Large-flowered Skullcap
(*Scutellaria montana*)

5-Year Review:
Summary and Evaluation

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

5-YEAR REVIEW

Large-flowered skullcap (*Scutellaria montana* Chapman)

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 history, and habitat of this species. Our sources included the final rule listing this species under the Endangered Species Act; the recovery plan; unpublished field observations provided by Service, Tennessee Valley Authority (TVA), Tennessee Army National Guard (TNARNG), National Park Service (NPS), State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. We published an announcement in the *Federal Register* requesting information on this species on September 21, 2007 (72 FR 54057), and a 60-day comment period was opened. We requested peer review from persons knowledgeable about the large-flowered skullcap (see Appendix A). Comments received were evaluated and incorporated as appropriate.

B. Reviewers

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

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

Cooperating Field Office: Georgia Ecological Services Field Office – Pete Pattavina, 706-613-9493

C. Background

1. Federal Register Notice citation announcing initiation of this review: 72 FR 54057 (September 21, 2007)

2. Species status: Stable – available monitoring data indicate that there is inter-annual variability in abundance of specific stage-classes and total numbers of *S. montana* plants, but that the species is stable.

3. Recovery achieved: 3 (3=51-75% species recovery objectives achieved)

4. Listing history

Original Listing
FR notice: 51 FR 22521
Date listed: June 20, 1986
Entity listed: species
Classification: endangered

Reclassification from Endangered to Threatened
FR Notice: 67 FR 1662
Date reclassified: January 14, 2002

5. Associated rulemakings: None.

6. Review History:
Recovery Plan: 1996
Recovery Data Call: 2013, 2012, 2011, 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, and 2000
Five Year Review: November 6, 1991.
In this review (56 FR 56882), different species were simultaneously evaluated with no species-specific, in-depth assessment of the five factors as they pertained to the different species' recovery. In particular, no changes were proposed for the status of this plant in the review.

7. Species' Recovery Priority Number at start of review (48 FR 43098): 8 (8 indicated a moderate degree of threat and a high recovery potential for the species.)

8. Recovery Plan
Name of plan: Recovery Plan for Large-flowered Skullcap (*Scutellaria montana* Chapman)
Date issued: May 15, 1996

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy: The Endangered Species Act (ESA or 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 is not applicable.

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, because the recovery criteria require that there be 15 adequately protected and managed self-sustaining populations, distributed throughout the range, and maintained for 10 years. In order for these criteria to be achieved, threats to the species' viability would have to be managed.

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.

Scutellaria montana (large-flowered skullcap) will be considered for delisting when there are 15 adequately protected and managed self-sustaining populations. Populations must be distributed throughout the range and must be maintained for 10 years. A population will be considered adequately protected when it is legally protected and all needed active management is provided. A population will be considered "self-sustaining" if monitoring data support the conclusion that it is reproducing successfully and is stable or increasing in size. The minimum number of individuals necessary for a self-sustaining population should be considered to be at least 100 until otherwise determined by demographic studies. If number of discrete populations increase to 25 (because of the discovery/establishment of additional populations) or the number of protected and managed self-sustaining populations becomes 10 or more (distributed throughout the known geographic range), the species will be considered for downlisting to threatened status (U.S. Fish and Wildlife Service – i.e., USFWS, Service – 1996).

The Service reclassified *S. montana* from endangered to threatened status in 2002, at which time there were 84 occurrences of the species distributed among 48 populations – 29 in Georgia and 19 in Tennessee (67 FR 1662). In doing so, the Service defined populations as follows: (1) a population is an occurrence that is generally at least 0.5 mile from other occurrences, taking into account the position of occurrences with respect to physical barriers (ridges, highways, etc.), contiguous habitat (e.g., two or more occurrences deemed part of a single population could be one mile apart on the same ridge or slope), and richness or diversity of the occurrence, and (2) a population is considered self-sustaining, or viable, if it has a minimum of 100 individuals. Of these 48 populations, 22 were protected through ownership by conservation organizations, county parks, historic sites, or Federal agencies; 11 of these protected populations were deemed self-sustaining.

According to data provided by Tennessee Department of Environment and Conservation (TDEC) (2014), currently there are 164 extant *S. montana* element occurrences (EOs, occurrences) in Tennessee, distributed among 28 extant populations. Element occurrences are the fundamental unit of information tracked by the Natural Heritage methodology and are defined as "an area of land and/or water in which a species or natural community is, or was present" (NatureServe 2004). Of the 28 extant populations in Tennessee, 22 have at least

100 plants and are located, in whole or part, on protected land (i.e., they meet the criteria for viability).

In Georgia, there are 52 extant EOs (K. Morris, email dated August 18, 2008), but their distribution among populations has not been evaluated. Georgia DNR received a section 6 grant to collect current data from extant occurrences in Georgia and survey for new occurrences during 2014. With these data, Georgia DNR intends to delineate populations in a manner consistent with the recent work in Tennessee (discussed in section II.C.1.d, below).

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:

Numerous entities contribute to monitoring throughout the range of *S. montana*, including TDEC, Tennessee Valley Authority (TVA), National Park Service (NPS), Georgia Department of Natural Resources (GDNR), Tennessee Aquarium, Tennessee Army National Guard (TNARNG), Tennessee Division of Forestry (TDF), University of Tennessee – Chattanooga, and the Service. Representatives from these groups participate in annual meetings for the purpose of sharing information about recovery efforts and coordinating monitoring activities among these groups. Monitoring methods used have varied over time and across agencies, but TDEC initiated a standardized approach to monitoring in 2004 (TDEC 2005).

Tennessee Valley Authority's Natural Heritage Project has been monitoring *S. montana* populations annually since first establishing permanent sampling plots in 1994 and 1995. In 2007, TVA established 10 permanent circular plots on four TVA parcels on the Chickamauga Reservoir in Hamilton County, where total count monitoring had been conducted in the past (TVA 2008). The transition to a circular plot-based monitoring system was implemented in an effort to conform to monitoring methods that TDEC (2005) developed for use throughout the entire range of *S. montana*.

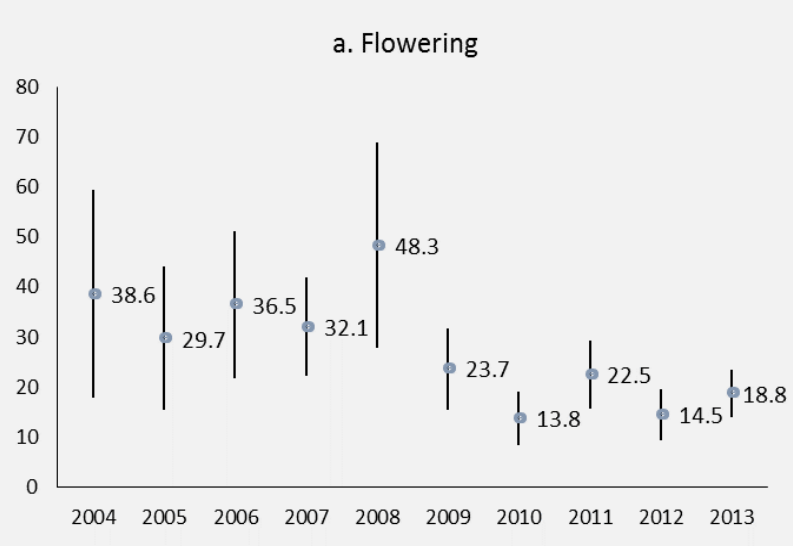
Permanent monitoring plots have been established at 46 locations throughout the range of *S. montana* in Tennessee. Biologists from TDEC initiated this monitoring program for *S. montana* in 2004, placing 10-meter (m) radius circular plots [.03 hectare (ha)] in locations where the species was found to be reasonably abundant after initial surveys of plant numbers throughout each monitored occurrence (TDEC 2005, TDEC 2012). Biologists from TVA established, and collect data from, 12 of the 46 plots in Tennessee. With assistance from TDF, NPS, Tennessee Aquarium, and the Service, TDEC monitors the other 34 plots. Flowering, vegetative, and juvenile (i.e., plants with one non-flowering stem and <15 cm height) plants are counted in each plot. Sample sizes have varied among

