



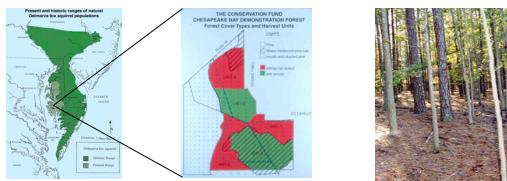
IMPACTS OF A MODIFIED PATCH CLEARCUT ON DELMARVA FOX SQUIRRELS

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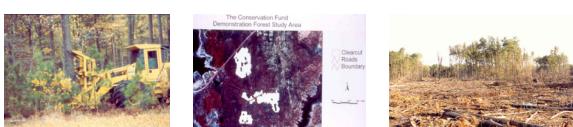
ABSTRACT

The Delmarva fox squirrel (*Sciurus niger cinereus*) is an endangered species found only in 10% of its former range. It only persists naturally in portions of Kent, Queen Anne's, Talbot, and Dorchester Counties, Maryland. First listed as endangered in 1967, it was adversely impacted by habitat loss and fragmentation from agriculture and timber harvest. Throughout its range, the Delmarva fox squirrel is found in mature stands of pine and oak, or pine and mixed hardwoods, both characterized by a relatively open understory. Most of this habitat is privately owned on the Delmarva peninsula. The squirrel is locally abundant in these areas but may be under increasing pressure from current timber management and land development trends. Little is known about the life history and habitat use of this endangered fox squirrel and research must continue to determine what forest managers and landowners must work together to find an economically productive and ecologically viable forest management method conducive to private land owner use in order to recover the Delmarva fox squirrel. Thus far, only one study has been done, and it showed that the current timber management method of clearcutting causes the dispersal of fox squirrels to adjacent stands. Our project provides an opportunity to determine the effect of a modified patch clearcut on Delmarva fox squirrels by studying 3 treatment sites at the Chesapeake Bay Forest Demonstration Area (owned by The Conservation Fund) where a timber harvest was conducted, and 3 reference sites at Blackwater National Wildlife Refuge where no harvest occurred. Capture-recapture data were collected from the spring 1996 through the spring of 1998 to determine baseline estimates on the density, demography, and movements of Delmarva fox squirrels and gray squirrels on all sites. Radio telemetry was done on fox squirrels in treatment sites during 1997 to determine base-line habitat use. The timber harvest was initiated on 1 of the 3 treatment sites in late August of 1998, and was completed on all sites by the fall of 1999. Radio telemetry was conducted before, during, and after the harvests in 1998 and 1999. Post-harvest capture-recapture data was started in the fall of 1999 and completed in the spring of 2002. Results from this project will provide the scientific groundwork for the development of Habitat Conservation Plans on the Delmarva Peninsula. However, this is merely the first alternative to clearcutting that has been investigated, and the method under investigation may fail to fulfill the life history needs of the fox squirrels. Additional research must be done to find alternative forest management methods that both provide essential habitat for the endangered species and promote economic benefit to private landowners.



INTRODUCTION

- * Delmarva fox squirrel listed as endangered in 1967
- * Original range spanned from Southeastern Pennsylvania and Southern New Jersey south through the entire Delmarva Peninsula
- * Current natural range is Kent, Queen Anne's, Talbot, and Dorchester Counties, MD
- * Habitat requirements include mature stands of pine/oak or pine/mixed hardwood forests with a relatively open understory - most of which occurs on private lands
- * Population decline due to habitat loss and fragmentation for agriculture, timber harvest, and land development
- * Current timber management method is clear cut, and a study of Delmarva fox squirrel response to this method shows that the squirrels abandon the site (Paglione, M.S. Thesis, 1996)
- * Project purpose is to "AVOID THE TRAIN WRECK" and investigate the impact of alternative timber management methods (this should be the first of many such studies searching for a method that promotes fox squirrel recovery and provides economic return to private land owners)



OBJECTIVES

- 1) To investigate the impact of a modified patch clearcut on Delmarva fox squirrel
 - A) density
 - B) age- and sex-specific survivorship
 - C) age- and sex-specific dispersal rates
 - D) habitat correlates
- 2) To refine and standardize data collection and survey techniques for squirrels and their habitat
 - A) evaluate trapping success by
 - a) trap session duration
 - b) season
 - c) time of day
 - d) temperature/weather
 - e) microhabitat of each trap location (study with Mary Paul and Jeff Hatfield)
 - f) gray squirrel populations
 - B) evaluate Taylor method - accuracy of habitat characterization

