

**Spring Creek bladderpod
(*Lesquerella perforata*)**

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



**U.S. Fish and Wildlife Service
Southeast Region
Cookeville Ecological Services Field Office
Cookeville, Tennessee**

September 2011

5-YEAR REVIEW
Spring Creek bladderpod/*Lesquerella perforate*

I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on the best available information pertaining to historic and current distributions, life history, and habitat of this species. Our sources include the final rule listing this species under the Endangered Species Act; the recovery plan; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. We published an announcement of this review in the *Federal Register* and requested information on this species on July 6, 2009 (74 FR 31972), and a 60-day comment period was opened. Comments received and suggestions from peer reviewers were evaluated and incorporated as appropriate (see Appendix A). No part of this review was contracted to an outside party. This review was completed by the Service's lead Recovery biologist in the Cookeville Field Office, Tennessee.

B. Reviewers

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

Lead Field Office – Cookeville, Tennessee, Ecological Services: Geoff Call, (931) 525-4983

C. Background

- 1. FR Notice citation announcing initiation of this review:** July 6, 2009, 74 FR 31972
- 2. Species status:**
Recovery Data Call: Stable, 2011; Development continues in and around the town of Lebanon, where all populations of Spring Creek bladderpod are located, especially those in the Bartons Creek drainage. However, monitoring data from 2011 indicate that no populations were lost during the year and that estimated abundance remained within typical ranges of variability observed.
- 3. Recovery achieved:** 3 (50-75% recovery objectives achieved)

4. **Listing history:**
Original Listing
FR notice: 61 FR 67493
Date listed: December 23, 1996
Entity listed: species
Classification: Endangered
5. **Associated rulemakings:** n/a
6. **Review History:**
Recovery Data Call 1998-2011
Recovery Plan for (*Lesquerella perforata*) Spring Creek bladderpod, 2006
7. **Species' Recovery Priority Number at start of review (48 FR 43098):** 2 – species with a high degree of threat and high recovery potential
8. **Recovery Plan**
Name of plan: Recovery Plan for (*Lesquerella perforata*) Spring Creek bladderpod
Date: August 24, 2006

II. REVIEW ANALYSIS

- A. **Is the species under review listed as a DPS?** *Lesquerella perforata* is a plant and therefore, is not covered by the DPS policy. The other DPS questions will not be addressed further in this review.
- B. **Recovery 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 and 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?** Yes
 3. **List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.**

Spring Creek bladderpod will be considered for reclassification to threatened status when there are 15 protected occurrences, five of which are located within the floodplain of each of three creeks (Spring Creek, Barton's Creek, and Cedar Creek). These occurrences, located on either public or private land, must be protected by a permanent conservation easement with a management agreement. Each occurrence must consist of an average of 500 plants over a five-year period, with no less than 100 plants in any given year.

Spring Creek bladderpod will be considered for delisting when there are 25 protected occurrences, with at minimum five occurrences located within the floodplain of each of the three creeks (Spring Creek, Barton's Creek, and Cedar Creek). Each occurrence located on either public or private land must be protected by a permanent conservation easement with a management agreement. Each occurrence must consist of an average of 500 plants over a ten-year period, with no less than 100 plants in any given year.

When the Recovery Plan for Spring Creek bladderpod was published in 2006, there were 21 known occurrences of the species. Of those 21 occurrences, six were located along Spring Creek, 11 along Bartons Creek and its tributaries, and four along Cedar Creek. All sites occurred on private or municipally owned land, which remains the case today. Based on information in our files and data provided to the Service by Tennessee Department of Environment and Conservation (TDEC) (2011), there currently are 22 extant occurrences of Spring Creek bladderpod.

We have not met the criteria for reclassifying Spring Creek bladderpod to threatened. No occurrences are protected by conservation easement; though three are protected by non-binding cooperative management agreements. Spring Creek bladderpod abundance fluctuates considerably over time (Table 1). While 500 or more plants have been observed at most of the occurrences at some point in time, fewer than 100 have also been observed at most occurrences at some point in time.

Data provided by TDEC follow the NatureServe Natural Heritage methodology, in which the fundamental unit of information is the element occurrence (EO), defined as "an area of land and/or water in which a species or natural community is, or was present" (NatureServe 2004). In the following discussion of current status of Spring Creek bladderpod in each of the three drainages where it occurs, we refer to EO numbers in order to be consistent with data provided by TDEC. Monitoring data presented below are taken from Tennessee Division of Natural Areas (TDNA) (2008).

