 56882). In this review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors or threats as they pertain to the individual species. The notice stated that the Service was seeking any new or additional information reflecting the necessity of a change in the status of the species under review. The notice indicated that if significant data were available warranting a change in a species' classification, the Service would propose a rule to modify the species' status. No change in the white-haired goldenrod's listing classification was found to be appropriate.

1993 Recovery Plan (see below)

Recovery Data Call – 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999, 1998

7. Species' Recovery Priority Number at start of review (48 FR 43098): 8. The "8" indicates degree of threat is moderate and high recovery potential.

8. Recovery Plan

Name of plan: Recovery plan for White-haired goldenrod (*Solidago albopilosa*)
Date issued: September 28, 1993

II. REVIEW ANALYSIS

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

1. **Is the species under review listed as a DPS?** No. The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

B. Recovery Criteria

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

2. **Does the recovery plan contain recovery (i.e., delisting) criteria?** Yes

3. **Do the recovery criteria reflect the best available information on the biology of the species and its habitat?** Yes

4. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?** Yes

List the recovery criteria as they appear in the recovery plan and discuss how each criterion has or has not been met, citing supporting information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5 listing factors are not relevant to this species, please note that here.

Criteria for delisting
Delisting of *S. albopilosa* will be considered when: 40 geographically distinct, self-sustaining occurrences are adequately protected and have been maintained for 10 years. An occurrence will be adequately protected when it is legally protected, has received adequate physical protection, and is assured of all required management. An occurrence will be considered to be self-sustaining if there is evidence of successful reproduction and the number of individuals is stable or increasing. It was noted in the recovery plan that the requirements for delisting are preliminary and may change as more information about the biology of the species is discovered.

When the recovery plan was completed in 1993 (USFWS 1993), the distribution of *S. albopilosa* was limited to 90 known occurrences in Menifee, Powell, and Wolfe counties, Kentucky. All of these locations were situated within the proclamation boundary of the Daniel Boone National Forest (DBNF), but only 69 occurrences (approximately 76 percent) were in federal ownership. The remaining occurrences (21) were located on private property. The recovery plan (USFWS 1993) defined an occurrence of *S. albopilosa* as a "cluster of plants within a single rock-shelter or on a single rock ledge." All subsequent discussions of occurrences in this five-year review will be based on this definition.

According to the recovery plan, damage to *S. albopilosa* occurrences reached a peak in the 1970s. During this period, 75 percent of known occurrences (68) were severely damaged, and 11 occurrences (3,422 individuals) were extirpated. Heavy use of rock shelters by hikers, campers, and rock climbers along with associated garbage dumping and fire-building resulted in trampling and loss of individuals in *S. albopilosa* populations. Other threats included digging in rock shelters by archaeological looters and logging of adjacent forests.

The 69 occurrences on federal property were protected from logging by the U.S. Forest Service's endangered and threatened species management policy, which prohibited or limited logging near cliffline habitats. No such logging restrictions were in place for the 21 occurrences located on private inholdings. To protect occurrences from trampling, fire-building, and digging, signs were installed in 1985 at all entry points to the Red River Gorge (Gorge) asking visitors not to remove or disturb historical resources. Similar signs were placed inside at least five archaeologically significant rockhouses that contained *S. albopilosa*. Unfortunately, the signs had little effect, and disturbance of rock shelters continued.

Based on current monitoring and distributional data compiled by the Kentucky State Nature Preserves Commission (KSNPC) and DBNF, a total of 119 white-haired goldenrod occurrences have now been documented within the Gorge. All of these occurrences are located within the proclamation boundary of the DBNF, and all but two of them are located on federal property (Deborah White, personal communication, KSNPC, 2006). The number of additional occurrences located on private property is currently unknown and under review (David Taylor, pers. comm., Daniel Boone National Forest, 2006). With few exceptions, each of the 119 occurrences has been monitored at least once over the last 10 years by KSNPC or DBNF personnel, and many of the occurrences have been evaluated several times over the same period. At present, 51 of the 119 known occurrences (43 percent) appear to be stable or increasing (the number of stems have remained constant or have increased, with flowering occurring at all occurrences); 11 occurrences (9 percent) are in a state of decline (number of stems have decreased over time, little or no flowering); and 17 occurrences have been extirpated. The remaining 40 occurrences cannot be evaluated with respect to stability at this time because only one year of monitoring data has been obtained for these occurrences. An average of approximately 2.7 monitoring events has been conducted for each of the 51 stable occurrences. These monitoring events were conducted generally between 1996 and 2005, resulting in an average monitoring period of 6.4 years.

All known occurrences have been ranked by KSNPC based on population size and viability, condition of the habitat, and degree of threat (White and Drozda, in press). The following specifications were used to rank the occurrences:

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

2. 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 to 4,000) at sites where the degree of recreational impact is medium or high.

