The Effect of Understory Foliage Density on American Redstart (*Setophaga ruticilla*) Distribution Near Douglas Lake

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THE EFFECT OF UNDERSTORY FOLIAGE DENSITY ON AMERICAN REDSTART (*Setophaga Ruticilla*) DISTRIBUTION NEAR DOUGLAS LAKE

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Abstract—This study investigated whether there is a correlation between American Redstart (*Setophaga ruticilla*) density and foliage density in a deciduous forest on Douglas Lake, Michigan. Birds were counted by observing and listening to American Redstarts as they sang early on four mornings at ten selected points in this forest. At the same ten points, understory foliage density was scored. A linear regression and scatter plot with a best fit line calculated by SPSS revealed a significant positive correlation (R^2 = 0.76) between the average number of American Redstarts at a given data collection point and its corresponding foliage density score, which supported the hypothesis that there would be more American Redstarts in areas with more foliage. This information can be used in maintaining the habitat of the American Redstart and related species.

INTRODUCTION

The American Redstart (*Setophaga ruticilla*) has remained a populous bird in Northern Michigan during the breeding season for numerous decades, in part due to its affinity for deciduous rather than coniferous forests (Sherry and Holmes, 1997). American Redstarts require breeding grounds with relatively abundant resources (Lovette and Holmes, 1995), and shorelines are resource-rich territories for this species because of the high concentration of available nutrients, including aquatic insects they forage for (Sherry and Holmes, 1989, Hunt, 1996). Concerning American Redstart distribution, Hahn (2006) demonstrated that the presence of other American Redstarts affects breeding territory size, and yet another factor is time. Later in the breeding season, such as July, territory size is shown to reduce from 0.41 acres to 0.07 as American Redstarts feed their young (Yarrow, 1970) later in the breeding season, such as July. Research also demonstrates a higher American Redstart density in the 20 feet and higher regions of trees where there is more foliage (Baker, 1944).

This study is designed to obtain and interpret more data about the specifics of this species' niche in Northern Michigan by investigating the relationship between American Redstart density and understory foliage density in a forest in Grapevine point on Douglas Lake, Michigan. A positive correlation between the two is anticipated based on previous studies concerning American Redstart habitat preferences and foraging habits. This study will aid conservation efforts to ensure the American Redstart a breeding ground for the future.

METHODS AND MATERIALS

Ten data collection points were selected and marked with flagging tape in the deciduous forest of Grapevine point on Douglas Lake, Michigan in areas varying in foliage densities. The ten points were arranged in a 2 x 5 rectangular area with five points 25 m from shore and another five points 85 m from shore (Fig. 3). From each of the ten points, 25 m was measured and marked with flagging tape in four

directions, indicating a 25 m radius circle in which American Redstarts were counted either by sight or American Redstart adult male song. Data were collected on four days in July, 2009 between 5:45 and 7:15 A.M., early enough in the day and breeding season to ensure the males would be singing. Each perceived American Redstart was plotted on a site specific data sheet on the four aforementioned days. For every adult male American Redstart seen or heard (males are distinguished by their ability to sing and their plumage), a female mate was assumed and counted in the density calculations because by mid-July, every adult male singing has bred.

At each of the ten data collection points, nine foliage scores were taken: At the center point, at four equidistant points on the 25 m radius circle, and the four mid-way points (12.5 m) (Fig. 3). A common foliage density index (Nudds, 1977) was employed for foliage density scoring, excepting the following amendments. A PVC pole was used with two foot (0.61 m) high layers painted half white and half red. Measurements were taken from 1 m to 3.44 m to avoid measuring ground cover where American Redstarts do not forage. At each point the pole was used, the foliage was scored on a scale of 1-5 from 10 m away in a random direction to control for perspective and visibility. Additionally, a cylinder was held straight up at each data collection point and canopy cover was estimated and scored on a scale on 1-5. The data for American Redstart density were averaged for each of the ten sites to avoid counting the same bird twice and skewing the data. These data were entered into a linear regression in SPSS along with the density scores averaged from the nine data points from each of the ten sites (Fig. 1, Fig. 2). Four regressions were calculated for average number of American Redstarts and each foliage layer. Mean distance from shore and mean number of American Redstarts were analyzed with a *Mann Whitney U* test.