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features, or demographic trends:

The monitoring approach currently used for Spring Creek bladderpod does not permit statistical evaluation of trends over time. The data available do, however, indicate that abundance at a given site varies considerably over time (Table 1). An annual life cycle and environmental variability, combined with the species' dependence on carefully timed and executed disturbances for maintaining suitable habitat conditions for both germination and growth, likely are strong contributors to the extreme fluctuations observed.

Table 1. Monitoring data for Spring Creek bladderpod, taken from TDNA (2008) and unpublished data for 2010-2011. Occurrences are listed in the order in which they appeared in TDNA (2008).

Watershed / Population	Element Occurrence Number	Site Name	Management Agreement	Year	Estimated Number (*= Count Attempted)
Barton's Creek	21	Cracker Barrel	YES	2004	*66
				2005	2000+
				2006	1,000+
				2007	*350
				2008	*1575
				2010	54
				2011	1558
	4	TRW	YES	2004	*9
				2005	350-375
				2006	615
				2007	500+
				2008	417
				2010	2
				2011	310
	18	Williams Bottom	NO	2006	*0
				2007	*0
	20	Coles Ferry North	NO	2004	*0
				2006	240+
				2007	350
				2011	300+
	19	Coles Ferry Pk South	NO	2004	*0
				2006	140+
				2007	480
				2011	485
17	Bartons Creek Ford	NO	2006	100+	
			2007	<300	
			2010	0	
			2011	0	
	Bartons Creek Ford	NO	2006	*0	
			2007	*711	
			2010	<20	
			2011	2	

Watershed / Population	Element Occurrence Number	Site Name	Management Agreement	Year	Estimated Number (*= Count Attempted)
Barton's Creek	11	Leeville Pike	NO	2006	*184
				2007	*121
				2008	*0
		Leeville Pike	YES	2004	*825
				2005	*1088
				2006	*805
				2007	2000+
				2008	*3010
				2010	10
				2011	*4369
	Leeville Pike Church Site	NO	2005	*1,600	
	10	Dump & Cell Tower-Tributary & Sewerline	NO	2004	*8
				2006	*88
				2007	*525
				2008	n/a
		Dump & Cell Tower-north field w/topsoil	NO	2004	1000+
				2006	1000+
				2007	1000+
				2008	n/a
				2010	280+
				2011	3 patches in graded area - rest of site not counted
	6	Carver Lane	NO	2004	*2103
				2005	2000+
2006				2000+	
2007				2000+	
2008				2000+	
2010				1000s	
2011				3000+	
33	Donnell Farm	NO	2008	1000+	
			2010	100+	
			2011	~200	
Cedar Creek	30	Beasley Bend Garden Site	NO	2006	200+
				2007	200+
				2008	200+
				2010	100s
				2011	500-1000+
	31	Cedar Creek Floodplain	NO	2006	*0
				2007	*0
				2011	329

Watershed / Population	Element Occurrence Number	Site Name	Management Agreement	Year	Estimated Number (*= Count Attempted)
Cedar Creek	28	Beasley Bend Bridge North	NO	2001	25
				2004	0
				2006	0
				2011	32
	29	Beasley Bend Bridge	NO	2004	100+
				2006	2000+
				2007	500+
				2010	100s
	2011	2000+			
Spring Creek	3	Spring Creek Bottoms	NO	2004	*<10
				2006	1000+
				2007	2000+
				2008	observed
				2010	1000s
				2011	10,000+
	15	Oakley Bottoms	NO	2006	0
				2010	100s
				2011	2000+
	14	Wood Duck Bottoms	NO	2004	*1
				2006	1,000+
				2007	2,000+
				2008	500+
	16	Mother Rock (bluff & glade)	NO	2006	1000+
				2007	n/a
		2010		43	
		Mother Rock (field & floodplain)	NO	2006	24+
	13	Zambia	NO	2006	500+
				2007	300+
				2008	300+
				2010	300+
				2011	300+
32	unnamed	NO	2006	8	
			2010	500+	
			2011	2000+	

