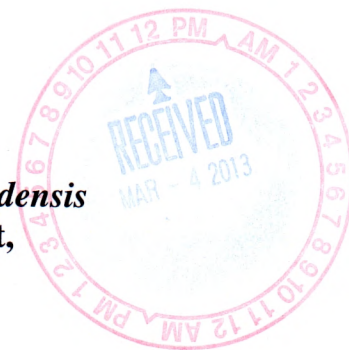


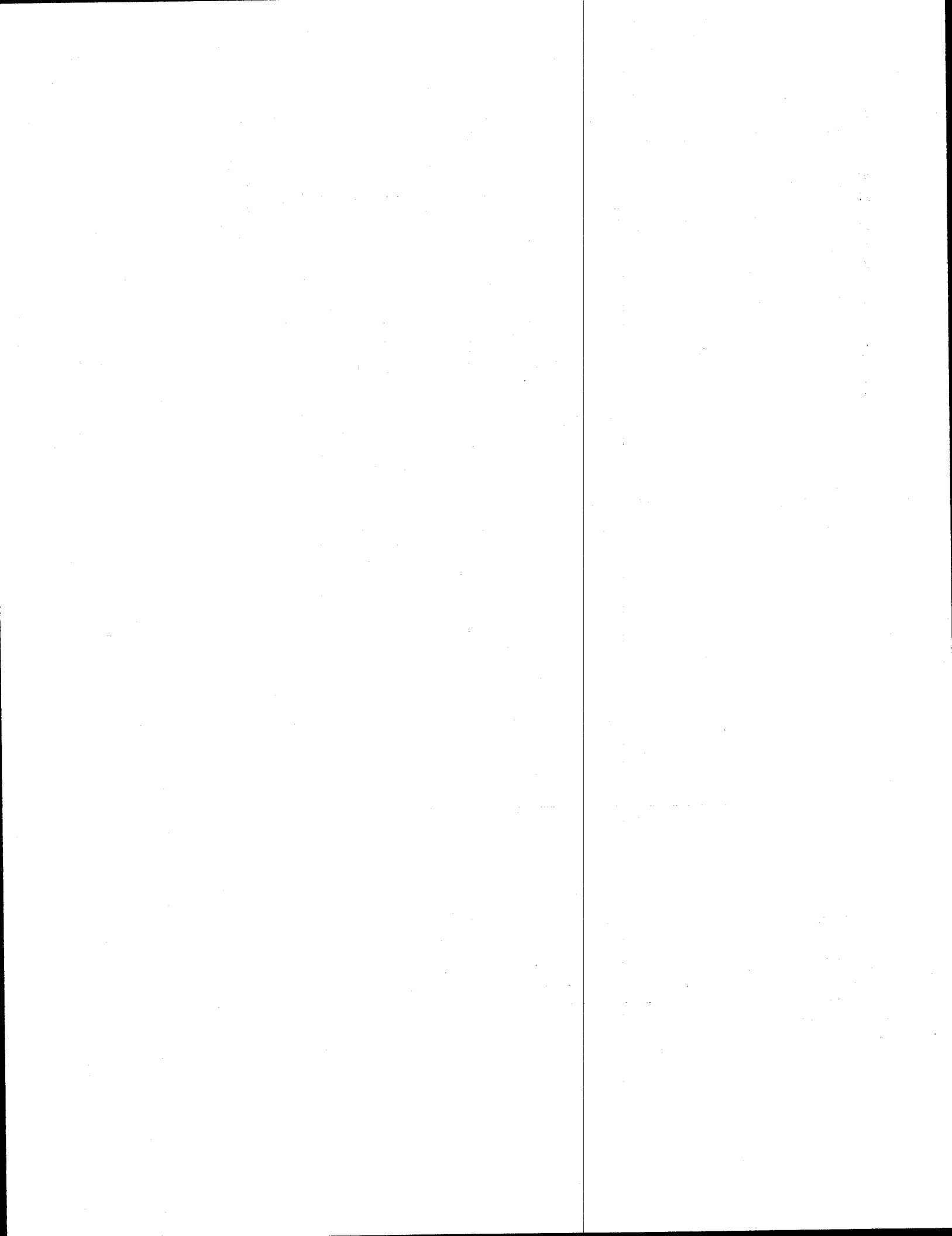
**2011-2012 Population Monitoring for *Arenaria cumberlandensis*  
(*Minuartia cumberlandensis*), Cumberland Sandwort,  
For the Tier 2 Sites**



