Lyrate bladderpod
(*Lesquerella lyrata*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
Mississippi Ecological Services Field Office
Jackson, Mississippi

5-YEAR REVIEW
Lyrate bladderpod (*Lesquerella lyrata* Rollins*)*

I. GENERAL INFORMATION

A. Methodology used to complete the review

In conducting this 5-year review, we relied on available information pertaining to historic and current distributions, life histories, and habitats of this species. We announced initiation of this review and requested information in a published *Federal Register* notice on August 2, 2007 (72 FR 42425). We conducted an internet search, reviewed all information in our files, and solicited information from all knowledgeable individuals including those associated with academia and state conservation programs. Our sources include the final rule listing this species under the Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished studies and survey reports; and notes and communications from other qualified biologists or experts. The completed draft was sent to affected Service offices and three peer reviewers for their review. Comments received were evaluated and incorporated as appropriate into this final document.

B. Reviewers

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

Lead Field Office: Jackson, Mississippi Ecological Services Field Office: Cary Norquist, 601-321-1128

Cooperating Field Office: Daphne, Alabama Ecological Services Field Office: Dan Everson, 251-441-5837

C. Background

1. **Federal Register Notice citation announcing initiation of this review:** August 2, 2007. (72 FR 42425)

2. **Species status:** Declining (2008 Recovery Data Call). Species is endemic to a three county area in north Alabama. One population is partially located on a TNC (The Nature Conservancy) preserve where protection and management are ongoing. The other 2 sites are on private land and along roadside rights-of-way. Surveys during the spring of 2008 located three populations. Population numbers at the TNC site were reportedly greater and estimated in the thousands. This is the only population that shows improvement over the last year. The remaining 3 sites (2 populations) are located along a county road, with one extending into a rapidly developing area.

3. **Recovery achieved:** 1= 0-25% recovery objectives achieved

4. **Listing history**
   Original Listing
   FR notice: 55 FR 39869
   Date listed: September 28, 1990
   Entity listed: Species
   Classification: Threatened

5. **Review History**
   Recovery Data Call: 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, and 2000
   1996 Recovery Plan
   FWS conducted a 5-year review for the lyrate bladderpod 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 FWS 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 this plant's listing classification was found to be warranted.

6. **Species' Recovery Priority Number at start of review (48 FR 43098):** 8
   Degree of Threat: Moderate
   Recovery Potential: High
   Taxonomy: Species

7. **Recovery Plan**
   Name of plan: Recovery Plan for the Lyrate Bladderpod (*Lesquerella lyrata* Rollins)
   Date issued: October 17, 1996

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, the DPS policy does not apply.

B. Recovery Plan and Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes.

2. Adequacy of recovery criteria

a. Do the recovery criteria reflect the best available (i.e., most up-to date) information on the biology of the species and its habitat? Yes.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threats)? The recovery criteria do take into account the threats to this species associated with the five listing factors.

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.

Criteria: Species will be considered for delisting when nine demonstrably secure and self-sustaining populations exist. A demonstrably secure population is defined as one for which legal protection and active, successful management have been established. A self-sustaining population is defined as a population that is shown by monitoring data to be reproducing and relatively stable for at least a 10-year period.

Status: Criteria have not been met. There are only three extant populations currently known for the lyrate bladderpod (Schotz 2008, U.S. Fish and Wildlife Service 1996). A large portion of one of these populations is permanently protected due to its location on a 40-acre TNC preserve (Prairie Grove Glade). This population has been actively managed and been shown to be increasing over the last several years. An adjacent portion of this population is currently being managed under a Wildlife Cooperative Extension Agreement (WCEA) through the Service until 2017. Management has enhanced this portion of the population; however, the WCEA does not provide for the protection and management of this area into perpetuity. The two other populations are solely on private land and are not protected. Site visits to these 2 populations the last few years indicate a decline in the

populations from lack of habitat management and an increasing threat from development.

