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Final Report to:

Department of Game and Inland Fisheries
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RCWO Contract ED0816db.a98

Submitted by:

Center for Conservation Biology
College of William and Mary
Williamsburg, Virginia

Principle Investigator:
Dana S. Bradshaw

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THE CENTER FOR CONSERVATION BIOLOGY AT WILLIAM & MARY

THE CENTER FOR CONSERVATION BIOLOGY IS A NOT-FOR-PROFIT ORGANIZATION DEDICATED TO FINDING PRACTICAL SOLUTIONS TO CURRENT ENVIRONMENTAL PROBLEMS BY INTEGRATING RESEARCH, EDUCATION AND MANAGEMENT. ONLY THROUGH THE EXCHANGE OF INFORMATION AND IDEAS MAY WE HOPE TO MAINTAIN THE RICH DIVERSITY OF THE MID-ATLANTIC REGION.

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Introduction

For the first time in Virginia's history, a Red-cockaded Woodpecker site has been purchased for long term management and protection. In addition, the site has been made ready to accommodate increasing population growth, through either productivity and recruitment, or outright translocation of birds from another source. Talks have also been underway to assess variable stragegies for engaging private landowners in the business of Red-cockaded Woodpecker conservation. Therefore, a great priority has been placed on the need to assess the current status of the birds and their habitat as a first step toward moving the conservation of this species into the new millenium.

It was with these issues in mind that this project evolved to undertake the challenge of re-asssessing the status of Red-cockaded woodpeckers and their habitat for the first time in 20 years. The project was designed to revisit the 1977/78 survey effort with slightly expanded coverage and decisively better survey tools. The current effort makes use of complete aerial photo and USGS topo coverage to comprehensively evaluate and survey ,where appropriate, relevant portions of the counties of Greensville, Southampton, Sussex, Prince George, Surry, and Isle of Wight, plus the cities of Suffolk, Chesapeake, and Virginia Beach. Only with a complete and current knowledge of the status and distribution of Red-cockaded Woodpeckers can any meaningful conservation effort begin to move forward.

Objectives

1. Identify and evaluate all accessible pine habitats capable of supporting Red-cockaded Woodpeckers (RCW) within the study area.

2. Map all currently suitable RCW habitats identified above, including a general description of stand size, speciation, condition, and age class.

3. Survey all sites identified above for evidence of past or present RCW occupancy.

4. Document numbers and status of Red-cockaded Woodpeckers and cavity trees at all sites where evidence of activity is found.

5. Document evidence observed of southern pine beetle or other infestations.

6. Through review of historic records and the activities described above, map and record all evidence of past and present RCW acitivity within the study area.

7. In addition, map and describe as above all habitats which appear likely to provide suitable trees for RCW cavity excavation within the next 20 years.

Background

Developing a Habitat Profile.

Cavity Trees

For nest and roost use, RCWs require older pines for cavity excavation. Age is important for three reasons. First, cavities can only be excavated into the dead heartwood of the tree, a component that does not reach suitable dimensions until the tree matures. Based on results from Francis Marion National Forest, average cavity diameters equaled 10 cm, suggesting a recommended heartwood diameter of 15 cm to ensure successful excavation (Hooper et al, 1991). As the heartwood to sapwood ratio increases with age, a certain threshold age becomes important to ensure overall tree dimensions large enough to support a cavity. The ages in question assume an average of about 70+ years for loblolly pine and 90+ for longleaf (Conner & Locke, 1982).

Secondly, advanced age further predisposes the tree to infection from pine red heart disease, a fungal infection that decays the heartwood, further enhancing the ability of RCWs to excavate cavities. Red heart fungi typically enter the tree through a broken limb stub or other injury (Steirly, 1957), thereby placing the usual origin of heartwood decay well up the bole of the tree, already in optimum position for cavity excavation. Red-cockaded Woodpeckers have been shown to selectively choose trees infected with red heart for cavity excavation over similar aged non-infected trees (Hooper et al, 1991). Abandoned start cavities are often the result of Red-cockadeds beginning a cavity excavation, then abandoning the effort when they find no evidence of heart rot once they penetrate the outer sapwood. When in an advanced stage, red heart disease is occasionally detectable on the tree exterior when it produces spores through an external sporophore that protrudes through the bark in a fungal outgrowth called a "conk" (Steirly, 1957). The conk is usually black or gray in appearance, resembling a mushroom.

While red heart is a natural phenomenon of senescent trees, its introduction can also be facilitated by other stressors such as high stocking density or poor site quality (Wahlenberg, 1960). Densely planted trees that do not undergo early thinnings and are therefore suppressed for a number of years are likely candidates for red-heart intrusion at an earlier age than normal. These trees are therefore subject to selection by Red-cockadeds for cavity excavation as readily as taller or older trees if red-heart is not prevalent among the more vigorous stems. The same is true for pines grown in poor soils which may show reduced girth and height from reduced nutrients, ultimately making them early candidates for red-heart infection.

A third importance of advanced tree age is advanced height (Jackson & Jackson, 1986). Assuming normal healthy pine stands, RCW cavity trees tend to be taller than random trees, which provides greater flexibility in cavity placement. In longleaf pine habitats cavity height is important as a preventive

measure against ignition of resin flow during fire events. Cavity tree mortality from fire is an important issue in more southern habitats because of the more copious resin flow from longleaf pines as opposed to other pine species. In loblolly habitats, tree height becomes important in order to enable cavities to be excavated above any encroaching midstory component. Assuming tree diameter is sufficient and heart-wood decay is prevalent throughout much of the bole, cavity height is often correlated with midstory height. RCWs have throughout their range exhibited a negative response to advancing midstory (Hooper et al, 1980; Conner & Rudolph, 1989; Kalisz & Boettcher, 1991). In addition to increasing the danger from fire, an advanced midstory component is thought to predispose cavity trees to greater predation risk as well as increased competition for nest cavities from other avian cavity nesters (Walters, 1990). Where habitat is limiting, Red-cockadeds' first response to an encroaching midstory is often to excavate new cavities higher on the tree, often on the same tree. It is not unusual to find two or more cavities on a single tree, typically only one of which is in use at any one time. When midstory height overtakes cavity height, the birds typically will abandon the area and seek a more open habitat for nesting. Where habitat is limited, the birds will often move their cavities to the edges of the stand to take advantage of the open area associated with an edge. This is typically a last resort. Based on several woodpecker groups that have adopted this strategy in Virginia, if cavities located on the edge of a forest stand are found to be abandoned, there is little hope of finding a new colony site within the forest interior (Bradshaw, pers. obs.)

Although RCWs select the oldest trees for nesting, these trees can be embedded in a younger stand. Most cavity trees in many populations of this species are remnant seed trees left from an era when stand regeneration was accomplished in this manner. This places a premium on examining what appears to be moderately-aged pine stands for the presence of relict seed trees that could be harboring active cavities.

Territory Characteristics and Foraging Habitat

Studies on small, isolated clusters of RCWs in east Texas have suggested that forest removal within 800 meters of active sites is positively correlated with small group size (Connor & Rudolph, 1991). However, Rudolph & Connor's (1994) reasoning is based on what they perceive as reduced dispersal efficiency rather than loss of foraging habitat.

Distances between the colony site and outer foraging boundaries tend to vary based on habitat quality and time of year. In both longleaf and loblolly habitats red-cockadeds have been observed to forage as far as 1.1 km away from their roost trees during the winter (Bradshaw, 1990; Nesbitt et al, 1978). As regards other aspects of landscape configuration and red-cockaded woodpecker occupancy little work has been done in this area. The RCW Recovery Plan (USFWS, 1985) however, recommends that foraging stands be no further than 5 chains apart (330 feet) based on what biologists perceive as a

threshold distance beyond which red-cockadeds are reluctant to cross if the intervening habitat is open land. Wood and Kleinhoff (1995) have subsequently secured approval from the Fish and Wildlife Service to grant Georgia Pacific permission to allow foraging habitat breaks not to exceed 10 chains (660 ft). This was based on personal observations by Wood and others within the Fish and Wildlife Service who had observed RCWs crossing large open areas to reach additional foraging habitat. Work on two clans in Virginia has shown that red-cockadeds will travel as far as 600 meters across non-forageable habitat to reach additional foraging areas (Bradshaw, 1990). In one case birds moved out to an unimproved secondary road and followed the road through a bottomland hardwood forest to reach an upland pine site 530 meters away. In the other case, birds traversed a 5 year old pine plantation to reach another mature pine site 600 meters from the forest edge of their departure stand. In this situation, the birds made use of several dead hardwood snags as waypoints across the field, at which they all (3 birds) regrouped at each tree before embarking on the next leg.

Given an upper one-way travel limit of approximately 1 km, in conjunction with potential habitat breaks of up to 600 meters, one has to ascertain that there is remaining in the landscape an adequate amount of forageable habitat to support a group of birds. If it can be assumed that winter home ranges typically exceed breeding season ranges, then there should be at least enough habitat to support birds through a winter season based on winter home ranges from that geographic area and general habitat type. For Virginia, results from 6 RCW groups monitored in the 1980s, showed an average winter home range of 120 ha, with a minimum value of 84 ha (Bradshaw, 1995). This contrasts with a Southeast region-wide average of 85 ha (S.D. 48.8; range 14.4 - 213.2 ha), including all pine habitats (McFarlane, 1995). Smallest reported home ranges were from the Carolina Sandhills region where 20 ha winter ranges were observed among groups within a dense RCW population (Sherril & Case, 1980). These values correspond to a large degree with habitat quality. The Sandhills region is a fire maintained community with little competition from hardwood encroachment and large blocks of mature timber. Virginia is characterized by a mosaic of agriculture, pine plantations, and the occasional old growth natural pine stand that is giving way to hardwood succession. As a result, if birds are surviving in these suboptimal habitats they must be sustaining themselves within these relatively loose aggregations of forageable habitat.

Methods

Survey Tools and Techniques

Aerial Photos

Acquisition of suitable resolution aerial photography is an invaluable first step towards identifying suitable RCW habitats and targeting specific search areas for ground surveys. Although black and white photography is useful in comparing tree crown dimensions for a rough measure of age classes, color-infrared allows for greater separation between tree species and therefore a quicker, more accurate index to potentially suitable habitats. For field work, aerial photography is most useful when combined with USGS topo maps. Photo interpretation is done using predefined search criteria, then target areas are mapped on corresponding field topos for ground truthing and subsequent search effort if applicable.

For assessing red-cockaded woodpecker habitat it is most useful to derive a habitat profile signature from the photos by first reviewing sites of known RCW presence. If enough sites are available, it should be possible to at least refine the image of what suitable habitat looks like relative to general stand characteristics like stem density, average crown size, proportion of hardwood, etc. More difficult attributes to assess would be issues of habitat fragmentation, or other perceived landscape disturbances. It has been shown that natural habitat breaks typically serve as barriers to red-cockaded movement within a given territory. Examples include large drainages that typically involve changes in cover type, as well as large open areas that offer no protection from avian predators. As a result, an active RCW site should afford access to suitable foraging habitats free of any natural barriers and all within a reasonable distance of each other.

