Interim Post-delisting Monitoring Report for the Delmarva Peninsula Fox Squirrel *(Sciurus niger cinereus)*

Prepared by

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Acknowledgements

This post-delisting monitoring report for the Delmarva Peninsula fox squirrel has been prepared by the U.S. Fish and Wildlife Service (USFWS), Chesapeake Bay Field Office. The primary author is Dr. Cherry Keller, the Recovery Lead for this species, with input, data and review by members of the Delmarva fox squirrel Recovery Team. This most recent Recovery Team includes Glenn Therres, Maryland Department of Natural Resources; Matt Whitbeck, USFWS, Blackwater National Wildlife Refuge; Holly Neiderriter, Delaware Division of Fish and Wildlife; Dr. Carol Bocetti, California University of Pennsylvania; Dr. Ray Dueser, Utah State University; Daniel R. Rider, Maryland Department of Natural Resources; Kevin Holcomb, USFWS, Chincoteague National Wildlife Refuge; Emarie Ayala, USFWS, Chincoteague National Wildlife Refuge; Ruth Boettcher, Virginia Department of Wildlife Resources; and Bill Giese, retired, USFWS, Blackwater National Wildlife Refuge.

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Background

The following provides the interim results, 2015 to 2020, of post-delisting monitoring for the Delmarva Peninsula fox squirrel (*Sciurus niger cinereus),* generally called the Delmarva fox squirrel. The Delmarva fox squirrel (DFS) is a subspecies of the eastern fox squirrel found only on the Delmarva Peninsula. It was listed as endangered in 1967 and delisted in September 2015 due to recovery. The following provides background on its recovery and the results of post-delisting monitoring from 2015 to 2020.

The original reason for listing this species was the approximately 90 percent decline in the size of its range. The most likely causes of this range retraction include loss of mature forest habitat through clearing land for agriculture and short-rotation timber harvest, as well as over-hunting that had probably occurred since the early 1900s. Since the initial listing, the hunting season was closed and Federal and state biologists translocated DFS to establish new populations within its historical range. Many of these translocations have been successful and have resulted in 11 new populations that continue to survive and grow 30 years after the initial releases. This substantially increased the size of the DFS range. In addition, by 2005, eight new populations were discovered on the periphery of the 1993 range that did not result from translocations (USFWS 2007, p.7).

In 2012, the 5-year status review identified additional occupied forest that further connected subpopulations (USFWS 2012, figure 3). These additional discoveries increased the range and reduced the risk of extinction. The status review (USFWS 2012, entire) evaluated the DFS population distribution, the abundance and connectivity of habitat, and all threats to DFS persistence, concluding that the DFS was not in danger of extinction throughout all or a significant portion of its range and not likely to become so in the foreseeable future. The Delmarva fox squirrel was removed from the endangered species list in September 2015 due to recovery. A Post-delisting Monitoring Plan was developed for the DFS (USFWS 2014, entire) and this report provides the results of that monitoring effort. Post-delisting monitoring will continue through 2025, when a final evaluation will be prepared.

Monitoring Goals

The two key variables that have been the focus of DFS monitoring since it was listed are (1) the size of the range and distribution of DFS populations and (2) the persistence of populations within the range. This species was listed because its distribution had diminished to 10 percent of its historical range, and initial recovery efforts therefore focused on translocations to increase the size of the range. The recovery criteria in the revised DFS recovery plan (USFWS 1993, pp. 41-43) focused on the persistence of the translocations and persistence of other populations within the range, as well as the need for discovery of new populations. Thus, monitoring the distribution of this species and ensuring its long-term persistence on the landscape have been the primary goals of the monitoring

program while listed and continue to be the primary goals of post-delisting monitoring.

In this report we describe the following changes in features of the DFS range and populations from the previous status review (data as of 2010):

1) Changes in the size of the range since delisting;
2) Persistence and extirpation of DFS within the range;
3) Changes in the distribution and connectivity of the subpopulations; and
4) Additional monitoring and conservation activities.

Results

1. Changes in the Size of the Range of the Delmarva Fox Squirrel

The range of the Delmarva fox squirrel is defined as all occupied forests buffered by 3 miles but truncated at large rivers or water bodies and this definition has been consistently used since 2005 (USFWS 2007, p. 34). Since delisting in 2015, the range has increased in size and now occupies 29 percent of the Delmarva Peninsula (table 1). New sightings in the last five years have documented additional occupied forest on the eastern periphery of the range as well as the southern portions of Maryland for an overall increase in the size of the range (figure 1).