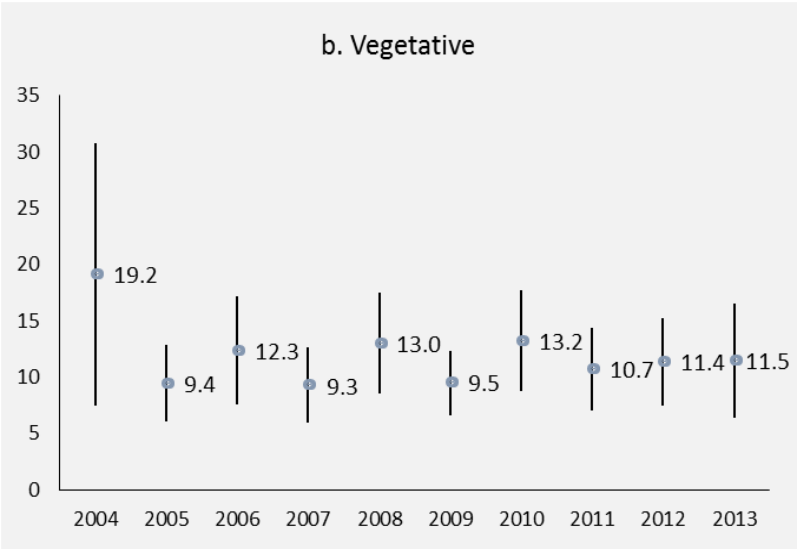
years for this monitoring program, both due to general increases in numbers of plots from 2004 through 2009, but also due to the fact that some plots have not been sampled in every year. Due to subjective plot placement and inconsistent sample sizes among years, analyses discussed here are limited to calculations of mean values and 95% confidence intervals for stage-specific counts and total numbers of plants per .03-ha plot (Figure 1).

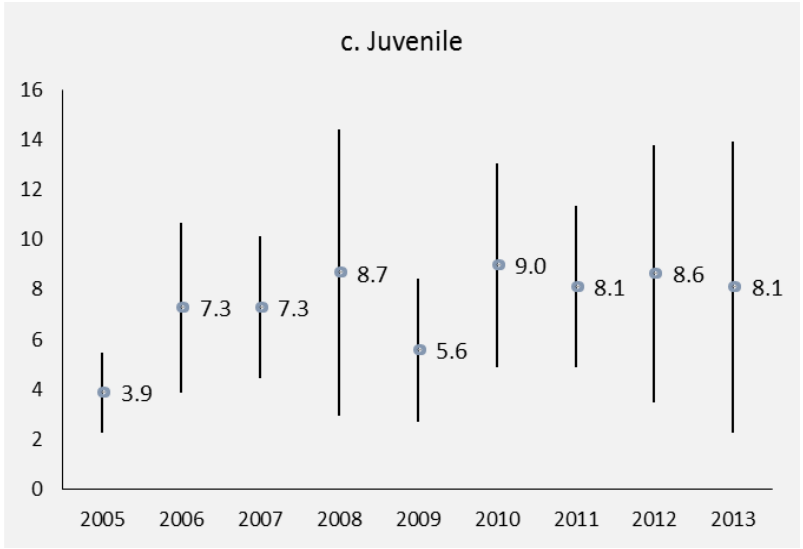
The only routinely monitored *S. montana* occurrences in Georgia are those at TNARNG's Volunteer Training Site, Catoosa County (VTS-C), where 46, 10-m radius circular plots (.03 ha) were established during 2004. The plots were subjectively established within representative (i.e., neither the most nor the least concentrated) clusters of plants distributed among the 26 management groups delimited on installation lands (discussed below in section II.C.1.d) for the purpose of monitoring trends at the training site. This monitoring program is similar to the one used in Tennessee, but life history stage-classes have been defined differently: adults are plants ≥ 10 cm height and/or those bearing flowers; juvenile are < 10 cm height and bear no flowers; yearlings are two-leaved plants < 3 cm height. Data in Figure 2 are from 45 plots: one of the plots was abandoned after 2010 because plants were translocated to another location to accommodate clearing for fence installation, and no monitoring data were collected at VTS-C during 2011. Due to inconsistent recording of the juvenile and yearling stage-classes during early monitoring years, these classes have been combined for analytical purposes (Figure 2).

Monitoring data indicate that counts of flowering plants and all stage-classes combined have varied in monitoring plots in Tennessee since 2004, but that the species is generally stable (Figure 1.d). The mean number of flowering plants (Figure 1.a) peaked at 48.3 in 2008 and decreased to a low of 13.8 in 2010. In 2013, the mean number of flowering plants per plot was 18.8. The mean number of plants across all stage-classes combined (Figure 1.d) peaked at 70.0 in 2008 before declining to a low of 34.4 during 2012. In 2013, the mean number of plants across all stage-classes was 38.4. The data for vegetative plants (Figure 1.b) indicate that this stage-class has been more stable than others, especially during the period from 2005-2013 when the mean number of vegetative plants per plot ranged from a low of 9.3 in 2007 to a high of 13.2 in 2010. This stage-class peaked during 2004, when there were 19.2 vegetative plants per plot. In 2013, there were 11.5 vegetative plants per plot. The data for juvenile plants (Figure 1.c) are more variable, as indicated by the wider confidence intervals, but appear to have generally increased or remained stable since 2005.

Monitoring data suggest a bimodal distribution for counts of individual stage-classes and all classes combined at VTS-C in Catoosa County, Georgia (Figure 2). The mean numbers of flowering plants, adults, and all stage-classes combined peaked during 2006, declined to low points in 2008 or 2009, and increased to a second, albeit lower, high point in 2010 or 2012 before declining again during 2013 (Figure 2). The mean number of flowering plants (Figure 2.a) per plot was 18.4 during 2006, reached a low point of 3.4 in 2009, rebounded to 8.3 in 2010,







