

THE EFFECTS OF UNDERSTORY DENSITY ON THE DISTRIBUTION OF AMERICAN  
REDSTARTS (*Setophaga ruticilla*) AROUND DOUGLAS LAKE

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**Abstract** - American Redstart density was examined in areas of various levels of understory foliage density around Douglas Lake in order to determine if understory foliage is a factor in American Redstart distribution. American Redstart density was determined by spot counting ten point count stations while understory foliage density was determined using a variation of Nudds method for scoring vegetation. It was determined that the density and distribution of American Redstarts in an area is directly correlated with the density of understory foliage of that area. The implications of this study add stress to the importance of stopping deforestation.

## INTRODUCTION

The *Setophaga ruticilla*, more commonly known as the American Redstart, is a common bird, found throughout the northern part of Michigan. This bird is a type of warbler that dwells mainly in second growth deciduous forests with a dense shrub layer (Sherry and Holmes, 1997). The American Redstart lives in this type of environment partly because of its preference to nest in the forks of trees (Baker, 1944). They prefer this type of branch because it is able to support their nests very successfully. These types of branches are fairly common in deciduous trees while in pine trees the branches grow perpendicularly from the trunk and are therefore unsuitable for an American Redstart nesting site (Hunt, 1996). Studies have hypothesized American Redstarts look for a greater amount of leaf coverage in addition to forked branches for nesting sites (Sodhi et al., 1999). It has been determined that American Redstart density is partly affected by their insect foraging habits which should result in a higher American Redstart concentration where there is more foliage or more densely vegetated areas (Smith et al., 2004). Where there is more leaf coverage there are also more insects in addition to American Redstarts nests. When the density of insects is not as great, American Redstarts will forage higher in the canopy in order to feed (Seidel et al., 1982). Foraging heights do not differ between males and females nor do they differ with American Redstart age. Normally the foraging heights do not vary throughout different habitats. However the differences in American Redstart foraging could be attributed to the greater abundance of insects in an area (Smith et al., 2004). A greater amount of insects are found where there is a greater density of understory foliage (Seidel et al., 1982). Since it's known that American Redstarts forage more heavily in the densest layer of foliage (Maurer et al., 1981), this indicates that the density of American Redstarts would be greater in areas of higher understory density. The purpose of this experiment is to determine whether the density of

understory in a deciduous forest does indeed have an effect on the density and distribution of American Redstarts in an area. A positive correlation between understory foliage and American Redstart density is expected based on the previous experiments conducted on American Redstart foraging habits and nesting preferences. The information gained from this study could benefit conservation efforts later on and it would also add power to the fight against deforestation by showing what could be lost if habitats are destroyed.

## METHODS AND MATERIALS

To determine American Redstart density along the shoreline of Douglas Lake, point count stations were established 25 m and 85 m away from Douglas Lake on five parallel transects 100 m apart from each other running perpendicular to Douglas Lake, giving a total of 10 sites. All 10 sites were located within a deciduous forest in Grapevine point on Douglas Lake in Emmett County in northern Michigan. At each point count station a 25 m radius circle was flagged in each cardinal direction indicating the area where birds were being recorded. The large radius was needed because the territory size of American Redstarts is variable, it can range anywhere from 0.07 ha to 0.41 ha (Yarrow, 1970). In order to determine the density of American Redstarts observers spot mapped the locations of American Redstarts within each point count station. Observers listened for ten minutes and recorded the approximate location of American Redstarts within the 25 m radius of each point count station. During the ten minute intervals once no more new birds were heard, the observer would attempt to sight the American Redstart they had heard in the point count station to verify the amount American Redstarts at that station. Data were collected on four different dates in July 2009 between 5:45 and 7:15 A.M.

Understory density at each point count station was determined after Nudds (1977). Changes were made to Nudds method in order to tailor it to the American Redstart population along Douglas Lake. Instead of using a “vegetation profile board” (Nudds, 1977) a 2.44 m pole with alternating orange and white coloration at 0.305 m intervals was used and instead of measuring the vegetation from the ground up, the pole was held 1 m above the ground in order to ensure that the foraging areas of American Redstarts were included in the evaluation of the density. At each point count station the pole was raised 1 m in the air and percent coverage of the four sections of the pole (Fig.1) was taken from 10 m away in a random direction. These measurements were taken at 9 separate points at each of the 10 point count stations (Fig. 2). In addition to the percent coverage on the pole, percent canopy coverage was taken at each of the nine points at all ten point count stations. To take the percent canopy coverage a cylindrical tube was used to look up at the canopy and then the percent of the opening that was covered by leaves was recorded (Korhonen et al., 2006).

