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THE CENTER FOR CONSERVATION BIOLOGY

COLLEGE OF WILLIAM AND MARY

VIRGINIA COMMONWEALTH UNIVERSITY

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The Center for Conservation Biology
College of William and Mary
Virginia Commonwealth University

Front Cover: Laura Duval with female to be translocated from cluster 19 within Piney Grove Preserve. Photo by Bryan Watts.

The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

Table of Contents

Contents

EXECUTIVE SUMMARY

The Virginia population of red-cockaded woodpeckers is the northernmost throughout the species range and has been in eminent danger of extinction for more than 30 years. The single remaining population within the Piney Grove Preserve has responded to intensive management and is now approaching capacity but continues to be at risk to stochastic events such as hurricanes, tornadoes and disease. To offset this risk a three-phase conservation plan was developed that includes the establishment of additional breeding locations. The Great Dismal Swamp National Wildlife Refuge was identified as a high priority site for the establishment of a second population due to its capacity for habitat management and the similarity of habitat to non-typical red-cockaded woodpecker sites in nearby coastal North Carolina. In an effort to establish a population within the swamp, habitat management was initiated several years ago and translocation of birds into established recruitment clusters began in 2015.

During the 2018 breeding season, three potential breeding groups were supported within the Great Dismal Swamp NWR (clusters S2-3, S3-3, C3-3) and nest trees appeared to be prepared by early May. Clusters supporting potential breeding groups were monitored weekly from mid-April through June but no breeding attempts were documented.

During the calendar year of 2018, 18 individual red-cockaded woodpeckers were identified within the Great Dismal Swamp NWR including two birds from the 2015 translocation cohort, one bird from the 2016 translocation cohort, seven birds from the 2017 translocation/local productivity cohort and eight birds from the 2018 translocation cohort. Two birds were lost between the 2017 winter survey and the 2018 spring survey leaving three males and seven females during the breeding season. Two translocation events were executed during the fall of 2018 including a move of four birds (2 females and 2 males) from Carolina Sandhills NWR, two birds (1 female and 1 male) from Palmetto-Peartree Preserve on 26 October and two birds (1 female and 1 male) from Piney Grove Preserve on 8 November. Eleven birds were detected during the 2018 winter survey. This compares to seven in 2015, eight in 2016 and twelve in 2017.

A total of 65 woodpecker cavities had been created within the Great Dismal Swamp NWR by the end of 2018. Three cavity trees were lost in October of 2016 during Hurricane Matthew, six cavity trees were lost in March of 2017 during high-wind events and three cavity trees were lost during a high-wind event in February of 2018. In addition, a natural cavity was lost during the February storm and a tree was lost to lightening during the fall of 2018. The second completed natural cavity (S3-2) was being used in December of 2018.

BACKGROUND

Context

The red-cockaded woodpecker (Picoides borealis) is endemic to the southeastern pine ecosystem breeding from Texas and Oklahoma east to Florida and north to Virginia (Jackson 1994). Highly specialized, the species requires old growth, fire maintained pine savannas. Throughout the twentieth century advances in transportation, wood processing, and silvicultural practices shifted the emphasis from long-rotation lumber production to maximum-yield fiber production and resulted in catastrophic declines in habitat availability for this species. Breeding distribution contracted from the edges of the range and became localized within the core of the historic range where remnant old growth remained. The red-cockaded woodpecker was listed as endangered in 1970 and received protection with the passage of The Endangered Species Act in 1973 (16 U.S.C. 1531 et seq).