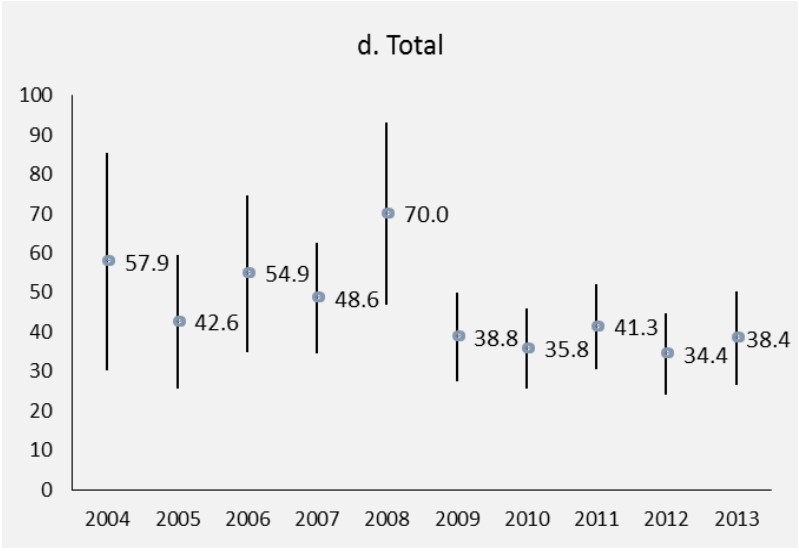
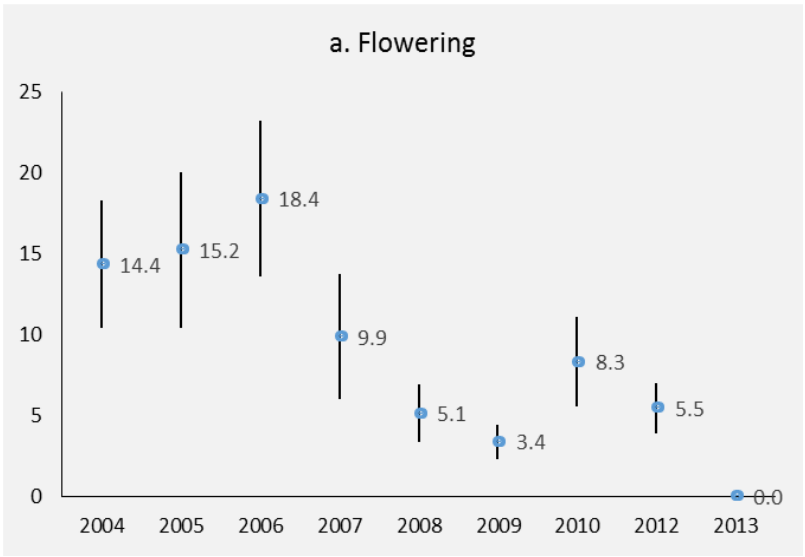
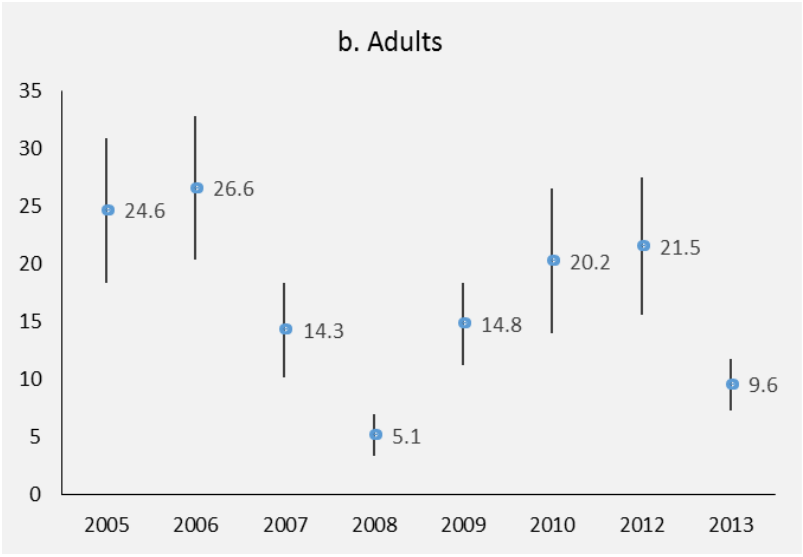
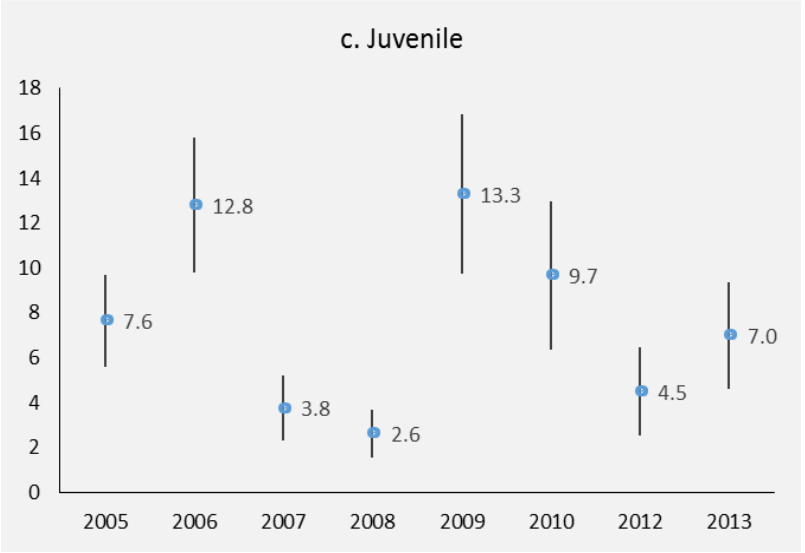


Figure 1. Mean and 95% confidence intervals for (a) flowering, (b) vegetative, (c) juvenile, and (d) total *Scutellaria montana* plants from 0.03-ha monitoring plots in Tennessee, 2004 - 2013 (note: sample sizes varied among years).







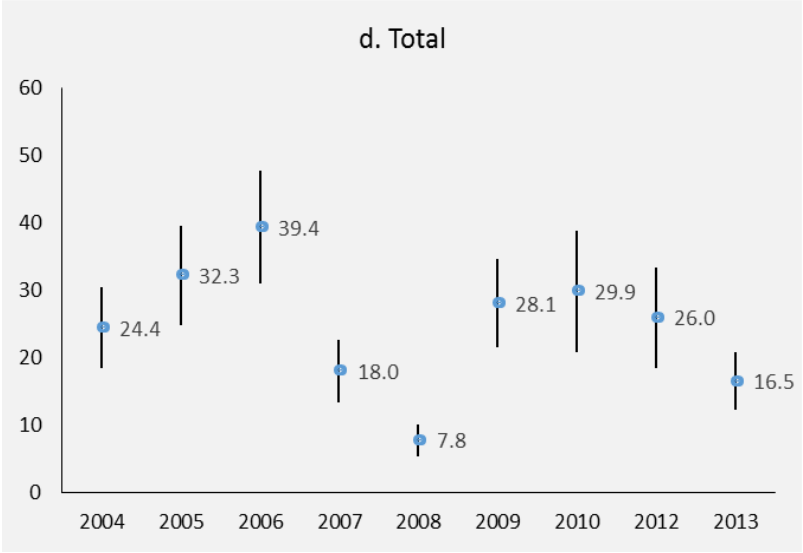


Figure 2. Mean and 95% confidence intervals for (a) flowering, (b) adults, (c) juvenile, and (d) total *Scutellaria montana* plants from 0.03-ha monitoring plots Volunteer Training Site, Catoosa County, Georgia, 2004 – 2013.

and decreased in 2012 to 5.5. No flowering plants were observed during 2013, but the lack of flowering plants is likely explained by the fact that sampling was initiated approximately one-and-a-half months later than average for prior years (Boyd et al. 2013). The mean number of adult plants (i.e., flowering plants and non-flowering plants ≥ 10 cm height, Figure 2.b) per plot was 26.6 in 2006, reached a low of 5.1 in 2008, rose to 21.5 in 2012, and declined again in 2013 to 9.6. The mean number of plants over all stage-classes (Figure 2.d) peaked at 39.4 in 2006, declined to a low of 7.8 in 2008, and increased to 29.9 in 2010. Mean numbers of juvenile plants (Figure 2.c) showed a similar distribution to other stage-classes and all plants combined, except that it peaked during 2009 and began to rise again in 2013, after declining during 2010 and 2012. As of 2013, there was an average of 16.5 *S. montana* plants per 0.03-ha plot (Figure 2.d).

The data in Figures 1 and 2 demonstrate the importance of long-term monitoring for documenting cyclical patterns of variability and responses to environmental conditions in populations of rare plant species. For example, the declining trend in numbers of plants observed at VTS-C that began in 2007 (Figure 2) was likely influenced by severe drought conditions that began in northwest Georgia and Southeast Tennessee in August 2007 and lasted until March 2008. This exceptional drought occurred in the midst of conditions ranging from abnormally dry to extreme drought from December 2006 through March 2009 (http://droughtmonitor.unl.edu/MapsAndData/MapArchive.aspx, retrieved April 30, 2014). It will be necessary to continue long-term monitoring to determine whether the effects of this drought, which extended across the geographic range of *S. montana*, and other factors will result in sustained reductions in population sizes.