Table 1. Changes in the range of the Delmarva fox squirrel. Numbers describe the size of the range as of the year where documents or data have been summarized.

	At listing circa 1970	**1990**	**2005**	**2010**	**At delisting 2015**	**Post-delisting 2020**
Number of Counties Occupied not including translocations	**3**	**3**	**6**	**6**	**7**	**7**
Number of Counties Occupied including translocations	4	10	10	10	10	10
Total Area of Occupied Forest (acres)	Not Available	103,311	128,434	134,778	140,616	142,458
Percentage of Delmarva Peninsula Occupied by DFS Range	10%	Not Available	27%	28%	28%	29%
Source	Taylor and Flyger 1974	USFWS 1993, recovery plan	USFWS 2007, 5-yr review	USFWS 2012, 5-yr review	USFWS 2015 data	USFWS 2020 data

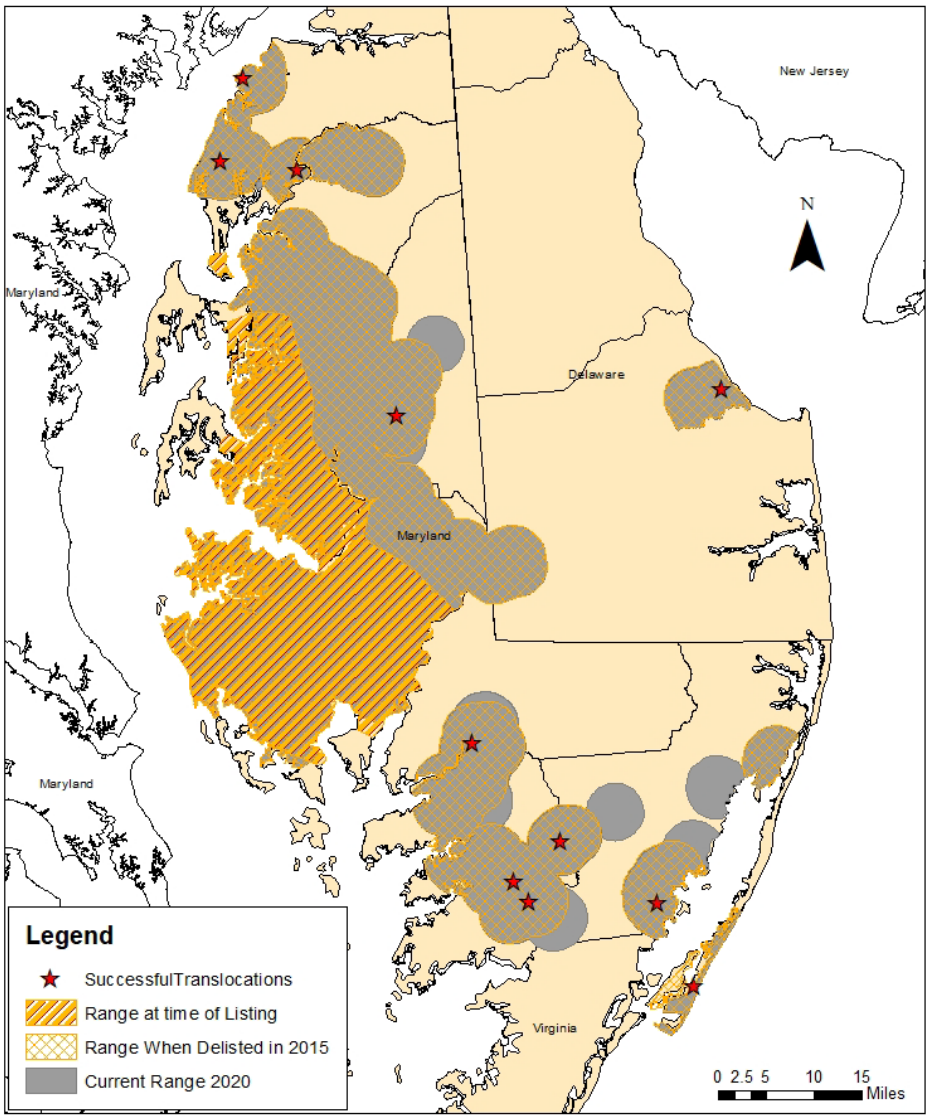


Figure 1. Current range of the Delmarva fox squirrel compared to the range at the time of listing and at the 2015 delisting.