C. Updated Information and Current Species Status

At the time of the lyrate bladderpod's listing in 1990, two populations were known for this species with one each in Franklin and Colbert counties, Alabama (U.S. Fish and Wildlife Service 1990). In 1992, a third population was discovered by David Webb in Lawrence County, Alabama (U.S. Fish and Wildlife Service 1996). Currently, only three populations are known to exist for this species, with one each in Colbert, Franklin, and Lawrence counties, Alabama. There are a number of historical sites, within the local area of these populations that have been observed periodically through the years following some type of ground disturbance; however, surveys in 2007 and 2008 have confirmed the existence of only the three populations (Hilton 1996, Schotz 2008, U.S. Fish and Wildlife Service 1996, Webb and Kral 1986, Webb 2008).

Population estimates vary widely from year to year since this species is an annual, whose individual numbers at sites differ dramatically depending upon environmental factors and any previous ground disturbance at the site. In Colbert County, plants occur at two local sites on private lands, with 100 to 150 plants estimated in one area (Webb 2008) and 16 stems counted at another site nearby (Schotz 2008). The largest population occurs in Lawrence County where thousands of plants occur over 7 acres on a TNC preserve, with several thousand more plants on an adjacent 9 acre site which is under a WCEA through the Service (Hurt 2008a). The last count at the Franklin County population totaled approximately 200 plants on a 0.1 acre site and 300 plants on about 0.25 acre nearby (Schotz 2008).

All extant populations of the lyrate bladderpod are found adjacent to limestone outcrops supporting cedar glades. However, little is known regarding the original system of which the lyrate bladderpod was a part. Historically, the northern Alabama glades occurred as glade complexes where open areas of limestone pavement or gravel were divided by fingers of woody vegetation to form an intricate pattern of habitats (Hilton 1996). It is thought that the lyrate bladderpod likely evolved on these type glade systems that are now highly disturbed, and exist today mostly as remnants (Webb and Kral 1986). Currently, none of the extant populations of the lyrate bladderpod occur on relatively pristine cedar glades, as the populations are found in disturbed places, including cultivated fields, roadsides, and cattle pastures (Baskin and Baskin 2000, Hilton 1996, McDaniel 1987, Schotz 2008, U.S. Fish and Wildlife Service 1996, Webb 2008,).

The northern Alabama cedar glade systems are distributed within a subdivision of the Interior Low Plateau Physiographic Province (Hilton 1996, Webb and Kral 1986). However, the populations of the lyrate bladderpod represent two different glade systems, with the Colbert County sites in the Tennessee Valley proper and the remaining populations in the Moulton Valley (Webb and Kral 1986). The Tennessee Valley glades are underlain by Tuscumbia limestone, and the Moulton Valley sites are on Bangor limestone (U.S. Fish and Wildlife Service 1996, Hilton 1996). These two subdivisions are separated by Little Mountain, which is characterized by sandstone outcroppings (Webb and Kral 1986).

The lyrate bladderpod is a winter annual with a long-lived seed bank. Baskin and Baskin (1998, 2000) conducted studies on seed dormancy and germination of the lyrate bladderpod. In greenhouse studies, they found that the seeds of the lyrate bladderpod germinated after 10 years (Baskin and Baskin 2000). However, it is likely that the seeds are viable much beyond 10 years in their native habitats, as evidenced by the reoccurrence of plants at sites where none have been observed for periods of time much longer than 10 years (Webb 2008). The presence of the seed bank means that this species can persist at a site even if it does not produce seeds every year (Baskin and Baskin 2000). It is not known how long seeds of this species are viable under natural conditions. However, based on lab studies, Baskin and Baskin (1998, 2000) speculated the persistence of this species at a population site may require seeds be produced only every 5 to 7 years. Their studies showed that some seeds even germinated when buried; however, germination in darkness may eventually deplete the soil seed bank (Baskin and Baskin 1998, 2000).