RESULTS

The R-squared value indicated a significant correlation (R^2=0.76) between the foliage density and the density of American Redstarts at the ten sites (Fig. 1). As foliage density increased, the number of American Redstarts also increased. Regressions for American Redstart density and layer density illuminated only one significant correlation (layer 2 R^2=0.718). Where layers are concerned, only in layer 2 were there significantly more American Redstarts where there was more dense foliage (Fig. 4). All other layers produced marginally significant results (layer 1 R^2=0.621, layer 3 R^2=0.654, layer 4 R^2=0.613). A linear regression was conducted on canopy cover and American Redstart density, producing an insignificant R-squared value (R^2=0.184) (Fig. 2). A *Mann Whitney U* test revealed no significant correlation between mean American Redstart density and distance from shore (p=0.113).

DISCUSSION

Because there is a significant (R^2=0.76) correlation between American Redstart density and average foliage density for the ten sites, and the trend shows an increase in number of American Redstarts in areas with higher foliage density scores, a positive correlation can be concluded. This rejects the hypothesis that American Redstart density is evenly distributed. Results support the hypothesis that there is a positive correlation between foliage density and American Redstart density. The ecological significance of these data is that American Redstarts prefer areas with denser foliage, likely because of foraging behaviors as there is a higher concentration of insects (including aquatic insects) in areas with more foliage (Hunt, 1996). A study found that the density of the American Redstart within a forest is affected by proximity to shore (Smith et al., 2004). A *Mann Whitney U* test revealed no significant correlation between distance from shore and American Redstart density in this study (p=0.113), factoring out distance from shore as a confounding factor. Therefore, it may be stated that foliage is an important factor in American Redstart distribution. The conservation significance of these data is another facet of information about exactly what the American Redstart needs in a breeding ground, and

that is areas of dense foliage. If an area such as this were to be deforested, the American Redstart would surely attempt to relocate, and yet timber harvesting is one of the greatest disturbances in Northern Michigan hardwood forests (Metzger and Schultz, 1984).

Results stated no significant correlation between canopy cover and American Redstart density (R^2=0.184), which eliminates canopy density as a factor in understory American Redstart density. These results may be seen as consistent with studies that reported higher American Redstart density in forested areas at 20 ft and taller (Baker, 1944), likely because the more dense foliage was on an absolute taller scale. These results pertain to the deciduous forests of northern Michigan, frequently used as both a breeding grounds and a stopover site for migratory birds. Further studies might investigate the same correlation in the migratory stopover areas for the American Redstart.

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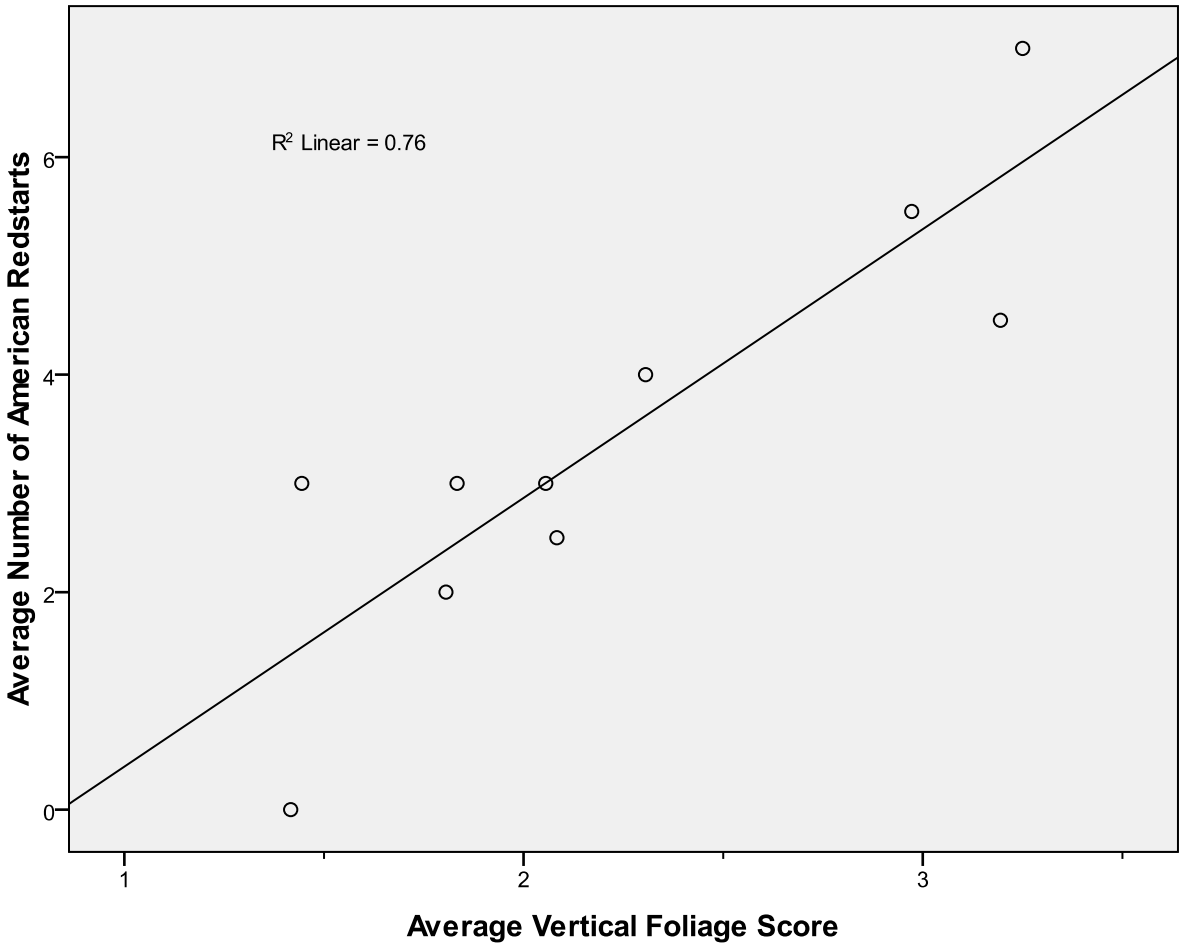