For the purposes of this project, habitats were evaluated on 1:10,000 scale color infrared aerial photos and ranked according to the following methodology. First, each USGS 7 1/2 minute topo was gridded off with a pencil and ruler along its respective UTM coordinates, producing a grid of square cells each containing one square kilometer in area. Data sheets were then designed to record information at the level of each 16 cell (4x4) grid block. A 16 square km area was deemed the most efficient area at which to view and interpret without undue visual fatigue. Acetate overlays were generated and gridded off at a scale corresponding to a 16 cell UTM grid block on the aerial photos. The gridded overlays were then placed on each aerial photo and the underlying photo was then interpreted on a cell by cell basis corresponding to the 16 cell blocks on the data form. Each data form was designed to accommodate information on four 16 cell grid blocks, or a 64 sqare kilometer area. It took an average of about 45 minutes to complete one aerial photo with times ranging from 30 to 75 minutes depending on the heterogeneity of the habitat.

Within each grid cell, a numeric/numeric, or numeric/alpha value was generated to describe the habitat according to the following criteria. The first value ranked the habitat within each cell according to its suitability for cavity trees.

0 = no suitable habitat;
1 = >10 large, mature pines w/i a 500 meter radius;
2 = > 5 hectares of large pines, or a situation preferable for a colony site. *

* Identifying characteristics of this type of habitat would be the presence of supercanopy trees, or trees with exceptionally large crowns relative to surrounding trees; also the appearance of a less dense stand or a stand with random gaps or openings in its interior (as might occur when tree mortalities create daylight openings in the canopy).

The second value in each rank was based on the remaining habitat in terms of its potential as additional nesting or foraging habitat, either currrently, or within the next 20 years. To be ranked, habitat must be within 1 kilometer of the cavity tree habitat and cannot be separated by gaps that exceed 500 meters in width. The ranks are described as follows:

0 = unusable = < 40 hectares of pine timber within 1 kilometer of cavity tree habitat;
1 = marginal potential = 40 - 70 ha of pine timber with 40% at least 30 years of age;
2 = potential = > 70 ha with 40% > 30 years of age;
3 = usable = 40 - 70 ha at least 30 years of age;
4 = preferred = > 70 ha pine timber > 30 years of age with 40% > 60 years.

If the habitat within each cell was unsuitable for RCWs for reasons other than age or acreage, an alpha value was inserted as the second value as a habitat descriptor in the form of **A**(agriculture), **H** (hardwood), **Y** (young pine plantation or clearcut), **W** (open water or swamp), **D** (developed), etc.

Aerial Surveys

Where large land areas or areas that are inaccessible on the ground are a prominent feature of a red-cockaded survey effort, Jackson (1985) offers the use of fixed wing aircraft as a viable alternative in suitable habitats. His protocol is based on certain visual references associated with red-cockaded woodpecker ecology. First, there is usually a coating of high visibility resin both above and below the cavities of active RCW trees. The longer the cavity has been in use, the more pronounced the candled effect tends to be. The dried resin is also apparent for years after abandonment assuming no additional external disturbances. Secondly, the birds tend to select cavity trees in relatively open stands, or within openings in denser stands. A third reference point is the fact that the species almost invariably excavates cavities

below the lowest branch. And finally, there are usually multiple cavity trees per group of birds, only one of which needs to be spotted.

Jackson (1985) recommended a flight altitude of approximately 150 meters at a speed of about 60 knots in either a Cessna 150 or 172. For increased success he suggested double coverage of an area using perpendicular transects on calm, overcast, winter days. His tests using untrained observers were remarkably successful suggesting this technique as a viable option in some cases. Where a hardwood midstory or pine regeneration layer has advanced to cavity height aerial observations would probably experience diminished success. However, this may be the only practical option in habitats that cannot be accessed on the ground.

Taped Vocalization Playbacks

Like most territorial passerines, red-cockaded woodpeckers will respond aggressively to conspecifics within their territory. As a result, tape playbacks of vocalizing RCWs can be an effective tool for locating birds. Nesbitt et al (1982) used tape recorded Red-cockaded vocalizations to call birds back to their cavity trees where they then captured the birds in suspended mist nets. They found the technique worked throughout the year, but the birds were most responsive in the months just prior to nesting. They found that the birds would return to the roost area from as far as .5 km away and up to 5 hours after they had left the roost area in the morning, although the response was more predictable earlier in the day.

Use of tape playbacks in Virginia has shown a similar response near the onset of breeding season. Both clans and single birds have shown an aggressive response toward perceived conspecifics in their territory. Given the positive response to this technique in Florida (Nesbitt et al, 1982), it appears to be a viable option for both determining the activity status of an uncertain colony as well as determining the existence of a colony site in areas that are difficult to access on the ground.

Foot Surveys

The most dependable survey technique for locating both active and historical colony sites is a foot survey making use of transect lines to canvas an entire forest stand. To maximize success for this technique, surveys should be conducted along north - south transects whenever possible and should not be conducted in, or immediately after a rain. The north-south line increases the probability of looking to the side and spotting a cavity with its associated resin wells, since the cavities are typically oriented along a southwest azimuth. Rather than shifting one's view from side to side while moving forward, this observer has concluded that more area can be searched more effectively by concentrating one's efforts only to the eastern side of the transect. This typically results in more "hits" at greater distances through the forest, since the search effort can be concentrated to the side with the greatest likelihood of spotting a cavity. In the afternoon, the effectiveness of this technique is increased when the sun shifts toward the west thereby

more effectively illuminating the majority of resin wells associated with a typical cavity. In strong afternoon sunlight it is difficult to see at all toward the west for more than a few meters, making a one-direction approach the only prudent policy.

Distance between transects is based on habitat quality. In open pine stands characteristic of some of the fire maintained southern forests, one can adequately survey all stems within 100 meters of the transect. This distance can drop to 30 meters or less in suboptimal habitats with an advanced midstory component. In Virginia, a good rule of thumb has been to start with about a 40 meter separation and adjust as necessary. The need to avoid rain, or post-rain, conditions is based on the shadowing effects that rain creates on trees often inviting a number of "false positive" sightings. Even in apparently windless conditions, rain tends to wet one side of a tree more than the other. This creates an illusion that makes the dry side of a tree look white in the distance, or like it has an abundance of flowing resin wells. The resulting confusion, although only temporary, can be frustrating resulting in lost search time.

Additional details that must be evaluated and reconciled include the workings of other animals on pine trees that may mimic red-cockaded woodpecker activity. Yellow-bellied sapsucker drillings may induce resin flow in pines, but such workings almost invariably follow the typical pattern of horizontal rows of holes. These may be within 1 meter of the ground or anywhere to the top of the tree. Red-cockadeds however rarely forage close to the ground, and their foraging technique is comprised of prying, or flicking off bark plates to access the arthropods beneath. Aside from the occasional hammering during certain forms of social contact, the only "drilling" that Red-cockaded Woodpeckers do is involved with the routine production and maintenance of resin wells that are concentrated most heavily in the areas immediately surrounding the cavity, but may be placed several meters away both up and down the tree as well as completely around the bole. These resin wells are typically comprised of tightly spaced pecking holes that usually extend for two or three inches in a somewhat semicircular pattern. From these "divots" as they have been described, the resin flows freely and produces the candled appearance indicative of RCW cavity trees.

Several species of beetles, both friend and foe, bore into pine trees and may induce resin flow from the tiny holes that they produce. Some species of *Cerambycid sp.* beetles overwinter under pine bark in this fashion, but pose no problems to the tree. On the other hand, at least 3 groups of pine pest species attack pines with varying degrees of damage (Wahlenberg 1960). Most common among these are the Southern pine beetles, which can, and frequently do, kill their pine hosts. These insects bore into the bark, and then feed on the sapwood underneath, leaving small tunneled trails under the bark. Their point of entry into the tree is usually marked by small resinous protuberances on the bark exterior that often look like popcorn. All such observations should be recorded and mapped as encountered. This is often the first sign of inevitable mortality.

Pileated Woodpeckers often select a tree injury site to exploit for potential prey. Lightning strikes, limb breaks, and beetle entrances are all candidates for Pileated feeding sites. Once there they will hammer at the site and often open it up until it looks almost like a cavity entrance. The Pileated's signature work however is always characterized by roughly hewn edges and usually results in something of a shield shape: a flattened top edge with rounded sides leading to a pointed bottom. Pileateds frequently enlarge Red-cockaded Woodpecker cavities in this manner, always hammering down from above, first from one side then the other. The net effect is to square off the hole at the top and bring it to a point at the bottom, all the while enlarging the sides to where it becomes unusable to Red-cockadeds.

Jackson (1978) suggests that Red-cockaded foraging areas can often be identified by the reddish bark on commonly visited trees. Their habit of prying off bark plates reveals a reddish unweathered plate beneath. Where Red-cockadeds commonly feed, the trees can all take on something of a reddish appearance relative to surrounding areas. However, in areas where there is a substantial midstory component, or even hardwood codominants, these signs are less useful. Storm events can remove a lot of bark from the constant striking of trees against each other. Breaking limbs can also scar up the side of a tree as they fall to the ground, leaving fresh reddish bark exposed.

Although foot surveys are clearly the most dependable means to locate cavity trees, they are time intensive and so should not be employed until other site criteria have been met. For the purposes of this project, several site characteristics were investigated first, upon visiting a habitat patch on the ground, to ensure the appropriateness of a foot survey. Any access signs or timber company markings were noted to determine access privileges. If the site was still present, cores were then taken of at least 5 trees to ascertain a general age class. Within a reasonable distance of the observer, selected trees included the two largest trees, the two trees that appeared to be the oldest based on bark characteristics, and one random tree. If no trees exceeded seventy years in age, no ground search was conducted and the site was listed as potential (within 2 decades). If one or more trees exceeded 70 years by a small margin, there was a cursory survey done of the stand to look for the presence of older seed trees or any obvious signs of woodpecker activity. If one or more trees exceeded 80 or more years of age, there was a thorough survey done of all standing timber within the stand.

Results

Historical Evidence

Strangely, the 1910 AOU Checklist listed the range for Red-cockaded Woodpeckers in the state as "southwestern Virginia". This must have stemmed from early observations by Bailey (1913), later reported on more fully in his book. These birds were undoubtedly associated with the small population known to inhabit southeastern Kentucky however, and should not be thought of as representing a continuum of Red-cockadeds across the state.

More puzzling is probably the first record of a specimen collected in Virginia, by C.W. Rives in Albemarle County in 1887 (Murray, J.J. 1952). No additional details seem to be available on that encounter, so it is difficult to determine the origin of the bird. It could have been a bird on the move from west to east or vice versa, but there is no indication that there was ever a breeding population in Albermarle County. A breeding record for the species was not actually documented in the state until Gould and Bailey confirmed an active nest cavity in the vicinity of Norfolk in 1912 (Bailey, H.H. 1913). Murray (1952) went on to reference rare but widespread observations across southeastern Virginia from Richmond south to Brunswick County and east to the Eastern Shore. Unfortunately, there are no specific locations for these early records.

Steirly (1957) was one of the first to accurately describe the natural history of the species and went on to provide useful population information on Red-cockadeds for southeastern Virginia. As a county forester, he became interested in the uniqueness of the species both from its live tree cavities as well as its social nature. As a result, he went on to study the ecology of the species more closely and documented the only known sites from the 1940s and 50s. He published a crude map of 9 colony sites that had been discovered and/or monitored from the mid-1940s to the mid-1950s. In addition, he gave general geographic locations for some 13 additional sites that harbored at least one active cavity tree. The mapped locations that Steirly provided in conjunction with his verbal descriptions have been compared against topo maps and the memories of colleagues from this period to generate an estimate of some of the more important woodpecker locations. Seven of the best known of these sights are presented in Figure 1. Two sites not included are poorly described sites from central Prince George County and western Southampton County.