2. Persistence and Extirpation within the Range

The Post-delisting Monitoring Plan provided a list of potential monitoring sites where follow up surveys could indicate persistence or extirpations after delisting (USFWS 2014; table 2). As described in the monitoring plan, if a sighting or camera detection was within the monitoring plot or within 0.25 miles of the edge of the plot (diameter of a home range) it was considered occupied (USFWS 2014; p.14). However, extirpations are only indicated if camera surveys at the site did not detect a Delmarva fox squirrel.

We were able to determine the presence or absence of squirrels in 48 monitoring sites; 32 in the core of the range and 16 in the periphery of the range. The core of the range includes all areas occupied at the time of listing; the periphery is all areas bordering the core (see figure 1). Data from 2016 to present indicated persistence in 46 (96 percent) of those plots and evidence of probable extirpations in 2 sites (4 percent) in the periphery of the range (table 2). In both of the extirpation sites, the habitat continues to be present and the causes of extirpation are unclear. However, squirrels continue to persist in a nearby woodlot and a new discovery of occupied habitat occurred immediately to the south (figure 2). In this area, located on the eastern edge of the range, animals may be moving among woodlots as they explore new areas. Some extirpations are to be expected, and we will continue to learn from these, but overall, DFS were persisting in 96 percent of the monitoring sites that could be surveyed and we consider overall persistence to be good. In addition to the persistence within the range, records since delisting have added 1,842 acres of new occupied forest in 18 locations.

Table 2. Persistence or extirpation of Delmarva fox squirrels in 48 monitoring sites where DFS were present prior to delisting.

Occupancy change since delisting	**Number and acres of 48 monitoring woodlots (sites) that are persisting or extirpated in the core or periphery of the range*.**		**Total number and percent of 48 monitoring sites persisting or extirpated**
	Core	**Periphery**	**Total**
Persistence	32 sites (12,716 acres)	14 sites (2,981 acres)	46 (96%)
Extirpations	0 sites	2 sites (438 acres)	2 (4%)

* core of the range is the area occupied at the time of listing, (USFWS 1993, p.5); periphery is the area outside the core (see figure 1).