To determine the amount of American Redstarts at a single point count station the number of American Redstarts heard or seen from each data collection date was averaged to eliminate human error and to accumulate a more accurate account of the amount of American Redstarts in that area. This average is then doubled because the assumption is that for every male there is a female partner. To determine if there was a significant correlation between number of American Redstarts in an area and the density of the understory foliage of an area, regressions were run. A regression of canopy cover in relation to American Redstart density was also run. To test if distance from shore was a confounding variable a *Mann-Whitney U* was run.

## RESULTS

There is a significant positive relationship between American Redstart density and average understory foliage density with a  $R^2$  value of 0.76 (Fig.3). Regressions were also run on each of the four levels of the understory coverage. There was a marginally significant correlation between American Redstart density and individual levels for levels 1, 3, and 4 with a  $R^2$  value ranging from 0.613 to 0.654 (Fig. 4, Fig. 6, Fig. 7). The regression run for the relationship between number of American Redstarts and the vegetation density of level 2 showed a significant correlation with a  $R^2$  value of 0.718 (Fig. 5). The percentage of canopy cover in relation to American Redstart density was also evaluated using a regression and the relationship between the two variables was not significant (Fig.8). A *Mann-Whitney U* test was run and a p value of 0.113 was determined, so distance from shore was not a confounding factor in American Redstart density.

## DISCUSSION

Based on the results it can be concluded that distribution and density of American Redstarts is determined in part by the amount of understory foliage of the area. It is shown that American Redstarts prefer to inhabit areas where there is a denser understory foliage and will tend to avoid areas with low density understory foliage. It can be concluded from the regression run on American Redstart density in relation to canopy cover that there was no significant variation in canopy cover that would account for the difference in distribution of American Redstarts along Douglas Lake. Also the *Mann-Whitney U* test eliminates distance from shore as a factor. This data corresponds with other studies done; in general where the understory foliage is denser there are a greater amount of insects, and the density of American Redstarts in relation to insect

density has been studied in other experiments to determine that American Redstarts prefer to be where the density of insects are greatest.

These findings stress the importance of protecting habitats. Many birds have very specific habitats where they migrate to and nest and if those areas are being depleted the competition between male birds for territories will increase and the population numbers will drop. Increased deforestation would not only affect American Redstarts, it would have a huge affect on a multitude of species. The smaller the area available to species, the more likely extinction is. In order to preserve the integrity of populations it is necessary to conserve their habitats.