In 1977-78, Dr. Byrd, together with colleagues and graduate student Gary Miller, initiated the first ever regional survey for RCWs throughout the southeastern Coastal Plain. They conducted a roadside driving survey of all accessible roads in Sussex, Surry, and Isle of Wight Counties, as well as portions of Southampton and Prince George Counties. These surveys produced 44 sites that showed evidence of RCWs. Within Dr. Byrds data archives, one of Miller's original county maps was recently discovered yielding the locations of colony sites in Sussex County in the late 1970's. These locations are reproduced on the following page in Figure 2.

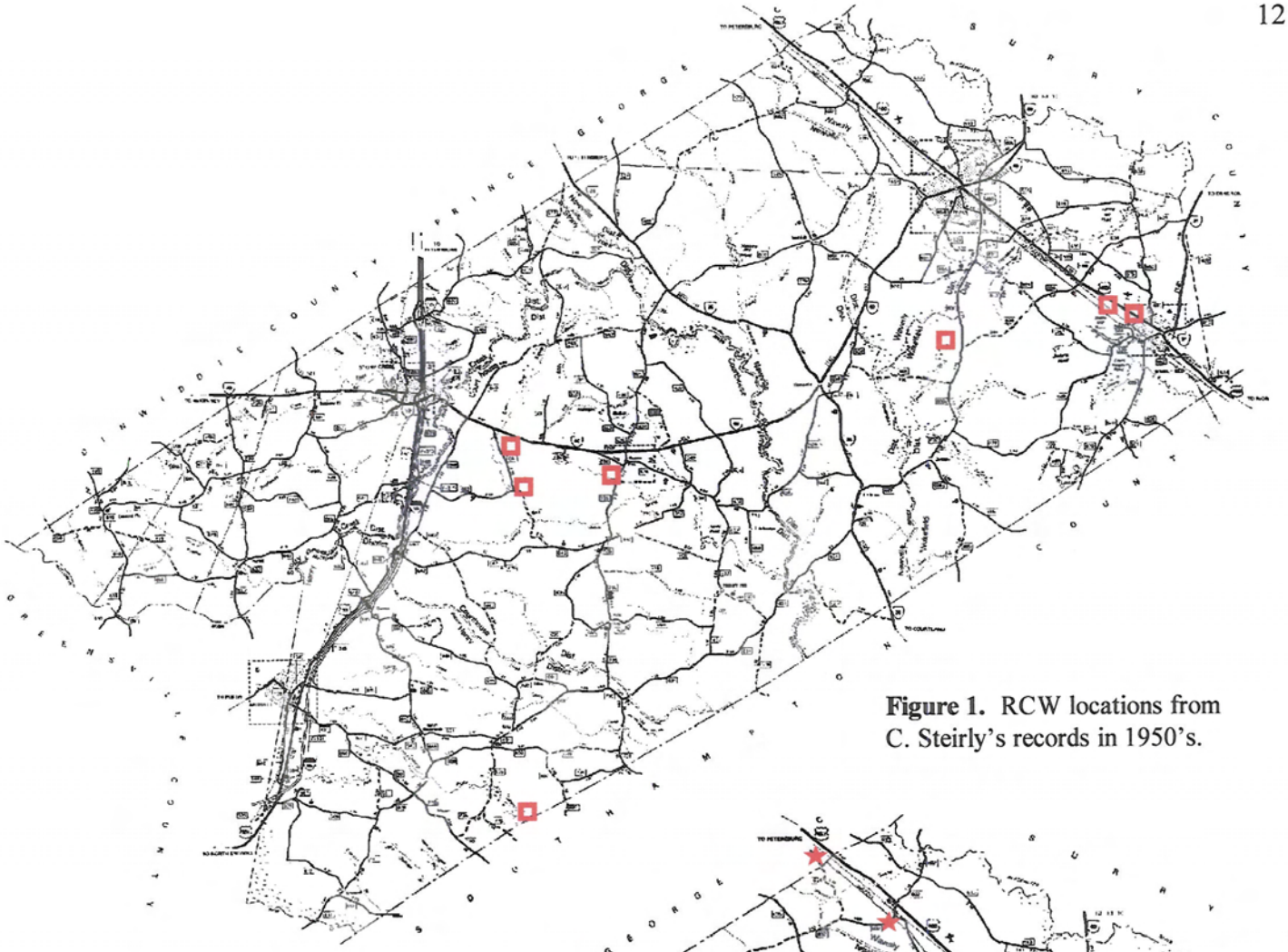


Figure 1. RCW locations from C. Steirly's records in 1950's.

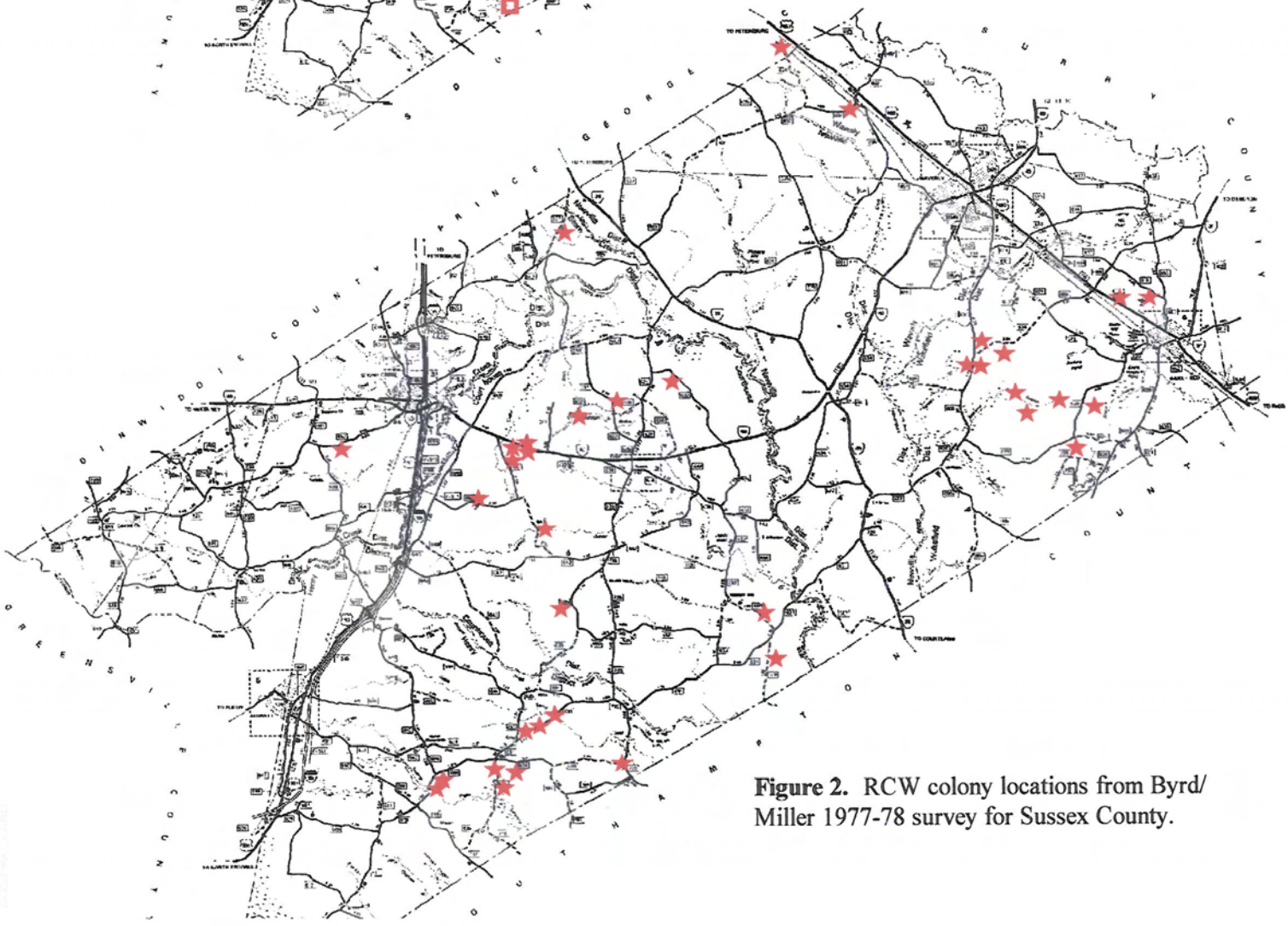


Figure 2. RCW colony locations from Byrd/ Miller 1977-78 survey for Sussex County.

Photo Interpretation

The first step to generating a search image for suitable habitat was to locate currently active colony sites to assess a habitat signature for Red-cockaded Woodpecker habitat. Examples of sites used are as follows:

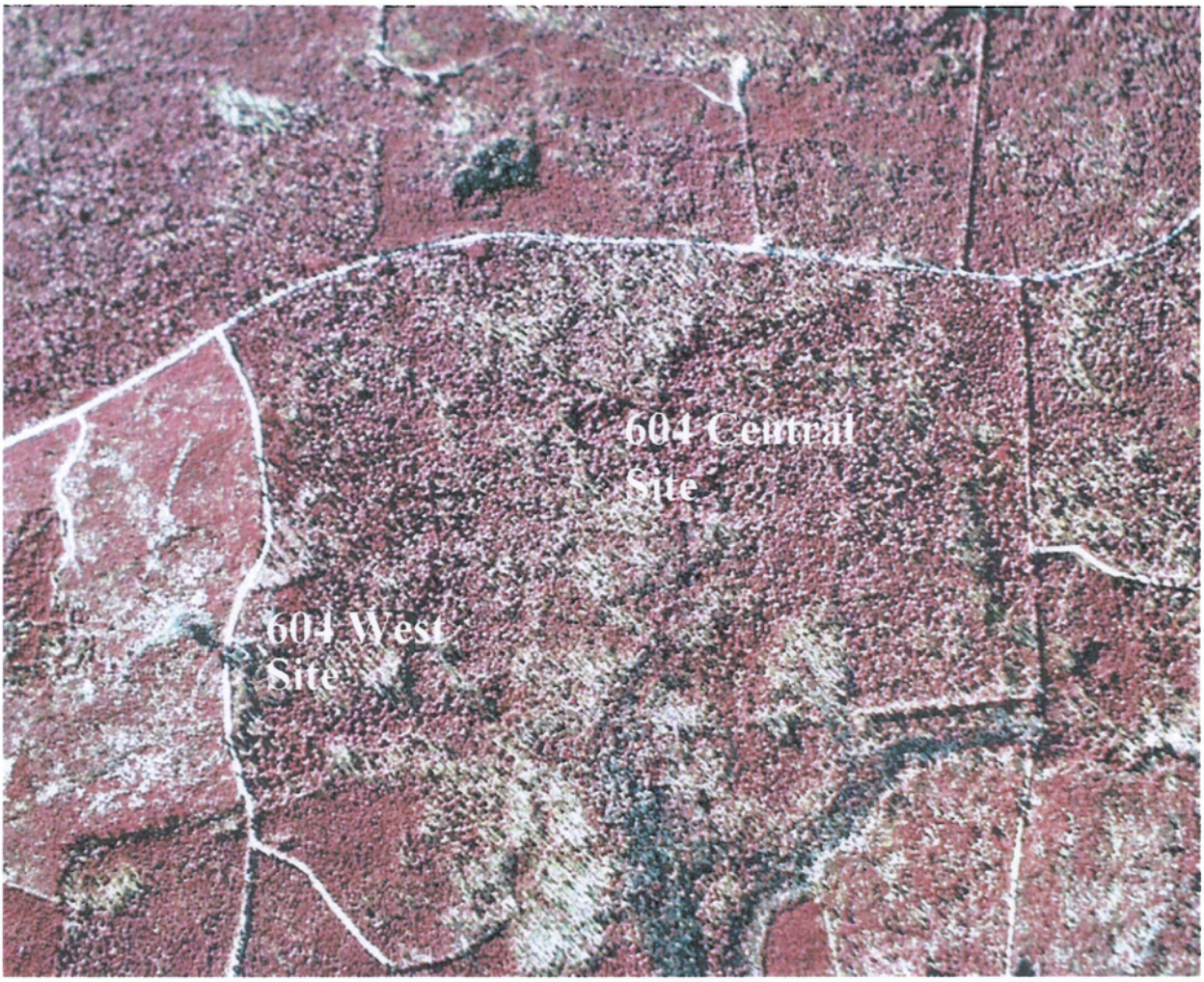


Figure 3. Route 604 in Sussex County provides the best example of good Red-cockaded Woodpecker habitat. Mature trees show individual rounded crowns with separation between trees.