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

Genetic variation and structure of Spring Creek bladderpod populations have been investigated via both isozymes (Baskauf 2002) and DNA microsatellites (A. Doust, Oklahoma State University, pers. comm. 2009). Baskauf (2002) found that overall genetic variability estimates for this species were similar to those reported for more widespread species, despite its restricted range and low number of populations. Both studies revealed that most of the genetic variation was within populations, but found that approximately 10 (Baskauf 2002) to 15 (A. Doust pers. comm. 2009) percent of the variation within the species was accounted for by differences among the populations (i.e., Barton's Creek, Cedar Creek, and Spring Creek). Baskauf (2002) also suggested that differences among these drainages with respect to specific allele frequencies indicated some level of gene flow restriction among them. However, she ultimately concluded that there were no major differences among the populations with respect to variation, nor were there consistent trends with respect to allele frequencies or genetic variation among upstream and downstream sites within a population. As would be expected of a generally outcrossing species, Baskauf (2002) reported that genotype ratios for Spring Creek bladderpod fit Hardy-Weinberg equilibrium expectations at most loci and that high heterozygosity levels were reflected in an extremely low inbreeding coefficient for the species.

c. Taxonomic classification or changes in nomenclature:

Lesquerella is a genus of the Brassicaceae, the mustard family, named for the seventeenth century Swiss and American botanist Leo Lesquereux. There are approximately 75 taxa of *Lesquerella* with the majority occurring in the western states; only a few taxa are found in the Interior Low Plateau of Tennessee, Alabama, and Kentucky (Al-Shehbaz 1987). Only one species, *Lesquerella lescurii* (Nashville mustard), had been described in the eastern states prior to the 1950s work of Dr. Reed C. Rollins, a Harvard University expert on the Brassicaceae. From 1952 to 1955, Rollins described three new species of *Lesquerella* endemic to the Central Basin of Tennessee: *L. densipila* (Duck River bladderpod), *L. stonensis* (Stones River bladderpod), and *L. perforata* (Spring Creek bladderpod).

O'Kane and Al-Shehbaz (2002) transferred all of the auriculate-leaved species of *Lesquerella* of the southeastern United States to the new genus *Paysonia*, which is distinguished from other previously congeneric taxa that have been moved to the expanded genus *Physaria* (Al-Shehbaz and O'Kane 2002), by the following characters: (1) stem leaves are sessile and auriculate, (2) chromosome numbers are based on $n = 8$, (3) annual life cycle, (4) interspecific hybridization is frequent, and (5) trichomes lack tubercles and are simple, one-branched, bifurcate, or dendritic rather than being stellate. The Flora of North America (http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250095101, accessed on July 25, 2011) recognizes this taxonomic change, providing the scientific name of *Paysonia perforata* (Rollins) O'Kane & Al-Shehbaz for Spring Creek bladderpod.

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

Barton's Creek

There currently are 11 occurrences considered extant in the Barton's Creek drainage (TDEC 2011). One occurrence (EO 25) not included in Table 1 is considered extant. However, the most recent data for this site are from 1999, when approximately 100 fruiting plants were observed. One occurrence (EO 34) in this drainage, estimated to contain greater than 1,000 plants, was discovered during 2008. The only three occurrences, for which management agreements have been established, albeit nonbinding, occur in the Barton's Creek drainage (Table 1).

Cedar Creek

There currently are four occurrences considered extant in the Cedar Creek drainage (Table 1) (TDEC 2011). One occurrence (EO 28) was thought to have been extirpated by excavation that was first noted during 2004. The site was visited again during 2006, at which time no plants were observed, but plants were observed there in 2011. No other historic or extirpated occurrences are known from this drainage.

Spring Creek

There currently are seven occurrences considered extant in the Spring Creek drainage (TDEC 2011), six of which appear in Table 1. The one occurrence not listed in Table 1 (EO 24) has not been observed since 1997, thus its status is questionable. One new (EO 32) was discovered in 2006 following publication of the recovery plan.

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

Table 2 reports the proportion of each of the major land uses occurring in each drainage where Spring Creek bladderpod occurs, as determined through analysis of 2006 National Land Cover Data. Two patterns are evident from the data below. First is that the proportion of developed land is greater in Barton's Creek drainage, where most of the known threats from habitat destruction have been observed. Second is that the proportion of cultivated crops, where the soil disturbances necessary to maintain suitable conditions for germination are most likely to be provided, is quite low in all three drainages. However, proportions of hay/pasture, where Spring Creek bladderpod often persist if not thrive, are quite high in these drainages.

Table 2. Proportion of primary land uses in Barton's, Cedar, and Spring Creek drainages based on analyses of 2006 National Land Cover Data.