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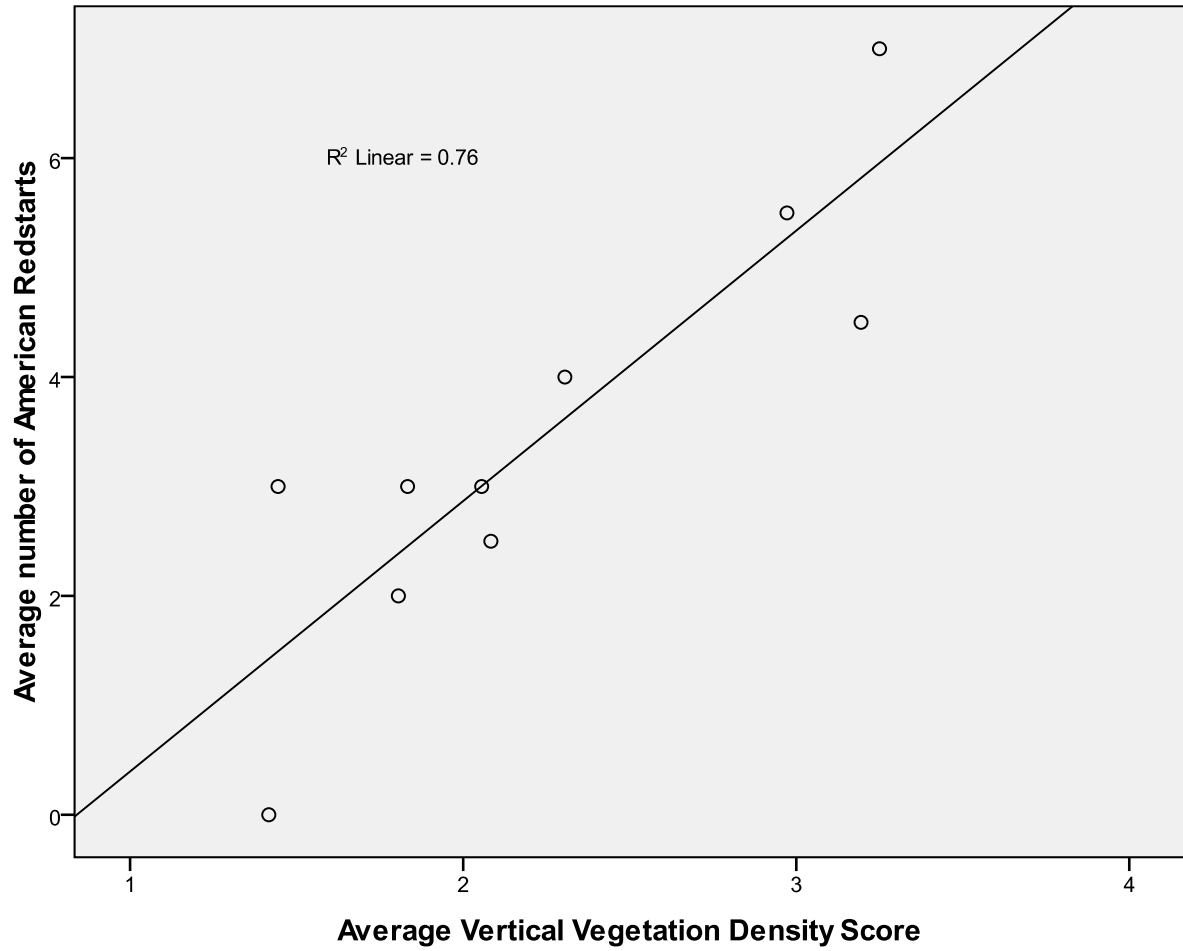


Figure 3. CORRELATION BETWEEN THE NUMBER OF AMERICAN REDSTARTS IN AN AREA AND THE AVERAGE DENSITY OF UNDERSTORY FOLIAGE IN AN AREA. The vertical vegetation density score was recorded as follows; 1=0-20% coverage, 2=21-40% coverage, 3=41-60% coverage, 4=61-80% coverage, and 5=81-100% coverage.