METHODS

3 TREATMENT SITES

Chesapeake Bay Forest Demonstration Area
Sites are 40 - 50 acres
Treatment = modified patch clearcut
(12-24% basal area left in patches identified by hydrology, tree species & tree size)

3 REFERENCE SITES

Blackwater National Wildlife Refuge
Sites are 40 - 50 acres
No treatment

PROCEDURES

Treatment sites and reference sites paired and trapped synchronously
7 days pre-baiting followed by 5 days trapping (baits = dried corn on cobbs)
ear tag, weigh, age and sex each gray and Delmarva fox squirrel

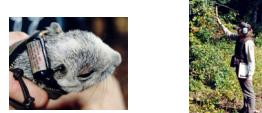


Pre-treatment mark-recapture field methods done for at least 3 spring and 2 fall sessions on all sites

Post-treatment mark-recapture field methods done for at least 3 spring and 2 fall sessions on all sites
same methods as pre-treatment, except add PIT tagging as marking method beginning in fall 2000

Mark-recapture models will be run during 2003 to estimate density and demography before and after harvest.

Radio-telemetry (pre-treatment = 1997 and during treatment = 1998 & 1999) on treatment sites only
triangulation using Locate II, and home range estimates using CalHome
analysis will be completed in 2003



Collect vegetation data (during 1998) from 1 Taylor Method transect and 5 tenth-hectare plots on all sites

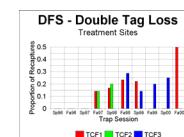


Compare: canopy cover, canopy species composition, shrub species composition, ground cover

Enter Taylor transect data into HSI model to predict DFS occurrence and compare to capture results

RESULTS

SPECIES	NUMBER OF INDIVIDUALS	NUMBER OF CAPTURES
Delmarva fox squirrel	336	1492
Gray squirrel	180	921



TURNOVER RATES OF DELMARVA FOX SQUIRRELS AT TREATMENT SITES

Site	# DFS marked in 1996 (Sp & Fa)	# DFS marked in 1996 that were recaptured in 1997 (Sp, Su & Fa)	# DFS marked in 1996 that were recaptured in 1998 (Sp, Su & Fa)	# DFS marked in 1996 that were recaptured in 1999 (Sp & Fa)
TCF1	9	8 (89%)	6 (67%)	4 (44%)
TCF2	8	2 (25%)	2 (25%)	1 (12%)
TCF3	8	1 (12%)	1 (12%)	0 (0%)

DELMARVA FOX SQUIRRELS CAPTURED PER 1000 TRAP-HOURS

Session	TCF1		TCF2		TCF3		Jarrett West		Kuhhole		White Marsh	
	New	Recap	New	Recap	New	Recap	New	Recap	New	Recap	New	Recap
Sp96	3.05	0.00	4.18	0.52	3.35	0.00						
Fa96	0.82	2.45	0.00	1.03	0.51	3.04	0.00	0.66	0.00	2.10	0.00	
Sp97	0.74	2.61	2.24	1.35	3.42	0.49	6.28	1.57	9.85	0.00	1.25	1.25
Sur97	2.25	5.62	2.32	0.00	1.63	1.63						
Fa97	1.65	2.88	0.60	4.22	1.42	2.36	5.22	4.75	3.25	1.95	4.44	1.48
Sp98	3.84	5.13	2.19	2.74	3.76	2.82	1.49	6.97	5.27	7.38	0.00	2.89
Su98	4.21	4.21	1.30	5.22	1.53	1.02						
Fa98	0.42	7.16	2.31	2.31	1.49	3.49	2.89	6.26	3.99	6.84	4.82	4.82
Sp99	0.40	3.6	0.80	2.80	0.40	2.80	0.80	7.20	3.60	7.60	0.40	2.80
Fa99	0.65	1.30	0.33	0.00	0.13	0.00	0.33	0.00	0.33	1.30		
Sp00	0.44	3.10	0.64	1.91	0.52	2.09	2.06	4.12	2.82	9.03	0.00	1.53
Fa00	1.63	0.81	0.57	2.29	1.06	0.00	0.00	3.19	1.74	4.07	3.38	3.38
Sp01	0.84	3.38	3.15	3.78	2.36	2.83	2.85	5.22	8.49	10.75	4.38	5.11
Fa01	1.24	2.49	0.56	1.68	2.09	2.61	3.71	4.24	1.28	9.58	0.73	8.02
Sp02	2.49	4.99	4.06	1.16	2.85	4.24	1.76	5.24	7.68	14.81	6.86	8.58