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

Cruzan (2001) found that levels of genetic variation within *S. montana* were relatively high compared to species with similar life-history characteristics – i.e., widespread herbaceous perennials and other species that are primarily outcrossed and associated with animal pollinators. Cruzan suggested that the high levels of genetic variation observed in *S. montana* resulted from multiple factors that helped to buffer populations from genetic drift: relatively high levels of gene flow among populations, plants in each population may be relatively long-lived, and populations appear to have persistent seed banks. He observed that large, gravity-dispersed seeds likely constrain the species' dispersal ability and cited unpublished data that indicated a persistent seed bank is likely in *S. montana* because cold treatments failed to break seed dormancy in this species; whereas, the same treatments resulted in fairly high germination rates for closely related *S. pseudoserrata* (Cruzan 2001). TDEC (2008) reported that *S. montana* can apparently live eight or more years.

Cruzan (2001) divided *S. montana* into two major regions for the purposes of data analysis after determining that populations lying south of Taylor Ridge, in the

Oostanaula River drainage in Georgia, were genetically distinct and lacked some alleles that were found only in populations within the Tennessee River drainage north of this divide. A separate, unpublished analysis of chloroplast DNA variation apparently supported this division into two groups, which Cruzan (2001) speculated were likely derived from separate Pleistocene refugia. Levels of genetic variation within these major regions were relatively high, but levels of differentiation among populations within a region were low, indicating that rates of gene flow may be relatively high within each of the drainages (Cruzan 2001).

Cruzan (2001) also examined measures of inbreeding and genetic diversity of individual populations in relation to estimated population size and the number of neighboring populations within circles of varying diameter (i.e., varying metapopulation sizes). Effects of small population size on mean allelic diversity were unclear, but a higher number of populations with fewer than 100 individuals tended to have lower proportions of polymorphic loci, when compared to populations with 100 or more individuals. With regard to metapopulation effects at different scales, Cruzan (2001) found that parameters associated with variation in levels of selfing and biparental inbreeding were most affected by the number of populations that occurred within 1 to 2 km (0.62 to 1.24 mi), while the proportion of variation in parameters associated with genetic diversity peaked between metapopulation diameters of 4 to 8 km (2.5 to 5.0 mi). These results indicate that small, isolated populations of *S. montana* are at higher risk for loss of alleles and reduction in the proportion of polymorphic loci, presumably due to increased selfing or sibling mating. However, it appears that erosion of genetic diversity in small and large populations that are not isolated is offset by gene flow from neighboring populations (Cruzan 2001).

Cruzan (2001) hypothesized that the increased incidence of inbreeding in isolated populations could be due to limited availability of specialized pollinators; though, it should be noted that pollinator ecology of *S. montana* has not been studied. He speculated that the apparently high levels of gene flow among populations within a given river drainage might be due to a historical relationship with pollinators capable of dispersing over large distances, e.g., large moths or bees. Cruzan (2001) considered this evidence consistent with his unpublished analyses of floral morphology and sugar composition of nectar of *S. montana*, which also indicated association with a large-bodied pollinator. He concluded that the hypothesized loss of specialized pollinators in *S. montana* is supported by unpublished field observation of floral visitors and lack of pollen deposition on stigmas (Cruzan 2001) and that absence of suitable pollinators could ultimately have consequences for rates of gene flow and levels and patterns of genetic variation among populations of the species.

c. Taxonomic classification or changes in nomenclature:

We have no new information on taxonomic classification of *S. montana*.

d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range

When the Service reclassified *S. montana* from endangered to threatened in 2002 (67 FR 1662), there were 48 populations known, of which 22 were considered protected. Eleven of the 22 protected populations were considered self-sustaining. The 48 populations consisted of 84 occurrences of the species. Surveys conducted later in 2002 at TNARNG's VTS-C produced 60 discrete clusters of *S. montana* that contained a total of 1,581 plants, which were grouped into 26 management groups based on habitat similarity and geographic proximity (SAIC 2002). There currently are 164 extant occurrences known from Tennessee (TDEC 2014) and there are 52 extant occurrences known from Georgia (K. Morris, email dated August 18, 2008).

The number of *S. montana* occurrences known from Tennessee has increased substantially since the species was reclassified to threatened. In many cases, occurrences have been found in areas that were previously treated as unoccupied habitat separating populations as delineated using the distance criteria described in section B above, necessitating a reevaluation of the numbers and distribution of populations. Applying the criteria used for delisting would have reduced the number of populations, due to the increased density of occurrences on the landscape within the same general region. In completing a status survey of *S. montana* in Tennessee, TDEC (2014) applied the following criteria for delineating populations among the 164 extant occurrences:

1. Populations are defined as groups of EOs that are located in a major drainage within a HUC-12 watershed and have topographic continuity (e.g., in some cases populations are delineated between groups of occurrences on the top of the Cumberland Plateau and those on the escarpment within the same HUC-12).
2. Subpopulations are defined as groups of EOs within a population that occur in continuous habitat with no apparent physical barriers to gene flow.

Based on these criteria, there are 30 populations distributed among 16 HUC-12 watersheds in Tennessee, 28 of which are extant (i.e., not F- or X-ranked as discussed below and reported in Table 1). Within 8 of these populations, 22 subpopulations have been delineated because of significant discontinuity in habitat between some groups of occurrences included within those population (TDEC 2014).

Using available data on *S. montana* abundance and threats for each EO, TDEC (2014) assessed the viability of the 30 populations in Tennessee (Table 1). The viability ranks are based on criteria in the recovery plan that a population will be considered self-sustaining if monitoring data support the conclusion that it is reproducing successfully and is stable or increasing in size and if the minimum

number of individuals is at least 100 (USFWS 2002). The rank specifications that follow are based on the most recent information taking into account habitat quality, including invasive plant species, and expert opinion:

A-rank (Excellent Viability): population of *Scutellaria montana* contains greater than 1,000 plants with the number of plants in each occurrence that makes up a population. A smaller population with the number of plants in each occurrence having 500-1,000 plants with minimal habitat disturbance and no or few invasive exotic plant species.

B-rank (Good Viability): population of *Scutellaria montana* with 500 -1,000 plants with the number of plants in each occurrence that makes up a population with some habitat disturbance, or smaller population with the number of plants in each occurrence having 100-500 plants in sites with minimal habitat disturbance and no or few invasive exotic plant species. Site may be restorable to an A rank

C-rank (Fair Viability): population of *Scutellaria montana* with 100 -500 plants with the number of plants in each occurrence that makes up a population with some habitat disturbance and some invasive exotic species.

D-rank (Poor Viability): population of *Scutellaria montana* with less than 100 plants with the number of plants in each occurrence that makes up a population. Restoration of disturbed or degraded sites would be unlikely.

E-rank: Extant but no data available, habitat does exist at the site.

F-rank: Failed to find during survey period

H-rank: Historic, not seen in 25 years

X-rank: Extirpated

Using these rank specifications and available data on minimum abundance recorded at each EO, TDEC (2014) determined that there are 22 viable populations (Table 1) in Tennessee. In many cases, recent counts of plants beyond those in permanent monitoring plots were not available, and the evaluation was based on plants in the plots alone. In other cases, no recent data were available. Prior to determining whether *S. montana* should be delisted, current data will need to be collected from some occurrences. The Service is working with partners to develop a plan for collecting these data over the next few years. Of the 22 viable populations, 11 occur completely on protected lands and the other 11 are partially protected. In most cases, the majority of the EOs within the partially protected populations are located on protected lands.

Table 1. Population ranks and protection status for *Scutellaria montana* in Tennessee (TDEC 2014).