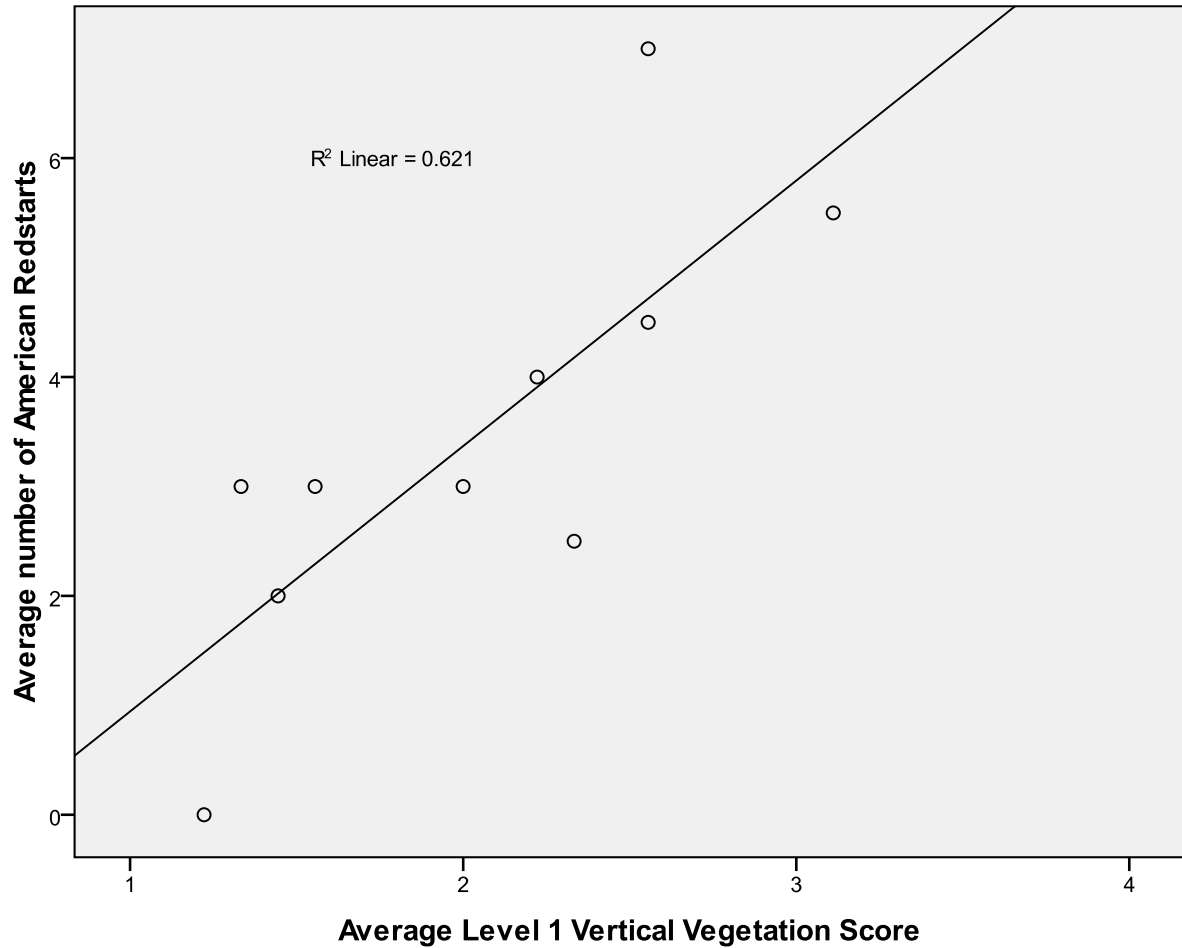


Figure 4. CORRELATION BETWEEN THE NUMBER OF AMERICAN REDSTARTS AT A SITE AND THE AVERAGE DENSITY OF UNDERSTORY FOLIAGE FROM 1 M OFF THE GROUND TO 1.61 M OFF THE GROUND The vertical vegetation density score was recorded as follows; 1=0-20% coverage, 2=21-40% coverage, 3=41-60% coverage, 4=61-80% coverage, and 5=81-100% coverage.