**Prepared for U.S. Fish and Wildlife Service  
Section 6, Segment 25**

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## INTRODUCTION

*Arenaria cumberlandensis* or *Minuartia cumberlandensis* (Cumberland sandwort) is endemic to the Cumberland Plateau of northeastern Tennessee and southeastern Kentucky. It was listed by the U.S. Fish and Wildlife Service as an endangered species in 1988 and is currently listed as state endangered in Tennessee and Kentucky. Monitoring data is necessary for assessing recovery goals and determining threats to the populations of *Arenaria cumberlandensis*.

In 2000, a monitoring protocol was established by the Tennessee Division of Resource Management (RMD) and baseline monitoring was conducted at 34 sites in Tennessee (Bailey and Shea 2000). In 2006-2008, the monitoring protocol was modified and monitoring occurred for the second time at 34 of the year-2000 sites and for the first time at 39 additional locations for a total of 57 element occurrences (EOs), or 73 sites, monitored (TDEC 2007, 2008). As a result of this survey, it was decided to divide the sites into three priority rankings for the monitoring, Tier 1, Tier 2 and Tier 3, based on the highest threats, the location, the ownership status (public and private) and the accessibility. Some of the sites are very remote and are difficult to access and may not be visited for several years. The sites that are on trails and can be easily accessed by hikers have the greatest threats and need to be monitored more frequently. The Tier 1 sites will be monitored every 1-3 years, Tier 2 sites monitored every 3-6 years, and Tier 3 sites monitored every 6-10 years. In 2010- 2011, 23 Tier 1 sites were monitored and the report completed (TDEC 2012). In 2011- 2012, 27 Tier 2 sites were monitored.

## MONITORING

### Monitoring Protocol

During the survey in 2000, a census was attempted at each EO, but due to the scattered distribution of the plants and their diminutive size it was considered an estimate. It was determined that census monitoring to determine numbers of individuals at a site could possibly be harmful to the plants. The habitat and the plants are very fragile and cannot withstand too much trampling and disturbance. The soils in rockhouses are very sandy, rocky and shallow so permanent markers and plots would be difficult to establish and maintain. Also in the winter, the floors of the rockhouses at the drip line are wet and the freeze/thaw dynamics disturb the substrate. Counting the *Arenaria* without standing right on top of them is almost impossible because the plants are so small and some occur on high ledges. It is not very accurate to monitor from a distance even with binoculars. It was determined that the most feasible monitoring method was to estimate the size of the area occupied by the plants. Site or field maps were drawn showing the distribution of plants in the rockhouses for future reference.

During the 2006-2008 monitoring period, the area occupied by *Arenaria* was estimated by meter square and attempts were made to estimate the number of plants at each site. Photographs were taken and the existing site drawings were updated. In total, there are 72 monitoring sites, 61 are on public lands and 11 are on private lands (TDEC 2008). The 2010-2011 and the 2011-2012 monitoring repeated the monitoring protocol of estimating area covered by plants. Numbers of plants were counted or estimated when time allowed.

All but one of the 27 Tier 2 sites is located on public land in PSP/SF, BISO and Pogue Creek State Natural Area. The one site on private land is located in Pogue Creek. The majority of the Tier 2 sites are rockhouses without designated hiking trails going near them. Five of the 27 sites have immediate threats to the sandwort population including trampling and relic digging mostly

because of the easy accessibility. In 2011-2012, a total of 27 Tier 2 sites were monitored by RMD (Table 1). EO 35 was originally assigned to the Tier 3 category; however, since it is in close proximity to EO 6, it has been changed to a Tier 2 site for convenience. EO 63, a Tier 2 site located on private land, has no immediate threats and is in a remote location. It will be changed to a Tier 3. Also EO 79(1& 2), a Tier 2 site, is fairly remote and will be changed to a Tier 3.