GRAY SQUIRRELS CAPTURED PER 1000 TRAP-HOURS

Session	TCF1		TCF2		TCF3		Jarrett West		Kuhhole		White Marsh	
	New	Recap	New	Recap	New	Recap	New	Recap	New	Recap	New	Recap
Sp96	0.00	0.00	3.65	0.00	8.94	0.00						
Fa96	1.22	0.41	1.22	1.22	0.51	1.03	0.00	0.00	0.00	0.00	2.80	0.00
Sp97	0.00	0.04	0.00	0.90	0.49	1.95	1.05	0.00	0.00	0.00	0.00	0.00
Sur97	9.00	7.72			4.03							
Fa97	0.42	2.92	1.81	6.03	1.41	5.17	1.42	1.42	0.00	0.00	1.49	2.23
Sp98	0.00	2.99	2.19	6.58	2.35	6.64	0.00	1.49	0.00	0.00	0.00	1.44
Su98	1.40	1.40	2.61	13.04	1.88	6.48	1.44	0.48	1.71	0.00	10.33	1.38
Fa98	3.79	3.37	2.88	8.08	1.99	6.48	1.76	0.00	2.88	0.00	1.05	1.80
Sp99	0.00	1.20	0.00									0.00
Fa99	0.65	0.98	2.93	4.10	0.00	2.99	0.53	1.59	0.58	0.00	0.00	2.73
Sp00	0.00	0.00	0.00									
Fa00	0.00	0.81	0.57	1.14	1.06	1.59	0.00	0.53	0.00	0.00	0.68	1.35
Sp01	0.42	0.84	0.63	2.52	1.42	0.94	0.48	0.48	0.56	0.56	1.46	1.46
Fa01	0.41	0.41	3.93	2.81	1.57	1.04	0.00	0.00	1.28	0.64	0.00	2.19
Sp02	0.00	1.50	1.16	2.32	0.53	0.00	0.00	0.55	0.00	0.00	0.86	0.86

COMPARISON OF HABITAT VARIABLE ESTIMATES USING TWO SAMPLING METHODS

Site	Canopy-%cover	Canopy-% spp	Canopy-% pine	Canopy-% >30cm	Shrub-% spp	Ground-%cover	Taylor Plot					
TCF1	0.90	0.864	8	7.2	0.286	0.367	0.067	0.118	6	3.8	0.000	0.384
TCF2	0.950	0.840	10	6.8	0.178	0.345	0.128	0.219	7	3.2	0.200	0.512
TCF3	0.950	0.880	9	9.0	0.156	0.139	0.188	0.146	11	4.0	0.300	0.504
JARW	1.000	0.744	9	6.4	0.444	0.539	0.210	0.144	3	2.6	0.400	0.472
KNLE	0.900	0.936	8	8.2	0.053	0.214	0.263	0.244	11	5.4	0.350	0.320
WHMA	0.900	0.920	7	5.8	0.196	0.074	0.186	0.197	10	3.4	0.200	0.488

HSI Model Rank	Expert Opinion Rank
JARW	KNLE
TCF1	JARW
TCF2	WHMA
TCF3	TCF2
KNLE	TCF3

*** REST OF RESULTS ARE CONTINGENT ON MARK-RECAPTURE AND HOME RANGE ANALYSIS ***

PRELIMINARY CONCLUSIONS

- Delmarva fox squirrels continue to use the leave areas
- Gray squirrels appear more impacted by the harvest
- Ear tags are not reliable markers for squirrels, PIT tags appear more reliable
- Fall capture rates are more variable than Spring capture rates. Fall is not a reliable trapping season if conclusions will be drawn from no/few captures.
- The catch-per-unit-effort is similar for the 3 treatment sites, but the turnover rates are different: TCF1 has the same squirrels repeatedly captured over the duration of their lives; TCF2 has fewer squirrels repeatedly captured; TCF3 has very few squirrels repeatedly captured
- The 3 treatment sites have different habitat structures: TCF1 has a very open shrub and ground layer; TCF2 has a moderately open shrub and ground layer; TCF3 does not have an open shrub and ground layer
- Preliminary telemetry results show no direct mortality from the harvest, and movements were not predictable based on the harvest activities. Movements occurred both toward and away from the harvest.
- Delmarva fox squirrels moved up to 3 miles and returned
- The Taylor method does not consistently capture the trends in the habitat structure, but it does provide land managers a quick, albeit limited, tool for habitat measurements (a compromise may be to conduct several Taylor transects at random starting points)
- The current version of the HSI model did remarkably well at predicting squirrel occurrence; additional modifications may be necessary to decrease the influence of pine in the canopy (the likely explanation for KNLE poor performance in the HSI model)

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