Other more difficult habitats to assess are older pine stands that are now sharing canopy dominance with hardwoods. These stands were probably once fire maintained but then let go when the market for sawtimber started to deterioate. As a result, hardwoods have crept in and will eventually overrun the pine stand if not harvested first. The Rt. 612 site (Figure 4) in extreme southwest Sussex County is one of the last remaining examples of what was once a multi-thousand hectare old growth pine stand that is slowly giving way to hardwoods.

Figure 4. Route 612 Site on Sussex/ Southampton County line. Unfortunately, this site has been all but harvested now, but provides a valuable reference for old growth pine stands having been taken over by hardwoods. A lone Red-cockaded Woodpecker resides in the eastern finger of habitat that still remains.

Once an appropriate habitat signature was identified and then ground truthed for different age classes, the task of photo interpretation was begun. The survey area was bordered by the western boundary of Greensville County to the west, then I85 to Petersburg, and to the James River for the northern boundary; then south along the southern boundaries of Tidewater's urban centers to Virginia Beach at Back Bay. From there, the area of coverage went south to the North Carolina border for the southern boundary.

Figure 5 presents the survey area coverage by USGS topo maps.

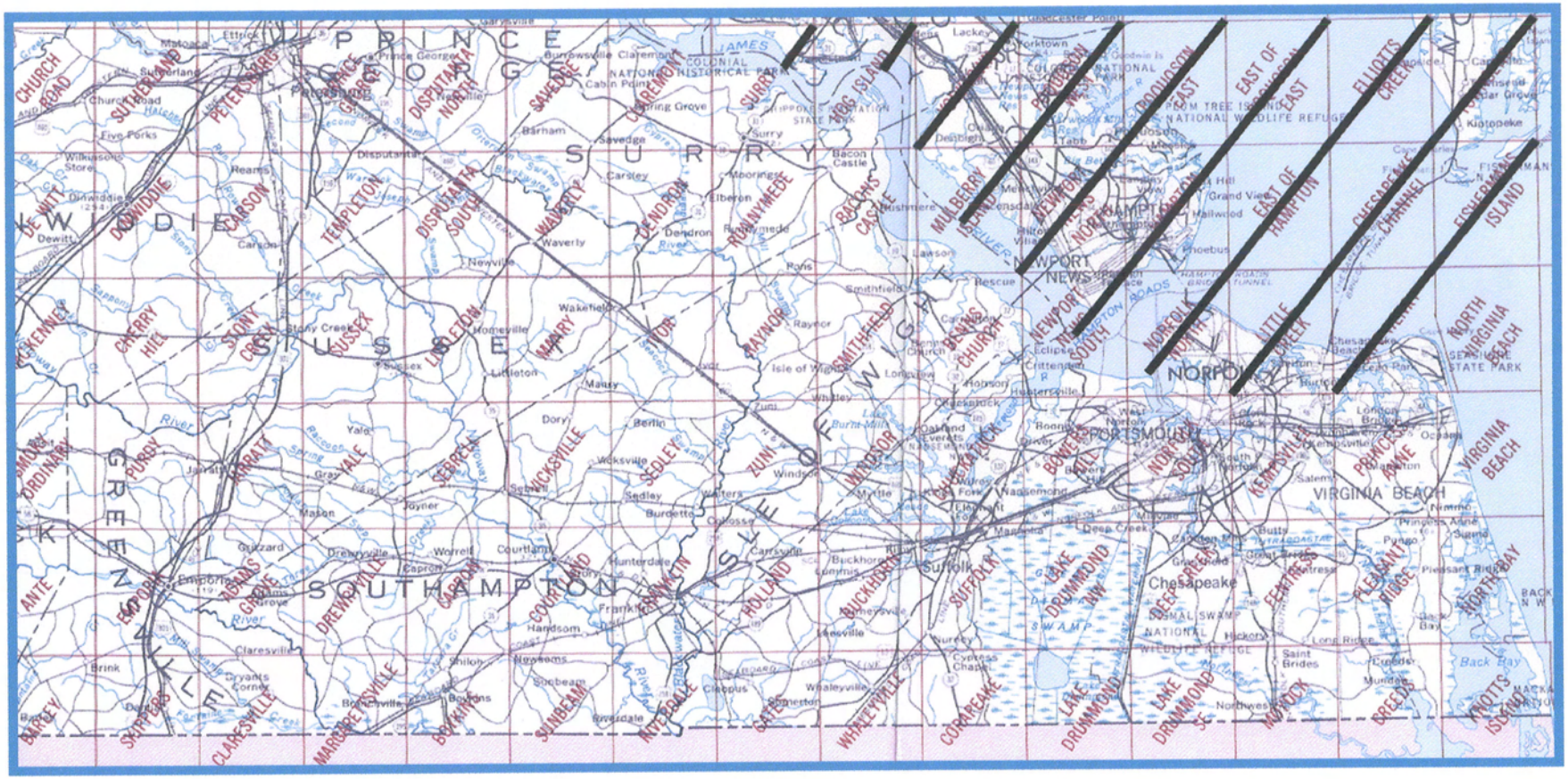


Figure 5. Topo map key to survey area. The area comprised most or all of 75 different USGS 1:24,000 topo maps as shown above.

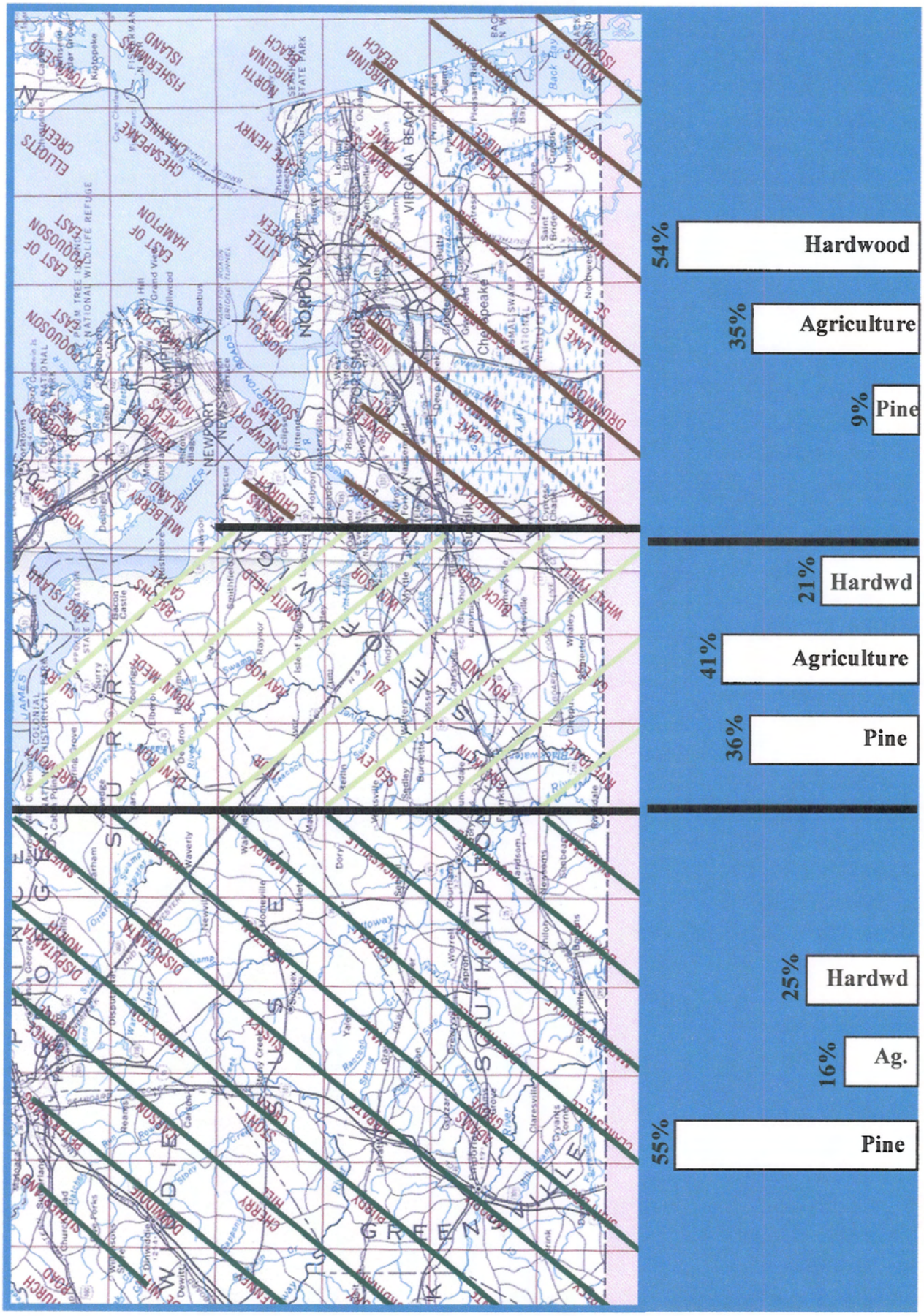


Figure 6. Broad Scale Cover Type Percentages Over Survey Area

Data was ultimately collected on 8725 square kilometers of land in southeastern Virginia. Most interesting was the striking pattern of land cover changes that emerged as the landscape was evaluated from east to west. Figure 6 illustrates the survey area in diagonal lines relative to changes in land cover percentages that were detected. Understandably, the easternmost lower Coastal Plain would be dominated by hardwoods and agriculture once free of urban influences. The Dismal Swamp would account for much of the hardwoods, along with the extensive drainages associated with the Northwest and North Landing Rivers, and most all other land area is tied up in farm fields. The interesting pattern however, is how distinct the break was between hardwoods and pines from one side of the survey zone to the other and the minimum agricultural component in the western half of the zone. These patterns no doubt have influenced the long term dynamics of Red-cockaded Woodpeckers in the state. And should be taken into consideration in any long term planning for the species.

The results of the aerial photo interpretation mirrored the landscape patterns closely with respect to where the majority of Red-cockaded Woodpecker habitat was located. Over 60% of the suitable habitat was identified within the western forested section as shown in Figure 6. Figure 7 illustrates the availability of potential habitats across the survey area as determined from the aerial photo interpretation.