**Table 1. 2011-2012 Monitoring Data for *Arenaria cumberlandensis* - Tier 2 Sites.**

EOID	EO R	COUNTY	OWNER/ SITENAME	LATITUDE	LONGITUDE	MEASURE	2006-2007- 2008	2011- 2012	SURVEY DATE	IMMEDIATE THREATS	2011-2012 COMMENTS
10857	6	Pickett	TDF/ Double Falls	36.5732	-84.7732	Est. # Plants	1500	1500	9/16/2011		
						Est. Area Cover (m <sup>2</sup> )	10	10			
9774	8	Pickett	TDF/Powerline Bluff	36.5729	-84.7885	Est. # Plants	1,000	500	2/28/2012	powerline maintenance	could not find patch #1, the largest of the 4 patches
						Est. Area Cover (m <sup>2</sup> )	10	3			
6251	12	Pickett	TSP/Swinging Bridge	36.5506	-84.8019	Est. # Plants	34+	35	5/22/2012		
						Est. Area Cover (m <sup>2</sup> )		0.25			
1439	14	Pickett	TDF/Hidden Passage Trail- Ridgetop	36.5685	-84.7788	Est. # Plants	100		2/29/2012	some trampling	
						Est. Area Cover (m <sup>2</sup> )	1	1.5			
12098	25	Fentress	NPS/Laurel Fork	36.4625	-84.8387	Est. # Plants	1500	<500	6/30/2011		no apparent reason for decline
						Est. Area Cover (m <sup>2</sup> )	20	3			
1671	33	Fentress	TDF/Hazard Cave South- west	36.5392	-84.8047	Est. # Plants	2000		7/1/2011		
						Est. Area Cover (m <sup>2</sup> )	25	15			
5608	34	Pickett	TSP/The Natural Bridge	36.5456	-84.7983	Est. # Plants	90	16	7/1/2011	trampling	Human & animal trampling

EOID	EO R	COUNTY	OWNER/SITENAME	LATITUDE	LONGITUDE	MEASURE	2006-2007-2008	2011-2012	SURVEY DATE	IMMEDIATE THREATS	2011-2012 COMMENTS
						Est. Area Cover (m <sup>2</sup> )	0.5	<0.25			originally Tier 3 but close to EO 06 so will be Tier 2
4358	35	Pickett	TDF/Lower Thompson Creek	36.5751	-84.7728	Est. # Plants	5000		9/16/2011		
						Est. Area Cover (m <sup>2</sup> )	50	50			
10367	39	Pickett	TDF Tunnel/Trail Intersection	36.5788	-84.783	Est. # Plants	1550	1500	9/16/2011		difference due to estimating area
						Est. Area Cover (m <sup>2</sup> )	9	5			
1940	43	Pickett	NPS/ Mill Creek	36.5269	-84.7553	Est. # Plants	750+		9/15/2011		
						Est. Area Cover (m <sup>2</sup> )	21	37			
11528	44	Pickett	NPS/ Mill Creek	36.5286	-84.7559	Est. # Plants	3325		3/1/2012		
						Est. Area Cover (m <sup>2</sup> )	34.5	30+			
15143	58	Pickett	TDEC/Johnson Branch	36.5402	-84.8299	Est. # Plants	(2005) 500		5/23/2012		better survey done
						Est. Area Cover (m <sup>2</sup> )	(2005) 10	30			
15229	59	Scott	NPS/Puncheon Camp	36.5700	-84.5883	Est. # Plants	100+	138	7/31/2012		
						Est. Area Cover (m <sup>2</sup> )	2	2			
16088	62	Fentress	TDEC/Pogue Creek	36.5226	-84.8461	Est. # Plants	50-100		5/22/2012		