	A-rank	B-rank	C-rank	D-rank	F-rank	X-rank
Total	8	2	12	6	1	1
Protected	5	1	5	3	1	0
Partially protected	3	1	7	3	0	0

2. Five-Factor Analysis

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

At the time *S. montana* was reclassified from endangered to threatened, 22 of the 48 known populations were protected, and 11 of the 22 protected populations were considered self-sustaining. Despite this fact, habitat destruction caused by logging, residential development, grazing, wildfire, and clearing of wooded areas for pasture were considered to pose some degree of threat to the species, as at the time of listing. The final rule reclassifying *S. montana* also identified off-road vehicle (ORV) damage, hiking traffic, and maintenance or rerouting of hiking trails as threats, as well as rapid urbanization (65 FR 42976).

Current data are lacking concerning threats to habitat for most populations or occurrences in Georgia, with the exception of those at VTS-C. The populations at VTS-C face potential threats from construction and maintenance of roads and trails and non-vehicular training of dismounted troops, but routine vehicular training under normal circumstances should not impact *S. montana* (SAIC 2002). Road construction was observed to have impacted three management groups prior to their discovery (SAIC 2002), emphasizing the need for properly timed surveys to be conducted prior to such projects. In order to reduce the threat of trampling during training exercises, TNARNG posted signs marking the boundaries of each *S. montana* management group and restricting entry into those areas to the period between July 1 and February 28. Foot traffic is the only permitted use of these areas at any time. Threats not related to the training mission at VTS-C include illegal ORV access and exotic species. Threats from exotic species include competition from invasive, exotic plants and potential habitat disturbance from feral hogs (SAIC 2002). However, despite this assessment of threats from initial surveys for *S. montana* at VTS-C, recent monitoring reports have noted only herbivory (discussed below) and frequent presence of invasive exotic plants in monitoring plots as the primary threats to the species habitat at the site (Boyd et al. 2010, Boyd et al. 2013). Monitoring reports by TDEC (2008) and TVA (2005) also identify habitat encroachment from invasive, exotic plants as a threat to the species.

A recent status survey for *S. montana* in Tennessee identified the following

potential threats to the species and its habitat:

- ORV traffic on undesignated trails
- Invasive exotic plants
- Trail construction and maintenance on public and conservation lands
- Power line maintenance including the use of herbicide, manual, and mechanical treatments for vegetation management
- Wildfire suppression involving construction of large fire lines
- Recreational impacts including unauthorized hiking, camping and picnicking on public and conservation lands
- Mineral mining and quarrying
- Removal of mature forest by logging or development on private lands

Only two of the Tennessee EOs currently face imminent threats (TDEC 2014). One of these is located on lands owned by the Town of Signal Mountain, where a trail to Rainbow Lake passes through forested land adjacent to a golf course. Several species of invasive exotic plants are abundant along the trail and encroaching into *S. montana* habitat. The other currently threatened EO, located on Prentice Cooper State Forest, is threatened by illegal ORV use and potentially by unintended adverse effects from powerline maintenance due to its position near a powerline right-of-way.

The threat of mining for surface rock for landscaping and construction purposes has become a wide-ranging, and in one circumstance imminent, threat to *S. montana* and the ecosystem it inhabits. The removal of surface rock destroys *S. montana* habitat due to severe soil disturbance and alteration or removal of vegetation in all vertical strata, which likely increase the risk of soil erosion and seed bank loss. One population on lands owned by the Cumberland Trail State Park (CTSP) was impacted by this activity in 2008. A spokesperson for TDEC was quoted in an April 19, 2007, newspaper article as stating that in 2002 approximately 65 rock harvesting operations were permitted in Tennessee and that there were about 172 permitted at the time the article was written (Sohn and Benton 2007). Abating this threat is particularly challenging due to a complex mix of conflicting and inadequate regulations, as discussed in section II.C.2.d. However, to date, this threat has only impacted a single occurrence of *S. montana*.

While these threats to habitat remain on the landscape and potentially could affect *S. montana*, the large number of populations and the protected status of many of them provides the redundancy and resilience needed for the species' conservation. Based on available data, no known threats to habitat are both widespread and severe enough to place *S. montana* at risk of extinction, nor are they likely to cause the species to become at risk of extinction in the foreseeable future given the fact that all viable populations are either partially or completely protected (Table 1).

The proposed rule to reclassify *S. montana* from endangered to threatened maintained that wildfire poses a threat to the species (65 FR 42976). However, a

recent study demonstrated that *S. montana* transplanted into a previously burned site had greater survival rates than a control plot and plots that had been either canopy-thinned or burned and canopy-thinned (Kile et al. 2013). This study did not examine effects of fire on individuals that were present at the time of the treatments. Anecdotal data from eight monitoring plots in the Tennessee River gorge, half of which burned in a 2007 wildfire reveal no detectable difference in stage-specific or overall abundance of *S. montana* between burned and unburned plots. And, *S. montana* abundance was greater in burned than unburned plots in preliminary results from a study in The Nature Conservancy's Marshall Forest Preserve in Georgia (S. Monteleone, Associate Professor of Biology, Shorter University, unpublished data). Based on the results of these studies, we no longer consider wildlfire to be a threat to *S. montana*. However, the potential exists for plants and habitat to be damaged during suppression operations that involve mechanical construction of fire lines (TDEC 2014).

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

We have no new information indicating that this is a threat to this plant.

c. Disease or predation:

The final rule to reclassify *S. montana* as threatened acknowledged that while herbivory, primarily by white-tailed deer (*Odocoileus virginianus*), had been observed at several sites, it was not considered to be a factor affecting the continued existence of the species at that time. Monitoring reports from TNARNG's VTS-C (SAIC 2006; SpecPro 2008) indicated that browse constitutes a potential threat to *S. montana*, occurring mostly at low levels across at least 60 percent of the 46 monitoring plots during the years covered by these reports. A subsequent study at VTS-C found that while white-tailed deer browse on *S. montana*, this herbivory did not significantly affect growth metrics at the individual level Benson and Boyd (in press). These authors also found that deer browse different stage-classes of *S. montana* proportionately to their representation in the population, which should buffer against population-level effects that could result from disproportionate herbivore pressure on specific stage-classes.

d. Inadequacy of existing regulatory mechanisms:

The threat of surface rock mining often presents itself on properties that former landowners sold through deeds that included language reserving mineral rights for the seller, severing them from the surface rights that were conveyed to the buyers. This has left vulnerable to mining without landowners' consent untold acres of private property as well as some lands acquired by the State of Tennessee for conservation purposes, including recovery of *S. montana*, but from which mineral rights had been severed from the surface rights that the State purchased. A specific example of this took place in 2008 on a property referred to as Deep

Creek, along the Cumberland Trail State Park (CTSP), in which surface rock removal heavily impacted the *S. montana* population and habitat (TDEC 2014). A private company, Lahiere-Hill, L.L.C. entered the property without first notifying the State and removed a large quantity of surface rock in the vicinity of the Cumberland Trail. The State of Tennessee sued Lahiere-Hill, L.L.C., seeking to stop this activity at the Deep Creek property it had acquired from Bowater, Inc., in Hamilton County, but for which mineral rights had been reserved by a former holder of the estate in a 1951 deed and later conveyed to Joseph and Josephine Lahiere in 1963. On July 31, 2008, The Court of Appeals of Tennessee at Knoxville vacated a summary judgment by the Chancery Court for Hamilton County, which had ruled in favor of Lahiere-Hill, L.L.C., and remanded the case back to the Chancery Court for further proceedings. In 2009, the two parties reached an agreement wherein the State purchased mineral and coal rights for this property and another on the CTSP, while Lahiere-Hill retained oil and gas rights on these parcels. To date, oil and gas extraction are not known to have adversely affected any *S. montana* populations.