The historic status and distribution of the red-cockaded woodpecker in Virginia is poorly known because no systematic survey of the species was completed prior to dramatic habitat losses. Early accounts of red-cockaded woodpeckers were made from all physiographic provinces of Virginia. Jurisdictions with records include the counties of Giles (Bailey 1913), Albemarle (Rives 1890), Brunswick (Murray 1952), Dinwiddie (Murray 1952), Chesterfield (Murray 1952), Southampton (Steirly 1949), Sussex (Steirly 1950), Prince George (Steirly 1957), Greensville (Steirly 1957), Isle of Wight (Steirly 1957) and the current independent cities of Norfolk (Bailey 1913), Suffolk (Steirly 1957), Virginia Beach (Sykes 1960), and Chesapeake (van Eerden and Bradshaw, unpublished observation). The first systematic survey of the species was initiated in 1977 and resulted in the documentation of 43 clusters within 5 counties (Miller 1978). By 1980, only 9 of these clusters were still forested (Bradshaw 1990). During the 20-year period between 1980 and 2000, the decline of the Virginia population is well documented (Watts and Bradshaw 2005). By 1990, only 5 of the original 23 clusters detected in 1977 were still active. During the breeding season of 2002, Virginia supported only 2 breeding pairs and 2 clusters with solitary males.

The red-cockaded woodpecker was recommended for endangered status within the state of Virginia in 1978 (Byrd 1979) and 1989 (Beck 1991) and was listed as a Tier I Species of Greatest Conservation Need in the 2005 Virginia Wildlife Action Plan (VDGIF 2005). The stated rationale for recommendations was the extremely low and declining population in Virginia, continued loss and degradation of required old growth forests and the fact that all remaining breeding sites existed on private lands making appropriate management unfeasible. Following these recommendations, the Virginia Department of Game and Inland Fisheries and partners have mounted extensive monitoring and management efforts for the past 30 years. Acquisition of the Piney Grove Preserve in 1998 by The Nature Conservancy was a critical turning point in the species' recovery (Watts and Bradshaw 2005). Intensive habitat and population management on this last remaining site in Virginia has resulted in a population increase from 2 breeding groups in 2002 to 13 breeding groups in 2014 (Watts et al. 2017).

The possibility of losing this single Virginia population due to stochastic events such as hurricanes, tornadoes, pests, and diseases over time is high. To offset this risk a three-phase conservation plan was developed that includes the establishment of additional breeding locations (Watts and Harding 2007). Red-cockaded woodpeckers have been found in non-typical habitats within coastal North Carolina over the past

decade that includes pond pine pocosin woodlands. This habitat type is abundant within the Great Dismal Swamp National Wildlife Refuge and the site has been identified as a high priority for establishment of a second population. Habitat restoration was initiated within the site several years ago and translocation of birds into established recruitment clusters began in 2015.

GOALS AND OBJECTIVES

The primary objective of this ongoing project is to establish a breeding population of Red-cockaded Woodpeckers within the Great Dismal Swamp NWR. A secondary objective is to collect information relevant to the continued management of birds and their habitat in Virginia. Specific objectives include:

1) To determine the number and identification of all birds resident within the Great Dismal Swamp NWR during the 2018 calendar year.
2) To monitor breeding activity in order to document productivity and allow for the unique banding of all individuals within the population.
3) To determine fledging success for all breeding attempts.
4) To translocate birds from donor sites to the Great Dismal Swamp NWR.
5) To monitor cavity tree and artificial cavity condition.

METHODS

Site Description

The Great Dismal Swamp is the northernmost of the great humid swamp forests within the southeastern United States and one of the largest remaining on the Coastal Plain. Considered to be centered on Lake Drummond in the Virginia cities of Suffolk and Chesapeake, the swamp extends into the North Carolina counties of Currituck, Camden, Perquimans, Gates, and Pasquotank. The swamp is positioned on a low, poorly drained, flat marine terrace that ranges from 4.5 to 7 m above sea level. Except for the western edge which is defined by the Suffolk Scarp, the boundaries of the swamp are poorly defined. The Great Dismal Swamp NWR (45,000+ ha) and the adjacent North Carolina Dismal Swamp State Park (6,000+ ha) are protected portions of the historic swamp that support a complex ecosystem. The vegetational composition of the swamp has changed dramatically over the past 100 years and comparisons to historical descriptions suggest a strong succession toward mesic forest types and away from swamp-like conditions. Virtually no virgin timber remains on the site.