3. C (fair estimated viability): 300 to 999 stems where recreational impacts are low or higher numbers of stems (1,000 to 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.

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

Occurrence ranks of all known sites produced the following categorical results: A-rank, 8 occurrences; B, 27; C, 31; and D, 24. The remaining 27 occurrences were considered to be either extirpated or could not be relocated.

Based upon the best available data, criteria for delisting have not been met. There appears to be a sufficient number of stable (self-sustaining) occurrences (51) to meet the recovery goal of 40 stable occurrences, but the average monitoring period for these occurrences is only 6.4 years, not 10 years as required in the recovery plan. The goal of sufficient protection and management has only been partially achieved. All DBNF occurrences are legally protected because the ESA prohibits the damage or destruction of listed plants in areas under federal jurisdiction. However, physical protection has been achieved for only 21 occurrences (through the placement of small fences) on the DBNF. Unfortunately, the species occupies scenic, picturesque habitats that are sought out by hikers, campers, rock-climbers, and other nature enthusiasts. Therefore, inadvertent trampling and ground disturbance continue to pose a threat to the species. Management of the species is accomplished through the 2004 Forest Plan (USFS 2004), including informal consultations between the DBNF and the KFO.

C. Updated Information and Current Species Status

1. Biology and Habitat:

a. Abundance, population trends, demographic features, or demographic trends: All available information on species abundance, population trends, demographic features, and demographic trends is summarized above in the recovery criteria section. Because additional monitoring is needed to determine if recovery criteria have been met, funds were obtained and used

by KSNPC so that range-wide surveys could be completed in 2008 and 2009. The 2008 surveys began in October and were completed in January 2009.

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

White-haired goldenrod is a tetraploid species (2n = 36) that could have resulted from hybridization and alloploidy (fusion of unreduced gametes from two different, diploid [2n = 18] species). The origin of the species remains unclear, but morphological and isozyme comparisons by Esselman and Crawford (1997) and Esselman (1995) concluded that *S. albopilosa* is most similar to *S. flexicaulis*, the broad-leaf goldenrod. However, they also concluded that there was no evidence that either *S. flexicaulis* or *S. caesia* (wreath or blue-stemmed goldenrod) has a recent close relationship with *S. albopilosa*. With respect to genetic diversity, Esselman (1995) reported that *S. albopilosa* is not genetically depauperate as evidenced by genetic diversity (Random Amplified Polymorphic DNA (RAPD) and isozyme markers) both within and between populations (genetic diversity is widely spread among populations – populations are not very genetically homogenous). The highest level of genetic diversity was observed among populations. Consequently, Esselman (1995) recommended that conservation efforts include the maintenance of as many populations as possible to capture the full genetic diversity of the species.

c. Taxonomic classification or changes in nomenclature

No changes have occurred with respect to taxonomic classification or nomenclature.

d. Spatial distribution, trends in spatial distribution, or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.)

Since the recovery plan was completed in 1993, 38 new occurrences have been discovered within the DBNF in Menifee, Powell, and Wolfe counties. This brings the total number of occurrences on the DBNF to 117. Only 2, confirmed occurrences are known from private property, a decrease of 19 occurrences from the total (21) reported in the recovery plan. Some of these occurrences likely occupy areas that are now owned by the DBNF, but the status of others is unknown.

e. Habitat or ecosystem conditions: White-haired goldenrod is an herbaceous, perennial, Kentucky endemic that is restricted to sandstone rock shelters and rock ledges of Menifee, Powell, and Wolfe counties in the east-central portion of the state. The species grows just behind the drip line of shelters and ledges on the upper slopes of the Gorge, between 800 and 1,300 feet mean sea level (USFWS 1993).

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

a. Present or threatened destruction, modification or curtailment of its habitat or range: Occurrences of white-haired goldenrod located within the DBNF are protected from general habitat disturbance due to their presence on Federal property. These occurrences are protected from logging or other management activities by DBNF's endangered and threatened species management policy, which prohibits or limits logging near cliffline habitats (DBNF 2004). However, habitat modification and/or destruction does occur on DBNF as a result of ground disturbance and trampling brought on by recreational activities such as hiking, camping, and rock-climbing that occur within or near rock shelters. The presence of Native American artifacts within the Gorge contributes to digging and archaeological looting at many of the *S. albopilosa* rockhouses, including those in the more remote areas. Some occurrences have been extirpated due to these activities, and many heavily visited rock shelters have been modified to the point that these habitats are no longer suitable for the species (Deborah White, personal communication, KSNPC, 2006). Occurrences located on private property are more severely threatened by direct habitat disturbance because these habitats do not receive the same protection as those occupying Federal land. These areas are vulnerable to land development and silvicultural practices that could severely alter habitats within and near rockhouses.