Baskin and Baskin (1998, 2000) documented that the seeds of the lyrate bladderpod have an annual dormancy/non-dormancy cycle with dormancy loss occurring in the summer and dormancy induction in late autumn/winter. Seeds are dormant at maturity in May and have a high temperature requirement to break dormancy; whereas, low temperatures cause nondormant seeds to reenter dormancy (Baskin and Baskin 2000). In greenhouse studies, the peak of germination occurred when the daily maximum and minimum temperatures were about 27 and 18 degrees Celsius, respectively (Baskin and Baskin 2000). These temperatures correspond to the mean monthly maximum and minimum air temperatures in northern Alabama for September, thus, it is expected that seeds would germinate in the field in September, as soon as soil moisture became non-limiting (Baskin and Baskin 2000). After germination and initial growth, young plants overwinter as rosettes (U.S. Fish and Wildlife Service 1990). The growth period for the lyrate bladderpod is from September/October

into May. Flowering takes place usually from mid-March to April, and seed dispersal generally occurs from the end of flowering until mid-May (U.S. Fish and Wildlife Service 1990).

The lyrate bladderpod appears to be an early successional species that historically colonized the shallow soils on or adjacent to cedar glade habitats. This species slowly disappears as the soil layer develops and other competing plants establish themselves (U.S. Fish and Wildlife Service 1996). Shading causes decreased vigor and death and decreases the number of seeds at the site (Baskin and Baskin 1998, 2000). In typical glade habitats, the shallow, droughty soils inhibit the establishment of competing plants. Some have suggested that fire or grazing bison may have also played a part in maintaining early successional stages on these cedar glades (Hilton 1996, Schotz 2008, U.S. Fish and Wildlife Service 1996). However, as stated previously, none of the current populations are in typical cedar glade habitats and none of these natural factors are at play in maintaining suitable habitat for this species. Thus, it appears that some sort of active management is necessary to maintain viable populations of this species today. Disturbance is needed primarily to remove competing vegetation and also to bring seeds to the soil surface for germination (Baskin and Baskin 2000, U.S. Fish and Wildlife Service 1990, 1996; Webb and Kral 1986). The need for ground disturbance to maintain populations is evidenced in the fact that the best populations are those that are subject to some type of recurring disturbance such as grazing, plowing, and mowing. To further illustrate this point, populations have disappeared following extended periods with no ground disturbance to the site, and reappeared with the reintroduction of some type of disturbance (U.S. Fish and Wildlife Service 1996, Webb 2008).

Baskin and Baskin (2000) suggest that it is best to implement actions such as plowing, mowing, and /or grazing in these habitats in June through August, outside the growth period for lyrate bladderpod plants. Due to the presence of a long-lived seedbank, it may be necessary to implement management actions only every 5 to 7 years to ensure the persistence of a population; however, more frequent management will be needed to maintain annual flowering populations (Baskin and Baskin 2000).

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

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

The lyrate bladder pod is endemic to cedar glade areas in northern

Alabama. Most glades have been unable to escape human disturbances, including those glades that naturally supported populations of the lyrate bladderpod (Hilton 1996, McDaniel 1987, U.S. Fish and Wildlife Service 1990, 1996; Webb and Kral 1986). Cedar glades have been fragmented by agriculture and development and mostly exist as remnants today. Housing development, trash dumping, adverse agricultural practices, and road building have destroyed or negatively impacted a number of cedar glade systems, including those associated with the lyrate bladderpod (U.S. Fish and Wildlife Service 1990, 1996). Populations in Franklin and Colbert counties are located near growing urban areas and residential development poses a threat to both of these sites (Schotz 2008). Plants extend onto roadsides at several sites, and mowing or herbicide application prior to seed set would negatively impact these populations (U.S. Fish and Wildlife Service 1990, 1996).

Certain agricultural practices are compatible with the survival of this species. Plowing associated with row crop farming and grazing on pasturelands, provides the needed disturbance to arrest succession in these populations. In row crop farming, incompatibility comes into play when plowing takes place prior to seed set and with the use of pre-emergent herbicides. At the time of this species' listing in 1990, a large number of plants of this species were observed in cultivated fields, however, these areas are no longer cultivated and plants today are located in pasturelands. The population in Lawrence County, located in pastureland, which is lightly grazed outside the growing season, is thriving (see Factor E); however, remaining populations have shown declines in numbers due to field abandonment (U.S. Fish and Wildlife Service 1990, 1996; Webb and Kral 1986).