The section of the swamp that has been designated for the establishment of red-cockaded woodpeckers is referred to as “The Blocks.” Thirteen recruitment clusters have been developed within this study area to facilitate population establishment (Figure 1). Each cluster includes four pine trees with artificial cavities and an access trail connected to the road system.

Breeding Monitoring

Documenting breeding attempts and their outcomes is an essential element of the monitoring program. We identified all potential breeding groups (PBG: sites with at least one male and one female) during the spring census and followed these sites through the breeding season. We initiated checks of clusters supporting PBGs in mid-April and conducted weekly checks through June to limit the risk of missing any breeding attempts. All cavities within PBG clusters were examined using a peeper scope (miniature video camera mounted on a telescopic, extendable pole that allows an observer to view the contents of a cavity). Cavities within surrounding clusters were examined periodically for any possible roosting or breeding activity.

Population Monitoring

We conducted two systematic surveys of all birds within the Great Dismal Swamp NWR to identify individuals and to determine distribution. We conducted surveys in the early spring prior to the expected breeding window and in early winter after the expected dispersal period. We visited all recruitment clusters before dusk to identify birds as they returned to roost trees for the night. We read combinations of color bands with spotting scopes and determined roost trees. We systematically worked through all sites over a period of days until all individuals were identified.

Translocation

A large, integrated team of biologists roosted birds in August and September within donor sites (Carolina Sandhills NWR, Piney Grove Preserve, Palmetto-Peartree Preserve) to determine retention of hatching-year birds and to identify target birds. Target birds and backup birds were identified for possible translocation. Target and backup birds were roosted again during the week running up to the scheduled translocation in preparation for captures. Trapping teams were deployed to capture birds prior to roosting during the night of the translocation. Birds were captured after entering cavities using pole nets. Once captured, birds were lowered to the ground and handled to confirm identification and gender. Birds were placed in transport boxes and driven to the Great Dismal Swamp NWR for placement.

Birds were placed in artificial cavities, screened in for the night and released at dawn the following morning. We climbed recipient trees using Swedish climbing ladders, placed birds in artificial cavities and tacked screens over the entrance. A release team returned to the recruitment cluster before dawn the following morning. Screens were removed just after dawn and birds were allowed to fly out into their new habitat.

Cavity Tree Monitoring

All known cavity trees were visited to evaluate tree condition and cavity characteristics. Tree-condition categories used included live or dead, standing, broken (snapped off), fallen (down by roots), evidence of

beetle or other insect damage and evidence of lightning strike. Cavity characteristics recorded included origin (artificial insert or natural), height, entrance orientation, occurrence of resin wells, size and completeness of entrance plate and the activity status. Activity status was determined by the presence or absence of chipping, fresh or recent sap flow, and dry sap. We used a peeper scope to examine cavities for the presence of competitors.

RESULTS

Breeding Monitoring

Great Dismal Swamp NWR supported three PBGs of red-cockaded woodpeckers in 2018 (Table 1). This compares to only one PBG in 2016 and two PBGs in 2017. Supporting clusters included S2-3, S3-3 and C3-3. During the 2016 breeding season only S2-3 supported a PBG (no nesting attempt was documented) and during and during 2017 both S2-3 and S3-3 supported PBGs (both sites made nesting attempts with S3-3 producing 2 fledglings). Despite supporting three PBGs in 2018, no breeding attempts were documented.

Table 1. Summary of 2018 breeding activity for red-cockaded woodpeckers within Great Dismal Swamp NWR.