EOID	EO R	COUNTY	OWNER/SITENAME	LATITUDE	LONGITUDE	MEASURE	2006-2007-2008	2011-2012	SURVEY DATE	IMMEDIATE THREATS	2011-2012 COMMENTS
						Est. Area Cover (m <sup>2</sup> )		4.75			
16099	63	Fentress	Private/Pogue Creek	36.5187	-84.8389	Est. # Plants	500+		6/20/2012		
						Est. Area Cover (m <sup>2</sup> )		10.7			Recommend to be Tier 3, private land
16111	64	Fentress	NPS/Rockhouse Benchmark	36.5245	-84.7755	Est. # Plants	425	128	9/15/2011		
						Est. Area Cover (m <sup>2</sup> )	3.25	1			no plants on ledges as seen in 2007
16113	66	Pickett	TSP/Lake & Ridge Trail Bridge	36.5562	-84.7998	Est. # Plants	500		2/28/2012		
						Est. Area Cover (m <sup>2</sup> )	3	3			
16115	69	Pickett	TDF/Spraugh Ridge	36.5615	-84.8104	Est. # Plants	1800+		2/29/2012		
						Est. Area Cover (m <sup>2</sup> )	37.5	14.5			Rockhouse B had a collapse of rock may account for some of the decline
16116	70	Pickett	TDF/Group Camp Bluffs	36.5702	-84.7952	Est. # Plants	10,000		2/12/2012		
						Est. Area Cover (m <sup>2</sup> )	30m <sup>2</sup> + 50	60			
16117	71	Pickett	TSP/Hidden Passage Trail Powerline	36.567	-84.786	Est. # Plants	300+		7/30/2010	trampling	
						Est. Area Cover (m <sup>2</sup> )	10.5	5			overestimated area in 2007

EOID	EO R	COUNTY	OWNER/SITENAME	LATITUDE	LONGITUDE	MEASURE	2006-2007-2008	2011-2012	SURVEY DATE	IMMEDIATE THREATS	2011-2012 COMMENTS
16296	72	Fentress	TDEC/Pogue Creek	36.5308	-84.8195	Est. # Plants 2 plants			5/23/2012		better survey done EO has 4 rockhouses
						Est. Area Cover (m <sup>2</sup> ) <0.1		20			
16297	73	Fentress	NPS/Skull Cave Creek	36.3308	-84.7758	Est. # Plants Est. Area Cover (m <sup>2</sup> ) <5.0	visited 1999=1,000	9	6/30/2011		better survey done
16524	76	Fentress	TDEC/Pogue Creek	36.521	-84.8404	Est. # Plants Est. Area Cover (m <sup>2</sup> ) 1	200+	1.5	6/20/2012		better survey done
16530	77	Pickett	TDF/Lower Thompson Creek	36.5777	-84.7787	Est. # Plants Est. Area Cover (m <sup>2</sup> ) 1	100	<1	9/16/2011		site dry, south exposure
16531	78	Pickett	TDF/Lower Thompson Creek	36.5771	-84.7779	Est. # Plants Est. Area Cover (m <sup>2</sup> ) 3	300	3	9/16/2011		
16536	79(1,2)	Pickett	NPS/Mill Creek	36.5274	-84.7589	Est. # Plants Est. Area Cover (m <sup>2</sup> ) 3.25	525	3.25	3/1/2012		recommend to be Tier 3
16537	80	Pickett	TDF/Spraugh Ridge	36.5603	-84.8156	Est. # Plants Est. Area Cover (m <sup>2</sup> ) 10	500	200	2/29/2012	recent digging	decline likely due to recent digging



