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Red-headed Woodpeckers (*Melanerpes erythrocephalus*) as an indicator of ecosystem health and function in oak savanna habitat

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Introduction

Managers and land stewards in Illinois and the Midwestern United States are currently faced with a fundamental problem concerning the welfare and sustainability of natural habitats and wildlife populations. Oak savannas and woodlands throughout the Midwest are not regenerating at historical (i.e. post-glacial) levels (Packard and Mutel 1997). As a result, without disturbance and appropriate management, oaks are being gradually replaced by shade tolerant species, especially Sugar Maples (*Acer saccharum*). Oak savannas functioned as a key element in the landscapes of the southern and central Midwest for nearly 8000 years (McClain 1991) and loss of this habitat or ecosystem has potentially critical implications for plant and wildlife populations and communities. Loss of savannas and related ecological factors are not entirely understood, but lack of frequent fire and disturbances are likely contributing factors. Therefore, there is considerable interest in acquisition of savanna habitats and use of prescribed fire (and removal of maples or other mesophytic species) as a management technique to ensure the persistence of oak woodlands in at least a semi-natural state (Packard and Mutel 1997).

Closely related to the problem of oak regeneration is the concern for the viability of populations of forest wildlife and how that relates to fire and other disturbances. This situation is somewhat uncertain for birds. The population ecology of many species of birds in the Midwest may be associated with periodic disturbance via fire (Brawn 1998), but many fundamental questions remain about the viability of bird populations in managed savanna habitat. Many bird species may benefit if comparatively open, savanna-like or woodland conditions persist.

Another related predicament is how to estimate the viability of wildlife populations and gauge the value of management policies or land acquisitions. However, there are a number of methods used to carry out viability assessments. Some researchers have proposed that certain census techniques may provide robust indices of population viability (Dennis et al. 1991), whereas others have shown that census data can be a misleading indicator and suggest that estimates of reproductive success are more reliable indicators (Brawn and Robinson 1996).

Our study examined the reproductive ecology of the Red-headed Woodpecker (*Melanerpes erythrocephalus*) in northeastern Illinois. The Red-headed Woodpecker (RHWO) is a sexually monomorphic primary cavity nester that is an expert and persistent flycatcher relative to other members in its family (Smith et al. 2000). The ecology of the RHWO, more than any other bird species found in the region, is tied to the presence of oak savannas (Brawn 1998). RHWOs are highly dependent on oak mast and may serve as key predators and dispersers of acorns. Therefore, RHWOs may be a keystone species in oak savanna ecosystems. Previous research in Illinois strongly suggests that RHWOs are nearly absent in closed-canopy forests and that their reproductive success is systematically greater in savannas than in forests (Brawn 1998). If any bird species in the Midwest is a "savanna bird," it is the Red-headed Woodpecker. The functionality of savannas in the Kankakee Sands region is a key question for future land management and acquisition, and the Red-headed Woodpecker (RHWO) is an ideal indicator. RHWO populations have been declining range-wide at a rate of 2.5% annually since 1966 (Sauer et al., 2001). We functioned under the assumption that Brawn and Robinson (1996) were accurate in their conclusion that estimates of reproductive success are more reliable indicators of population viability. The primary objectives of this study were to assess the nesting habitat of the RHWO in Midwestern oak savannas, determine if nesting habitat is associated with nesting success, and establish the extent and nature of RHWO reproductive behavior.

Materials and Methods

Study sites. – This study was conducted on three sites in northeastern Illinois in an area commonly referred to as "Kankakee Sands," comprising Iroquois and Kankakee Counties. This region of the state contains relatively large, established oak savannas and a series of newly acquired savannas. Hooper Branch Savanna is a 195-ha preserve purchased by the Illinois Department of Natural Resources (IDNR) in 1984. This piece of land is considered the largest single tract of rare native savanna remaining in Illinois and the IDNR maintains a frequent burn regime on the savanna. Mskoda Sands, a recently acquired piece of property belonging to the Illinois Chapter of The Nature Conservancy, is a 263 ha site, consisting of oak savanna, black oak barrens, woodlands, and row crop agriculture. Sweet Fern savanna is a privately owned and recently acquired 26 ha site.

Habitat assessment. – We gathered data on nest tree characteristics to determine potential correlations with breeding success in the 2002 breeding season (May-September). To assess nest-site characteristics, 12 measurements were obtained at each nest; we identified nest tree species, number of cavities present in the nest tree, level of snag decay, and measured cavity orientation, diameter at breast height (DBH), tree height, nest height, nest diameter, basal area, percent canopy cover, distance to the nearest edge, percents each of bare ground, litter, grasses and forbs, and shrub. These measurements were helpful in assessing associations between success and nest site characteristics. These characteristics are being analyzed with univariate and multivariate analyses using SYSTAT.