Breeding Group	Potential Breeding Group?	Breeding Attempt?	Eggs Laid	Eggs Hatched	Banding Age	Fledged
Cluster S3-3	Yes	No	-----	-----	-----	-----
Cluster S2-3	Yes	No	-----	-----	-----	-----
Cluster C3-3	Yes	No	-----	-----	-----	-----
Total	3	0	0	0	0	0

Monitoring Details

Cluster C3-3

This is the first year that this cluster has been occupied during the breeding season. Both the male (AL/RE:DB/YR/YR) and the female (YE/DB/WH:AL/PK) were from the 2017 cohort with the male being moved from Carolina Sandhills NWR and the female being produced within cluster S3-3 of GDSNWR. The pair had formed and was occupying C3-3 by the time of the winter survey. During the 2018 breeding season the male was roosting in T-011 and the female was roosting in T-009 (a replacement tree established in 2017). During visits throughout the breeding season both birds were typically present within the forest block around the cluster and could be heard or seen. T-011 showed relatively little work

on resin wells and the interior of the cavity was never highly prepped for breeding. T-009 was well worked with a well-formed cavity plate and extensive resin wells that reached most of the way around the bole of the tree. By early May the cavity contained a good layer of chips and appeared to be prepped for nesting. Although the birds appeared to be tree sitting during some visits, no eggs were laid.

Cluster S3-3

This is the second year that this cluster has been occupied during the breeding season. The male (AL/PU: DG/RY/OR) was from the 2015 cohort that was translocated from Carolina Sandhills NWR. This bird was half of the PBG located within S2-3 during the 2016 breeding season and moved to S3-3 in 2017 and bred successfully, producing 2 females. Running up to the breeding season there were two females including one of the birds (YE/DB/PK: PK/AL) produced in the cluster during the 2017 breeding season and a bird (AL/RE:LB/HP/DG) translocated during the fall of 2017 from Carolina Sandhills NWR. The male was roosting in T-101, the local female in T-103 and the translocated female in T-102. T-101 was the nest tree in 2017 and was in very good shape with extensive, active resin wells coming into the breeding season and later had some chips in the cavity. A great deal of scaling and resin-well work was done to T-102 running up to the breeding season and by early May the tree had a good amount of chips and appeared prepped for breeding. T-103 showed very little signs of work. Both the male and translocated bird were present in the area through the breeding season. It is unclear if the female produced in the cluster during 2017 remained within the cluster through the entire breeding season. Birds were rarely observed within the cluster during cavity checks but were often heard north near the road. Despite the preparation of the cavities, no eggs were laid.

Cluster S2-3

This is the third year that this cluster has been occupied during the breeding season. During the 2016 breeding season, the site was occupied by male (AL/PU: DG/RY/OR) and female (AL/PU: OR/DB/LG). Both of these birds were from the 2015 cohort that was translocated from Carolina Sandhills NWR. No breeding attempt was documented despite consistent monitoring. This female disappeared from the site during the fall of 2016. The male had moved to S3-3 by the winter of 2016. The 2017 breeding female and male were from the 2015 and 2016 cohorts respectively and had been translocated from Carolina Sandhills NWR. Both of these birds were present during the 2018 breeding season. The breeding female (AL/PU: YR/LG/RY) was present throughout the northwest quadrant of the study area throughout 2016 and had settled in S2-3 by the winter 2016 survey. Following translocation, the breeding male was roosting in YCC1 and moved over to S2-3 just before the breeding season. The male was roosting in T-49 and the female was roosting in T-48 in 2017 and 2018. The nest cavity in 2017 was T-48. The birds produced three eggs in 2017 but no young hatched. Early in the breeding season a second female (AL/RE:DB/WH/PK) was also roosting within the cluster in T-50/T-46. T-48 had considerable resin well work running up to the breeding season but no chips were added to the cavity. Birds were rarely in the cluster area during cavity checks. The group within this cluster has never appeared to be cohesive and birds come into the site to roost from

different directions and at different times implying that they are not moving or foraging together in the afternoon. Despite the birds being present during the breeding season, no eggs were laid.

Population Monitoring

During the calendar year of 2018, 18 individual red-cockaded woodpeckers were identified within the Great Dismal Swamp NWR (Table 2). This includes two birds from the 2015 translocation cohort, one bird from the 2016 translocation cohort, seven birds from the 2017 translocation/local productivity cohort and eight birds from the 2018 translocation cohort. Two birds were lost between the 2017 winter survey and the 2018 spring survey. This included the breeding female (AL/PU:WH/YE/YE) from S3-3 that was translocated in 2015 and a male (YE/WH/BK:PK/AL) translocated from Piney Grove Preserve in 2017 that had been roosting in C3-1.