Land Cover	Barton's Creek	Cedar Creek	Spring Creek
Developed, Open Space	12.5	4.2	4.84
Developed, Low Intensity	11.7	0.33	0.81
Developed, Medium Intensity	3.52	0.01	0.06
Developed, High Intensity	1.74	0.01	0.01
Deciduous Forest	13.05	16.57	22.45
Evergreen Forest	3.4	6.23	6.02
Mixed Forest	2.45	5.02	4.17
Shrub/Scrub	3.67	3.30	3.53
Grassland/Herbaceous	1.05	0.70	1.01
Hay/Pasture	43.10	59.51	52.93
Cultivated Crops	2.31	3.48	2.88

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

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

We are aware of specific threats to three occurrences in the Barton's Creek drainage (EO 6, 10, 17) and one in Cedar Creek drainage (EO 28) (Table 3). We also learned in 2008 that habitat had been covered by fill material at part of EO 11 (D. Lincicome, TDEC, pers. comm. 2008). The majority of this occurrence is located on property owned by the City of Lebanon (Table 1), which entered into a cooperative management agreement with TDEC and the Service in 2001.

Table 3. Specific habitat destruction threats observed by TDEC, through 2011, during Spring Creek bladderpod monitoring.

EO Number	Observed Threat	Status
6	Site for sale, commercial zoning, road widening	Stable under existing management
10	Construction disturbance, dumping	Decline
17	Topsoil removal	Decline
28	Surface scraping / rock excavation	Temporary decline, but recovery observed in 2011

In addition to the specific disturbances noted above, TDNA (2008) reported that other occurrences across all three drainages have been subjected to increased cattle grazing, incompatible management, or time periods lacking beneficial soil disturbance. The Recovery Plan for Spring Creek bladderpod encourages that site management strategies include no land disturbances between September 15 and May 15, followed by light disking prior to September 15. Bush-hogging is permitted during the summer months. However, beyond a few sites, there has been minimal coordination with

landowners to promote a sustainable management regime for Spring Creek bladderpod across its range.

The suggestions in the recovery plan for managing Spring Creek bladderpod should be reviewed periodically and more specific recommendations produced as a better understanding of the species' ecology is gained. Current guidelines fail to recommend specific timing for cultivation practices or other soil disturbance within the period May 15 – September 15, which could be adjusted to promote seed bank maintenance. The suggestions in the recovery plan might unwittingly contribute to disrupting germination and recruitment by extending the period for discing through September 15. Based on knowledge of the species' seed ecology and life cycle, Fitch et al. (2007) proposed that agroecosystem management for Spring Creek be conducted as follows:

- Planting, field preparation, or other soil disturbance for cultivation should occur after mid-May when seeds disperse, but before seeds are photostimulated – i.e., exposed to sufficient periods of light to break dormancy. Once seeds are photostimulated, by about mid-July under current climatic conditions, they would be prone to higher germination rates than if they were buried during cultivation prior to this time. While higher germination rates might seem desirable, excessive germination rates could result in seed bank depletion over time.
- Crops should be harvested before seeds germinate in early September to minimize disturbance to newly germinated plants.
- Fields should not be disturbed from September until completion of the above-ground life cycle of the plant, in May.

The threat of habitat destruction, modification, or curtailment is pervasive across the range of Spring Creek bladderpod. Only three sites are enrolled in cooperative management agreements, and inconsistencies in management at these sites have contributed to fluctuations in habitat condition and Spring Creek bladderpod abundance over time. The remaining sites are all located on private lands, primarily under agricultural uses. Additional coordination with landowners and refinement of agroecosystem management through a well-monitored, adaptive management framework will be necessary to manage the threat of habitat loss or decline on agricultural lands. Those sites on private lands in the City of Lebanon, primarily in Barton's Creek drainage, remain at high risk of loss to urbanization.

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

We have no new information indicating that these uses pose a threat to Spring Creek bladderpod.

c. Disease or predation:

We have no new information indicating that disease or predation pose a threat to Spring Creek bladderpod.

d. Inadequacy of existing regulatory mechanisms:

We have no new information concerning this threat, which was identified as a factor affecting the species in the final listing rule.

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

We have no new information to suggest that other natural or manmade factors are affecting the continued existence of Spring Creek bladderpod.