The lack of effective regulatory control over surface rock mining poses a potential threat to *S. montana* throughout much of its range. Abating this threat is particularly difficult due to a complex mix of conflicting and inadequate regulations. First, the material being harvested (i.e., primarily sandstone) is not subject to federal mining regulations administered by the Office of Surface Mining. Second, conflicting laws exist at the state level concerning sandstone mining: Tennessee does not regulate the operations as mining, but the Department of Revenue allows counties to tax the material as a mined product. Instead, the State of Tennessee regulates this activity with Tennessee Rock Harvesting Act (T.C.A. 69-3-143 – 69-3-149), enacted in 2011. The Tennessee Rock Harvesting Act was introduced to the Tennessee Legislature following the destruction of State property harboring *S. montana* in 2008, which prompted the State to file a lawsuit to stop the activity.

With the passing of the Tennessee Rock Harvesting Act in 2011 (T.C.A. 69-3-143 – 69-3-149), regulations governing surface rock removal have been strengthened, but do not eliminate the threat. Current rules (TDEC 0400-40-18 Rock Harvesting) require operators to apply for a permit from TDEC to authorize the activity under the National Pollutant Discharge Elimination System, if they intend to disturb one or more acre of land in the course of removing surface rock, which TDEC would issue if the operator demonstrates that certain conditions have been met. Key among the provisions of the rules is the requirement that landowners be notified at least 30 days prior to beginning the operation in those cases where mineral rights are severed. A reclamation plan also is required in order to obtain a permit; however, the revegetation component of this plan must follow the recommendation of the Tennessee Erosion and Sediment Control Handbook, which does not ensure that native vegetation is restored to the site. In effect, these rules should prevent surprises for landowners where mineral rights have been severed and minimize water quality degradation; however, they provide no real protection for *S. montana* even in cases where operators have complied with the

rules and obtained a permit.

In assessing the extent of this threat to "protected" populations, TDEC (2014) determined that, where *S. montana* is located, mineral rights remained with surface rights on lands owned by the Tennessee River Gorge Trust, TVA, Hamilton County Parks and Recreation, and National Park Service. Most of the mineral rights at Prentice Cooper State Forest, including lands where *S. montana* occurs, are held by the State of Tennessee.

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

Drought conditions periodically occur within the range of *S. montana*, and are predicted to increase both in frequency and severity, with the potential for adversely affecting populations of the species, at least in the short term (Boyd et al. 2013). The geographic extent of areas in the Southeast region affected by moderate to severe spring and summer drought has increased over the past three decades by 12 and 14 percent, respectively (Karl *et al.* 2009). These trends are expected to increase. Rates of warming are predicted to more than double in comparison to what the Southeast has experienced since 1975, with the greatest increases projected for summer months. Depending on the emissions scenario used for modeling change, average temperatures are expected to increase by 4.5^{o}F to 9^{o}F by the 2080s; consequently, increases in evaporation of moisture from soils and loss of water by plants in response to warmer temperatures are expected to contribute to increased frequency, duration, and intensity of droughts (Karl *et al.* 2009).

Most recently, severe drought conditions began in northwest Georgia and Southeast Tennessee in August 2007 and lasted until March 2008. This exceptional drought occurred in the midst of conditions ranging from abnormally dry to extreme drought from December 2006 through March 2009 (http://droughtmonitor.unl.edu/MapsAndData/MapArchive.aspx, retrieved April 30, 2014). As noted above, the population at VTS-C in Catoosa County, Georgia, experienced a sharp reduction in numbers of plants in all stage-classes, but recovered from this decline considerably during the next two years before experiencing a second downturn (Figure 2). The effect of the drought was less apparent in the monitoring dataset from the Tennessee populations (Figure 1). While it appears that the Tennessee populations experienced a reduction following the drought, there was considerable overlap in confidence intervals among the years before, during, and following the drought. The stage-class that appeared most strongly affected was flowering plants. However, Hopkins (1999) demonstrated that *S. montana* exhibits considerable interannual variability in abundance at the population level and in plant size and flower production at both the individual and population levels. These life history characteristics make it difficult to discern potential effects of drought from variability that is characteristic of *S. montana* individuals and populations. Long-term monitoring will be necessary both for establishing the range of natural variability in *S.*

montana populations and to detect any trends that could be related to climate-induced effects.

D. Synthesis

When the Service reclassified *S. montana* from endangered to threatened in 2002 (67 FR 1662), there were 48 populations known, of which 22 were considered protected. Eleven of the 22 protected populations were considered self-sustaining. The 48 populations consisted of 84 occurrences of the species. The number of extant *S. montana* occurrences known from Tennessee has increased to 164 since the species was reclassified to threatened status, and there are 52 in Georgia. In many cases, occurrences have been found in areas that were previously treated as unoccupied habitat separating populations as delineated using the distance criteria described in section B above, necessitating a reevaluation of the numbers and distribution of populations. In completing a status survey of *S. montana* in Tennessee, TDEC (2014) delineated 30 populations in Tennessee alone using the criteria described in section II.C.1.d above; 28 of these are extant and 22 are viable. Of the viable populations, 11 are located entirely on protected lands and the other 11 are partially protected. In most cases, the majority of the EOs within the partially protected populations are located on protected lands. Georgia DNR will be collecting current data on the status of extant occurrences in Georgia during 2014 and intends to delineate populations in a manner consistent with the recent work in Tennessee. At least one population in Georgia occurs on protected lands at VTS-C, and there are occurrences located on conservation lands owned by U.S. Forest Service (Chattahoochee NF) and The Nature Conservancy (Blacks Bluff and Marshall Forest).

While there are many potential threats that could affect *S. montana* or its habitat, as discussed in section II.C.2, only two occurrences in Tennessee face imminent threats. The extent and severity of threats to occurrences and populations in Georgia is not currently known, but GDNR will collect data during 2014. Drought conditions in the Southeast U.S. are predicted to be more frequent and extreme as a result of climate change (Karl et al. 2009). However, available data indicate that *S. montana* populations are capable of recovering from short-term reductions that could result from prolonged, extreme drought.

There is a sufficient number of protected and self-sustaining (i.e., viable) populations in Tennessee alone to satisfy the criteria for delisting *S. montana*. However, the criteria require that the protected, self-sustaining populations be distributed throughout the species' range. While there are protected occurrences in Georgia, data are available only for the population at VTS-C to assess whether it is self-sustaining. This population has exhibited variability in total numbers of plants and specific stage-classes, with two separate periods of increases and decreases since 2004 (Figure 3). Data from 2013 indicate the population could be in a period of decline (Boyd et al. 2013); though, the 2013 monitoring took place later than normal, and continued monitoring will be needed to determine if the population is stable.

Based on available data, the recovery priority number for *S. montana* should be changed from 8 to 14, indicating a species with high recovery potential and low degree of threat.

No change in classification is recommended at this time. In order for the Service to be able to recommend delisting *S. montana*, the following are needed: continued monitoring across the species' range to infer general trends, collection of census data from populations for which recent data are lacking to evaluate viability ranks assigned by TDEC (2014) and to establish viability ranks for populations in Georgia, development of management agreements for protected sites to ensure that conservation of the species would continue into the future if it were delisted, and preparation of a post-delisting monitoring plan. The Service is working with partners via an informal recovery working group, coordinated by TVA, to develop a strategy for completing these actions within three-to-five years.

III. RESULTS

A. Recommended Classification:

__X__ **No change is needed**

B. New Recovery Priority Number: 14 (indicates a species with high potential for recovery and low degree of threat).

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

A. Continue long-term monitoring using standardized protocols across the geographic range of *S. montana* to provide a basis for establishing whether populations exhibit cyclical patterns of demographic variability and for assessing population responses to local and regional environmental conditions.