Ten birds were detected during the spring 2018 census including two from the 2015 cohort, one from the 2016 cohort and seven from the 2017 cohort (Table 2). This included three males and seven females. All of the males and five of the females were associated with PBGs. Two females were roosting together with no male in YCC1. The population supported three PBGs into the breeding season compared to two during the breeding season of 2017 and only one during the 2016 breeding season.

Eleven birds were detected during the 2018 winter survey (Table 2). This compares to seven in 2015, eight in 2016 and twelve in 2017 (Table 2). Included were two birds from the 2015 translocation cohort, one bird from the 2016 cohort, four from the 2017 translocation cohort, one bird produced locally in 2017 and three birds from the 2018 translocation cohort. There were four males included in the winter count including the three males associated with PBGs in 2018 and a male from the 2018 cohort that was roosting in S2-3. Of interest is that the breeding male ((AL/PU:DG/RY/OR) from the 2015 cohort was roosting in both S3-3 (T-101) where he produced young in 2017 and in a completed natural cavity in S3-2. Both of these clusters have resident females. During the winter survey a pile of fresh red-cockaded woodpecker feathers was found in C3-2 at the base of T-115. The identity of the bird could not be determined.

Table 2. Occurrence of individual red-cockaded woodpeckers within the Great Dismal Swamp NWR during winter and spring surveys. Presence is indicated by cluster and roost tree codes (cluster, roost tree).

USGS	Left Leg	Right Leg	Cohort	Sex	Winter 2015	Spring 2016	Winter 2016	Spring 2017	Winter 2017	Spring 2018	Winter 2018
2651-13366	WH/RE/WH	AL/RE	2015	M							
2651-03124	AL/PU	OR/LG/LB	2015	M	S2-3, T50						
2651-03069	AL/MV	OR/HP/YE	2015	M	S3-2, T27						
2651-03051	AL/PU	OR/DB/LG	2015	F	S2-3, T47	S2-3, T50					
2651-13336	OR/YE/OR	LG/AL	2015	F	YCC1, T04	YCC1, T02	YCC1, T02				
2651-03019	AL/PU	WH/YE/YE	2015	F	C3-1, T31	C3-1, T31	C3-1, T31	S3-3, T102	S3-3, T102		
2651-03119	AL/PU	DG/RY/OR	2015	M	S2-3, T48	S2-3, T48	S3-3, T101	S3-3, T101	S3-3, T101	S3-3, T101	S3-3, T101
2651-03221	AL/PU	YR/LG/RY	2015	F	S2-3, T49	S2-1, T51	S2-2, T63	S2-3, T48	S2-3, T48	S2-3, T48	S2-3, T48
2651-03370	AL/YE	WH/RY/PU	2016	M							
2651-03404	AL/YE	LG/YR/HP	2016	F							
2651-03330	AL/YE	LB/YE/DB	2016	F							
2651-03319	AL/YE	HP/HP/LG	2016	M							
2651-03411	AL/YE	DB/YE/RY	2016	M							
2651-03333	AL/YE	HP/YR/DG	2016	M							
2651-03309	AL/YE	OR/LB/OR	2016	M			YCC1, T01				
2655-03414	AL/YE	RY/YE/LG	2016	F			C3-3, T006				
2651-03344	AL/YE	YE/YR/YE	2016	F			C2-3, T121	S2-3, 50			
2651-03358	AL/YE	PU/YE/YR	2016	M			YCC1, T02	S2-3, T49	S2-3, T49	S2-3, T49	S2-3, T49
2421-02968	GY/DB/LG	PK/AL	2017	F							