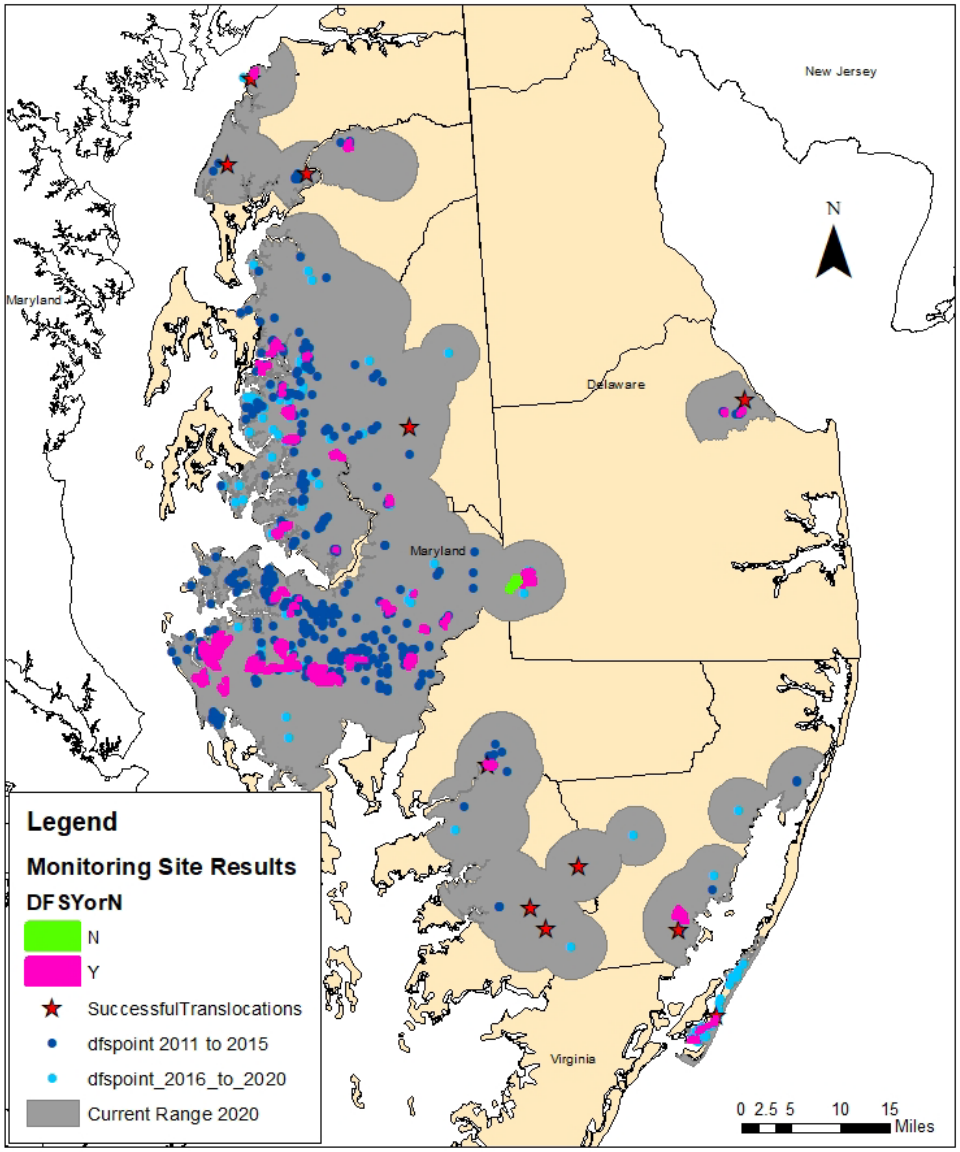


Figure 2. Locations of monitoring sites where DFS were found persisting (DFS Y) and assumed extirpated (DFS N). Recent records outside monitoring plots are also indicated across the range for post-delisting (2016 to current) and in the 5 years prior to delisting (2011 to 2015).

3. Changes in the Distribution and Connectivity of Subpopulations

The population viability analysis (PVA) for the Delmarva fox squirrel examined dispersal distances and identified 3.6 km (2.25 miles) as the distance within which animals were likely to be interbreeding because approximately 75 percent of the population would be dispersing within these distances (Hilderbrand et al. 2007, entire). In the last Status Review (USFWS 2012, entire), we used this distance to identify 22 subpopulations that were separated by greater distances, or roads and rivers, and that were likely to be isolated populations. New records of

Delmarva fox squirrels discovered since that review now connect several of these 22 subpopulations (figure 3). Thus the Tuckahoe River Corridor, Southern Talbot, and Tunis Mills/Wye Mills subpopulations are now connected. The St. Michaels South and St. Michaels Road subpopulations are also connected. The Carmichael Road and Tunis Mills/Wye Mills subpopulations were previously considered to be separated by river and roads, but these are now considered connected as new sightings have occurred between these subpopulations. These additional sightings all indicate improved connectivity in the current range.