b. Overutilization for commercial, recreational, scientific, or educational purposes: The species occupies a scenic and unique geological area that is heavily visited by hikers, campers, rock-climbers, and other nature enthusiasts. The U.S. Forest Service estimates recreational use of the Gorge at approximately 500,000 visitor days per year (David Taylor, personal communication, Daniel Boone National Forest, 2006). Unfortunately, this heavy use by visitors causes the species to be overutilized for recreational purposes. Inadvertent trampling and ground disturbance by Gorge visitors continue to pose threats to the species. Evidence of trampling and ground disturbance within rock shelters has been observed repeatedly by KSNPC and DBNF personnel (Deborah White, personal communication, KSNPC, 2006; David Taylor, personal communication, Daniel Boone National Forest, 2006).

To protect occurrences from trampling, fire-building, and digging, signs were installed in 1985 at all entry points to the Red River Gorge asking visitors not to remove or disturb historical resources. Similar signs were placed inside at least five archaeologically significant rockhouses that contained *S. albopilosa*. Unfortunately, the signs had little effect, and disturbance of rock shelters continued. Beginning in February 2000, the DBNF began to redirect trails and install fencing (chicken wire) around selected rockshelters (those with greatest visitation) containing *S. albopilosa*. Signs were also placed at these shelters, alerting visitors to the presence of the species and warning them against potential damage to plants. Currently, 21 occurrences have

been fenced. Preliminary monitoring results suggest that fencing has had a positive effect on the species. Specifically, disturbance from trampling, camping, rock-climbing has been reduced in these areas, and the number of stems has increased.

The species' small range and low number of individual plants also makes it vulnerable to overcollecting for scientific purposes. The species is afforded some protection from these potential impacts, because the majority of known occurrences are located on Federal land (Daniel Boone National Forest), and many of the occurrences are located in areas that are remote and/or difficult to locate (*e.g.*, clifflines). Plants located on federal lands cannot be collected without a Section 10 Permit from the U.S. Fish and Wildlife Service; these permits are only issued for valid scientific purposes. Plants occurring on private property are not afforded this protection.

c. Disease and predation: *Solidago albopilosa* is not currently known to be threatened by disease. Plants are occasionally damaged by herbivores, such as white-tailed deer, woodrats, and caterpillars, but we have no information that grazing by these species represents a serious threat.

d. Inadequacy of existing regulatory mechanisms: Populations located on DBNF lands within the Gorge are protected from damage and unauthorized taking by Federal regulation (36 CFR 261.9). Unfortunately, limited manpower makes enforcement difficult. No such protection is available for populations located on private property. The species is state-listed as endangered in Kentucky (KSNPC 2005), but this designation conveys no legal protection.

e. Other natural and manmade factors affecting its continued existence: *Solidago albopilosa* is uniquely adapted to the present combination of climatic, geologic, and topographic conditions within the Red River Gorge. The species could be negatively impacted by only minor changes in the surrounding forest, resulting in drying, erosion, and competition from sun-tolerant species. Competition from aggressive, non-native grasses (e.g., *Microstegium vimineum* and *Miscanthus sinensis*) and other plant species (e.g, garlic mustard [*Alliaria petiolata*]) also has the potential to negatively impact the species (Ron Jones, personal communication, Eastern Kentucky University, 2006).

D. Synthesis

When the recovery plan was completed in 1993 (USFWS 1993), the distribution of *S. albopilosa* was limited to 90 known occurrences in the Red River Gorge area of Menifee, Powell, and Wolfe counties, Kentucky. Sixty-nine of these occurrences were in Federal ownership (DBNF), with the remaining 21 occurrences occurring on private property. Based on current monitoring and distributional data compiled by the Kentucky State Nature Preserves Commission (KSNPC) and DBNF, a total of 119 white-haired goldenrod occurrences have now been documented within the Gorge. The vast majority

of these (117) are in federal ownership, with only 2 confirmed occurrences on private property.

Three of the five listing factors considered by the Service pose threats to white-haired goldenrod: the present or threatened destruction, modification or curtailment of its habitat or range; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. The species' habitat and range continues to be modified and damaged by Gorge visitors who trample and disturb rock shelter habitats while hiking, camping, rock-climbing, digging, fire-building, and other activities in and near rockshelters. Undoubtedly, disturbance by Gorge visitors continues to represent the primary threat to the survival of the species. Other threats to the species include competition from exotic species (*Microstegium* in particular) and logging of surrounding forests on private land.