Site Surveys

Prior to initiation of the survey effort, project staff met with John Carroll, regional forester for the Virginia Department of Forestry. Mr. Carroll is headquartered in Waverly and has extensive knowledge of forest resources in the southeastern corner of Virginia. When questioned about the status and distribution of old growth pine stands within his region, Mr. Carroll was reluctant to discuss the holdings of private landowners given the sensitive nature of endangered species issues. Rather than provide any pertinent site specific information, he did provide us with valuable information on some recent trends in pine timber management. Mr. Carroll reported that a large scale pine beetle outbreak in the central Piedmont area of Virginia in 1994 triggered a widespread harvesting frenzy among landowners throughout eastern Virginia. He stated that many small farms that had harbored relatively small, but old stands of pines, had resorted to harvesting for fear of losses to beetle infestation. He speculated that probably the majority of private, non-corporate landowners harvested any remaining old growth still under their ownership. Corporate landowners on the other hand, would have the resources to monitor stands and conduct small salvage cuts if necessary without having to harvest whole stands.

This may speak to the issue of why some 42% of all stands initially characterized as suitable for Red-cockaded Woodpeckers had been clearcut when visited in 1997. The aerial photos from which the stands were initially identified were taken in March of 1994, just prior to the beetle outbreak. This is troublesome in view of the fact that the bulk of all sites identified as potentially suitable were actually owned by timber companies, making the number of private, non-corporate sites (where ownership was determined) that had been clearcut nearly 100%.

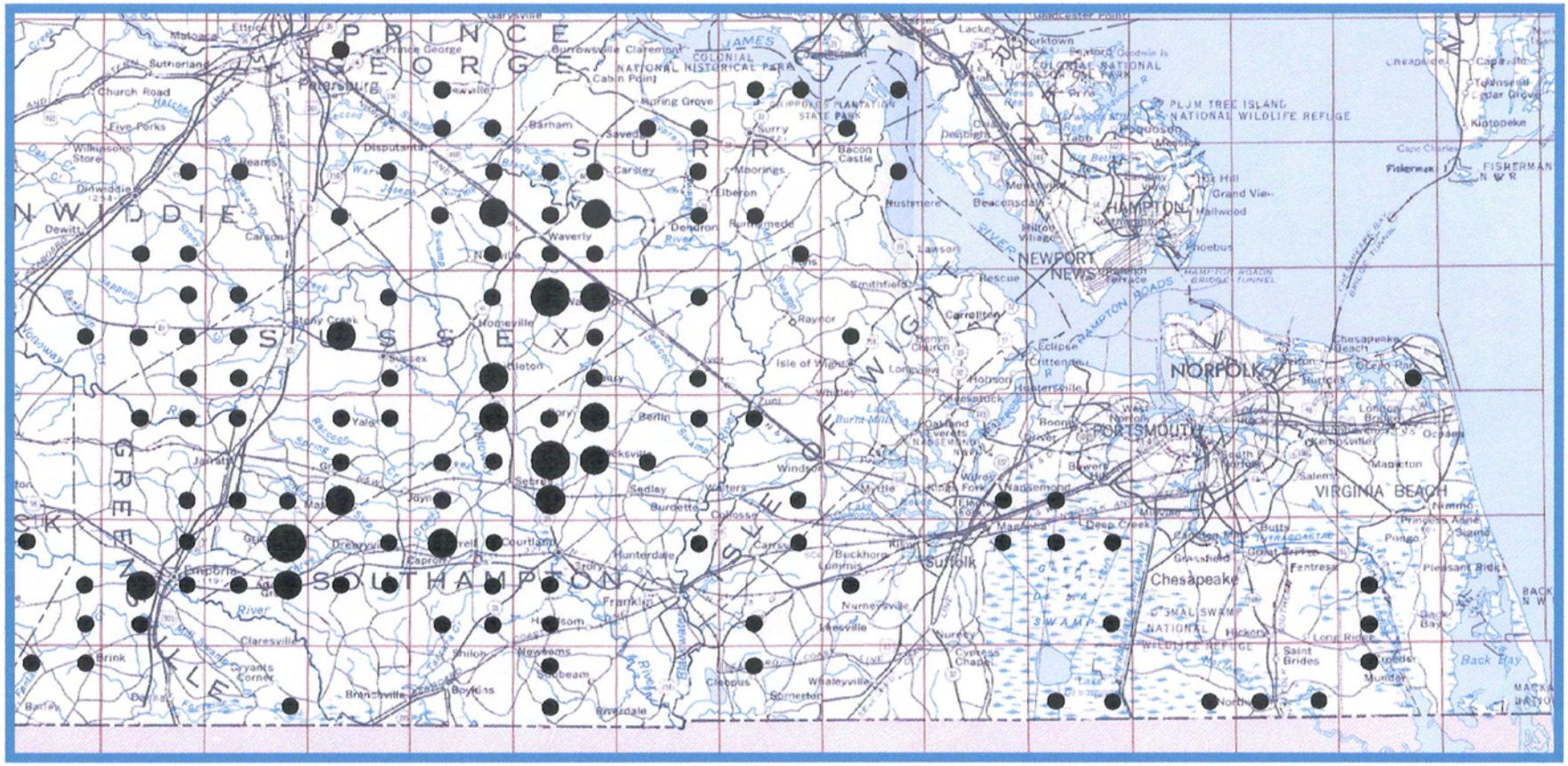


Figure 7. Density and location of potentially suitable RCW sites based on interpretation of aerial photography. Each dot describes a sixth of a topo quad, per Breeding Bird Atlas methodology. Each sixth of a quad comprises an area 25 square kilometers in size. The smallest dot denotes from 1-4 square kilometer blocks that include potential RCW habitat. (Suitable was defined as the presence of at least 5 hectares of old pines suitable for cavities plus a minimum of 40 hectares (~100 acres) of adequate foraging habitat.) The intermediate sized dot represents from 5-8 blocks that included potential habitat, and the largest dots indicated areas where there were more than 8 square kilometer blocks that harbored potential RCW habitat within that sixth of a quad.

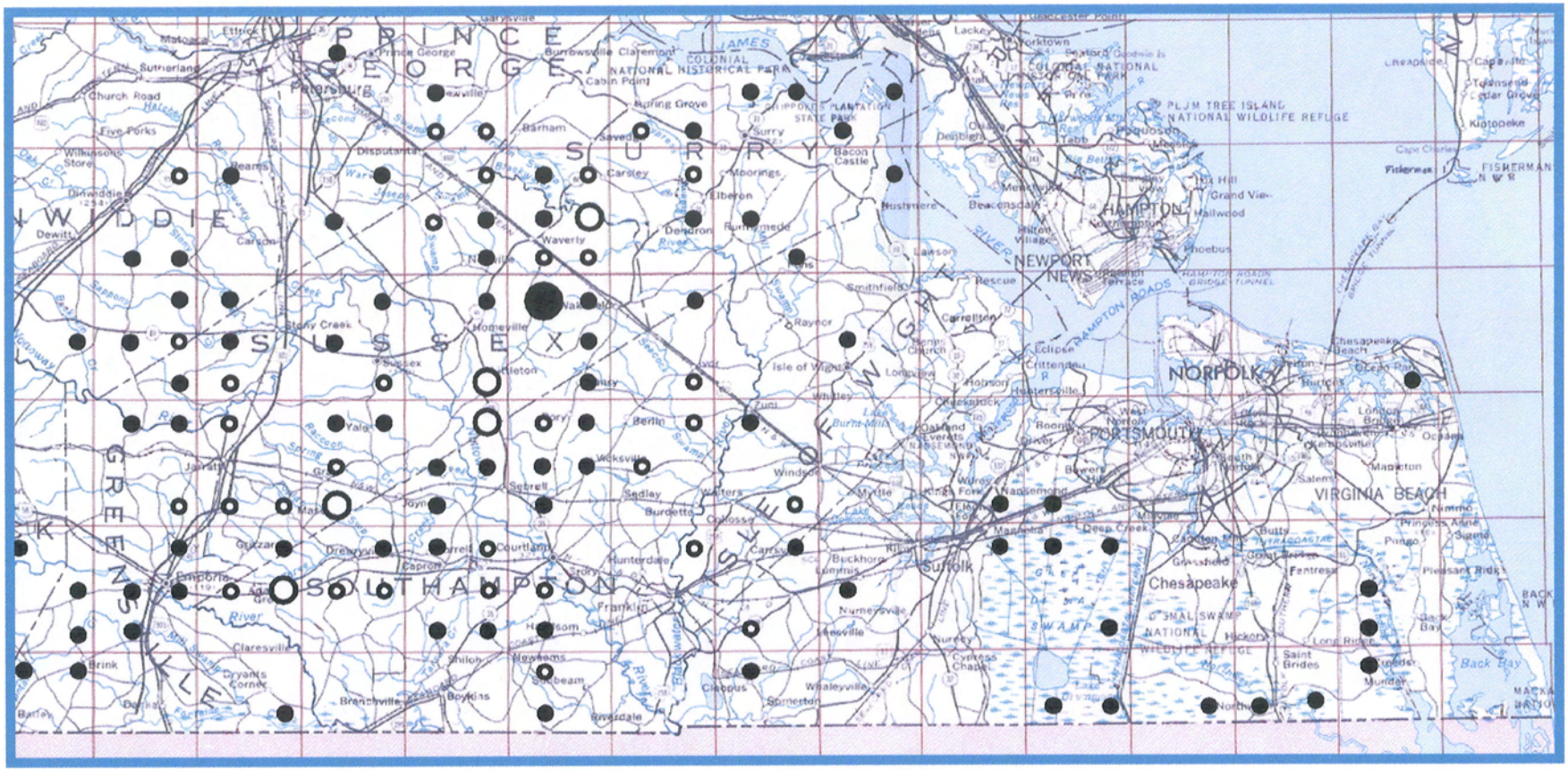


Figure 8. Density and distribution of suitable RCW habitat following ground surveys.
Empty circles here represent areas that have been entirely clearcut since the 1994 aerial photography.

Of the 235 potentially suitable habitat patches identified in the survey zone during the course of the study, over 80 had been clearcut by the time we made it into the field the first year, some three years after the photos had been taken. Of the remaining 155 over 40 more have been harvested in the last two seasons. Fortunately, we had been able to search over 85% of them before they were cut. All had 80 year old or older timber, but none showed evidence of RCWs. Approximately 60 of the remaining old-growth patches are incorporated in 3 to 4 large complexes of habitat spread across the western portion of the study area, as well as embedded in the swamps and pocosins of southeastern Tidewater. Of the remaining 55 blocks, 26-30 are either too disjunct from other suitable habitat now to be viable as woodpecker sites, or were marginal in stand age for current suitability. Another ten have been modified or partially harvested enough to compromise their value as suitable habitat. And from 12 to 15 sites were not visited either because of landowner access issues or habitat barriers.

In total, we searched just over 120 units of habitat comprising almost 3000 hectares. Another 25 stands were visited, deemed adequate in terms of stand age, but were given only a cursory search for historical evidence, because the surrounding timber stands had been harvested leaving an inadequate amount of foraging habitat. The cavity tree stands that had been identified in each case from the photos were all less than 20 hectares in size, making it necessary for the presence of additional support stands for foraging habitat. In summary, of the 8725 square kilometers evaluated by aerial photograph, only 235 of them yielded evidence of suitable Red-cockaded Woodpecker habitat, or less than 3%. By the

Aerial Surveys

Despite intensive ground efforts to check each candidate site, some habitats were still impossible to access. Foremost among those were the pocosin habitats of the North Landing and Northwest Rivers. Although RCW's had been recorded from the North Landing River as recently as 1980, there had been no ground effort to investigate them at any time. It was therefore decided that low level aerial surveys would be used to access these sites. During the Spring of 1998, the North Landing River was flown intensively for 2 hours. That time period enabled us to fly a complete grid pattern over the entire lower North Landing River pocosin. From an altitude of approximately 150 feet we were able to easily view the trunks of what we perceived were most of the suitable pines there. A number of cavities were spotted, some even with resin flow, but multiple passes seemed to confirm that all suspect cavities were the work of Pileated woodpeckers or normal tree injuries. The site quality did not appear to be very suitable for RCW foraging or nesting. There were few mature trees and all were characterized by relatively small diameters, as is typical of pond pine. The trees were not dispersed homogeniously across the landscape either, but rather were consolidated in ridges surrounded by dense hardwood shrub subcanopies, as shown in Figure 9 on the following page.