- D. Synthesis:** Based on the data available, there are 22 extant occurrences of Spring Creek bladderpod, an increase of one occurrence since the recovery plan was published in 2006. There are 11 occurrences in the Barton's Creek drainage. It appears that at least one known occurrence (EO 23) has been lost from this drainage; however, one new occurrence was discovered in this drainage in 2008, which offset this loss. Though the greatest number of occurrences is located in Barton's Creek, specific threats have been observed at several occurrences in this drainage, and occurrences here appear to face the greatest threat from urbanization in and around the city of Lebanon. There are four extant occurrences in the Cedar Creek drainage and seven occurrences in the Spring Creek drainage.

Because the Spring Creek bladderpod continues to face threats reported in the recovery plan (e.g., habitat destruction or modification including development, cattle grazing, and incompatible agroecosystem management), the number and distribution of occurrences among drainages as required by the recovery criteria have not been met, and no sites are permanently protected through conservation easement or other means, we conclude that this species continues to meet the definition of endangered. Because the degree of threat to the species is high and the recovery potential is low (i.e., threats are pervasive and difficult to alleviate; intensive management is required and optimal techniques are not well understood), we recommend that the recovery priority number be changed from 2 to 5.

III. RESULTS

- A. Recommended Classification:** No change is needed.
- B. New Recovery Priority Number:** 5 (see explanation in "Synthesis" above)

- IV. RECOMMENDATIONS FOR FUTURE ACTIONS** – Continued efforts to implement recovery actions identified in the species' recovery plan, improve monitoring techniques, and refine guidance for managing Spring Creek bladderpod are necessary. Specific emphasis should be placed on determining whether additional occurrences exist in the Cedar Creek drainage, and efforts should be redoubled to work with private and

municipal landowners to ensure long-term protection of known occurrences through conservation easements.

V. REFERENCES

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Spring Creek bladderpod / *Lesquerella perforata*

Current Classification **Endangered**
Recommendation resulting from the 5-Year Review

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

Review Conducted By: Geoff Call, Recovery Coordinator, Ecological Services, Cookeville, Tennessee

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve *Mary E Jennings* Date 9/12/11

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

Lead Regional Director, Fish and Wildlife Service

Approve *Joni M. Hiji* Date 10-19-11

APPENDIX A: Summary of peer review for the 5-year review of Spring Creek bladderpod (*Lesquerella perforata*)

A. Peer Review Method: We emailed requests for peer review of a draft of this 5-year review for Spring Creek bladderpod to the following people: Andrea Bishop (Tennessee Department of Environment and Conservation), Dr. Jeffrey Walck (Middle Tennessee State University), Elizabeth Fitch (Motlow State Community College), Dr. Carol Baskauf (Vanderbilt University), and Dr. Andrew Doust (Oklahoma State University).

B. Peer Review Charge: The text of the email request for peer review, which includes details on the specific nature of the requested review, follows:

The U.S. Fish and Wildlife Service (Service) is conducting a 5-year review of the appropriateness of the current listing of the Spring Creek bladderpod (as an endangered species under provisions of the Endangered Species Act of 1973, as amended (Act)). On July 6, 2009, we published a notice in the Federal Register announcing our intent to conduct this review on this species for which our office has the lead responsibility under section 4(c)(2)(A) of the Act. At that time, we requested any new information on the Spring Creek bladderpod since the time of its listing in 1996. In order to support the Service's interest in making its decision based on the best available science, portions of the draft review need to be subjected to an appropriate level of peer review. Due to your expertise regarding this species, we request that you peer review the attached portion of the document. We must receive your review comments within 30 days of the date of this email in order to consider them in our final review document.

The goals of peer review during this process are (1) to ensure that the best available biological data, scientifically accurate analyses of those data, and the reviews of recognized experts are used in the decision-making process; and (2) to indicate to the public, to other agencies, to conservation organizations, and to personnel within the Service that the best available data and scientific analyses were used in the decision-making process.

The following materials are enclosed for use during your review:

Peer Review in Endangered Species Act Activities - This July 1, 1994, *Federal Register* notice established a peer review process for all listing and recovery actions taken under the authorities of the Endangered Species Act.

The Biological Portion of the Draft 5-Year Review – This is the draft material that we hope you will review.

The Literature Cited section of the Draft 5-Year Review - The list is enclosed.

We appreciate your assistance in ensuring that this review is based on the best available science. If you have any questions or if we can provide additional information, please contact Geoff Call by telephone at 931/525-4983, or via email at geoff_call@fws.gov.

C. Summary of Peer Review Comments/Report: We received replies to the request for peer review from Drs. Doust and Baskauf, neither of whom offered any corrections or suggested edits to the document.