The recovery criteria have not been met for delisting of the species. There appears to be a sufficient number of self-sustaining occurrences (51) to satisfy the recovery criteria goal of 40 occurrences, but insufficient monitoring data is available to show that these occurrences have been stable or increasing for a 10-year period as required in the recovery plan (current monitoring data is only available for an average time period of 6.4 years). In addition, adequate protection of occurrences has not been guaranteed at a sufficient number of sites; fencing and signs have only been placed around 21 occurrences and have only been in place for a maximum of 6 years. Because of the restricted distribution of the species, extirpation of some occurrences, continued threats, and lack of achievement of all recovery criteria, we believe the species continues to meet the definition of threatened at this time and should remain classified as such.

III. RESULTS

A. Recommended Classification: No change is needed in this species status at this time. However, the species is showing improvement. New occurrences have been located since completion of the recovery plan, and a significant number of occurrences (51) appear to be stable. With recent funding we received, we anticipate making additional progress with partners, and we believe delisting should be considered for this species in the near future.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

(order does not indicate priority)

- Complete the two-year range-wide survey initiated in the fall of 2008.
- Upon completion of the two-year survey, evaluate the species' status to determine (1) if delisting is possible and/or (2) what additional management or protective measures are needed. Pursue what is necessary for delisting with partners.
- Continue to install fencing and informative signs at selected occurrences as needed.
- Continue implementation of all management and protective actions for permanently protected occurrences – restrictions on rock shelter use, fencing, signs, rerouting of trails.
- Continue searches for new populations in the Red River Gorge area.

- Conduct searches for new populations in surrounding counties.
- Continue to pursue permanent protection (through registry agreements, easements, or land purchases) of occurrences located on private property.
- Continue to investigate the life history and ecological requirements of the species.

V. REFERENCES

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U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR REVIEW on *Solidago albopilosa* (White-haired goldenrod)

CURRENT CLASSIFICATION **Threatened**

RECOMMENDATION resulting from the 5-Year: **No Change**

REVIEW CONDUCTED BY: **Dr. Michael A. Floyd, Kentucky ES FO**

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 2/24/09

Do not Approve_____ Date_____

Lead Field Offices must ensure that all other Field Offices within the range of the species have been provided an adequate opportunity to review and comment prior to the review's completion. If it is concluded that a change in classification is warranted, written concurrence from other Field Offices is required.

Lead Regional Director, Fish and Wildlife Service

Concur _____ Date 3/3/09

Not concur_____ Date_____

The Regional Director must sign all 5-year reviews, unless the authority has been delegated by the Regional Director to the ARD of Ecological Services.

APPENDIX A

Summary of peer review for the 5-year review of white-haired goldenrod (*Solidago albopilosa*)

A. Peer Review Method: Prospective peer reviewers were notified electronically and by phone on June 1, 2006 and asked of their willingness to participate in the peer review process. They were asked whether they would be able to complete their review in a timely manner and follow peer review guidance. In June and July 2006, we received summary comments and edited copies of the draft five-year review from Deborah White, Kentucky State Nature Preserves Commission, Frankfort, Kentucky; David Taylor, U.S. Forest Service, Daniel Boone National Forest, Winchester, Kentucky; and Dr. Ronald Jones, Eastern Kentucky University, Department of Biological Sciences, Richmond, Kentucky. Comments received were addressed and incorporated as appropriate.

B. Peer Review Charge: Peer reviewers were asked to read the 5-year review and provide any comments, both editorial and content.

C. Summary of Peer Review Comments/Report: Peer reviews were mainly editorial in nature with very minor substantive comments to the content. Substantive comments included (1) a suggestion by Deborah White that we explain the difference between site and occurrence and use one of the two terms appropriately and consistently throughout the review, (2) a statement by Deborah White regarding her opposition to the inclusion of "establishment of new populations" as a recommended future action; (3) a question by Ronald Jones regarding the number of occurrences located on private versus public property; (4) a suggestion by Ronald Jones to add herbivory by white-tailed as a potential threat to the species; (5) a suggestion by Ronald Jones to include garlic mustard (*Alliaria petiolata*) as a potential threat to the species (under Factor E); and (6) a comment by Ronald Jones that Esselman and Crawford (1997) and Francis (1998) be added to the References list.

D. Response to Peer Review: General edits and minor substantive changes were added to the review as appropriate. More substantive comments summarized above were addressed as follows: (1) the term occurrence was defined and used consistently throughout the text while use of the term "site" was abandoned; (2) "establishment of new populations" was dropped from the list of future actions; (3) the number of occurrences on private versus public land was summarized; (4) the white-tailed deer was added to the list of potential grazers for the species; (5) garlic mustard was added to the review as a potential competitor of the species; and (6) Esselman and Crawford (1997) and Francis (1998) were added to the list of References.