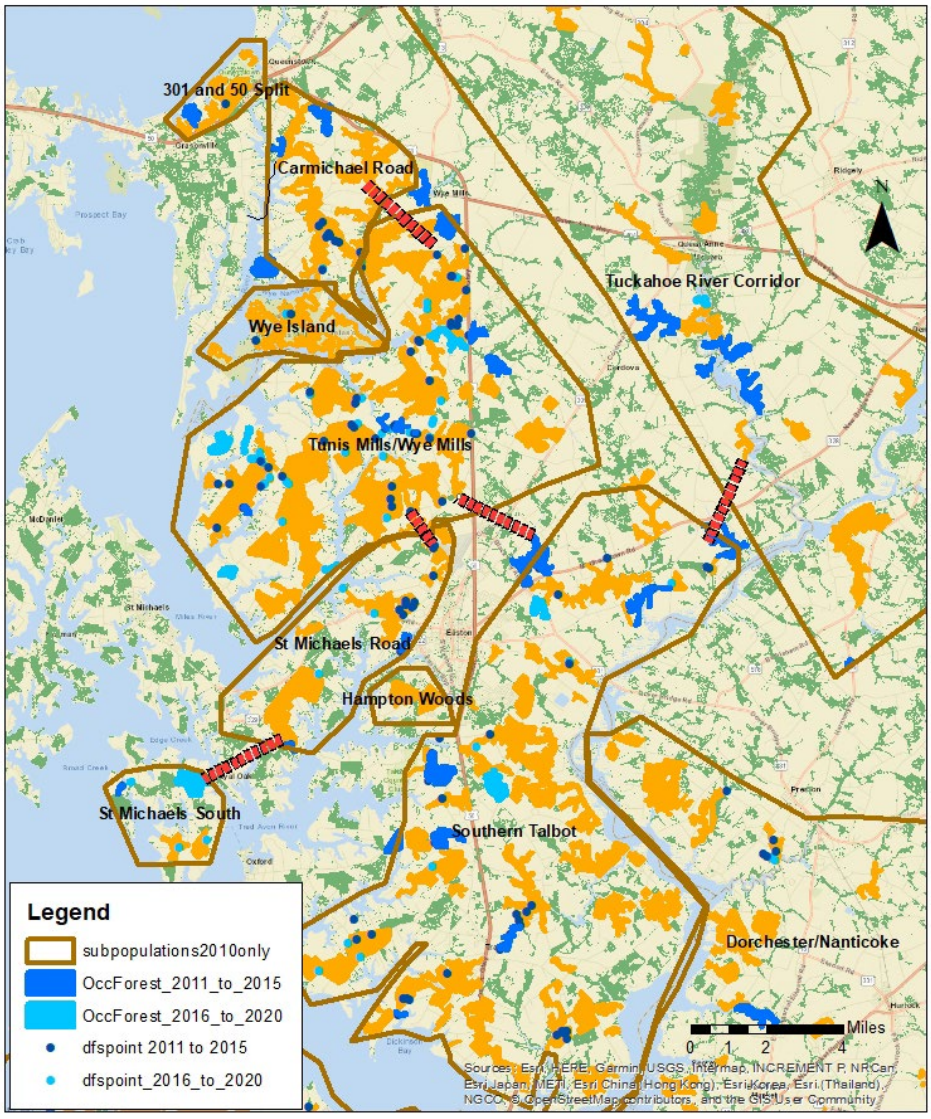


Figure 3. Subpopulations delineated in 2010 and red lines indicating where new occurrence data indicates they are now connected.

4. Additional Monitoring and Conservation for the Delmarva Fox Squirrel

a) Monitoring the Delmarva fox squirrel population at Blackwater National Wildlife Refuge – The Refuge has used occupancy modeling and camera surveys to provide a statistically rigorous monitoring program for a refuge-wide assessment of Delmarva fox squirrels. Trail cameras were deployed during 2016, 2017, and 2018 and modeling indicated DFS occupied 57 percent of the suitable habitat at the Refuge. The FWS Inventory and Monitoring Program in Ft. Collins, CO provided valuable advice during the planning of this monitoring effort and review of the final document. This monitoring provides a full refuge baseline and enables future determinations of changes in the populations over time. The final report can be found at: https://www.fws.gov/uploadedFiles/Region_5/NWRS/South_Zone/Chesapeake_Marshlands_Complex/Blackwater/BLK_DFS_occupancy_report_FINALDecember_2019.pdf