Figure 1. AVERAGE NUMBER OF AMERICAN REDSTARTS IN RELATION TO AVERAGE VERTICAL FOLIAGE SCORE This graph is a linear regression scatter plot for the average number of American Redstarts in relation to the average foliage density score at ten points in Grapevine point on Douglas Lake, Michigan. Foliage density scores: 0-20%=1, 21-40%=2, 41-60%=3, 61-80%=4, 81-100%=5. This graph demonstrates a significant positive correlation (R^2=0.76), showing that where there is more dense foliage, there are more American Redstarts.

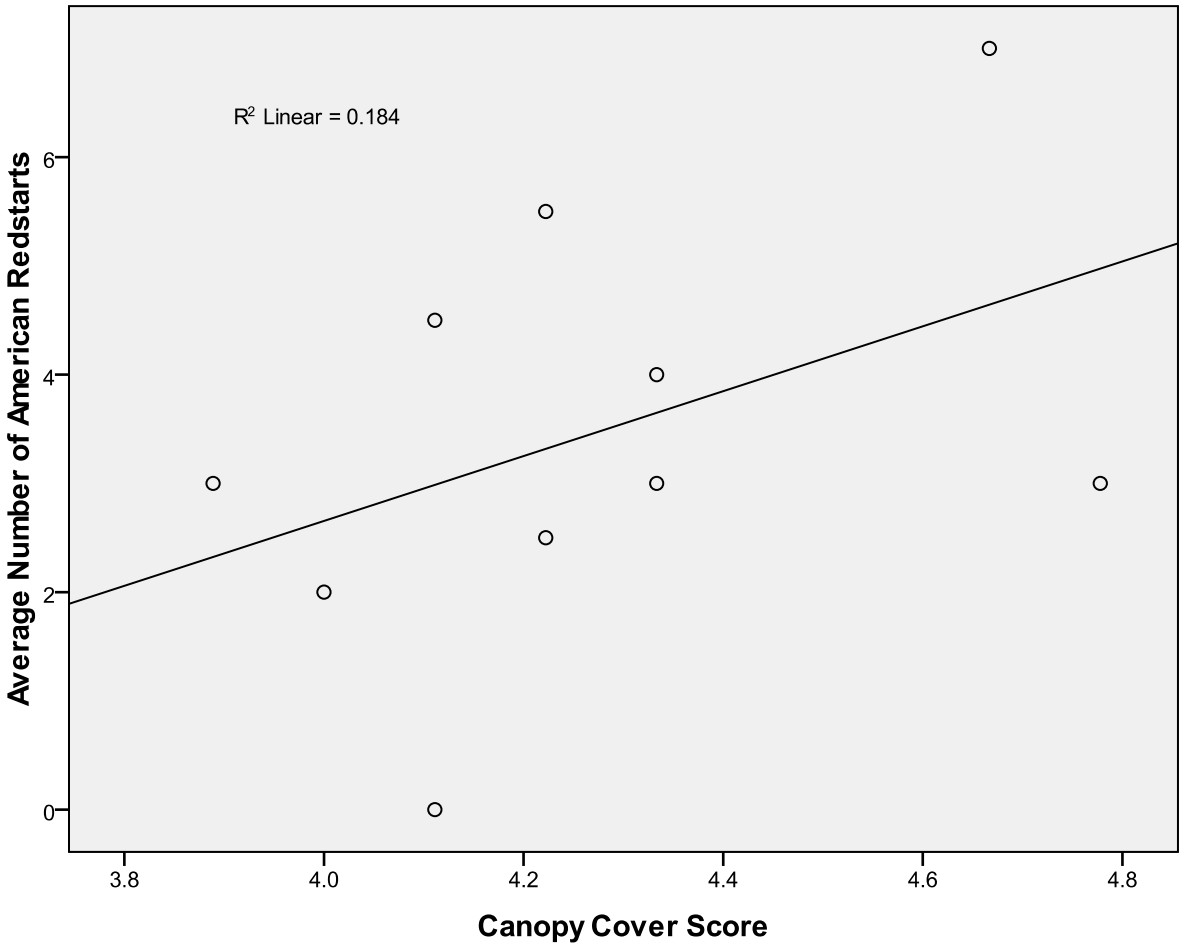
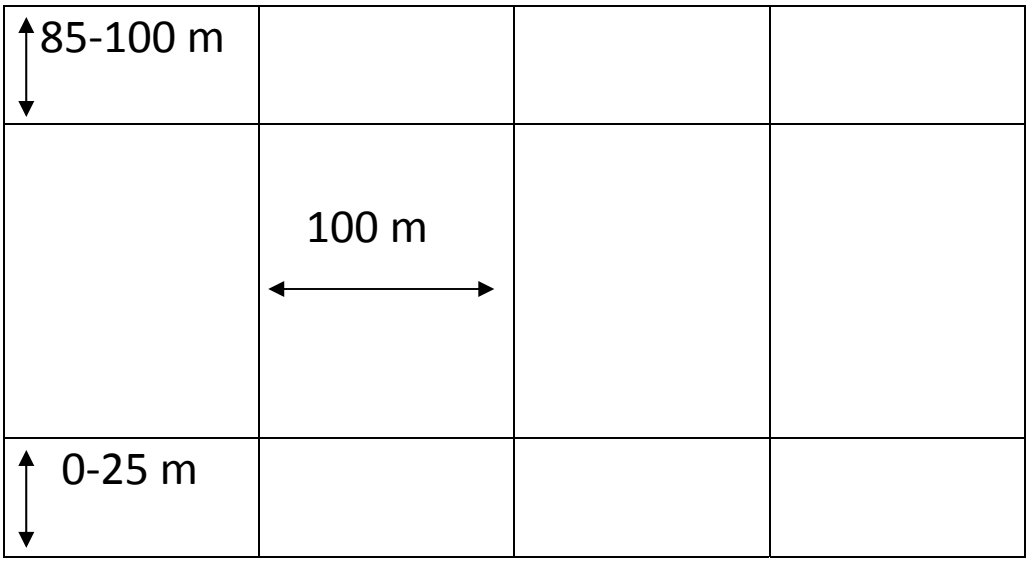


Figure 2. CORRELATION BETWEEN AVERAGE NUMBER OF AMERICAN REDSTARTS AND CANOPY COVER SCORES This graph is a linear regression scatter plot for the average number of American Redstarts in relation to the average canopy cover score at ten points in Grapevine point on Douglas Lake, Michigan. Foliage density scores: 0-20%=1, 21-40%=2, 41-60%=3, 61-80%=4, 81-100%=5. This graph shows that there is no significant relationship between the number of American Redstarts and canopy cover in this study (R^2=0.184).

A)



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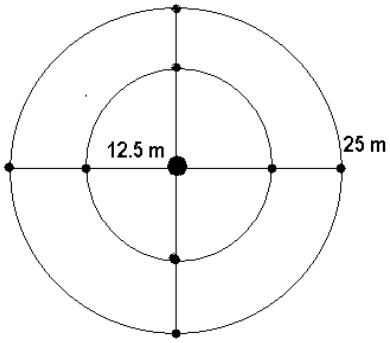

Figure 3. DATA COLLECTION POINTS FOR COUNTING NUMBER OF AMERICAN REDSTARTS AND FOLIAGE DENSITY SCORING A) and B) are methods used to collect number of American Redstarts and foliage density. A) Transect set up on Grapevine Point on Douglas Lake, Michigan. Data were collected from all 10 points intersecting the 25 m line as well as the 85 m line. B) At each of the ten sites, foliage was scored from all 9 points of intersections, i.e. at the center, 12.5 m marks, and 25 m marks in the four cardinal directions.