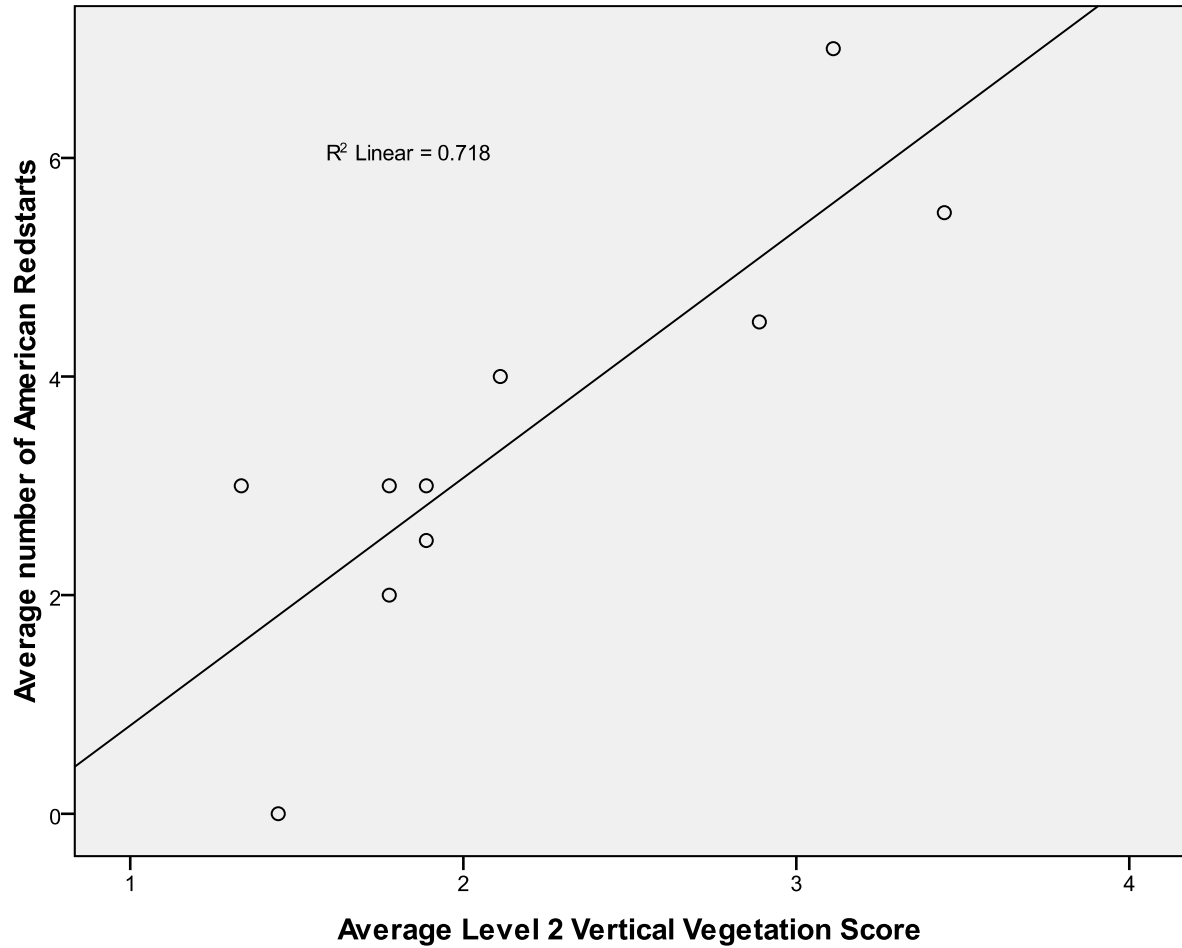


Figure 5. CORRELATION BETWEEN THE NUMBER OF AMERICAN REDSTARTS AT A SITE AND THE AVERAGE DENSITY OF UNDERSTORY FOLIAGE FROM 1.61 M OFF THE GROUND TO 2.22 M OFF THE GROUND The vertical vegetation density score was recorded as follows; 1=0-20% coverage, 2=21-40% coverage, 3=41-60% coverage, 4=61-80% coverage, and 5=81-100% coverage.