USGS	Left Leg	Right Leg	Cohort	Sex	Winter 2015	Spring 2016	Winter 2016	Spring 2017	Winter 2017	Spring 2018	Winter 2018
2651-03675	AL/RE	WH/RY/DG	2017	M							
2651-03772	AL/RE	YR/YR/YE	2017	M							
2651-03764	LG/LB/YE	AL/RE	2017	M							
2421-02965	YE/WH/BK	PK/AL	2017	M					C3-1, T31		
901-29850	YE/DB/PK	PK/AL	2017	F					S3-3, T103	S3-3, T103	
2651-03660	AL/RE	DB/WH/PK	2017	F					S2-3, T50	S2-3, T46	
901-29849	YE/DB/WH	PK/AL	2017	F					C3-3, T011	C3-3, T011	C3-3, T010
2651-03670	AL/RE	LB/HP/DG	2017	F					S3-3, T102	S3-3, T102	S3-3, T102
2651-03784	AL/RE	HP/DB/OR	2017	F					YCC1-T01	YCC1,T01	YCC1,T01
2651-03714	AL/RE	YE/DB/RY	2017	F					YCC1-T02	YCC1-T02	S2-2,T64
2651-03655	AL/RE	DB/YR/YR	2017	M					C3-3, T009	C3-3, T009	C3-3, T011
2641-58950	LB/PU/LB	LB/AL	2018	F							
2651-03877	AL/DP	DB/LB/YR	2018	M							
2701-94028	AL/DP	HP/YE/YE	2018	M							
2421-02994	LB/YE/LB	AL/DB	2018	M							
2421-02991	YE/WH/YE	AL/LB	2018	F							
2701-79461	RE/YE/RE	LG/AL	2018	M							S2-3,T50
2701-94017	AL/DP	RY/DB/WH	2018	F							S3-2,T29
2651-03842	AL/DP	LB/LG/YR	2018	F							YCC1,T02

Translocation

Two translocation events were executed during the fall of 2018 including a move of four birds (2 females and 2 males) from Carolina Sandhills NWR and two birds (1 female and 1 male) from Palmetto-Peartree Preserve on 26 October and two birds (1 female and 1 male) from Piney Grove Preserve on 8 November (Table 3). Both of these events were scheduled following two rounds of intensive identification of target birds and location of roost trees. Birds were captured successfully following roost entry, placed in transport boxes, driven to Great Dismal Swamp NWR, placed in artificial inserts and screened in cavities for the remainder of the night. Birds were released the following morning by pulling screens and allowing the birds to fly out. All birds were translocated and released without incident. Birds were released into three clusters including C2-2, C3-1 and S3-1.

Table 3. Individual red-cockaded woodpeckers translocated to Great Dismal Swamp NWR during the fall of 2018. Donor sites included Carolina Sandhills NWR (CSNWR), Piney Grove Preserve (PGP) and Palmetto-Peartree Preserve (P3).

USGS	Left Leg	Right Leg	Release Date	Donor Site	Donor Cluster	Release Cluster
2701-79461	RE/YE/RE	LG/AL	10/26/2018	P3	23	C2-2
2641-58950	LB/PU/LB	LB/AL	10/26/2018	P3	42	C2-2
2651-03842	AL/DP	LB/LG/YR	10/26/2018	CSNWR	09-01	C3-1
2651-03877	AL/DP	DB/LB/YR	10/26/2018	CSNWR	09-01	C3-1
2701-94028	AL/DP	HP/YW/YW	10/26/2018	CSNWR	13-05	S3-1
2701-94017	AL/DP	RY/DB/WT	10/26/2018	CSNWR	08-11	S3-1
2421-02994	LB/YE/LB	AL/DB	11/8/2018	PGP	11	C2-2
2421-02991	YE/WH/YE	AL/LB	11/8/2018	PGP	19	C2-2

Cavity Tree Status

A total of 65 woodpecker cavities had been created within the study area on the Great Dismal Swamp NWR by the end of 2018 (Table 4). This includes 32 artificial cavities that were installed in 2015, 21 that were installed in 2016, nine that were installed in 2017 and one that was installed in 2018. Two natural cavities have been excavated by woodpeckers. Three cavity trees were lost in October of 2016 during Hurricane Matthew, six cavity trees were lost in March of 2017 during high-wind events and three cavity trees were lost during a high-wind event in February of 2018. In addition, a natural cavity was lost during the February storm and a tree was lost to lightening strke during the fall of 2018. To compensate for losses, an artificial cavity was installed during the fall of 2018 (cluster S3-3). The second completed natural cavity (S3-2) was being used in December of 2018.