From there we moved over to the Northwest River. Although the Northwest River harbors more typical loblolly pine stands, these were too overshadowed by hardwoods to gain adequate visual access in many cases. Among the pocosin habitats, suitable pines were primarily limited to linear bands running along the channel edge. Although suitable age and stature, these trees appeared to provide an insufficient

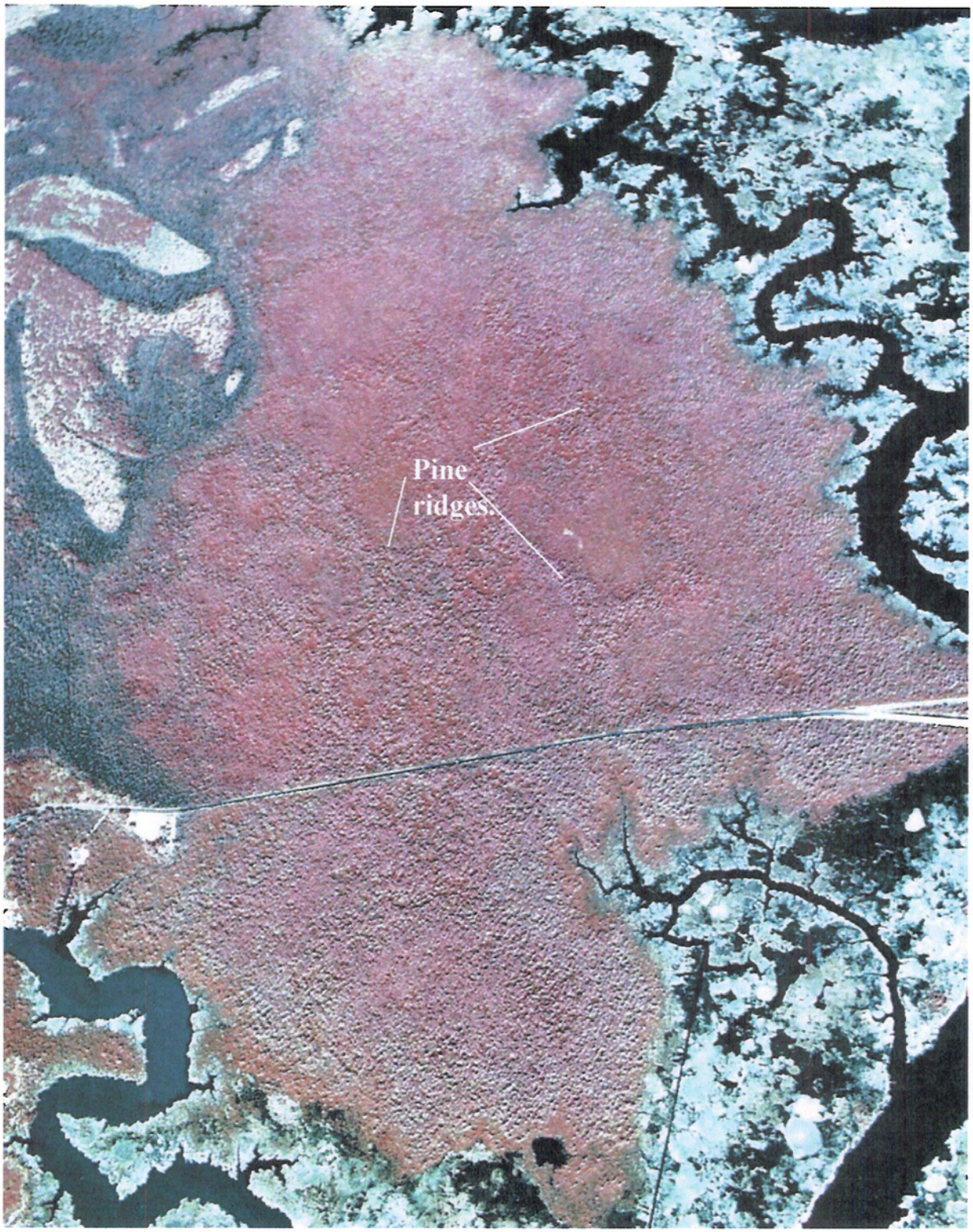


Figure 9. Lower North Landing River pocosin habitat. Mature pines are consolidated along ridges embedded in dense hardwood shrub layer. Last RCW's apparently observed from bridge in 1980. The angular shaped upland area to the immediate west has some excellent mature pine habitat, and was searched on foot, but yielded no evidence of woodpecker activity.

source for long term habitat needs. As both of these rivers flow toward North Carolina the habitat improves, but at the expense of widending gaps between forest patches. Once at the Carolina line, all that remains are disjunct habitat islands linked in a staggered fashion along the river, (Figure 10).

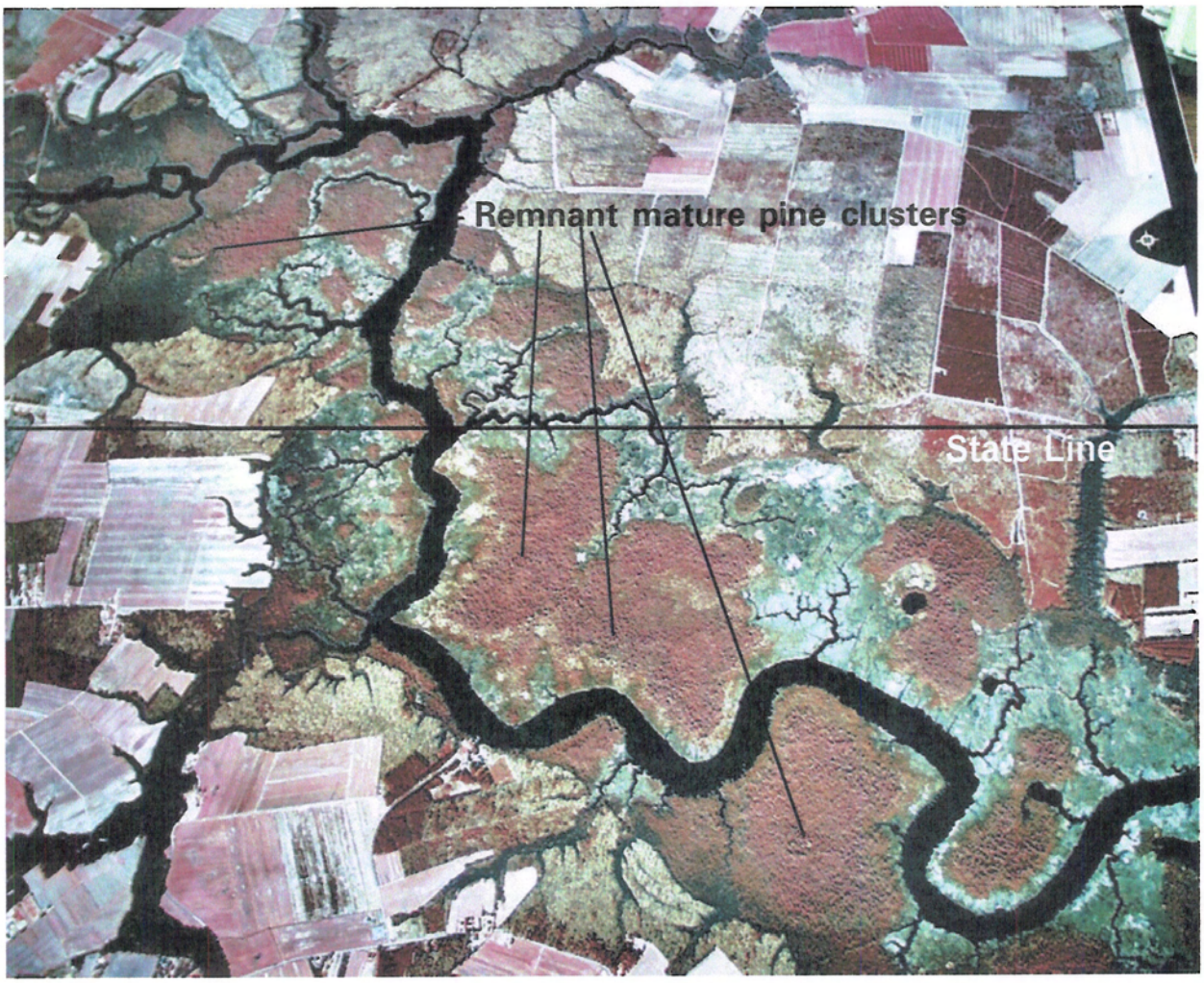


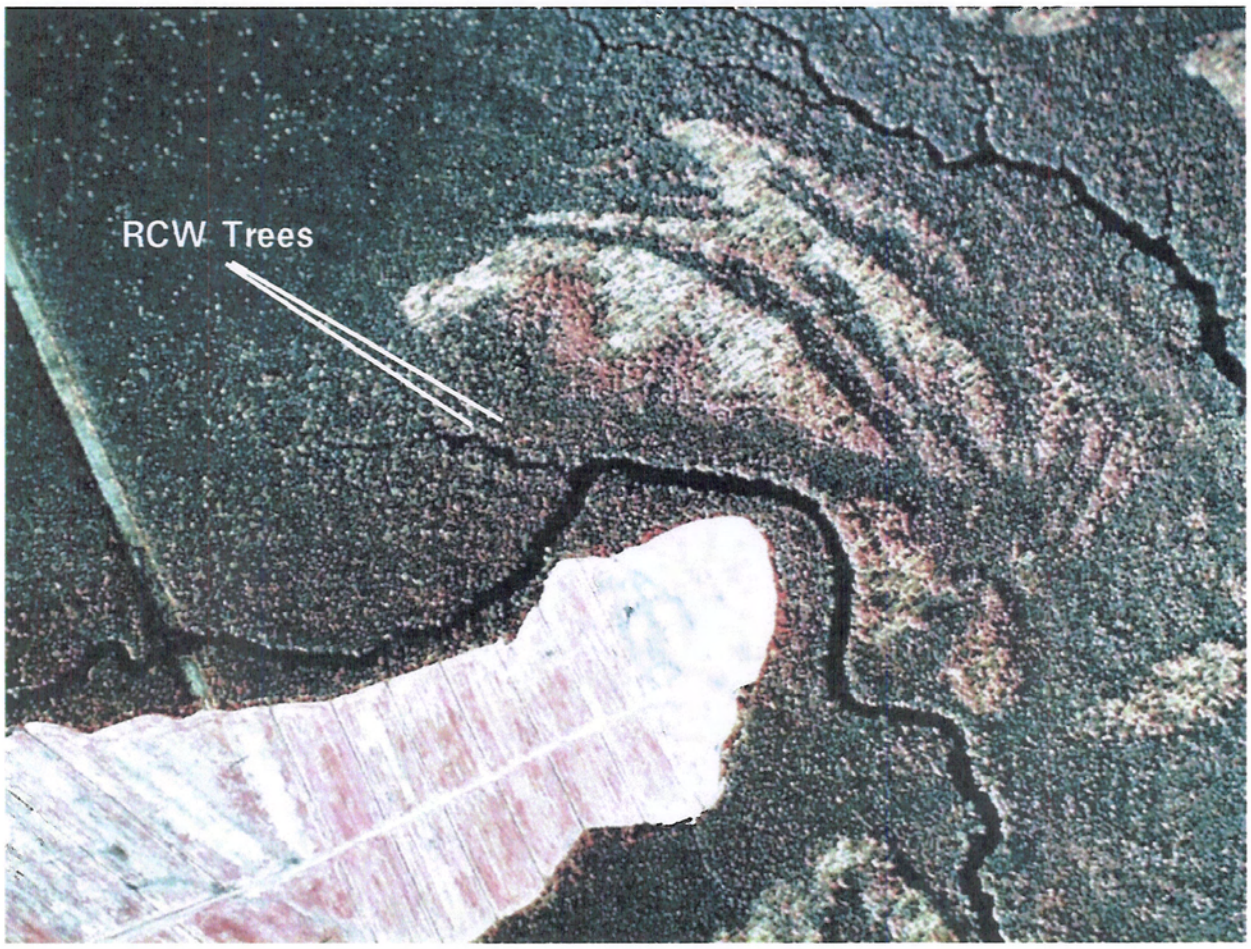
Figure 10. Lower Northwest River showing small pockets of mature pine embedded in island pocosins as the river approaches, and enters, North Carolina.