B. Work with TDEC, TVA, UT-Chattanooga, TNARNG, TN River Gorge Trust, TDF, NPS, and others to develop plan for collecting current census data, where needed in Tennessee, to evaluate long-term persistence and stability of populations for which recent data are lacking. Appendix B includes a draft list of EOs where census data should be collected. Georgia DNR will be collecting census data from populations in Georgia during 2014.

C. Establish cooperative management agreements with landowners for protected occurrences and populations to ensure that conservation efforts for the species would continue following delisting of the species.

D. Develop a post-delisting monitoring plan.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Large-flowered skullcap (*Scutellaria montana*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

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

Review Conducted By: Geoff Call, Tennessee Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Mary E Jennings Date 9/19/14

REGIONAL OFFICE APPROVAL:

for
Lead Regional Director, Fish and Wildlife Service

Approve Aaron L Valdez Date 1-8-15

APPENDIX A: Summary of peer review for the 5-year review of large-flowered skullcap (*Scutellaria montana*)

A. Peer Review Method: The Service requested peer review from knowledgeable individuals who participate in the informal recovery working group for large-flowered skullcap. These individuals included Adam Dattilo, Andrea Bishop, Sunny Fleming, Dr. Jennifer Boyd, Tom Patrick, and Malcolm Hodges.

B. Peer Review Charge: See guidance on next page.

C. Summary of Peer Review Comments/Report – We received technical and editorial comments from Adam Dattilo.

D. Response to Peer Review – We have incorporated the suggested technical and editorial changes into this 5-year Review.

Guidance for Peer Reviewers of Five-Year Status Reviews

U.S. Fish and Wildlife Service, Tennessee Ecological Services Field Office

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with U.S. Fish and Wildlife Service (Service) policy.

Peer reviewers should:

1. Review all materials provided by the Service.

2. Identify, review, and provide other relevant data apparently not used by the Service.

3. Not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.

4. Provide written comments on:
   - Validity of any models, data, or analyses used or relied on in the review.
   - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
   - Oversights, omissions, and inconsistencies.
   - Reasonableness of judgments made from the scientific evidence.
   - Scientific uncertainties by ensuring that they are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear.
   - Strengths and limitation of the overall product.

5. Keep in mind the requirement that the Service must use the best available scientific data in determining the species' status. This does not mean the Service must have statistically significant data on population trends or data from all known populations.

All peer reviews and comments will be public documents and portions may be incorporated verbatim into the Service's final decision document with appropriate credit given to the author of the review.

Appendix B. Large-flowered skullcap EO Census List

Tuesday, May 20, 2014

Population Name	Population Viability Rank	EO Number	Current Count Needed	Protected	Owner	Date of Count used in 2014 Status Survey	2014 Status Survey Count	High Count
Ashland Terrace	D	87	no	No	Private	5/26/2005	4	12 (1996)
Big Ridge	F	32	maybe	Yes	TVA	2004-05	0	150 (1987)
Blue Springs	D	57	yes	Yes	TVA	1999-5-17; 1998-05-17	95	95
Booker T. Washington	D	14	no	Yes	TDEC	2004-00	0	3 (1986)
	D	56	no	Yes	TVA	5/13/1997	3	15 (1987)
Chattanooga Creek	C	18	yes	Yes	NPS	6/5/2008	15	30 (1997)
	C	19	yes	Yes	NPS	2008-05-28; plot only	74	74
	C	20	yes	Yes	NPS	2008-05-28; plot only	49	570 (1999)
	C	28	no	Yes	NPS	6/5/2008	0	4
	C	29	no	Yes	NPS	6/5/2008	0	21
Conner Creek	C	73	no	Partial	TDF	5/30/2007	29	29
	C	77	no	Partial	Private	6/7/1995	6	6
	C	78	yes	Partial	Hamilton County Board of Education	6/11/2008	19	19
	C	79	yes	Partial	Hamilton County Board of Education	6/11/2008	0	41
	C	80	yes	Partial	Hamilton County Board of Education	6/1/2008	66	167 (1995)
	C	81	no	Partial	Private	6/6/1995	78	78
	C	82	no	Partial	Private	6/6/1995	9	9
Dry Creek	A	35	yes	Yes	TDF	5/29/2008		5000+
Enterprise South	C	40	maybe	Yes	Hamilton County Parks and Recreation	5/23/2008	0	6

Population Name	Population Viability Rank	EO Number	Current Count Needed	Protected	Owner	Date of Count used in 2014 Status Survey	2014 Status Survey Count	High Count
Enterprise South	C	41	yes	Yes	Hamilton County Parks and Recreation	2008-05-00 total survey		200+
Fairview Slopes	A	12	yes	Partial	TVA	5/16/2001	46	46
	A	13	yes	Partial	TVA	2008-05 plot and outside plot	26	321(2000)
	A	75	yes	Partial	Private	1994-00-00	103	1+
	A	91	yes	Partial	TVA	5/15/2001	19	19
	A	92	no	Partial	TVA	2008-05; plot and outside plot	49	49
	A	93	yes	Partial	TVA	5/19/1999	53	53
	A	94	no	Partial	TVA	5/17/2000	5	5
	A	95	yes	Partial	TVA	2008-05; plot and outside plot	218	823 (2000)
	A	96	no	Partial	TVA	5/19/1999	7	7
	A	97	no	Partial	TVA	5/19/1999	3	3
	A	98	no	Partial	TVA	2008-05; plot and outside plot	137	137
	A	99	yes	Partial	TVA	5/17/2000	60	60
	A	112	no	Partial	Private	5/16/2001	3	3
	A	113	no	Partial	TVA	5/15/2002	51	51
	A	114	no	Partial	TVA	5/14/2002	49	49
Falling Water Creek	C	33	yes	Partial	TDEC	2007-05-24; plot and outside plot	160	160
	C	88	no	Partial	Private	5/21/1996	4	4
Grasshopper Creek	B	60	yes	Yes	TVA	2008-05; plot and outside plot	15	310 (2004)
	B	100	yes	Yes	TVA	5/19/1998	31	31
	B	101	no	Yes	TVA	1998-00-00	3	3
	B	102	yes	Yes	TVA	5/19/2003	36	36
	B	150	no	Yes	TVA	2008-05; plot and outside plot	27	27

Population Name	Population Viability Rank	EO Number	Current Count Needed	Protected	Owner	Date of Count used in 2014 Status Survey	2014 Status Survey Count	High Count
Grasshopper Creek	B	151	no	Yes	TVA	2008-05; plot and outside plot	30	30
Hurricane Creek	D	2	no	No	Private	5/16/1982	3	3
	D	118	no	No	Private	2003-00-00	0	50
Little Soddy	C	125	yes	Yes	TDEC	5/29/2007	14	14
	C	126	yes	Yes	TDEC	5/29/2007	4	4
	C	127	yes	Yes	TDEC	5/29/2007	8	8
	C	128	yes	Yes	TDEC	2007-06-07; plot only	55	100 (2004)
Lookout Creek	C	21	no	Yes	Reflection Riding Nature Center	5/8/2007	5	51 (2002)
	C	22	yes	Yes	NPS	2008-05-28; plot only	102	253 (1999)
	C	23	no	Yes	NPS	5/28/2008	17	17
	C	24	yes	Yes	NPS	2008-06-05; plot and outside	13	13
	C	25	yes	Yes	NPS	2008-06-05; plot and outside	35	66 (2004)
	C	26	yes	Yes	NPS	6/5/2008	30	30
	C	27	yes	Yes	NPS	6/5/2008	10	41 (1997)
	C	30	yes	Yes	NPS	1998-05	60	39 (1993)
	C	31	no	Yes	NPS	6/5/2008	0	90 (1997)
Lower Possum	C	58	yes	Partial	TVA	5/20/1998	167	167
	C	104	yes	Partial	TVA	5/20/1998	5	5
	C	165	no	Partial	Private	2004-05-00	24	24
Middle Creek	A	15	yes	Yes	Town of Signal Mountain	5/30/2007	511	2000 (1986)
	A	63	no	Yes	TDF	5/30/2007	79	79
	A	65	yes	Yes	TDF	5/30/2007	14	50 (1996)
	A	66	maybe	Yes	TDF	5/30/2007	154	154