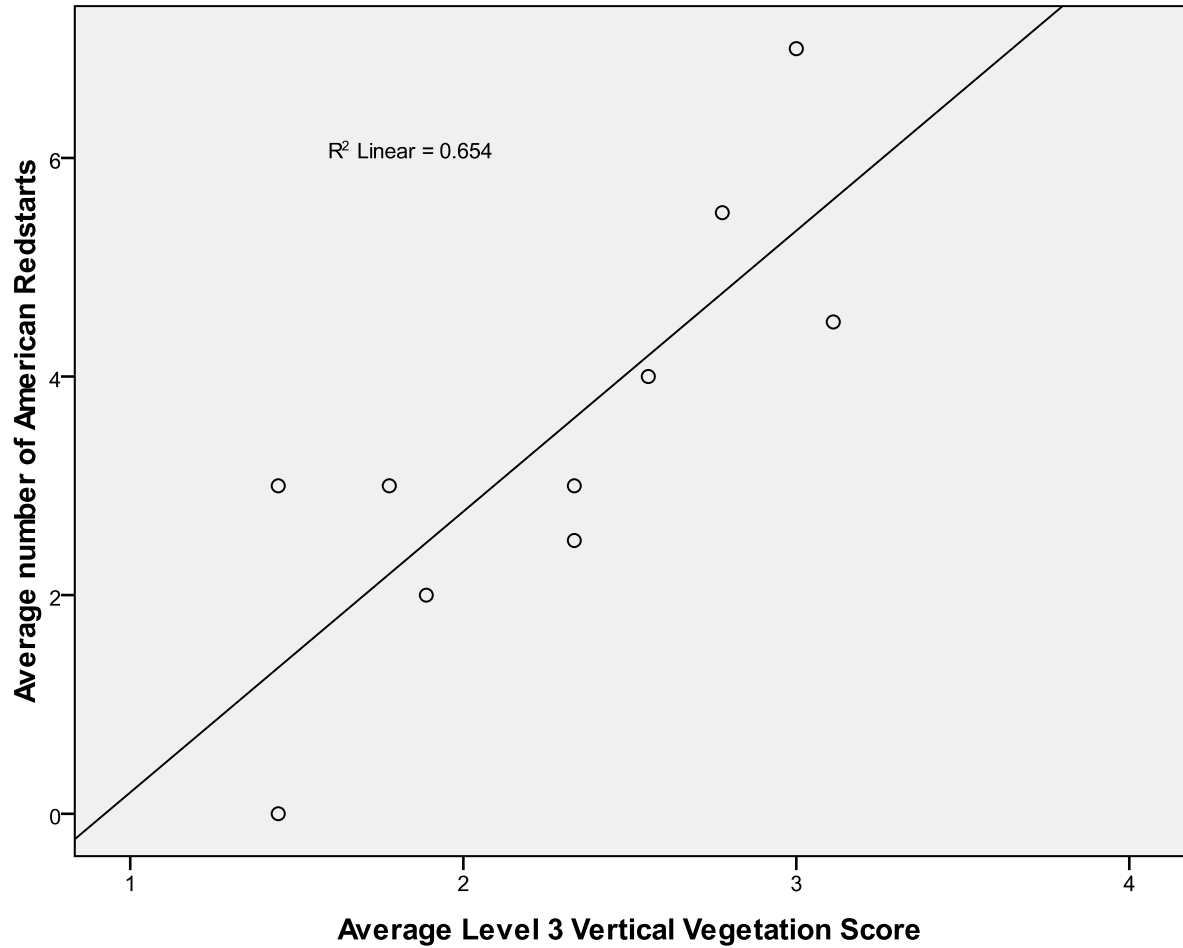


Figure 6. CORRELATION BETWEEN THE NUMBER OF AMERICAN REDSTARTS AT A SITE AND THE AVERAGE DENSITY OF UNDERSTORY FOLIAGE FROM 2.22 M OFF THE GROUND TO 2.83 M OFF THE GROUND The vertical vegetation density score was recorded as follows; 1=0-20% coverage, 2=21-40% coverage, 3=41-60% coverage, 4=61-80% coverage, and 5=81-100% coverage.