Table 4. Condition and observations of red-cockaded woodpecker cavities within the Great Dismal Swamp NWR during December 2018.

Cluster	Tree ID	Tree Species	Condition	Type	Established	Cavity Seal	Observations
C2-2	T-20	Pond Pine	Live	Insert	2015	Dry	P. Ivy seeds
C2-2	T-21	Pond Pine	Live	Insert	2015	Dry	Clean
C2-2	T-22	Pond Pine	Live	Insert	2015	Dry	Clean
C2-2	T-23	Pond Pine	Live	Insert	2015	Dry	Clean
C2-3	T-120	Pond Pine	Live	Insert	2016	Dry	Paper Wasps
C2-3	T-121	Pond Pine	Lost 3/2017	Insert	2016	-----	-----
C2-3	T-122	Pond Pine	Live	Insert	2016	Dry	Cobwebs
C2-3	T-123	Pond Pine	Live	Insert	2016	Dry	Straw
C2-3	T-124	Pond Pine	Live	Insert	2017	Dry	P. Ivy seeds
C3-1	T-31	Loblolly Pine	Live	Insert	2015	Dry	Clean
C3-1	T-32	Loblolly Pine	Live	Insert	2015	Dry	Clean
C3-1	T-33	Loblolly Pine	Live	Insert	2015	Dry	Clean
C3-1	T-34	Loblolly Pine	Live	Insert	2015	Dry	Clean
C3-2	T-110	Pond Pine	Lost 3/2017	Insert	2016	-----	-----
C3-2	T-112	Pond Pine	Live	Insert	2016	Dry	P.W. and M.D.
C3-2	T-113	Pond Pine	Lost 2/2018	Insert	2016	-----	-----
C3-2	T-114	Pond Pine	Dd 12/2018	Insert	2016	-----	-----
C3-2	T-111	Pond Pine	Live	Insert	2016	Dry	Paper Wasps
C3-2	T-115	Pond Pine	Live	Insert	2017	Dry	Straw
C3-2	T-116	Pond Pine	Live	Insert	2017	Dry	Mud Daubers
C3-3	T-006	Pond Pine	Lost 3/2017	Insert	2016	-----	-----
C3-3	T-007	Pond Pine	Live	Insert	2016	Dry	Mud Daubers
C3-3	T-008	Pond Pine	Lost 3/2017	Insert	2016	-----	-----
C3-3	T-009	Pond Pine	Live	Insert	2017	Dry	Clean
C3-3	T-10	Pond Pine	Live	Insert	2016	Dry	Clean
C3-3	T-11	Pond Pine	Live	Insert	2017	Dry	Clean
S2-1	T-51	Pond Pine	Live	Insert	2015	Dry	Mud Daubers
S2-1	T-52	Pond Pine	Live	Insert	2015	Dry	Mud Daubers