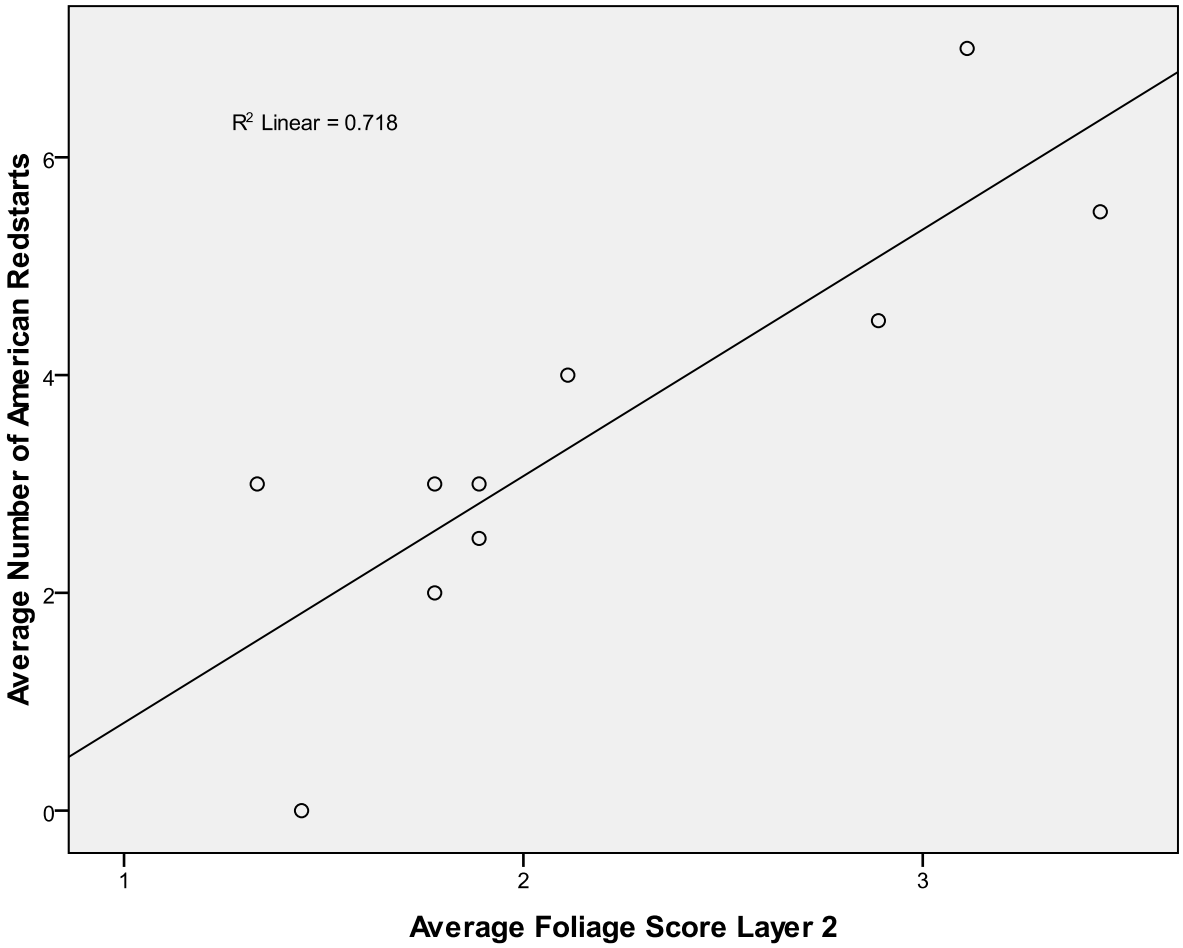

Figure 4. CORRELATION BETWEEN AVERAGE NUMBER OF AMERICAN REDSTARTS AND AVERAGE FOLIAGE SCORE FOR EVERY LAYER 2 This graph illustrates a significant positive correlation (R^2=0.718) between average number of American Redstarts and the average foliage density scores of layer 2 in the forests of Grapevine point on Douglas Lake, Michigan. Foliage density scores: 0-20%=1, 21-40%=2, 41-60%=3, 61-80%=4, 81-100%=5. As foliage density increases, so does the number of American Redstarts.