## Monitoring Results

Overall, during the 2011-2012 monitoring, the estimated cover of *A. cumberlandensis* stayed the same as compared to 2008 at eight sites, EOs 6, 12, 35, 59, 66, 70, 78 and 79. Seven sites showed an increase greater than 1 m<sup>2</sup> in cover, Mill Creek (EO 043), Johnson Branch (EO 58), Pogue Creek (EO 62), Pogue Creek (EO 63), Pogue Creek (EO 76), Skull Cave Creek (EO 73), and Pogue Creek (EO 72). As aforementioned, more complete surveys were done at all the Pogue Creek sites explaining the marked increases. One site, Hidden Passage (EO 14), showed a slight increase of 0.5 m<sup>2</sup>. Lower Thompson Creek (EO 77) and Natural Bridge (EO 34) showed a slight decrease, less than 1 m<sup>2</sup>. Nine sites showed appreciable decrease greater than 1 m<sup>2</sup>. Powerline Bluff (EO 8), Laurel Fork (EO 25), Hazard Cave Southwest (EO33), and Tunnel/Trail Intersection (EO 39), Mill Creek (EO 44), Rockhouse Benchmark (EO 64), Spraugh Ridge (EO69), Hidden Passage Trail Powerline (EO71), and Spraugh Ridge (EO80).

The decreases in numbers at some of the sites can be attributed to human differences in the estimated cover since no observable site conditions had changed from 2006 to 2012. The declines at seven of the sites may possibly be explained by the following reasons: Powerline Bluff site (EO 8) is very high bluff rockhouse with four individual patches of *A. cumberlandensis* in four different areas. The largest patch with about 500 plants that was observed during the 2007 monitoring could not be found. The powerline runs through the middle of the site and is maintained by periodic vegetation clearing. In 2006, the vegetation had been cleared in the recent past, but in 2012 the site was overgrown, mostly with climbing fern and small trees. It appears that the ledges with this patch of plants was overgrown and shaded, no plants were found. At EO 34 located along a trail, there was evidence of trampling by animals and people. At EO 39, about the same number of plants was estimated, but the difference in the area covered is due to counting discrepancies. At EO 64, the decline was possibly due to drought. The plants were found on the floor, not on the ledges as they were found in 2006. A rock fall had occurred at EO 69 where plant had been found in 2007. The surveyor at EO71 reported that the area covered by plants was overestimated in 2007. At EO 80, there was recent relic digging where plants had been found in 2007.

Repeating the "estimation" of cover of *A. cumberlandensis* proved to be a challenge given the differences in the way people visually estimate the area covered. The plants are scattered in uneven patches over large areas on the floor and the ledges of the rockhouses making it is more difficult to estimate cover. So the decreases or increases in cover may be attributed to human error and not an actual change in site conditions or threats. During the next monitoring period, a more accurate and repeatable method for determining cover will be tested. For example, all estimates should be done by 2 to 3 observers and then the results averaged for each site. This would reduce the amount of observer error for the count and area estimates.

## REFERENCES

Bailey, Claude and Andrea Shea. 2000. New Population Survey, Site Protection Survey, and Monitoring Protocol for *Arenaria cumberlandensis*. Division of Natural Heritage, Report for U.S. Fish and Wildlife Service, Atlanta GA, Section 6, Segment 14.

Tennessee Department of Environment and Conservation (TDEC). 2007. Population Monitoring for *Arenaria cumberlandensis*, Cumberland Sandwort, on Public Lands in Tennessee, 2006-2007. Division of Natural Areas, unpublished report for USFWS, Cookeville, Tennessee.

Tennessee Department of Environment and Conservation (TDEC). 2008. Report on Population Protection for *Minuartia (Arenaria) cumberlandensis*, Cumberland sandwort. Division of Natural Areas, unpublished report for USFWS, Cookeville, Tennessee. Section 6, Segment 21.

Tennessee Department of Environment and Conservation (TDEC). 2012. 2011 Population Monitoring for *Arenaria cumberlandensis (Minuartia cumberlandensis)*, Cumberland Sandwort, For the Tier 1 Sites. Division of Resource Management, unpublished report for USFWS, Cookeville, Tennessee. Section 6, Segment 24.

U.S. Fish and Wildlife Service (USFWS). 1988. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for *Arenaria cumberlandensis*. Federal Register 53(121): 25268-25271.