The striking characteristic of Figure 10 above, and Figure 9 to a lesser extent, is the solid corridor of agriculture that borders each river, another negative attribute to the quality of these sites as Red-cockaded Woodpecker preserves.

Management and Planning Considerations

Despite an intensive effort to categorize and evaluate the pine forest cover of southeastern Virginia it certainly cannot be said that there are no longer birds out there waiting to be discovered. The possibility for this species to exist in a degraded, fringe habitat for long periods of time has shown itself a number of times already in Virginia. The recurring presence off and on in the North Landing River pocosins through the 1970's and into the 80's is surprising. The presence of a single bird in Grafton, Virginia through a winter in 1985, and more recently, a bird in Lancaster county on Mosquito Point in the winter of 1996 make it seem like there must be a number of individuals still wandering the landscape looking for conspecifics. Still more impressive was the location during the late winter of 1998 of a recently active colony of Red-cockadeds along the Northwest River in a narrow fringe of pines. Although we had indicated this habitat as suitable for the species in terms of its age, we were not dedicating survey time to it for what seemed like obvious reasons. It was embedded in a hardwood swamp and there appeared to be minimum pine habitat available to sustain a clan of birds. Figure 11 best illustrates these unlikely conditions and serves as an example of how these birds can survive undetected for years at a time in unexpected habitats.

Figure 11. RCW Cavity Trees embedded in a hardwood swamp along Northwest River.



Existing Suitable Habitat

In summary, of the 8725 square kilometers evaluated by aerial photograph, only 235 of them yielded evidence of suitable Red-cockaded Woodpecker habitat, or less than 3%. By the time ground searching was underway, this number had dwindled to 155 sites, of which ultimately only 120 habitat patches were searched. As of mid 1999, there existed only 4 discreet complexes of habitat of the magnitude necessary to support a clan of Red-cockaded Woodpeckers. Foremost of those is the Route 604 area in Sussex County, a portion of which has been purchased by The Nature Conservancy. Figure 12 depicts why this site is so valuable. The area is centered around a thousand plus acre stand of mature pine capable of supporting multiple clans of birds. Adjacent to this in every direction are continuing stands of variable age classes, broken only by intermittent mature stands again, collectively providing a model environment from which to manage a core population of this species for many decades.

Figure 12. 604 Site - Premier RCW site in Virginia. Over a thousand hectares of old-growth pine timber still present in loose aggregations along Routes 604 and 606 in Sussex County, Manry Quadrangle

Secondary to this area lies another site still under management by RMS Inc. that holds the next single greatest possibility of sustaining birds for an undetermined amount of time. Although the core site is only a couple of hundred acres now, it is adjacent to regenerating stands that will be suitable for foraging in less than 10 years.

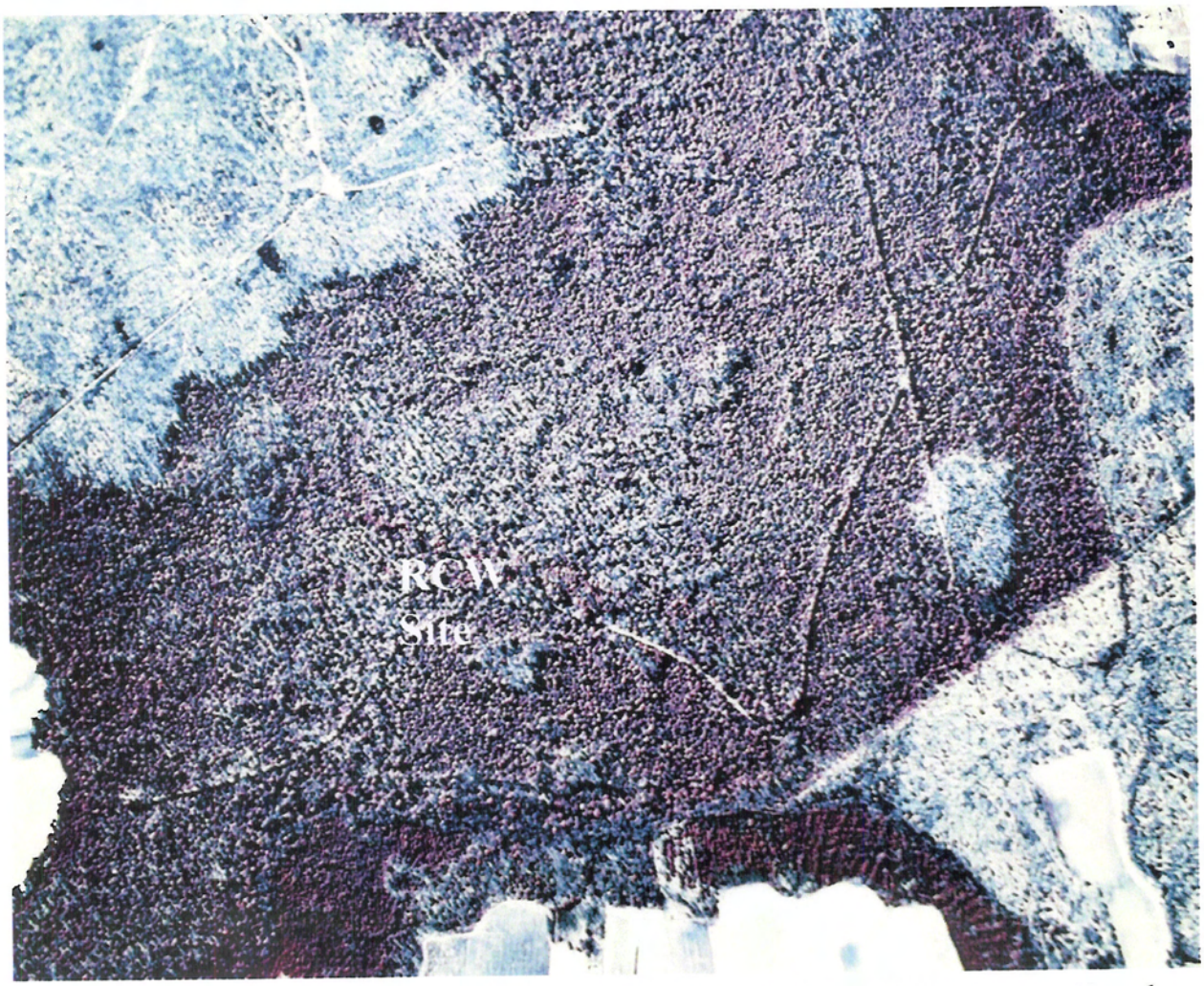


Figure 13. Route 35 Site - A hundred plus hectares of old growth pine remaining along Rt. 35 on the Sussex / Southampton County border, Sebrell Quad. In addition, this site lies less than 5 kilometers from the historic Rt. 608 site due west across the Nottoway River. All hardwoods were removed in a thinning operation over a year ago and the stand is currently open and park-like with a single RCW present. First discovered in 1995, this site harbored a clan of 3 birds that produced two young before abandoning, probably due to hardwood encroachment. RMS removed the hardwoods, but not in time to lure the birds back apparently. Although after an absence of two years, a lone bird showed up in the winter of 1998/99 and still resides on the site.

Decreasing in size and significance is a third site, that although smaller than the others, still yields old-growth pines and an assortment of variable aged pine stands around it.

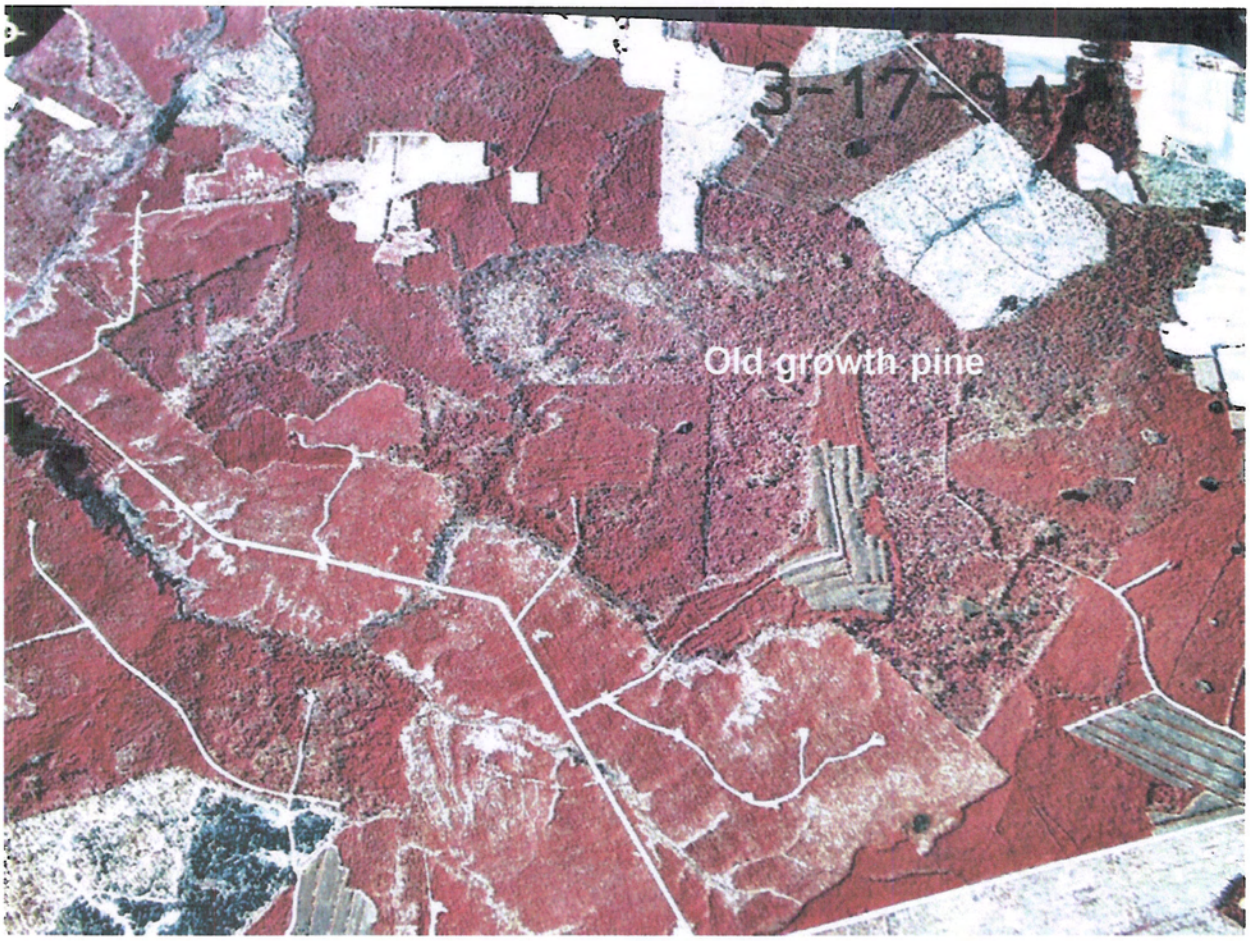


Figure 14. Route 628 Site - Approximately 100 ha of old growth pine along Rt. 628 between Rt. 35 and Wakefield at the community of Dory. This block contains many 100+ year old trees and is within just a few kilometers of several smaller mature pine forest patches. The stand was owned by Union Camp Corporation and has not been visited in just under a year. In addition it lies embedded in a matrix of younger pine stands of varying ages. No evidence of RCW activity. Located on Vicksville Quadrangle.