Nesting activity. – Each study site was methodically and thoroughly searched to determine general areas of Red-headed Woodpecker (RHWO) use in the pre-breeding and breeding seasons of 2002. Potential nest trees were located via direct visual observations. A cavity was determined to be an active nest site if a RHWO was engaged in incubation or feeding behaviors. Each nest tree location was recorded on a hand-held Garmin GPS unit. Thereafter, active nests were monitored until their conclusions (i.e. either by fledging or failing) and checked once every three days. To get a more accurate estimation of the levels of RHWO reproduction, attempts

were made to directly observe the nesting chamber. This was accomplished with the aid of a small infrared camera attached to a 50-foot telescoping pole. We extended the pole and camera to the nest cavity, and with the aid of an oval mirror mounted on the camera itself, we identified and counted cavity occupants. Nests were considered successful if at least one young fledged. We calculated nest success by using Mayfield's daily survival rate (Mayfield 1975). This figure is obtained by finding the predation rate, the daily survival rate, the number of exposure days, and the standard deviation. The success rate is found by taking the square root of (Predation)(Daily Survival Rate) / (Exposure Days). Discriminant function analysis is currently being performed on the data to determine if nesting habitat is associated with nesting success.

Parental feeding activity. – In addition to three-day rotations of nest checks, rates of prey delivery by adult RHWOs were recorded. Each nest was observed once every three days, for a period of fifteen minutes during incubation and thirty minutes during the feeding periods. Observers remained at least 20 meters from the nest tree and observed all activity at the nest with the aid of binoculars.

Results

Statistical analyses of the 2002 Red-headed Woodpecker breeding season are ongoing. Preliminary analyses on nest site characteristics suggest that, with the characteristics measured, no significant differences exist between successful and unsuccessful nests. For the nesting activity portion of the study, some descriptive data are available. A summary of nest occupation and success rates is shown below (Figure 1).

SITE	# OCCUPIED NESTS	# SUCCESSFUL	% SUCCESS
Hooper Branch	31	19	61.29%
Mskoda Sands	9	4	44.44%
Sweet Fern	3	2	66.67%

Figure 1.

Utilizing the pole-mounted camera system, we were able to gain direct visual access to seven active nests. These checks allowed us to track the nest contents through individual breeding efforts. Each of the seven nests contained at least two and up to four chicks. Nest checks later in the breeding effort gave more reliable estimates of nest success. Coupled with observations conducted after the breeding pair fledged their young, relatively accurate estimates of overall nest success will be obtained. Using Mayfield's rate of nest success, we were able to obtain figures for the 2002 breeding season (Figures 2 & 3).

NEST FOUND AS	EXPOSURE DAYS	DAILY SURVIVAL RATE	MAYFIELD ESTIMATE
Eggs	1093	.984446	.984 +/- .004
Chicks	90	.988889	.989 +/- .011

Figure 2.

There were many more nests, and subsequently a higher total number of exposure days, that were discovered during the incubation stage. However, the daily survival rates were surprisingly similar between nests found in the incubation stage and those found in the chick-rearing stage.

LOCATION	EXPOSURE DAYS	MAYFIELD ESTIMATE
Hooper Branch	879.5	.986 +/- .004
Mskoda Sands	189.5	.974 +/- .012
Sweet Fern	114	.991 +/- .008

Figure 3.

Differences in the rates of Mayfield's nest success were slight between study sites.

Parental partitioning, or feeding behavior, was obtained for every active nest during the 2002 breeding season (Figure 4). On average, RHWOs produced 1.4 fledglings per nesting attempt.

# PREY DELIVERY (PD) OBSERVATIONS	TOTAL # PD	AVERAGE PD/HOUR/NEST
151	1952	12.93

Figure 4.

Discussion/Summary

Preliminary analysis of our nest characteristic measurements of Red-headed Woodpecker nesting habitat in northeastern Illinois gives no indication that microhabitat contributes to success or failure of any given nest attempt. However, other important factors may be contributing to the success or failure of a nest. For example, accessibility to nest predators may be a very important factor. We did find evidence of predation events. In one instance, as we checked the nest contents of a cavity, we found a Southern Flying Squirrel (*Glaucomys volans*) inside where, at the previous check, there had been woodpecker eggs present. The internal quality of a cavity may play a role in a pair's breeding effort. If parasites or other potentially harmful conditions exist inside the nesting chamber, there may very well be negative impacts on nestlings. It is possible, however, that the field sites studied provide suitable habitat, and where that habitat is available, it is utilized.

Establishing the extent and nature of RHWO reproductive behavior is an ongoing process. Utilizing our data pertaining to the successes and failures of individual nests, more comprehensive statistical analyses will be run. Specifically, we will look at the date a nest was initiated, and its outcome, to quantify within-year effects. We will compare these numbers to the data from 2001's breeding season to consider between-year effects, and compare the number of prey deliveries early on and later in the nesting attempt and its relation to the outcome.

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Expenditures made under the grant agreement

NRES #	MONTH	AMOUNT	JUSTIFICATION
TR203866	June-02	$106.00	2 nights Watseka Super 8
TR517411	June-02	$106.00	2 nights Watseka Super 8
TR523093	June-02	$306.00	4 nights Watseka Super 8, 3 days per diem
TR523094	June-02	$204.00	2 nights Watseka Super 8, 3 days per diem
Indirect cost	June-02	$72.20	Indirect University cost
TR	June-02	$183.00	2 nights Watseka Super 8, 3 days per diem
Indirect cost	June-02	$18.30	Indirect University cost