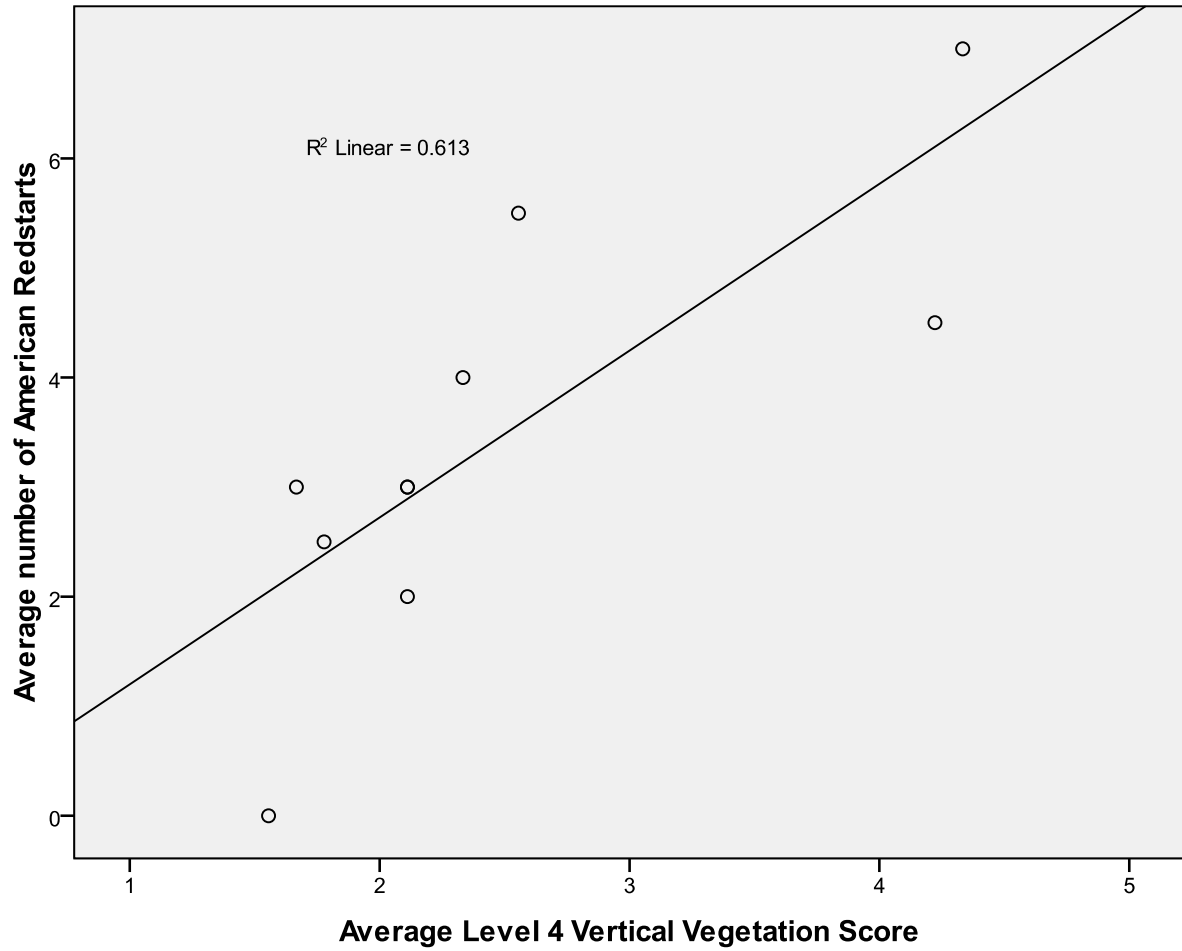


Figure 7. CORRELATION BETWEEN THE NUMBER OF AMERICAN REDSTARTS AT A SITE AND THE AVERAGE DENSITY OF UNDERSTORY FOLIAGE FROM 2.83 M OFF THE GROUND TO 3.44 M OFF THE GROUND Correlation between the number of American Redstarts at a site and the average density of understory foliage from 2.83 m off the ground to 3.44 m off the ground. The vertical vegetation density score was recorded as follows; 1=0-20% coverage, 2=21-40% coverage, 3=41-60% coverage, 4=61-80% coverage, and 5=81-100% coverage.