Cluster	Tree ID	Tree Species	Condition	Type	Established	Cavity Seal	Observations
S2-1	T-53	Pond Pine	Live	Insert	2015	Dry	Mud Daubers
S2-1	T-55	Pond Pine	Live	Insert	2015	Dry	Mud Daubers
S2-2	T-61	Pond Pine	Lost 10/2016	Insert	2015	-----	-----
S2-2	T-62	Pond Pine	Live	Insert	2015	Dry	Mud Daubers
S2-2	T-63	Pond Pine	Lost 3/2017	Insert	2015	-----	-----
S2-2	T-64	Pond Pine	Live	Insert	2017	Dry	Clean
S2-2	T-65	Pond Pine	Live	Insert	2015	Dry	Mud Daubers
S2-2	T-66	Pond Pine	Live	Insert	2017	Dry	Cobwebs
S2-2	T-67	Pond Pine	Lost 2/2018	Natural	2017	-----	-----
S2-3	T-46	Pond Pine	Live	Insert	2017	Dry	Clean
S2-3	T-47	Pond Pine	Lost 10/2016	Insert	2015	-----	-----
S2-3	T-48	Pond Pine	Live	Insert	2015	Dry	Clean
S2-3	T-49	Pond Pine	Live	Insert	2015	Dry	Clean
S2-3	T-50	Pond Pine	Live	Insert	2015	Dry	Clean
S2-4	T-130	Pond Pine	Live	Insert	2016	Dry	Paper Wasps
S2-4	T-131	Pond Pine	Live	Insert	2016	Dry	Paper Wasps
S2-4	T-132	Pond Pine	Live	Insert	2016	Dry	Paper Wasps
S2-4	T-133	Pond Pine	Live	Insert	2016	Leaked	Paper Wasps
S3-1	T-56	Loblolly Pine	Live	Insert	2015	Dry	Cobwebs
S3-1	T-57	Loblolly Pine	Live	Insert	2015	Dry	Clean
S3-1	T-59	Pond Pine	Live	Insert	2015	Dry	Clean
S3-1	T-58	Loblolly Pine	Live	Insert	2015	Dry	Clean
S3-2	T-27	Pond Pine	Live	Insert	2015	Dry	Clean
S3-2	T-28	Pond Pine	Lost 10/2016	Insert	2015	-----	-----
S3-2	T-29	Pond Pine	Live	Insert	2015	Dry	Mud Dauber
S3-2	T-30	Pond Pine	Live	Insert	2015	Dry	Clean
S3-2	T-31	Pond Pine	Lost 2/2018	Insert	2017	-----	-----
S3-2	Nat	Pond Pine	Live	Natural	2018	Dry	Clean
S3-3	T-100	Pond Pine	Lost 2/2018	Insert	2016	-----	-----
S3-3	T-101	Pond Pine	Live	Insert	2016	Dry	Clean

Cluster	Tree ID	Tree Species	Condition	Type	Established	Cavity Seal	Observations
S3-3	T-102	Pond Pine	Live	Insert	2016	Dry	Clean
S3-3	T-103	Pond Pine	Live	Insert	2016	Dry	Clean
S3-3	T-104	Pond Pine	Live	Insert	2018	Dry	Clean
YCC1	T-01	Pond Pine	Live	Insert	2015	Dry	Clean
YCC1	T-02	Pond Pine	Live	Insert	2015	Dry	Clean
YCC1	T-03	Pond Pine	Live	Insert	2015	Dry	Cobwebs
YCC1	T-04	Pond Pine	Live	Insert	2015	Dry	Clean

The majority of cavities continue to be in good condition during 2017 (Table 4). Only one cavity had any indication of recent water. The single largest cavity problem continues to be the construction of mud dauber nesting tubes. Ten of the artificial cavities had dauber tubes during the last assessment. This problem is consistent with observations in 2016 and 2017. Although this problem has been documented in other populations the frequency is high and appears to be somewhat specific to the swamp ecosystem. The nesting tubes are constructed in mid to late summer after the breeding season suggesting that a late summer to early fall management period may effectively reduce potential impacts to birds. However, during the summer of 2018 five artificial cavities were completely filled with tubes to the point that material could not be removed in place. We are contemplating removing these inserts and replacing them with new boxes. Seven inserts had large infestations of paper wasps. The first indication of this activity was documented during the 2017 translocation in cluster S3-1. In early November of 2018, the inside of six cavities was completely covered with congregations of wasps. We do not know if these represent congregations of males with unfertilized females or congregations of overwintering fertilized females. We are exploring this issue and possible options for management.

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