And finally, this fourth site is actually more of a swamp forest, and contains a greater hardwood component. But it is large enough and close enough to other pine stands to warrant consideration if an appropriate stand management plan could be implemented. It contains mixed age classes of pines up to 80 years of age together with an integrated hardwood component that would have to be managed.

Figure 15. Dendron /Runnymede Quads - Over two hundred hectares of moderately old pine laced with hardwood just off Route 31 south of Elberon, between Dendron and Surry. This was actually part of an old Cypress Pocosin off the Blackwater River, and is very near to a number of smaller medium to old aged pine stands loosely scattered to the north and east. Area of the stand is just over two hundred hectares.

Beyond these sites, the only other biologically feasible places to introduce birds to or to expect birds to naturally occur are the Tidewater pocosins of the North Landing River, and to a lesser extent, the Northwest River. These sites have the advantage of being more stable from a habitat point of view, and probably harbor fewer cavity competitors, but the amount of land required per colony site would probably be much greater than a traditional upland pine site. An additional complication would involve the ability to monitor birds once present.

If funds are available for a rigorous land management plan, then the Dismal Swamp might qualify for a translocation site for birds. There are actually large expanses of moderately old pines primarily to the north and southeast of Lake Drummond that could provide valuable habitat if the hardwoods could be removed or brought under control. Once again, the ability to monitor the species would be handicapped considerably by lack of visibility and mobility within the Swamp.

Other pockets of habitat exist along oxbows and turns of the Nottoway and Blackwater Rivers, but these areas would be too isolated from suitable foraging habitat to sustain birds for long. And as for set-aside areas like the Zuni Pine Barrens, this area is still decades away from being suitable, on top of being really too small to effectively accommodate more than one clan of birds. To the west, scattered pockets of habitat still exist, usually associated with lake shores or millponds. And there are some areas of decent habitat spread across Greensville County, but these are typically either associated with bottom-land and therefore too far removed from adequate foraging habitat, or the patches are located along ridge lines bounded by hardwoods on both sides.

By far, the only truly biologically and geographically significant habitat area left in the state for Red-cockaded Woodpeckers is along the eastern half of Sussex County, including the Surry County boundary. The Route 604 core area is key to all lands around there, and it is in those adjacent lands that the best and most promising habitat for the future still exists. There are still good pockets of habitat along Rt. 460 between Wakefield and Disputanta. And to the south, both the Vicksville and Sebrell topo quadrangles still have habitat blocks that would complement the Manry area well, potentially even linking Route 604 to the Route 35 site.

Future Habitat Suitability

As for looking down the road twenty or more years, there is more flexibility in terms of ultimate habitat availability. Actions can be taken now to customize future sites for habitat suitability. An initial look at this was derived from the fieldwork in this project. An attempt was made to map both currently suitable habitat and habitat that had potential in twenty to thirty years. Figure 16 graphically represents potential habitats of mature pine that could become suitable for occupation by Red-cockadeds within two to three decades.

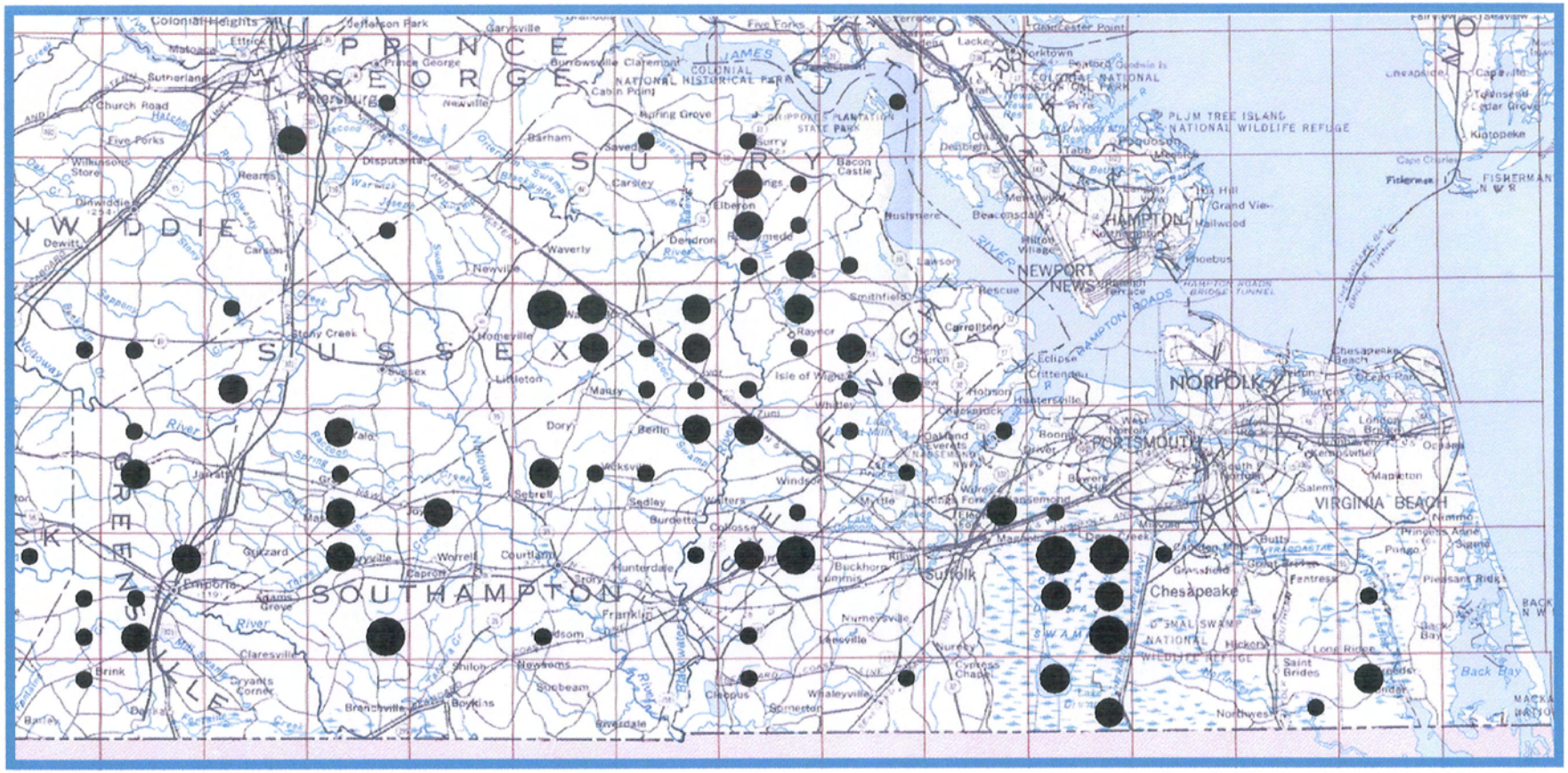


Figure 16. Density and location of potentially suitable RCW habitats in 20 to 30 years. Dot size represents abundance of suitable habitat patches within 25 sq. km. portion of topo map. Smallest dot represents 1-3 sq.km. blocks that contain mature pines that would be old enough to support RCWs in 20-30 years. Intermediate sized dots represent 4-6 blocks that contain suitable habitat, and the largest dot size represents 7-10 blocks of habitat.

Interestingly, we see the central portion of the region regaining potential significance in the future if intermediate aged stands that exist now are allowed to continue to mature. One large area that bears monitoring over the future is the area surrounding the confluence of the four central counties: Sussex, Surry, Isle of Wight and Southampton. A line could be drawn from the Zuni Pine Barrens site in western Isle of Wight County northwest to the Route 604 site in eastern Sussex County, then northeast to Surry, southeast to Chuckatuck then back west to Zuni. The area enclosed within this boundary holds the greatest percentage of habitat remaining in southeast Virginia that will be suitable to harbor woodpeckers in 20 to 30 years. But only if steps are taken in the next 5 years to secure longterm availability of some of it.

The most visually apparent site for future habitat shows up in the Dismal Swamp. This National Wildlife Refuge does harbor hundreds of acres of mature and intermediate aged pines. There are many sections that are contiguous with large blocks of pines emanating in multiple directions. Only a portion of it though would be practical to manage for woodpeckers. Competition from hardwoods is intense in this landscape with the existing hydrology and soils. So pine management should only be undertaken if the long term support is there for a complete committment to woodpecker habitat. This is an area that warrants intensive evaluation and long range planning if it's decided that the Swamp is a candidate for Red-cockaded translocations.

Other potential areas that pop up in the eastern section include the pocosin habitats, particularly those associated with the lower North Landing River. Given the long term stability of these habitats and relative ease of management, pocosins can be a viable habitat for RCW occupation. The species is already utilizing these habitats in substantial numbers in northeastern North Carolina, and could potentially be linked to other birds in southeastern Virginia if a small population could be started here.

Moving back west, there are a number of maturing pine stands associated with rural areas north of Holland and Carrsville along the Suffolk/Isle of Wight County line. There were several blocks of mature pines each over 50 hectares in size as recently as two years ago. Further west, there are large acreages of mature pines in the area of Drewryville in western Southampton County. The largest block is south of Route 58 a mile or two, but then a string of pine patches exist between Drewryville and Yale to the north back to where birds used to occur along Routes 609 and 635.

Other pockets of potential habitat can be found to the immediate north and south of Emporia as well as further up to the north and west of Jarratt. These areas seem to be under heavier timber harvest pressures than sites to the east however, so it is questionable whether these sites are worth considering given their somewhat isolated status and separation from the core of the species range in Virginia. This ties back to the issues of current woodpecker distribution as well. Given the extensive areas of currently suitable habitat and protected lands in eastern Sussex County where the birds occur in viable groups, the emphasis it would seem should be placed on a thorough evaluation of the land use plans for the additional blocks of land that have been identified as potential future habitats in association with the core habitats already under protection.

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