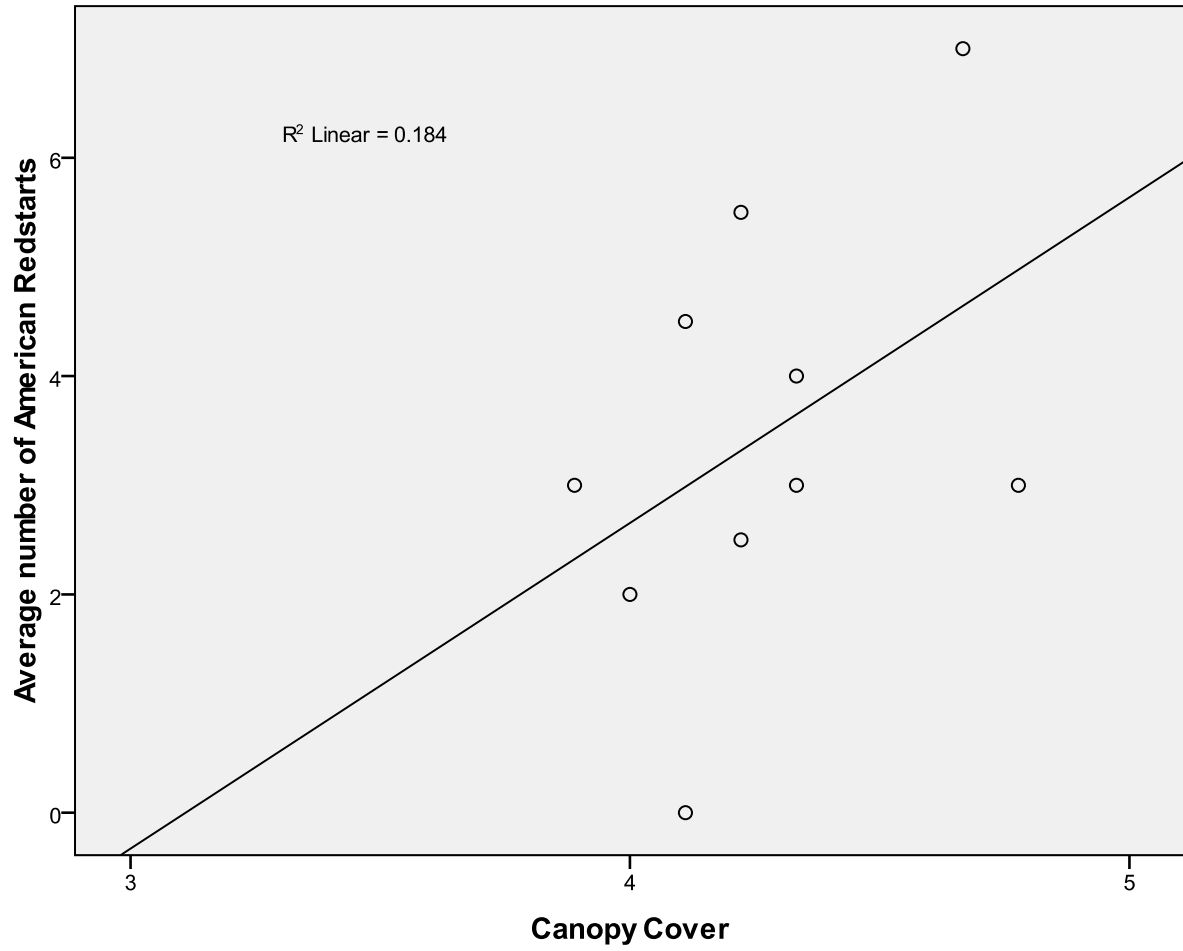


Figure 8. THE AVERAGE NUMBER OF AMERICAN REDSTARTS IN RELATION TO THE CANOPY COVER AT EACH SITE Canopy cover was determined on a point system of 1=0-20% coverage, 2=21-40% coverage, 3=41-60% coverage, 4=61-80% coverage, and 5=81-100% coverage.

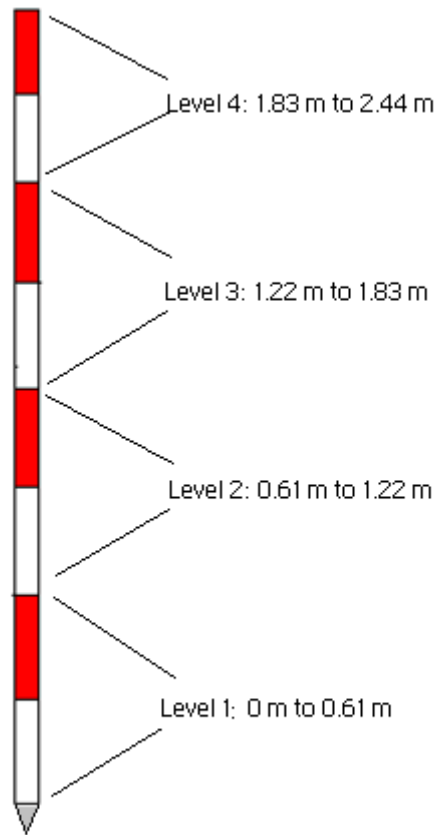


Figure 1. VEGETATION PROFILE POLE The pole is broken into 4 levels; each level is equal to 0.61 m. The numbers by each level represents height above 1 m gap between the ground and the pole.

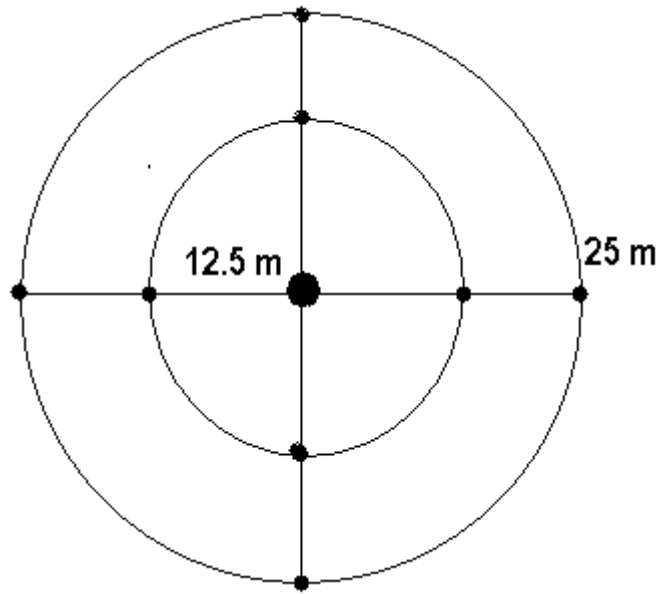


Figure 2. DIAGRAM OF VEGETAION SCORING POINTS FOR EACH INDIVIDUAL SITE  
Nine total measurements for each site, 1 measurement at the center of the point count station, 4  
measurements 12.5 m from the center of the point count station, and 4 measurements at 25 m  
from the center of each point count station.