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

Not considered to be a threat to this species.

c. Disease or predation

Not considered to be a threat to this species**.**

d. Inadequacy of existing regulatory mechanisms

There are no State laws in Alabama protecting the lyrate bladderpod and its habitat. Otherwise, protection is afforded to this species under Section 7 and Section 9 of the ESA. The majority of one of the populations is permanently protected and

consistently managed due to its location in a Nature Conservancy preserve. An adjacent portion of this population is currently being managed for the lyrate bladderpod under a voluntary Wildlife Cooperative Extension Agreement (WCEA) until the year 2017 (Hurt 2008a). The management outlined in the WCEA has been beneficial for the species, however, it does not provide for the permanent protection and management of this site.

e. Other natural or manmade factors affecting its continued existence

The lyrate bladderpod continues to be extremely vulnerable due to the small number of populations and absence of protection for two of the three populations. This species is an early successional species and a poor competitor, which is eliminated by shade and competition from invading perennials (U.S. Fish and Wildlife Service 1990, 1996). Populations today are located on disturbed remnants of cedar glades. Thus, the most pressing concern is the need for active management to maintain populations of this species since it no longer exists as part of a functioning glade system, with its own naturally supplied disturbances (U.S. Fish and Wildlife Service 1996).

At the time of this species listing in 1990, only two populations were known, with one each in Colbert and Franklin County. Both of these populations have shown declines due to lack of regular management at the sites (Schotz 2008, Webb 2008). Plants have not been observed in recent years at two sites that are now heavily overgrown with grasses and low shrubs (Schotz 2008). This species' long-term survival is dependent upon its ability to reproduce and reseed an area regularly. These populations will move towards extinction if conditions continue to remain unsuitable for reproduction for many years.

Only the Lawrence County population, which was located after the species' listing, is thriving due to consistent management. Most of this population is on a Nature Conservancy preserve which is consistently grazed by cattle during the summer months, prior to the beginning of the lyrate bladderpod's growing season in the fall. Within the last 2 years, an area adjacent to the preserve was entered into a WCEA agreement through the Partners for Wildlife Program of the U.S. Fish and Wildlife Service (Hurt 2008a). Active management of this site with bush-hogging after the growing season in 2007 (Hurt 2008b) dramatically increased numbers of plants on this portion of the Lawrence County population from several hundred counted to a count of thousands of plants in the season following the bush-hogging in 2008 (Webb 2008).

D. **Synthesis-** At the time of listing, this species was known from two sites in northern Alabama. Several additional sites have been located since its listing in 1990, including a large population in an additional county. Two of these sites discovered after listing, have not been seen in recent years. Currently, there are three populations in three different counties known for this species. The majority of the largest population (Lawrence County) is permanently protected and managed due to its location on a Nature Conservancy preserve. An adjacent portion of this population is protected and managed until 2017 due to its inclusion under a WCEA. This Lawrence County population is thriving and there are no apparent threats. The remaining two populations are small, isolated and declining due to lack of adequate management. There is no protection for these sites and their continuation is questionable.

At this time, the lyrate bladderpod continues to meet the definition of a threatened species under the Act. The largest population is protected and thriving but the two remaining populations continue to be vulnerable. The small number of sites and lack of protection for all but one of these, illustrates this species' extreme vulnerability. However, since populations exist for years as seed banks, it is likely that a number of the populations not seen in recent years will reappear with the introduction of some type of management. Thus, it is probable that there are more than the three populations currently known today.

III. RESULTS

A. **Recommended Classification:** No change is needed**.**
Recovery criteria have not been met. There are only three populations known for this species. Most of the largest population is permanently protected and consistently managed, and shown to be stable to increasing in size. Permanent protection and management needs to be obtained for remaining known sites. In addition, to reach recovery, a number of other populations need to located and come under ownership which would ensure their protection and management into perpetuity. Long-term monitoring will be needed at all sites to accurately assess population trends. Additional information provided above under "Synthesis".

B. **New Recovery Priority Number**: N/A

IV. RECOMMENDATIONS FOR FUTURE ACTION

A. Continue management and monitoring on Lawrence County population.

B. Work to secure protection and implement appropriate management for all other populations, most likely through conservation easements.