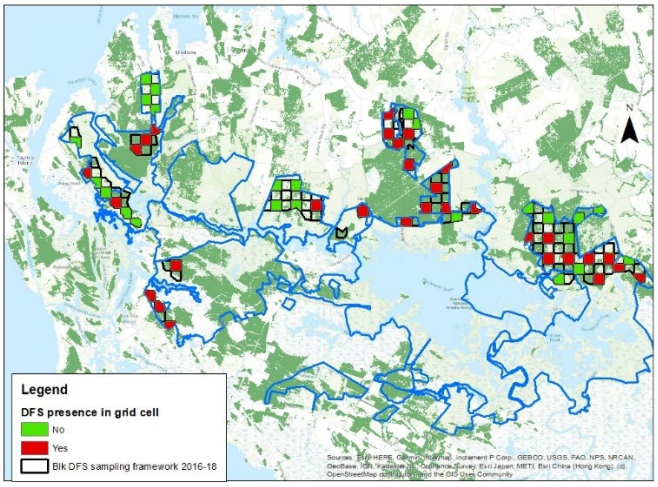
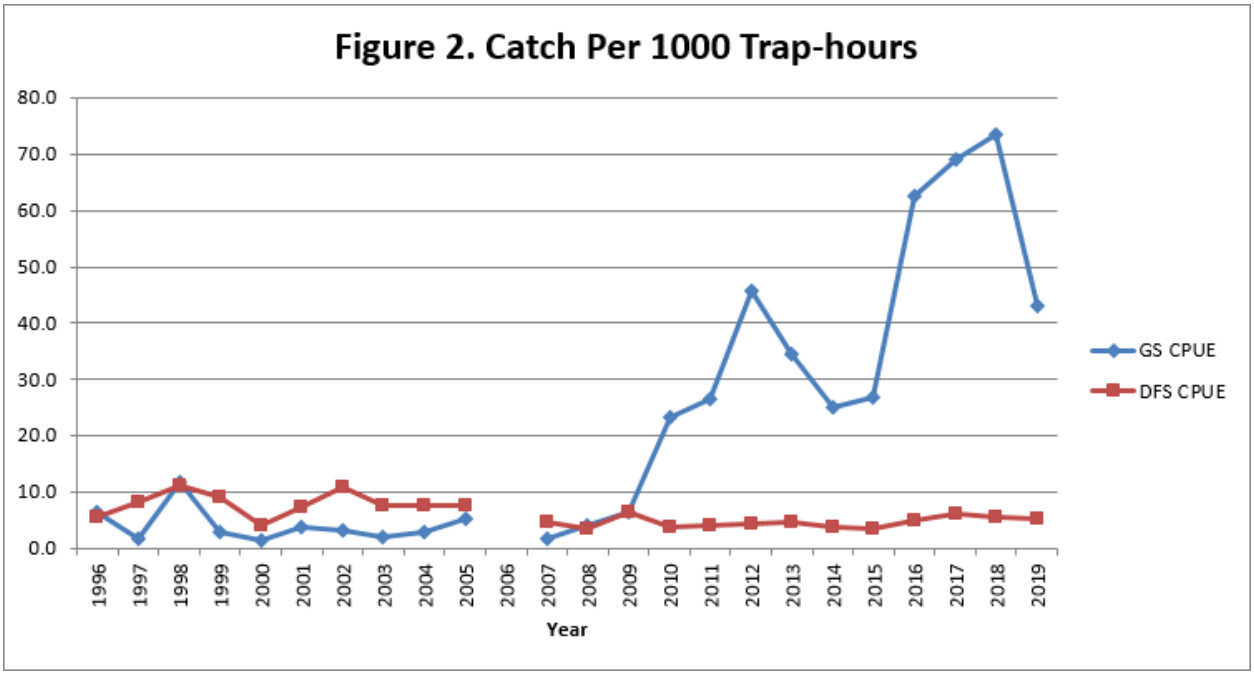


Figure 4. Presence/absence of Delmarva fox squirrels on a sampling grid at Blackwater National Wildlife Refuge from camera surveys conducted during 2016, 2017, and 2018.

b) An Additional Translocation of Delmarva fox squirrels in DE: The State of Delaware's *Delmarva Fox Squirrel Conservation Plan* (DNREC 2014, entire) includes plans for additional translocations of DFS to Delaware. The State conducted its first translocation in September of 2020 with additional translocation being planned. https://delawarestatenews.net/outdoors/delmarva-fox-squirrels-translocated-to-sussex-county/. See the Conservation Plan at https://dnrec.alpha.delaware.gov/fish-wildlife/conservation/fox-squirrel/. Results of these translocations will be described in the final post-delisting monitoring report in 2025.

c) Long-term investigation of DFS response to timber harvest continues:

A long-term study of Delmarva fox squirrel and gray squirrel responses to timber harvest continues in Dorchester County, led by Dr. Carol Bocetti. This study trapped and marked both Delmarva and gray squirrels on 3 study sites for 24 years. Prior to the timber harvest, Delmarva's were more abundant than gray squirrels; immediately after the harvest (conducted in 1998 and 1999) there was a decrease in the number of gray squirrels, but the number of Delmarva fox squirrels occupying the sites was relatively unchanged. Ten years post-harvest, however, the gray squirrel population increased rapidly, and the Delmarva fox squirrel population declined by half. Starting in 2015, Delmarva's started to slowly recover. The number of gray squirrels is expected to decline once the forest again becomes mature, but when that happens is yet to be confirmed. For more information, contact C. Bocetti at bocetti@calu.edu.



Summary

Overall, the Delmarva fox squirrel continues to do well. We are discovering new sites where it occurs that expand the size of the total range. This increases the redundancy of populations and continues to make them even more secure from extinction. We can confirm its persistence in many areas throughout the range and a sample of 48 monitoring sites indicates 96 percent persistence within the range and newly discovered occupied forest as well. New sightings within the range indicate improved connectivity between previously isolated subpopulations and this improves the resiliency of subpopulations within the range. DFS continue to occur in a wide range of habitats and locations. Overall, the increased redundancy and resiliency make this species even more secure from extinction. A second and final report for the 10-year PDM will be prepared after the monitoring period ends in 2025.

Citations

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LEAD FIELD OFFICE APPROVAL:

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