Population Name	Population Viability Rank	EO Number	Current Count Needed	Protected	Owner	Date of Count used in 2014 Status Survey	2014 Status Survey Count	High Count
Middle Creek	A	67	yes	Yes	TDF	5/30/2007	50	50
	A	68	no	Yes	TDF	5/30/2007	102	102
	A	71	yes	Yes	TDF	5/30/2007	64	100 (1995)
	A	83	no	Yes	TDF	5/30/2007	0	12
	A	189	no	Yes	TDF	5/30/2007	26	26
	A	190	no	Yes	TDF	5/30/2007	83	83
Mullens Creek	D	17	yes	Yes	TDF	6/11/2008	64	64
	D	62	yes	Yes	TDF	6/11/2008	11	11
	D	108	yes	Yes	TDF	6/11/2008	13	13
	D	109	no	Yes	TDF	2008	0	1+
Murphy Hill Slough	C	9	yes	Partial	TVA	5/17/1998	10	136 (1986)
	C	10	no	Partial	TVA	2008-05 plot and outside plot	213	213
	C	59	no	Partial	Private	6/3/1986	3	3
	C	105	maybe	Partial	TVA	5/22/1995		1+
North Chickamauga Creek Gulch	A	8	yes	Yes	TDEC	2007-05-24; plot and outside	145	2000 (1996-estimate)
	A	46	yes	Yes	TDEC	2008-05-14; plot	95	2231 (2005)
	A	152	maybe	Yes	TDEC	2006-05	104	104
	A	154	no	Yes	TDEC	6/6/2002	10	10
North Chickamauga Creek Upper	B	44	yes	Partial	Private	5/23/1993	50	50
	B	45	no	Partial	TDEC	2007-05-23; plot and outside	225	225
	B	48	no	Partial	TDEC	6/12/2008	48	78 (2004)
	B	49	maybe	Partial	TDEC	2007-05-18; plot	13	13

Population Name	Population Viability Rank	EO Number	Current Count Needed	Protected	Owner	Date of Count used in 2014 Status Survey	2014 Status Survey Count	High Count
North Chickamauga Creek Upper	B	84	yes	Partial	Private-Conservation Easement	7/10/1996	2	2
	B	107	no	Partial	TDEC	5/25/2007	5	5
	B	116	no	Partial	TDEC	5/25/2007	3	3
	B	153	no	Partial	TDEC AND PRIVATE	5/25/2007	3	3
	B	157	yes	Partial	Private-Conservation Easement	2003-05	28	28
	B	158	maybe	Partial	Private	2003-05	46	46
	B	159	no	Partial	Private	2003-05	10	10
	B	160	yes	Partial	Private-Conservation Easement	2003-05	9	9
	B	161	no	Partial	Private	2003-05	9	9
	B	162	yes	Partial	Private-Conservation Easement	2003-05	8	8
	B	169	yes	Partial	TDEC	2007-05-18; plot and outside	18	18
	B	170	no	Partial	Private	5/19/2004	24	24
	B	171	no	Partial	TDEC	5/18/2007	2	5 (2004)
	B	173	yes	Partial	TDEC	5/25/2007	1	18 (2004)
	B	177	no	Partial	TDEC	5/25/2007	43	43
North Suck Creek	C	120	no	Partial	Private	6/9/2000	100	100
	C	178	yes	Partial	Private -Forest Legacy Conservation Easement	2008-05-28; two plots only	57	57
Rock Creek	C	141	yes	Partial	TDEC	6/6/2007	6	6
	C	142	no	Partial	TDEC	6/6/2007	60	60
	C	143	yes	Partial	TDEC	2007-06-06; plot and outside	21	21
	C	144	yes	Partial	TDEC	6/5/2007	20	20
	C	147	yes	Partial	TDEC	6/5/2007	10	10

Population Name	Population Viability Rank	EO Number	Current Count Needed	Protected	Owner	Date of Count used in 2014 Status Survey	2014 Status Survey Count	High Count
Rock Creek	C	167	yes	Partial	TDEC	2007-06-05; plot only	32	42 (2005)
	C	175	no	Partial	Private (Bowater Inc.)	6/6/2007	50	50
	C	179	no	Partial	Private (Bowater Inc.)	2006-05	63	63
	C	180	no	Partial	Private (Bowater Inc.)	2006-05	12	12
	C	181	no	Partial	Private (Bowater Inc.)	2006-05	39	39
	C	183	no	Partial	Private (Bowater Inc.)	2006-05	3	3
	C	184	no	Partial	Private (Bowater Inc.)	2006-05	39	39
	C	185	no	Partial	Private (Bowater Inc.)	2006-05	46	46
	C	186	no	Partial	Private (Bowater Inc.)	2006-05	9	9
	C	187	no	Partial	Private (Bowater Inc.)	2006-05	11	11
Shoal Creek	X	4	no	No	Private	7/8/1984	8	8
Soddy	A	129	no	Partial	TDEC	7/25/2007	260	260
	A	131	no	Partial	TDEC	2007-06-07; plot and outside plot	73	89 (2006)
	A	132	yes	Partial	TDEC	2008-05-29; plot only	32	200 (2006)
	A	182	no	Partial	Private (Bowater Inc.)	2006-05	67	67
	A	192	no	Partial	TDEC	7/17/2007	295	295
	A	193	yes	Partial	TDEC	2008		
Soddy Escarpment	C	121	no	Yes	TDEC	5/17/2007	0	7
	C	122	maybe	Yes	TDEC	5/17/2007	118	118
	C	123	yes	Yes	TDEC	5/17/2007	39	39
	C	124	maybe	Yes	TDEC	5/23/2002	3	3
Tennessee River Gorge South	C	34	yes	Partial	TRGT	2008-06-04; plot and outside plot	100	100
	C	43	yes	Partial	TRGT	6/4/2008	17	24 (1995)

Population Name	Population Viability Rank	EO Number	Current Count Needed	Protected	Owner	Date of Count used in 2014 Status Survey	2014 Status Survey Count	High Count
Tennessee River Gorge South	C	50	no	Partial	Private	5/29/2008	0	1
	C	51	no	Partial	Private	6/4/2008	0	1+
	C	90	no	Partial	Private	6/4/2008	58	58
	C	119	yes	Partial	TRGT	2008-05-16; plot only	23	50 (1999)
	C	194	maybe	Partial	TRGT	2008-06-04; plot and outside plot	31	31
	C	195	no	Partial	TVA	5/19/2009	12	12
	C	197	maybe	Partial	TVA	2009-05-00 plot and outside plot	41	41
Upper Possum	A	133	no	Yes	TDEC	5/31/2007	261	261
	A	136	no	Yes	TDEC	5/31/2007	1046	1046
	A	137	no	Yes	TDEC	2004-05-00	0	3
	A	138	no	Yes	TDEC	2006-06-00	0	4
	A	140	yes	Yes	TDEC	5/21/2004	27	27
	A	163	yes	Yes	TDEC	2007-06-06; plot and outside plot	28	48 (2004)
Ware Branch	A	11	yes	Yes	TVA	5/18/1999	50	120 (1997)
	A	61	maybe	Yes	TVA	5/19/1997	0	16 (1986)
	A	103	yes	Yes	TVA	2004-05-00; plot only	52	52
	A	115	yes	Yes	UT	2008-05; plot and outside plot	98	693 (2004)
	A	148	yes	Yes	TVA	5/27/2003	86	86
	A	149	yes	Yes	TVA	5/20/2003	66	66
Wolftever Creek	D	16	no	No	Private	6/5/1989	6	6