C. Renew contact with State and county highway department to ensure proper protective measures are implemented for those areas where plants occur onto roadside rights-of-way.

D. Survey in vicinity of known populations and revisit all known historical sites regularly.

E. Work with landowners to reintroduce some type of ground disturbance activity at historical sites during appropriate time of year and follow with survey of sites next flowering season.

F. Gather base-line data on all populations and initiate long-term monitoring as means to track population trends and evaluate management efforts.

G. Expand species' biology studies to include field experiments.

H. Ensure preservation of genetic material from all populations through long-term seed storage through coordination with USDA Seed Storage Laboratory in Fort Collins, Colorado.

I. Implement all other tasks identified in the recovery plan, as appropriate.

J. Update recovery plan.

V. REFERENCES

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U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; determination of threatened status for the plant *Lesquerella lyrata* (lyrate bldderpod). Federal Register 55 FR 39869.

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Peer Reviewers

Al Schotz, Botanist
Alabama Natural Heritage Program

Mr. Brian Martin, Botanist
The Nature Conservancy

David Webb, Botanist
Tennessee Valley Authority

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
of
LYRATE BLADDERPOD

Current Classification: Threatened
Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist**
_X_ **No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable: ____________

Review Conducted By: Cary Norquist

FIELD OFFICE APPROVAL:

Acting Lead Field Supervisor, Fish and Wildlife Service

Approve ______________________ Date 3-16-09

Acting Field Supervisor, Cooperating Field Office

Approve ______________________ Date 4-08-09

REGIONAL OFFICE APPROVAL:

Regional Director, Fish and Wildlife Service

Approve ______________________ Date 4/8/09

FOR Assistant Regional Director
Ecological Services

APPENDIX A: Summary of peer review for the 5-year review of lyrate bladderpod (*Lesquerella lyrata*)

A. **Peer Review Method*:*** The draft 5-year review document was sent to biologists associated with Daphne, AL Field Office (Randy Roach, Rob Hurt, and Dan Everson). In addition, the document was also sent to three independent peer reviewers including: Al Schotz, botanist with the Alabama Natural Heritage Program; David Webb, botanist with the Tennessee Valley Authority; and Brian Martin, botanist with the Alabama Office of The Nature Conservancy.

B. Peer Review Charge: The following cover letter was sent along with the draft 5 year review (excluding the signature page) to the peer-reviewers:

On August 2, 2007, the U.S. Fish and Wildlife Service published a notice in the Federal Register announcing a 5-year review of 25 federally listed species, including lyrate bladderpod (*Lesquerella lyrata*). The purpose of the 5-year review is to ensure that the classification of species as threatened or endangered is accurate and reflects the best available information.

You have provided data used to review the status of this species, and you have been identified as knowledgeable about this species. Therefore, in order to ensure that the best available information has been used to conduct this 5-year review, we now request your peer review of the attached document. Specifically we ask for comments on the validity of the data used, and identification of any additional new information on any of these species that has not been considered in this review. Please note that we are not seeking your opinion of the legal status of these species, but rather that the best available data and analyses were considered in reassessing their status.

We appreciate your interest in furthering the conservation of rare plants and animals by becoming directly involved in the review process of our Nation's threatened and endangered species. Your review and comments will become a part of the administrative record for this species, and you can be certain that your information, comments, and recommendations will receive serious consideration.

We hope that you view this peer review process as a worthwhile undertaking. Please give me a call if you have any questions (601-321-1128). Please feel free to respond by email or letter. Thank you for your assistance.

Sincerely,

Cary Norquist
Assistant Field Supervisor/Botanist
U.S. Fish and Wildlife Service
6578 Dogwood View Parkway
Jackson, MS 39213

C. Summary of Peer Review Comments/Report – All peer reviewers supported the analyses and information in the document. Editorial comments were also provided by peer reviewers.

D. Response to Peer Review – Only editorial comments were provided and these changes were made in the document. There was no disagreement expressed by any of the reviewers.